

# OCEAN YEARBOOK 27



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# Coastal and Marine Spatial Planning

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## Protecting Marine Spaces: Global Targets and Changing Approaches

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## INTRODUCTION

Threats to the marine environment are complex, multiple, and often overlapping or synergistic.<sup>1</sup> Mitigating these threats, likewise, is not simple, but rather relies on

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1. B.S. Halpern et al., "A global map of human impact on marine ecosystems," *Science* 319 (2008): 948–952; C.D.G. Harley et al., "The impacts of climate change in coastal marine systems," *Ecology Letters* 9 (2006): 228–241.

*Ocean Yearbook* 27: 213–248

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multiple management approaches, ranging from controls on fishing, sand and gravel extraction, energy development, shipping, and waste water disposal, to active interventions such as restoration and re-stocking, through to managing *ex situ* threats by managing human activities in adjacent watersheds. Among this array of approaches, one of the key tools for conservation has been marine protected areas (MPAs).

Initially, calls for MPAs were highly targeted, with conservation-based non-governmental organizations (NGOs) driving attention towards conserving critical habitats for endangered and charismatic species such as turtles and marine mammals, and to high-profile habitats such as coral reefs, intertidal wetlands and rocky shores. In most cases, the primary focus was on preserving the healthiest and most diverse ecosystems.<sup>2</sup>

World-wide efforts at marine conservation were given a clearer framework within the formulation of the Convention on Biological Diversity (CBD).<sup>3</sup> This Convention called for a broad ecosystem approach to conservation, and while protected areas were described as one important means to achieve conservation gains, they were not intended to be the sole mechanism. Subsequent efforts used protected areas as both a target and a metric for assessing conservation progress. Given the lack of any other reliable global metrics,<sup>4</sup> this may have led to an over-reliance on MPA assessments as an indicator of progress in marine conservation.

The most recent review and renewal of global biodiversity conservation commitments came in Nagoya with the formulation of the Aichi Targets.<sup>5</sup> As with earlier targets these once again stress the need for a broad array of conservation efforts, taking an ecosystem-based approach. Protected areas are again mentioned as a *part* of the solution. The Aichi Targets also greatly strengthen the emphasis on the broader benefits of biodiversity to people. While biodiversity *per se* remains important, the Aichi Targets expressly added the need to reconcile conservation and development, and conserve ecosystem service benefits for human well-being.

This article provides a broad overview of the development of international commitments with regard to marine biodiversity conservation, giving a particular focus on MPA-related targets. The work falls into four main sections beginning with a summary of the international policy and legal frameworks that have encouraged the protection and management of living marine resources. Section II provides a review of global MPAs, considering political and biogeographic patterns in coverage. Section III takes a detailed look at the Aichi Targets for protected areas coverage, and

2. J. Roff and M. Zacharias, "Approaches to Marine Conservation," in *Marine Conservation Ecology* (London: Earthscan Ltd., 2011), pp. 73–99.

3. Convention on Biological Diversity, entered into force 29 December 1993. 1760 *United Nations Treaty Series* 79; 31 *International Legal Materials* 818 (1992), available online: <<http://www.cbd.int/convention/text/>>.

4. S.H.M. Butchart et al., "Global Biodiversity: Indicators of Recent Declines," *Science* 328, no. 5982 (2010): 1164–1168.

5. CBD "COP 10 – Tenth Meeting of the Conference of the Parties to the Convention on Biological Diversity. Nagoya, Japan 18–29 October 2010. Decision X/2. Strategic Plan for Biodiversity 2011–2020," (United Nations Environment Programme, 2010).

considers how current coverage contributes to that target. Finally, Section IV draws together these observations to consider future trends and needs for marine protection and the achievement of international targets.

MPA coverage has shown dramatic increases in recent years. While this gives the impression that area-based conservation targets might be attainable, we point out that protected area targets extend well beyond simple metrics of cover, calling for effectiveness, for representative coverage, for ecosystem services benefits, and for the consideration of protected areas within wider ecosystem settings. We suggest that recent trends in MPA coverage may not be contributing as greatly to progress as the headline numbers suggest. We highlight the urgent need for a wider debate on definitions and metrics in order not only to measure progress but to support countries in their approaches to improving conservation and management of ocean space and resources. In particular, we recommend that greater attention be given to the role of economic and social factors in MPA selection and designation in order to secure greater benefits to people; that MPAs be embedded in a wider context of comprehensive marine and coastal management; and that they be placed where they can truly address the primary threats and gaps, not simply where they can be established with minimal conflict.

## I. POLICY AND MANAGEMENT SETTINGS

Early efforts towards protection and management of oceans and marine resources by the international community began through a series of somewhat unconnected measures and legal instruments focusing on the prevention of marine pollution and on the sustainable management of specific living marine resources. These were followed by agreements more specifically targeting the conservation of species and habitats. More recently, there has been a clear move towards a more integrated approach, in which the conservation of marine biodiversity as a regulatory goal is firmly embedded with other management measures.<sup>6</sup>

The United Nations Convention on the Law of the Sea (UNCLOS), considered by many as the “constitution for the oceans,” establishes the foundation of the management regime in the oceans.<sup>7</sup> UNCLOS was built on the principle that “the problems of ocean space are closely interrelated and need to be considered as a whole.”<sup>8</sup> It provides a comprehensive framework for regulating the use and development of ocean space, and specifies the rights and responsibilities of nations as well as the general objectives and principles that are to guide ocean use, both within and

6. P. Sands, J. Peel, A. Fabra and R. MacKenzie, *Principles of International Environmental Law* (Cambridge: Cambridge University Press, 2012).

7. UNCLOS, “United Nations Convention on the Law of the Sea of 10 December 1982,” (United Nations Environment Programme, 1982).

8. UNCLOS, Preamble, n. 7 above.



beyond states' national jurisdiction. UNCLOS often has very broad and general provisions and does not address all marine-related issues, particularly in relation to the conservation of marine biodiversity and ecosystems. The general provisions that it includes on protection of the marine environment are primarily in Article 192 which establishes that "States have the obligation to protect and preserve the marine environment," and Article 194(5), which primarily outlines states' obligations to prevent, reduce, and control pollution, and adds that "the measures taken in accordance with this Part shall include those necessary to protect and preserve rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other forms of marine life."

UNCLOS was designed to serve as a unifying framework for a growing number of more detailed international agreements on marine environmental protection and the conservation and management of marine resources.<sup>9</sup> It has proven to be sufficiently flexible to allow the incorporation of modern principles of ocean governance in the many treaties and regional measures adopted since 1982.

The Earth Summit in Rio 1992 instituted one of the most important principles in modern conservation, namely the ecosystem approach, through the adoption of the CBD that played a key role in fostering the notion of ecosystem-based management, with ecosystems as the primary framework for implementation.<sup>10</sup> It actively promoted the importance of protected areas as a tool to implement ecosystem-based management. The Earth Summit also adopted Agenda 21,<sup>11</sup> a non-binding, but comprehensive blueprint for action to be taken globally, nationally, and by local governments and other stakeholders to achieve environmental sustainability. Its dedicated chapter on oceans acknowledged that it was necessary to take "new approaches to marine and coastal area management and development ... that are integrated in content and are precautionary and anticipatory in ambit." Agenda 21 called on states to "undertake measures to maintain biological diversity and productivity of marine species and habitats under national jurisdiction" and to "identify marine ecosystems exhibiting high levels of biodiversity and productivity and other critical habitat areas and ... provide necessary limitations on use in these areas, through, inter alia, designation of protected areas." This effectively introduced the "ecosystem approach" to conservation planning.

Ten years later, the Johannesburg Plan of Implementation of the World Summit on Sustainable Development (WSSD) encouraged the application, by 2010, of the ecosystem approach and promoted "integrated, multidisciplinary and multisectoral coastal and ocean development." WSSD set one of the first targets for MPAs, calling

9. L. Kimball, *International Ocean Governance. Using international law and organisation to manage marine resources sustainably* (Gland, Switzerland and Cambridge, UK: IUCN – World Conservation Union, 2001).

10. CBD, "Convention on Biological Diversity," (United Nations Environment Programme, 1992).

11. UNCED, *Earth Summit Agenda 21. The United Nations Programme of Action from Rio* (UN Department for Economic and Social Affairs, 1992).

for the establishment by 2012 of MPA networks as one of the diverse approaches to improve the management of oceans.<sup>12</sup>

After the Earth Summit, and more intensively after the WSSD, other international arrangements began to introduce progressively an ecosystem approach to their regimes, with growing calls to conserve marine and coastal biodiversity, and in particular to establish MPAs. Several regional initiatives have followed the global processes towards greater integration of regulations. The regional seas conventions that were originally heavily focused on pollution have either been amended or have adopted additional instruments to incorporate new principles of ecosystem-based management and the conservation of marine biodiversity. For example, the 1983 Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention) adopted the Specially Protected Areas and Wildlife (SPAW) protocol in 1990; and the 1976 Convention for the Protection of the Mediterranean Sea Against Pollution (Barcelona Convention) was amended in 1995 to broaden its original scope on pollution to integrate protection of the marine environment and the natural resources.<sup>13</sup>

In addition to the conservation oriented agreements, the notion of ecosystem management has also been taken up by a number of marine sectoral activities, in particular fisheries. FAO adopted the *Code of Conduct for Responsible Fisheries* in 1995 that set forward the ecosystem approach to fisheries and recognized opportunities to integrate MPAs as a fisheries management tool.<sup>14</sup> FAO later developed technical guidelines on the design, implementation and testing of MPAs in fisheries management to assist its member states to achieve the World Summit on Sustainable Development (WSSD) goal with respect to representative networks of MPAs by 2012.<sup>15</sup> As a result, many regional fisheries management organizations are increasingly considering establishing MPAs within their areas of application. Until 2002, the majority of international commitments for ocean conservation focused on achieving an integrated approach to ocean management and highlighted MPAs primarily as one measure among others that could help in the implementation of such an approach.

### Numerical Targets for MPA Coverage

In 2006, the Convention on Biological Diversity further reinforced the 2012 MPA target set by WSSD, by adopting a number of biome-specific sub-targets. Specifically,

12. WSSD, "Plan of Implementation of the World Summit on Sustainable Development," (United Nations, 2002).

13. See UNEP website: <<http://www.unep.org/regionalseas/>>.

14. FAO, *Code of Conduct for Responsible Fisheries* (Rome: Food and Agriculture Organization of the United Nations, 1995).

15. FAO, "Report of the twenty-sixth session of the Committee on Fisheries. Rome, 7–11 March 2005," Committee on Fisheries (COFI), Food and Agriculture Organization of the United Nations, FAO Fisheries Report No. 780 (Rome, 2005).

these focused on the agreement that “at least 10% of each of the world’s ecological regions [should be] effectively conserved” (target 1.1), and that “areas of particular importance to biodiversity [should be] protected” (target 1.2).<sup>16</sup> For the past few years, these targets have dominated the marine conservation agenda of countries, NGOs and donor agencies. They have spurred numerous dedicated initiatives and attracted resources to support their achievement. The focus for these efforts was on protecting areas of importance for biodiversity, with their objectives generally focusing on conservation and management of habitats, species, or genetic diversity.

In 2010, Toropova et al. provided an assessment of where the global community stood with regard to the MPA target,<sup>17</sup> showing that while the total ocean area protected had risen by over 150 percent since 2003, the world was still far from achieving the 10 percent target, with only 1.31 percent of the ocean’s surface area designated within MPAs, and with uneven and patchy ecological representation. The global community was likely to fail to meet this target, as well as many others.<sup>18</sup>

The CBD meeting in Nagoya in 2010 had a strong focus on assessing progress, and led to the negotiation of a series of new targets for biodiversity conservation: the Aichi Targets. Not surprisingly these were heavily influenced by the perceived feasibility of the task as countries struggled to reach a compromise between ambitious and realistic targets. The MPA target was one of the most controversial to negotiate. There were lengthy debates as some countries argued for adopting a smaller percentage of the ocean surface to be protected, while others fought to keep the 10 percent target. The resulting compromise consisted of keeping the 10 percent figure with the addition of few but significant changes in the target’s scope. Aichi Target 11 states that “by 2020 ... 10 percent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.”

The revised language on spatial protection measures presented in Aichi Target 11 includes four novel concepts that are important to highlight:

*The Addition of the Areas of Particular Importance for Ecosystem Services*

A vision of “living in harmony with nature” overarches all the Aichi targets, and at various points the targets require a shift in the objectives and design of conservation

16. CBD, “COP 8 – Eighth Ordinary Meeting of the Conference of the Parties to the Convention on Biological Diversity. Curitiba, 20–31 March 2006. Decision VIII/15: Framework for monitoring implementation of the achievement of the 2010 target and integration of targets into the thematic programmes of work. Annex 4,” (United Nations Environment Programme, 2006).

17. C. Toropova, I. Meliane, D. Laffoley, E. Matthews and M. Spalding, eds., *Global Ocean Protection: Present Status and Future Possibilities* (Gland, Switzerland: IUCN, The Nature Conservancy, UNEP-WCMC, UNEP, UNU-IAS, Agence des aires marines protégées, France, 2010).

18. Butchart et al., n. 4 above.

measures to deliver benefits for people. This is specifically called for in Aichi Target 11, by adding ecosystem services alongside biodiversity as a central criterion for selecting conservation areas.

Such a shift is not controversial, in that many studies have highlighted the importance of MPAs for human well-being,<sup>19</sup> and such benefits are often listed as justification for establishing MPAs. Even so, it represents a significant shift from the 2010 protected areas targets, which remained focused on biodiversity benefits. It may also challenge some of the existing prioritization and site selection approaches that have tended to focus solely on maximizing biodiversity benefits.<sup>20</sup>

By calling for a specific inclusion of ecosystem services in spatial conservation goals, Aichi Target 11 makes explicit an acknowledged and important connection. Application of this concept, however, could bring some important changes to conservation planning.

### *The Notion of Equity*

The explicit use of the term “equitably managed” in Aichi Target 11 reflects both the importance of addressing equity and governance issues as fundamental to the success of MPAs, and the need to undertake further efforts in this regard. Equity issues regularly arise because MPAs will most likely affect user groups disproportionately.<sup>21</sup> There has also been a long history of conservation measures that were seen as top-down and harmful to local communities and users of natural resources.<sup>22</sup> This is now widely acknowledged and there has been a burgeoning of efforts to engage local and indigenous peoples in protected areas establishment and management. Principles of equity, power sharing, participation, and sharing of benefits are increasingly a norm in MPAs at local and national levels, and these same principles are being incorporated into government, NGO, and donor policies, and are being

19. A. Balmford et al., “Economic reasons for conserving wild nature,” *Science* 297, no. 5583 (2002): 950–953; N. Dudley et al., *Natural Solutions: Protected areas helping people cope with climate change* (Gland, Switzerland: IUCN WCPA, TNC, UNDP, WCS, The World Bank and WWF, 2010); C. Leisher, P. van Beukering and L.M. Scherl, *Nature’s Investment Bank: How marine protected areas contribute to poverty reduction* (Arlington, VA: The Nature Conservancy, 2007); C.M. Roberts, J.P. Hawkins and F.R. Gell, “The role of marine reserves in achieving sustainable fisheries,” *Philosophical Transactions of the Royal Society of London, B* 360, no. 123–132 (2005).

20. H. Leslie, “A synthesis of marine conservation planning approaches,” *Conservation Biology* 19, no. 6 (2005): 1701–1713; K.A. Wilson et al., “Conserving biodiversity efficiently: What to do, where, and when,” *PLoS Biology* 5, no. 9 (2007): e223.

21. M.B. Mascia, C.A. Claus and R. Naidoo, “Impacts of marine protected areas on fishing communities,” *Conservation Biology* 24, no. 5 (2010): 1424–1429; J.N. Sanchirico, K.A. Cochran and P.M. Emerson, *Marine Protected Areas: Economic and Social Implications*, (Washington D.C.: Resources for the Future, 2002).

22. D. Brockington and J. Igoe, “Eviction for conservation: A global overview,” *Conservation and Society* 4, no. 3 (2006): 424–470.

used as tools by communities to demand changes in policy and practice.<sup>23</sup> In some senses, then, the recognition of the need for equity in MPA management is simply an acknowledgement of an ongoing process, but there are still cases where user needs and local participation are not included.<sup>24</sup>

*The Notion of “Other Effective Area-based Conservation Measures”*

While earlier targets had a clear focus on MPAs, Aichi Target 11 explicitly recognizes that other spatial conservation measures, not recognized or recorded as MPAs, may also achieve important conservation gains. This wording may help to ensure that existing protected areas that have not been incorporated into formal datasets are not ignored, but it also allows for the inclusion of other spatial management interventions that may not meet the definition of a protected area. Part of the motivation for this change in the wording came from a concern by some Parties that protection is widespread even beyond clearly defined protected areas, and that a focus solely on the latter would make it hard, if not impossible, to achieve the target within the timeframe. Parties also argued that this clause was particularly important to ensure the inclusion of areas protected under fisheries regulations.

In sum, the clause clearly requires that the measures be effective, area-based, and with a conservation focus, but there remains an urgent need to further explore the extent and limits of what these “measures” might include. In Section IV we consider some of these ideas further.

*The Notion of “Integration into the Wider Landscapes and Seascapes”*

As highlighted above, all international commitments up to WSSD have promoted MPAs as *part* of the solution to marine conservation. MPAs cannot be effective in isolation, but need to be nested in a broader framework of integrated management, and complemented by other measures to reduce threats and impacts. The future of marine biodiversity, of associated ecosystem service benefits, and indeed of MPAs themselves, is heavily dependent on the management of their surrounding environments.<sup>25</sup>

23. A. Kothari, “Protected areas and people: the future of the past,” *Protected Areas Programme* 17, no. 2 (2008): 23–34.

24. P.J.S. Jones, “Marine reserve strategies: Issues, divergences and the search for middle ground,” *Reviews in Fish Biology and Fisheries* 11 (2002): 197–216; E. De Santo, P. Jones and A. Miller, “Fortress conservation at sea: A commentary on the Chagos marine protected area,” *Marine Policy* 35, no. 2 (2010): 258–260.

25. F. Douvère and C. Ehler, “Ecosystem-based marine spatial management: An evolving paradigm for the management of coastal and marine places,” *Ocean Yearbook* 23 (2009): 1–26; M.M. Foley et al., “Guiding ecological principles for marine spatial planning,” *Marine Policy* 34, no. 5 (2010); S. Katsanevakis et al., “Ecosystem-based marine spatial management: Review of concepts, policies, tools, and critical issues,” *Ocean & Coastal Management* 54, no. 11 (2011): 807–820.

Aichi Target 11 gives a valuable, formal expression to this fact and should be used to encourage the tracking not only of MPA coverage, but also of management of the wider environment in order to measure success. This provision provides a clear link between Target 11 and many of the other Aichi targets, including several that are particularly relevant to the marine environment (see Table 1). These targets have received less attention, but if properly applied would have a profound and positive influence on the use and condition of ocean space. They are central to designing and implementing an ecosystem-based approach for ocean and coastal management.

Table 1.—Nagoya Aichi Targets of particular relevance to marine and coastal settings

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| <p><b>Target 5</b><br/>By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.</p> <p><b>Target 6</b><br/>By 2020, all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem-based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.</p> <p><b>Target 8</b><br/>By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.</p> <p><b>Target 9</b><br/>By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.</p> <p><b>Target 10</b><br/>By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.</p> <p><b>Target 11</b><br/>By 2020, at least 17 percent of terrestrial and inland water areas, and 10 percent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.</p> <p><b>Target 14</b><br/>By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.</p> <p><b>Target 15</b><br/>By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 percent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.</p> |
|---|

Source: CBD, n. 5 above.

## II. GLOBAL MPA ANALYSIS

### Methods

The data for the analysis of MPA coverage were drawn from the World Database on Protected Areas.<sup>26</sup> This dataset has been in existence for over 30 years, and has formed the basis for an ongoing series of studies.<sup>27</sup> The WDPA itself is in a constant flux, with regular updates largely supplied by government sources, although sometimes through intermediaries (regional agencies, national agencies, and NGO compilations). The WDPA uses the IUCN definition of protected areas as the basic criterion for inclusion of data,<sup>28</sup> and relies on government sources to confirm related information, including whether or not sites contain marine components.

In any analysis of this kind it is necessary to make minor amendments to the version of WDPA that forms the starting point. These include the removal of likely errors and addition of new sites. Some of this takes the form of direct improvements to the public version of the WDPA, but in other cases there are corrections that cannot be made public because of the formal process for inclusion that must be followed. To this end our version of the dataset is slightly different from the public version.

Updating the dataset included the following modifications:

- 1) Inclusion of the WDPA sites not marked as marine, but believed to contain (and be designated for) marine elements. Although data providers to the WDPA in large part identify marine sites as such, this is not always the case. For this effort we therefore created a layer of all “non-marine” sites that overlapped the sea and calculated the area and proportion of the site that was apparently located over marine space. Not all of these sites are marine, some may simply be poorly georeferenced polygons, others may include a coastal area, but with no management or regulation for those areas. Following a general overview, sites were shortlisted following a basic rule

26. IUCN and UNEP-WCMC, “The World Database on Protected Areas (WDPA) May 2012 Release,” IUCN World Commission on Protected Areas and the UNEP World Conservation Monitoring Centre (Distributed by UNEP-WCMC, Cambridge, UK, 2012).

27. L. Wood, L. Fish, J. Laughren and D. Pauly, “Assessing progress towards global marine protection targets: shortfalls in information and action,” *Oryx* 42, no. 3 (2008): 340–351; S. Chape, J. Harrison, M. Spalding and I. Lysenko, “Measuring the extent and effectiveness of protected areas as an indicator for meeting global biodiversity targets,” *Proceedings of the Royal Society of London, B* 360, (2005): 443–455; M. Spalding, L. Fish and L. Wood, “Towards representative protection of the world’s coasts and oceans – progress, gaps and opportunities,” *Conservation Letters* 1, no. 5 (2008): 217–226; Toropova et al., n. 17 above.

28. A protected area is “a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values.” See N. Dudley, *Guidelines for Applying Protected Areas Management Categories* (Gland, Switzerland: IUCN, 2008).

combining total marine and proportion of marine coverage. This was followed by a *post-hoc* review that enabled some removal or inclusion of sites based on category (all sites with “marine” or similar words in their designation were included) or on geospatial indicators of marine presence (obviously misplaced sites such as those tracing a coastline or island boundary but offset).

- 2) Improvement of particular site information from other regional or national datasets where these were not included in the latest version of the WDPA (e.g., US MPAs for US Caribbean and Pacific territories; Caribbean Islands MPAs from The Nature Conservancy’s (TNC’s) regional database; and a small number of Indonesian islands from TNC),
- 3) New large sites. While MPAs are being continually designated and it is impossible to remain fully up-to-date, an internet-based search, including checking of all recent editions of *MPA News*,<sup>29</sup> was undertaken to ensure that large designations, at the scale likely to influence national and regional statistics, were included.

Previous studies of this sort excluded international designations. The reasons for this were twofold. First, almost all sites designated under the global conventions (e.g., Ramsar, World Heritage) are also protected under national regulations and so would still be counted. Secondly, the level of protection or additional protection provided by such designations was once somewhat limited, but this may be changing. The latest version of the WDPA includes a very large number of international sites covered by regional conventions (EU, OSPAR, CCAMLR), while we are aware of a small but not trivial number of sites covered by global conventions such as Ramsar that do not have matching national designation, but that do indeed provide some level of legal protection. There are also a number of newly designated sites in areas beyond national jurisdiction, which can only be governed through competent regional agreements, and one site (Rainbow Hydrothermal Vent Field, Azores) that has been designated in an extended jurisdiction claim for national level management.<sup>30</sup>

#### *Data Preparation*

Following the compilation of data from WDPA and other sources, duplicated sites were removed leaving a total of some 10,000 sites. These included 1,626 sites for which boundary information was unavailable, but centroid geographic co-ordinates are known. For these, a buffer was created around these centroids equal to the reported site area. For just 172 sites, the size of the site area was also unknown.

29. See *MPA News*: <<http://depts.washington.edu/impanews/>>.

30. M.C. Ribeiro, “The Rainbow: The first national marine protected area proposed under the high seas,” *The International Journal of Marine and Coastal Law* 25, no. 2 (2010): 183–207.



In most cases such sites are small and so we buffered these to create circular polygons of 1 km<sup>2</sup> following the protocol established in an earlier study.<sup>31</sup>

Many protected areas in the database are overlapping – most of this is real and related to the existence of multiple designations for the same location, such as stricter levels of protection within larger sites, or international designations overlapping national sites. Thus, while all sites were used for the calculation of MPA numbers per country, for the spatial analysis it was important to avoid double counting and so all overlapping polygons were dissolved to create a single layer for the intersection analysis.

### *Spatial Analysis*

With this final global layer, statistics were generated using ArcMap, calculating the spatial overlap of MPAs with the following layers:

- 1) Areas of potential jurisdiction – Recognizing that many areas are disputed, and that some countries have not yet ratified international conventions or registered claims, our map here covers areas of potential jurisdiction rather than legally defined Exclusive Economic Zones. The figures are drawn out from the coastline to the 200 nautical mile outer boundary or the intermediate boundary between nations. This information has been prepared at UNEP-WCMC from multiple sources.
- 2) Marine Ecoregions of the World (MEOW) – A set of intertidal and subtidal biogeographic regions extending from the coast to the 200 m depth contour, these form a nested hierarchy of 232 ecoregions within 62 provinces and 12 realms.<sup>32</sup>
- 3) Pelagic Provinces of the World – A set of biogeographic regions for the off-shelf epipelagic waters of the world, broadly aligned with the MEOW system, and non-overlapping.<sup>33</sup>
- 4) Benthic provinces – A set of benthic biogeographic regions that provide a near total cover of benthic waters for bathyal (defined in this system as extending from 300 m to 3,500 m deep) and abyssal (3,500 to 6,500 m). An

31. M. Spalding, L. Wood, C. Fitzgerald and K. Gjerde, “The 10% target: Where do we stand?,” in Toropova et al., n. 17 above, pp. 25–40. Note that in using this article, corrected statistics were released, which are used in this document and are available online: <[http://www.iucn.org/about/work/programmes/marine/marine\\_resources/marine\\_publications/?7040/global-ocean-protection](http://www.iucn.org/about/work/programmes/marine/marine_resources/marine_publications/?7040/global-ocean-protection)>.

32. M.D. Spalding et al., “Marine ecoregions of the world: A bioregionalization of coast and shelf areas,” *BioScience* 57, no. 7 (2007): 573–583.

33. M. Spalding, V. Agostini, S. Grant and J. Rice, “Pelagic provinces of the world: A biogeographic classification of the world’s surface pelagic waters,” *Ocean and Coastal Management* 90 (2012): 19–30.

early draft version was published by UNESCO, but this version is modified and was used in Toropova et al.<sup>34</sup>

The results from this overlay were also compared with findings from earlier studies, and are presented in maps and tables.

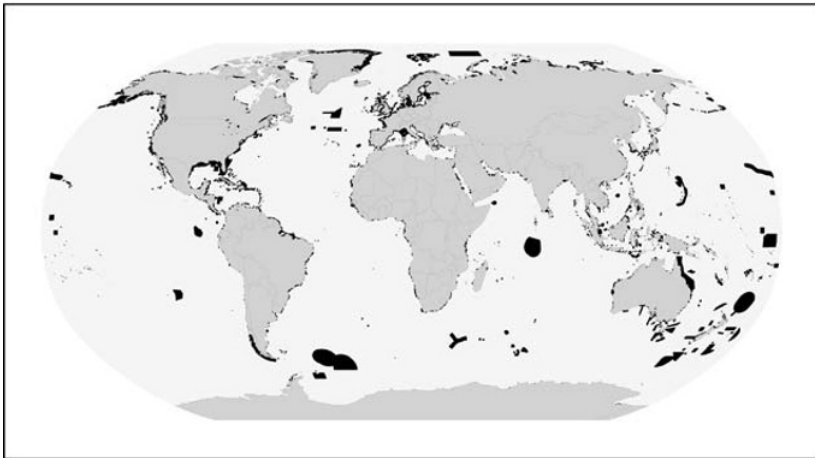
## Results

This study reviewed 10,280 marine protected areas. These cover over 8.3 million km<sup>2</sup> or 2.3 percent of the global ocean area (Figure 1). Table 2 lists the world's largest MPAs, with greater than 100,000 km<sup>2</sup> marine coverage. A relatively small number of very large MPAs dominate the maps and statistics.

### *Biogeographic Coverage*

As in previous studies the majority of MPAs lie in coastal and nearshore waters, with MPAs now covering 7.9 percent of continental shelf and equivalent areas (areas from the coastline to 200 m depth: MEOW ecoregions). Off-shelf waters coverage now stands at 1.79 percent of the world's oceans, and the great majority of that is still located relatively close to land, within jurisdictional waters.

FIGURE 1.—The global coverage of MPAs. Although many MPAs include land areas, only marine portions are marked.



34. UNESCO ed., *Global Open Oceans and Deep Seabed (GOODS) – Biogeographic Classification*. (Paris: Intergovernmental Oceanographic Commission, UNESCO-IOC, 2009); Toropova et al., n. 17 above.

Table 2.—The 17 MPAs with over 100,000 km<sup>2</sup> of marine coverage

| Site Name and Designation  | Country of Jurisdiction | Marine Extent (km <sup>2</sup> ) |
|--|-------------------------|----------------------------------|
| South Georgia and South Sandwich Islands Marine Protected Area                 | UK                      | 1,070,000                        |
| British Indian Ocean Territory Marine Protected Area (Chagos)                  | UK                      | 640,000                          |
| Kermadec Benthic Protection Area   | New Zealand             | 620,467                          |
| Phoenix Islands Protected Area and World Heritage Site                         | Kiribati                | 410,500                          |
| Papahānaumokuākea Marine National Monument and World Heritage Site*            | United States           | 362,075                          |
| Great Barrier Reef Marine Park and World Heritage Site                         | Australia               | 344,004                          |
| Marianas Trench Marine National Monument                                       | United States           | 246,600                          |
| Pacific Remote Islands Marine National Monument                                | United States           | 225,000                          |
| Motu Motiro Hiva Marine Park   | Chile                   | 203,374                          |
| Prince Edward Islands Marine Protected Area                                    | South Africa            | 180,000                          |
| Reef Fish Longline and Buoy Federal Fishery Management Zone**                  | United States           | 176,525                          |
| Macquarie Island Commonwealth Marine Reserve                                   | Australia               | 162,060                          |
| Charly-Gibbs Fracture Zone Marine Protected Area (OSPAR)                       | High Seas               | 145,420                          |
| Galapagos Marine Reserve, World Heritage Site and UNESCO-MAB Biosphere Reserve | Ecuador                 | 140,000                          |
| Greenland National Park and UNESCO-MAB Biosphere Reserve                       | Greenland               | 110,600                          |
| Antipodes Transect Benthic Protection Area                                     | New Zealand             | 110,185                          |
| East Florida Coast Closed Area Federal Fishery Management Zone**               | United States           | 102,035                          |

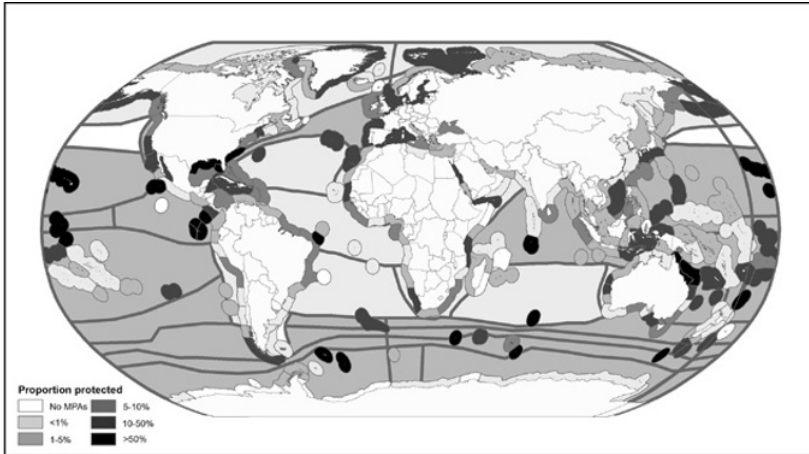
\* This site also provides additional protection over 95 percent of its extent through two Federal Threatened/Endangered Species Protected Areas (lobster closed area and longline protected area).

\*\* The WDPA includes a large number of fisheries management areas that offer only limited protection and may not be widely enforced. There is ongoing discussion as to whether such sites conform to the IUCN protected area definition.

Figure 2 shows the MPA coverage by coastal and pelagic ecoregions. Annex 1 provides summary statistics for the coastal biogeographic coverage while Annex 2 summarizes the data for pelagic and benthic biogeographic provinces. As might be expected, the offshore pelagic and benthic biogeographic provinces are less well represented, although two of the 14 bathyal provinces have over 11 percent MPA coverage.

At the finest resolution there is considerable variation in MPA coverage in coastal waters – some 13 MEOW ecoregions have no MPA coverage, but five of these lie in international or disputed waters. A further 50 ecoregions have less than one percent MPA coverage. By contrast 73 ecoregions have over ten percent MPA

FIGURE 2.—MPA coverage by ecoregion and pelagic provinces. For ease of visualisation the MEOW ecoregions are extended to 200 nautical miles, but the coverage here refers only to continental shelf and equivalent waters (down to 200 m), which in some cases is a very narrow coastal strip.



coverage, with 13 having over 75 percent coverage. The latter areas are typically far from population centres.

Looking at broader MEOW regions, there is now MPA representation in each of the 62 provinces. Four of the 12 coastal realms have exceeded ten percent MPA coverage, with the small Eastern Tropical Pacific realm having almost 20 percent coverage. By contrast, only two realms now have less than five percent MPA coverage: the Western Indo-Pacific and Temperate South America. Even these areas have undergone considerable growth since the last assessment.

### *Political Coverage*

The vast majority of MPAs fall within national jurisdictional areas. Their combined coverage represents 5.51 percent of this space. Of the 193 countries and territories considered in this assessment, a total of 28 countries and territories already have over ten percent of their jurisdictional area incorporated into MPAs (Table 3). This number represents a remarkable increase from just 12 countries listing in 2010. The numbers have been strongly boosted by the growth in very large sites (12 of the 28 jurisdictions in Table 3 include mega-MPAs listed in Table 2), but the expansion also extends to other areas where human use of marine space is intense, including 10 member states of the European Union.

By contrast 111 countries and territories (58 percent of the total) have less than 1 percent MPA coverage. This number includes 11 countries and territories that have no recorded MPAs. Some of these are small nations that do not greatly alter global statistics, while others are remote territories such as Pitcairn Island and Nauru, where relatively low levels of direct threats offer some indication that there are still considerable opportunities for biodiversity conservation.

The MPA coverage of extra jurisdictional or high seas waters remains remarkably low. Designation in these waters requires the existence of some level of international agreement and management. Thus far the existing areas recognized in the WDPA have been declared in only two areas of international collaboration: the Southern Ocean under the Commission for the Conservation of Antarctic Marine

Table 3.—The 28 countries or territories with over 10 percent MPA coverage

| Name   | No. of MPAs | Jurisdictional Area (km <sup>2</sup> ) | MPA coverage | Proportion under MPAs |
|--|-------------|--|--------------|-----------------------|
| Monaco                                       | 4           | 284                                    | 284          | 100.00%               |
| British Indian Ocean Territory               | 8           | 642,745                                | 641,062      | 99.7%                 |
| Slovenia                                     | 9           | 164                                    | 161          | 98.2%                 |
| Gibraltar                                    | 1           | 389                                    | 310          | 79.7%                 |
| South Georgia and The South Sandwich Islands | 3           | 1,445,888                              | 1,063,048    | 73.5%                 |
| Estonia                                      | 113         | 35,982                                 | 17,335       | 48.2%                 |
| Germany                                      | 130         | 56,258                                 | 26,497       | 47.1%                 |
| Belgium                                      | 9           | 3,468                                  | 1,255        | 36.2%                 |
| Finland                                      | 115         | 79,611                                 | 26,012       | 32.7%                 |
| Jordan                                       | 1           | 96                                     | 29           | 30.0%                 |
| New Zealand                                  | 120         | 4,120,297                              | 1,134,200    | 27.5%                 |
| Northern Mariana Islands                     | 11          | 971,617                                | 248,418      | 25.6%                 |
| France                                       | 254         | 334,316                                | 82,449       | 24.7%                 |
| Poland                                       | 30          | 31,954                                 | 7,211        | 22.6%                 |
| Netherlands                                  | 63          | 64,255                                 | 14,405       | 22.4%                 |
| Svalbard and Jan Mayen                       | 29          | 380,315                                | 77,494       | 20.4%                 |
| Denmark                                      | 238         | 100,657                                | 18,229       | 18.1%                 |
| Dominican Republic                           | 123         | 270,520                                | 43,753       | 16.2%                 |
| Heard Island and McDonald Islands            | 1           | 416,111                                | 64,102       | 15.4%                 |
| Sudan  | 3           | 67,396                                 | 8,814        | 13.1%                 |
| Ecuador                                      | 14          | 1,079,928                              | 139,819      | 13.0%                 |
| United States                                | 1045        | 8,745,687                              | 1,096,607    | 12.5%                 |
| United Arab Emirates                         | 8           | 53,143                                 | 6,653        | 12.5%                 |
| US Minor Outlying Islands*                   | 9           | 1,864,899                              | 225,000      | 12.1%                 |
| Kiribati                                     | 16          | 3,459,402                              | 408,406      | 11.8%                 |

(Continued)

Table 3.—(Cont.)

| Name         | No. of MPAs | Jurisdictional Area (km <sup>2</sup> ) | MPA coverage | Proportion under MPAs |
|--------------|-------------|--|--------------|-----------------------|
| South Africa | 52          | 1,542,637                              | 176,637      | 11.4%                 |
| Australia    | 304         | 7,437,707                              | 836,582      | 11.2%                 |
| Lithuania    | 16          | 6,147                                  | 683          | 11.1%                 |

\* For this statistic we excluded Midway and Kure, and Navassa Island in the Caribbean which are included in the mainland US statistics.

Living Resources (CCAMLR) and the North Atlantic under the Convention for the Protection of the Marine Environment of the North-East Atlantic (the OSPAR Convention). Combined, these sites cover 382,000 km<sup>2</sup>, which is 0.17 percent of the high seas.

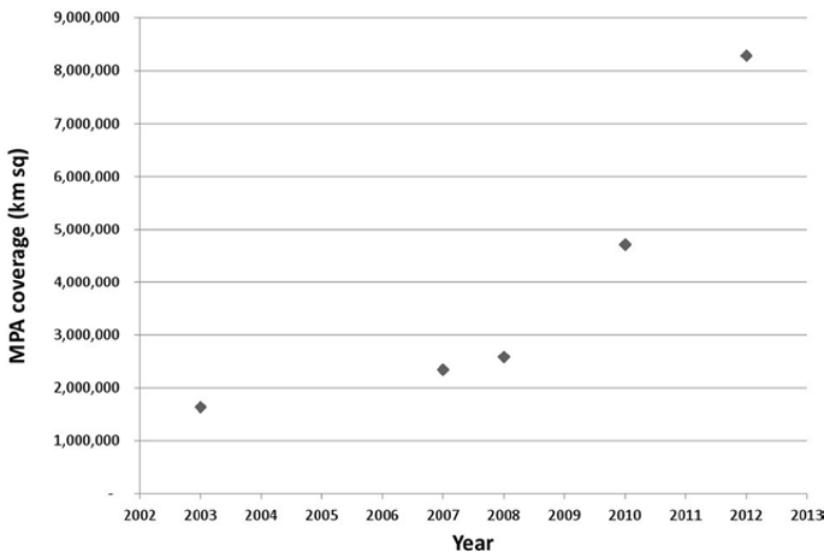
#### *Underlying Trends*

The global statistics represent a continuing rapid increase in MPA coverage, with an apparent fivefold increase in area over the last 10 years (Figure 3). This growth is geographically widespread, as shown by the increases in every realm. These numbers also draw attention to some important regional changes, including the increase of protection in the temperate Northern Atlantic from 1.6 percent to 12.9 percent MPA coverage.

As shown in Table 2, a relatively small number of MPAs exert a considerable influence over global statistics: the 20 largest MPAs cover over 5 million km<sup>2</sup>, or 60 percent of the entire global MPA coverage. These sites have been fundamental in driving changes, but there are other important trends and patterns in protected areas designations, a number of which we highlight below:

- New very large MPAs – much of the growth over the last decade has been driven by the designation of just a small number of very large sites. For example since the 2010 summary statistics the addition of just 3 sites (South Georgia and South Sandwich Islands Marine Protected Area; the British Indian Ocean Territory Marine Protected Area (Chagos); and Motu Motiro Hiva Marine Park, Chile), has added over 1.9 million km<sup>2</sup> to the global total. These three sites represent 23 percent of the world's MPA coverage.
- The appearance of extensive high seas protected areas began only in 2010 with declaration of the South Orkney Islands Southern Shelf Marine Protected Area and the six OSPAR MPAs in the North Atlantic, together adding over 380,000 km<sup>2</sup>.
- The inclusion of fisheries protected areas into global statistics is noteworthy, as are a number of very large tracts of ocean managed for fisheries, notably Federal Fisheries Management Zones in the US and Benthic Protection Areas in New Zealand. These categories alone cover 549,000 km<sup>2</sup> and 1.874 million km<sup>2</sup>

FIGURE 3.—Summary of MPA coverage from recent WDPA assessments.



Source: The 2012 statistic comes from this work. Sources for the other numbers are as follows: for 2003: S. Chape, M. Spalding, and M. Jenkins, *The World's Protected Areas. Status, Values, and Prospects in the Twenty-first Century* (Berkeley, California: University of California Press, 2008); for 2007: Wood et al., n. 27 above; for 2008: Spalding et al., n. 27 above; and for 2010: Spalding et al., n. 31 above.

respectively. While the New Zealand sites were only declared in 2007 and were included in the 2010 assessment, some of the US sites date back to 1983, but have only recently been included in the WDPA.

- The addition of international site designations has also had an important influence. While sites covered under global agreements such as World Heritage and Ramsar typically overlap existing sites and so will not alter statistics, a number of regional conventions include sites that do not have other existing national protection. Perhaps the most important for influencing global statistics are the Special Protection Areas and Sites of Community Importance, declared under the EU Birds Directive and Habitats Directive respectively. These add 951 sites, covering some 208,000 km<sup>2</sup> of European seas. Most of these sites are relatively new, and so their appearance in this study does represent real growth to the network rather than a change in approach.

In November 2012 the largest single addition to the global MPA network was made with the declaration of 2.3 million km<sup>2</sup> of new sites around Australia, including the 1 million km<sup>2</sup> Coral Sea Commonwealth Marine Reserve. These are not included in our main statistics, but they bring the total MPA coverage to 2.93% of the global oceans, and 7.1% of jurisdictional waters. It is noteworthy that declaration was made without imposing any changes to management on the ground. Further rapid growth is to be expected, with 2.5 million km<sup>2</sup> currently being developed in new sites in the Southern Cook Islands and New Caledonia alone.

*MPA Coverage Summary*

This brief analysis clearly shows recent dramatic increases in global MPA coverage. The geographic scope of MPA coverage is global, with notable increases in both biogeographic and political realms that were significantly under-represented in earlier studies.

While high seas MPA coverage is still very low, the appearance of the first sites in the North Atlantic represents a significant change and may offer a precedent for other regional approaches for high seas MPAs. There are also further patterns in the coverage. Most of the global statistics are driven by a small number of very large sites and a review of these sites shows that many are located in remote locations, where protection costs per unit area are relatively low and where there are fewer challenges or conflicts from local stakeholders.<sup>35</sup>

Rates of progress suggest that it may well be possible to attain 10 percent MPA coverage by 2020, but it is important to interpret such numbers with considerable caution. Firstly, MPA coverage may not equate to protection – sites may be ineffective due to failures in management or design. In addition, consideration of simple coverage ignores some of the considerable challenges of placing MPAs in the most effective settings to provide the most benefit for marine biodiversity and for people. It also cannot provide any indication of how such sites are aligned with management measures across wider seascapes and adjacent lands.

It is clear that the global MPA estate still only provides a partial coverage of the oceans. Despite rapid growth of protection there remain notable gaps in the global MPA estate, whether looked at from a biogeographic or a political perspective. Such measures, however, are only a partial picture: there may also be weaknesses in terms of what is being counted, or indeed excluded, from studies such as this. Aichi Target 11 points to a need for a much broader perspective, both in terms of what is included as spatial conservation measures, and the metrics against which such coverage is assessed. The following section will consider some of the challenges of using MPA coverage as a primary metric of progress in marine conservation, and some of the wider needs for assessing progress in marine conservation efforts required under Aichi Target 11.

### III. ASSESSING PROGRESS TOWARDS TARGETS

The dramatic acceleration of MPA coverage in recent years, pointing as it does to a very real likelihood of attaining the areal extent targeted under international agreements provides an important, even urgent, prompt to revisit precisely what is being protected and how much real protection is being achieved. As mentioned, Aichi

35. A. Balmford et al., “The worldwide costs of marine protected areas,” *Proceedings of the National Academy of Sciences* 101, no. 26 (2004): 9694–9697.



Target 11 does not simply require MPA coverage, nor does it solely target biodiversity. In this section we first consider what has been counted in this and earlier reviews of MPA coverage, and what may have been left out. We then go on to consider progress on some of the other criteria specified under the Aichi Targets.

## Spatial Coverage

### *What MPAs are Counted?*

In looking at the global map and statistics for MPA coverage, it is important to be aware of what is included in terms of both definition and efficacy, but also at what may be missing. The definition of a protected area used by IUCN (and WDPA) is relatively broad. Sites must have nature conservation as a primary objective rather than an incidental gain, but such conservation can be limited, even to just a subset of species or habitats, or a subset of threats acting on any site.<sup>36</sup> Such variability is sometimes overlooked by those reading the statistics, but is important. Simple MPA coverage assessments make no differentiation between sites where there may just be a few simple fisheries or pollution regulations and others where no natural resources can be extracted or that do not allow any access at all.

Associated with the broad definition is a range of interpretation by the data suppliers to WDPA of which sites meet this definition, and while useful efforts have recently been made to improve understanding of these definitions,<sup>37</sup> the possibility for varied interpretation remains. This is perhaps best exemplified by the USA. In recent years there have been notable efforts to develop a centralized list of protected areas, which in this large country include private, county, state, and federal protected areas, with sites at each level being developed by multiple departments, sectors, or stakeholders. As a result, the task is not simple. Two groups have developed databases – the Protected Areas Database of the US (PAD-US),<sup>38</sup> managed by the USGS Gap Analysis Program and the National Marine Protected Areas Center run by NOAA.<sup>39</sup> Both groups have been collaborating with each other and indeed with WDPA to develop a common framework and classification and means of cross-walking between national definitions and the IUCN definitions and management categories. In reality there have been considerable challenges with this task. Both datasets contain a number of spatial management measures that may not meet the IUCN definition (such as narrowly targeted fisheries regulations, seasonal or short-term

36. Dudley, n. 28 above.

37. J. Day et al., "Guidelines for Applying the IUCN Protected Area Management Categories to Marine Protected Areas," IUCN, Best Practice Protected Area Guidelines Series (Gland, Switzerland, 2012); S. Wells and J. Day, "Application of the IUCN protected area management categories in the marine environment," *Parks* 14, no. 3 (2005): 28–38.

38. See USGS Gap Analysis Program: <<http://gapanalysis.usgs.gov>>.

39. See National Marine Protected Areas Center: <<http://www.mpa.gov>>.

protection measures); however, there are other sites whose inclusion or exclusion under the IUCN definition is unclear, perhaps even arbitrary. The MPAs currently held in the WDPA for the USA and associated territories currently cover 13.2 percent of the US jurisdictional space, but sites include a number of very large areas with fishery regulations that are limited in overall scope and that might not be considered as MPAs by other countries. Two analyses from the MPA Center database point to the extraordinary range of “protection” that can be generated using different MPA definitions. Using their full listing of 1,681 sites, some 40 percent of US jurisdictional waters fell within MPAs in 2011. By contrast, filtering the database to only include marine reserves (areas where extractive uses are forbidden) the list drops to only 223 sites covering some 3.1 percent of US waters, with over 95 percent of this area being located in the Papahānaumokuākea Marine National Monument in Hawaii.<sup>40</sup>

The decision on what level of fisheries management to “count” as MPAs is not only a debate in the USA. For example, WDPA contains New Zealand’s system of Benthic Protection Areas, some of the largest MPAs in the world, where fisheries restrictions prohibit benthic trawling and also protect a 100 m vertical buffer above the seabed. Very similar regulations have been enacted in the European Union over most of the waters around the Azores, Madeira, and the Canary Islands (where benthic trawling is not permitted, and nor is the use of a range of other fishing gears at depths below 200 m).<sup>41</sup> These sites are not in the WDPA, but they extend over 1.1 million km<sup>2</sup>. If they were included they would alter global statistics, and Portugal and Spain would become major MPA nations.

While other definitions exist, the IUCN definition of an MPA probably represents something close to consensus, given the widespread involvement of governments in providing data to WDPA, but there are clearly considerable challenges in applying this definition, and there are likely inconsistencies in the database that are the result of national level variation in decisions, interpretation, and even perhaps the diligence of data providers. Given this, there would be considerable value in improving the common understanding of the definition of an MPA. There is likely also a need to think further about whether this definition is sufficiently useful as a metric for conservation progress. A great strength of the US databases mentioned above is that they allow further scrutiny on the levels of protection, including the particular targets and management approaches developed by different sites.

40. L. Wenzel, T. McTigue and M. D’Iorio, “Marine Reserves in the United States,” MPA Center, NOAA Office of Ocean and Coastal Resource Management (Silver Spring, Maryland, 2011); L. Wenzel, M. D’Iorio and K. Yeager, “Snapshot of United States MPAs,” MPA Center, NOAA Office of Ocean and Coastal Resource Management, (Silver Spring, Maryland, 2011).

41. EC, “Council Regulation (EC) No. 1568/2005 of 20 September 2005 amending Regulation (EC) No. 850/98 as regards the protection of deep-water coral reefs from the effects of fishing in certain areas of the Atlantic Ocean,” (Official Journal L 252: 2005), Vol. 1568/2005.

*Other Effective Area-based Conservation Measures*

In the negotiation of Aichi Target 11, a number of Parties to the CBD were concerned about issues relating to inconsistencies of definitions of MPAs. There was also a general concern that the target should not be too narrowly defined, but be achievable at a relatively fast rate. These factors played an important part in the decision to add the concept of “other effective area-based conservation measures” to be counted alongside MPAs under the revised Aichi Target 11. Unfortunately, beyond these initial discussions there has been little debate as to what can be counted as other measures, leaving a potentially large flaw in the process that could undermine the overall purpose of establishing a numerical target. Here we offer three classes of “other measures” that may be relevant and may merit further discussion and refinement:

- 1) From the original negotiations there is certainly a tacit recognition that many sites that do meet the definition of an MPA are simply not included in global or regional datasets. This may simply be a failure of reporting, from the oversight of certain sectors such as fisheries, private, local or non-legal/traditional protected areas, through to an overly narrow interpretation of the protected area definitions.
- 2) Other measures could also allow for the wider interpretation of how an MPA might be defined. While IUCN’s protected area definition is widely used, there are others that are even broader in scope. FAO, for example, describes an MPA as “any marine geographical area that is afforded greater protection than the surrounding waters for biodiversity conservation or fisheries management purposes” noting that such a definition could even include some entire EEZ areas.<sup>42</sup> This definition, like that of the US MPA Center described above, allows the inclusion of many large fishery management areas.<sup>43</sup> The CBD also has a definition that covers “any defined area ... reserved ... with the effect that its marine and/or coastal biodiversity enjoys a higher level of protection than its surroundings.”<sup>44</sup> Depending on interpretation such a definition could allow for many, perhaps all of the areas covered under regional fisheries agreements and Regional Fisheries Management Organizations.
- 3) Both IUCN and to some degree FAO and others are focused on sites that are declared for biodiversity (and for fisheries management in the case of FAO). In reality there are many other spatial management measures that achieve

42. FAO, “Marine protected areas and fisheries,” (Rome: Food and Agriculture Organization of the United Nations, FAO Technical Guidelines for Responsible Fisheries, 2011).

43. Wenzel et al., n. 40 above.

44. CBD, “COP 7 – Seventh Ordinary Meeting of the Conference of the Parties to the Convention on Biological Diversity. Kuala Lumpur, Malaysia, 9–20 February 2004. Decision VII/28: Protected areas (Articles 8 (a) to (e)),” (United Nations Environment Programme, 2004).

“incidental” or de facto conservation benefits. These might include sites where fisheries, military, or industrial uses or restrictions create de facto protection by restricting damaging practices, and might include cultural sites such as shipwrecks. While IUCN recognises that such sites may be valuable, they fall outside of the IUCN definition and are not included in the WDPA.<sup>45</sup>

A subset of this latter group may occur where overlapping spatial management measures create a combined management framework directly equivalent to an MPA. While the individual measures may be insufficient to meet the definition of an MPA (single species protection, limited gear restrictions, seasonal limits), the combination can have exactly the same impact as an MPA. Thus, when the world’s largest MPA, the South Georgia and South Sandwich Islands Marine Protected Area, was declared in 2012, a government press release noted that the MPA “enshrines in law the existing levels of protection and the current access to fishing in the seas around South Georgia.”<sup>46</sup> In other words, designation made no difference to the legal or management regime in this area, but designation led to inclusion in the global assessment of MPA coverage and led to a significant change in global MPA statistics.

As with more clearly defined MPAs, there is potentially enormous variability of interpretation of these “other measures.” For example, there are strong arguments to support the inclusion of a large tract of the Southern Ocean falling under the Convention for the Conservation of Antarctic Marine Living resources (CCAMLR) – this area is highly managed and has even been assigned a management category under the IUCN definition of MPA.<sup>47</sup> More contentious, but not beyond argument might be some of the more effective fisheries management areas. For example, the Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Interest restricts and controls tuna fishing operations, including activities that might threaten other species such as whale sharks, in an area that covers over one-quarter of the world’s tuna supply. The Nauru Agreement covers 4.5 million km<sup>2</sup> while CCAMLR covers over 35 million km<sup>2</sup> (10 percent of the entire ocean surface). The inclusion of either would utterly change global summary statistics, and they are not unique – the Indian and Southern Ocean Whale Sanctuaries established under the International Whaling Convention cover tens of millions of square kilometres, and, although smaller, a growing number of countries are designating their entire EEZ areas as shark sanctuaries.

As with IUCN style protected areas, these “other effective” sites need to be better defined if they are to be used to assess progress and indeed if Aichi Target 11 is to

45. Dudley, n. 28 above.

46. Government of South Georgia and the South Sandwich Islands, “Press Release: South Georgia and the South Sandwich Islands Marine Protected Area,” (Stanley, Falkland Islands: Government House, 2012).

47. Day et al., n. 37 above.

remain a useful target. There may be a strong case for maintaining a broad definition of both MPAs and other effective measures, but if this is done then further thought may be needed to encourage, track, and report on a portfolio of protection approaches.

#### *Further Criteria for Assessment*

Of course measures of spatial extent alone cannot be directly equated to progress in attaining Aichi Target 11 with its goal that “10 percent of coastal and marine areas, especially areas of particular importance for *biodiversity* and *ecosystem services*, are conserved through *effectively and equitably managed, ecologically representative and well connected systems* of protected areas and other effective area-based conservation measures, and *integrated into the wider landscapes and seascapes*” (emphasis added). Here we offer brief thoughts on how such requirements might be assessed and some thoughts on progress relative to the target.

#### *Important for Biodiversity and Ecologically Representative*

Thanks to the relatively new global biogeographic classifications, it is now possible to have at least a partial view of ecological representation in the global MPA estate (Section II). Such classifications, however, provide broad generalisations of patterns in the distribution of species, ecosystems and evolutionary processes. They do not capture the finer distribution of individual habitats and species.

In order to support the conservation of biodiversity it is necessary not only that biodiversity should be fully incorporated into spatial conservation planning, but that such planning should take into account the ecological needs of species as well as wider ecosystem processes. Sites must contain sufficiently large populations of target species to ensure continued survival, with replication to provide additional security. Networks of sites must be built to allow for different life-history phases, including pelagic larval phases and migratory patterns. Increasing volumes of information are available at global levels on the distribution of diversity,<sup>48</sup> and future assessment could be made to at least gain a partial picture of species coverage (or subsets such as threatened, endemic or keystone species). Habitat distribution maps are less widely available at global scales but exceptions include systems often singled out for attention, such as coral reefs and mangrove forests. Recent studies have suggested that some of these are in fact well covered by MPAs (27 percent of coral reefs and 25 percent of mangrove forests), and further investigation along these lines can help to single out areas where there may still be gaps in MPA coverage.<sup>49</sup>

48. M.J. Costello et al., “A census of marine biodiversity knowledge, resources, and future challenges,” *PLoS ONE* 5, no. 8 (2010): e12110.

49. L. Burke, K. Reyter, M. Spalding and A.L. Perry, *Reefs at Risk Revisited* (Washington, D.C.: World Resources Institute, The Nature Conservancy, WorldFish Center, International

One effort to help the process of identifying and prioritizing biodiversity conservation in the open oceans and deep seas has been the drive to describe and map Ecologically and Biologically Significant Areas (EBSAs).<sup>50</sup> Recognizing that detailed spatial data on biodiversity in such areas are not widely available this process has also utilized proxy indicators such as productivity, seabed morphology and ocean currents to help identify priority areas for conservation attention.

#### *Importance for Ecosystem Services*

As mentioned, one of the most important distinguishing features of Aichi Target II was the specific requirement that marine conservation should target ecosystem services as well as biodiversity. This change is not in fact a radical departure from wider conservation thinking – the importance of nature for people was a defining feature of some of the earliest conservation agreements. But its specific inclusion in an Aichi Target for spatial conservation efforts is important and may reflect growing concern of a failure to act upon this connection in some areas.

That MPAs and equivalent areas can indeed support the provision of ecosystem services has long been an argument for their implementation. Much has been written about the roles of protected areas in enhancing fisheries, supporting tourism and recreation, in coastal protection, carbon sequestration, and poverty reduction.<sup>51</sup>

As with biodiversity protection, however, not all MPAs are equivalent and a process is needed to identify priorities and gaps in the global MPA coverage based on their role in enhancing ecosystem services. For most services, such enhancement will be greatest close to populations who can directly benefit from provisioning and cultural services; however, those same populations are often a cause of stress or

Coral Reef Action Network, UNEP World Conservation Monitoring Centre and Global Coral Reef Monitoring Network, 2011); M.D. Spalding, M. Kainuma and L. Collins, *World Atlas of Mangroves* (London: Earthscan, 2010).

50. CBD, "Fourteenth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice, 10–21 May 2010, Nairobi, Kenya. XIV/3. In-depth review of the implementation of the programme of work on marine and coastal biological diversity," (United Nations Environment Programme, 2010).

51. C.J. Klein, C. Steinback, M. Watts, A.J. Scholz and H.P. Possingham, "Spatial marine zoning for fisheries and conservation," *Frontiers in Ecology and the Environment* (2009): doi:10.1890/090047; J.A. Garcia-Charton et al., "Effectiveness of European Atlanto-Mediterranean MPAs: Do they accomplish the expected effects on populations, communities and ecosystems?," *Journal for Nature Conservation* 16, no. 4 (2008): 193–221; I. Tetreault and R.F. Ambrose, "Temperate marine reserves enhance targeted but not untargeted fishes in multiple no-take MPAs," *Ecological Applications* 17, no. 8 (2007): 2251–2267; J. Wielgus et al., "Coral reef quality and recreation fees in marine protected areas," *Conservation Letters* 3, no. 1 (2010): 38–44; E. Green and R. Donnelly, "Recreational scuba diving in Caribbean marine protected areas. Do the users pay?," *Ambio* 32, no. 2 (2003): 140–144; D.d'A. Laffoley and G. Grimsditch, eds., *The Management of Natural Coastal Carbon Sinks* (Gland, Switzerland: IUCN, 2009). See also Leisher et al. and Roberts et al., n. 19 above; and FAO, n. 42 above.

impact on marine biodiversity, creating a paradox. Areas of greatest importance for biodiversity often lie some distance from human populations, but those of greatest importance for their ecosystem services are likely to lie close to human populations.

In fact, it is the very existence of this paradox that makes the inclusion of ecosystem services in Aichi Target 11 so important. Conservation offers a solution not only to the problem of biodiversity loss, but also to declining ecosystem service delivery. Well-run, effective MPAs should be able to counter the negative impacts of humans on biodiversity, and should at the same time be able to provide for ongoing and higher value ecosystem services than unmanaged sites in the same location. Caution is needed, however. In certain settings the designation of MPAs can actually reduce apparent values of certain ecosystem services, closing off avenues of income or food provision by reducing access or restricting harvests. This is particularly the case if assessments only look at short-term influences, only measure single benefits, or do not look at spill-over benefits to wider regions.

At present the greatest efforts towards MPA establishment are currently located away from human populations. In a study of coral reef protected areas, Burke et al. noted that “MPAs, particularly large sites, are located disproportionately in areas of low fishing pressure, and management effectiveness tends to be lower in areas of high fishing pressure.”<sup>52</sup> This same trend of MPAs being located away from human populations is also illustrated in the comparison of MPA coverage with coastal population density statistics by ecoregion in Figure 4.

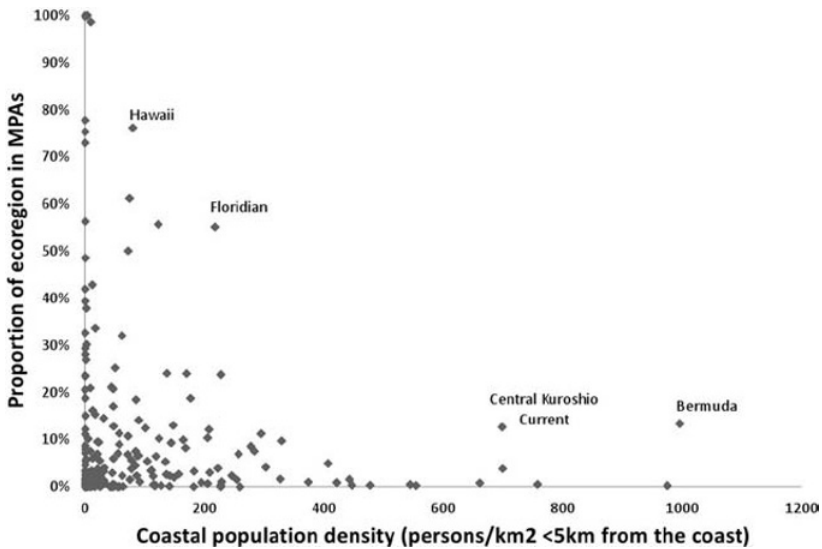
Remote MPAs do of course protect some important ecosystem services: they may be important refugia, nursery and spawning areas, or indeed offer large-scale regulating services such as water purification or climate regulation. Even so, it seems likely that progress towards Aichi Target 11 will require a greater focus on the high-value local ecosystem service benefits that will require increasing focus on MPAs and equivalent areas closer to human populations. Achieving the revised Aichi Target 11 requires setting in motion a process to guide Parties to identify areas that best yield such services and better link to delivering social, cultural, and economic benefits to communities.

### *Effectively and Equitably Managed*

Many sites set aside for conservation purposes are less effective than intended, due to problems either in site design or in subsequent management, or both. Effective conservation requires both planning and implementation. Many protected areas suffer from impacts arising beyond their boundaries and may be ineffective in conserving their biota. Others may lack a sufficiently robust regulatory regime to achieve their intended aims, or may be poorly designed with respect to key species or habitats, excluding key areas for certain species or life-history phases. For these, even

52. Burke et al., n. 49 above.

FIGURE 4.—A comparison of MPA coverage in coastal waters with coastal population density. Data for both use the MEOW ecoregions as spatial units and some outlying ecoregions are labelled. Coastal population densities were generated from CIESIN and CIAT population maps for populations within 5 km of the coast.



Source: CIESIN AND CIAT, "GRIDDED POPULATION OF THE WORLD VERSION 3 (GPWv3)," (Distributed by Center for International Earth Science Information Network (CIESIN), Columbia University and Centro Internacional de Agricultura Tropical (CIAT), Palisades, New York, 2006).

perfect application of the rules would be insufficient. Yet more sites fail to be managed effectively: they lack the resources or the commitment to be managed according to their regulatory regime or management plan, or the rules are poorly understood or implemented, and the biota is damaged or lost.<sup>53</sup>

Although there have been a number of efforts to look at management effectiveness,<sup>54</sup> there is, as yet, no means to assess this globally. Burke et al. were able to apply a three-level scoring of effectiveness to coral reef MPAs worldwide and were able to score 1,147 sites. Of these, only 15 percent of sites were considered fully effective, 38 percent partially effective and 47 percent ineffective.<sup>55</sup>

53. T. Agardy, G.N. di Sciara and P. Christie, "Mind the Gap: Addressing the shortcomings of marine protected areas through large scale marine spatial planning," *Marine Policy* 35, no. 2 (2011): 226–232.

54. F. Leverington et al., "A global analysis of protected area management effectiveness," *Environmental Management* 46, no. 5 (2010): 685–698; R.S. Pomeroy, J.E. Parks and L.M. Watson, *How is your MPA doing? A guidebook of natural and social indicators for evaluating marine protected areas management effectiveness* (IUCN, WWF and NOAA, 2004). See also Chape et al., n. 27 above.

55. Burke et al., n. 49 above.



MPAs can bring considerable benefits to adjacent communities, but they do not always do so.<sup>56</sup> The reference to equitable management underlines the need for ensuring stakeholder acceptance of MPAs, engaging them, as appropriate in the designation and management of sites and any potential benefits that might accrue. Such equity clearly lies at the heart of many new movements in conservation, including the Locally Managed Marine Area (LMMA) movement,<sup>57</sup> as well as many new fisheries regulations such as spatial quotas and Territorial Use Rights in Fisheries (TURFs). Even so, some new MPAs have been accused of failing to achieve such agreement, perhaps most notably the celebrated Indian Ocean marine reserve in the Chagos Archipelago, which has won considerable acclaim as the world's largest no-take zone, but which is being challenged in courts and in ongoing debate for failing to garner the support of the Chagossian Islanders or the Mauritian Government that also claims sovereignty over the islands.<sup>58</sup>

#### *Well-connected Systems*

Marine biodiversity, more so than terrestrial, is highly interconnected over very large spatial scales. This occurs not only because of the dynamic, fluid nature of the ocean environment, but also because even apparently sedentary species typically have dispersal phases as eggs or larvae, during which they may travel vast distances. Furthermore, pelagic species, from plankton to the great whales, have vast ranges over which they may drift or actively migrate. Many threats too, such as pollution and disease, are widely and rapidly dispersed. These two factors raise the importance that conservation efforts are not isolated, but that MPAs are built into a network. Such a network will allow natural patterns of movements, as well as provide resilience in the face of impacts.

Wood et al. assessed the connectedness of MPAs, taking minimum size for MPAs and maximum distances for larval dispersal from earlier authors.<sup>59</sup> They estimated as a lower bound that only 18 percent of MPAs (but 54 percent by area) could be considered part of a network, while the higher bound was 49 percent of MPAs (80 percent by area). Such figures have likely increased following the threefold increase in MPA coverage since that publication, but such figures only discuss the connectedness of existing sites, and must be considered alongside the complete gaps in the network.

56. Mascia et al., n. 21 above.

57. C.Y. Bartlett, K. Pakoa and C. Manua, "Marine reserve phenomenon in the Pacific islands," *Marine Policy* 33, no. 4 (2009): 673–678.

58. P.H. Sand, "Fortress conservation trumps human rights? The 'marine protected area' in the Chagos Archipelago," *Journal of Environment and Development* 21, no. 1 (2012): 36–69; C.R.C. Sheppard et al., "Reefs and islands of the Chagos Archipelago, Indian Ocean: Why it is the world's largest no-take marine protected area," *Aquatic Conservation: Marine and Freshwater Ecosystems* (2012): 30. See also De Santo et al., n. 24 above.

59. Wood et al., n. 27 above.

*Integrated into the Wider Landscapes and Seascapes*

Linked to all of the other factors already considered, it is clear that, in isolation, MPAs and equivalent areas are not enough. Even with the most parsimonious distribution it would likely be impossible to provide protection for all marine biodiversity with only 10 percent MPA coverage. Even the best managed sites are still vulnerable to external factors that cannot be managed, from local effects of pollution to global impacts from warming and acidification.<sup>60</sup> The remaining 90 percent will also need to be managed for biodiversity, but also for the sustained supply of ecosystem services on which so many people depend. It is thus fundamental to the success of any MPAs that they be considered as part of a wider management strategy, including both marine and terrestrial management measures.<sup>61</sup> This call for wider management of landscapes and seascapes of course also provides a critical link to the wider array of Aichi targets. At the present time there are no global datasets on wider marine spatial planning, but an understanding of such measures would be an invaluable contribution to our understanding of progress in marine conservation.

#### IV. CONCLUSIONS AND FUTURE TRENDS

Over the first half of the 21st century, coastal populations are likely to continue growing at rates higher than the global average. Fisheries will likely remain a constant or growing pressure on marine resources, but there are also likely to be rapid increases in other uses of marine space, including oil, gas and mineral extraction, energy generation, aquaculture, shipping, and recreation. Coastal lands will also undergo dramatic alterations in order to provide living space, industrial production and food for growing populations. All of these changes will undoubtedly increase pressures on marine resources. Climate change will bring an additional suite of pressures from warming and acidification, as well as more unpredictable and spatially variable changes to storm patterns, ocean currents and surface water stratification. Sea-level rise is accelerating, raising the threat of erosion and inundation to many coastal and intertidal ecosystems.

Recognition of the impacts that these threats are likely to have not only on biodiversity, but also on ecosystem services for millions of people, has led to growing calls for action at local, national, and global levels. MPAs are widely recognized as part of the portfolio of tools needed to conserve marine biodiversity and support sustainable provision of socio-economic benefits.

60. B.E. Huntington, M. Karnauskas and D. Lirman, "Corals fail to recover at a Caribbean marine reserve despite ten years of reserve designation," *Coral Reefs* 30, no. 4 (2011): 1077–1085. See also Agardy et al., n. 53 above.

61. T. Agardy, *Ocean Zoning: Making Marine Management More Effective* (London: Earthscan, 2010). See also Katsanevakis et al., n. 25 above.

Recent trends in MPA coverage suggest that global coverage could reach 10 percent by 2020. Using a broader definition of MPAs and “equivalent areas” there is even a risk that some might claim that such a level has already been reached. Such apparent success, however, would mask some significant failings, and it is critically important to realize that Aichi Target 11 calls for a great deal more than MPA coverage.

Part of this caution arises from a number of concerns that have been raised in earlier publications. Many MPAs may be ineffective or partially effective, due to failure in design or management, and so their role in achieving conservation aims is minimal. Notwithstanding such concerns, the global coverage of MPAs is still uneven, meaning that the system, such as it is, is far from representative. Targets such as Aichi are not intended to be a single global end-point, but are calling for progress across both ecological and political space. Biogeographic reviews represent the best tool currently available for assessing ecological coverage and the present study shows progress, but also significant gaps with over a quarter of ecoregions being very far from the target and having less than 1 percent MPA coverage. Politically this uneven spread is even stronger, with 58 percent of countries and territories having less than 1 percent MPA coverage.

There are also concerns about what is being measured. Protected areas, as defined by IUCN, are a highly variable array of management interventions. The Aichi inclusion of “other spatial measures” enables further broadening of this definition. The result is that many extremely large sites could potentially be “counted” towards the overall goal. There are of course considerable benefits from using a broad range of management approaches, which enable different levels of use, and facilitate targeting key pressures, or safeguarding particular elements of biodiversity, social or economic value. At the same time the considerable benefits from stricter levels of protection (including no-take areas or marine reserves) must be acknowledged.

There is an urgent need to more clearly specify definitions of protection within the general Aichi framework. We would recommend that such specification would recognize the diversity of management approaches, but would also require that stricter levels of protection should be seen as an integral part of spatial conservation measures, and even that countries should be encouraged to set sub-targets for the inclusion of such areas.

Over and above these cautions, there is also a need to recognize that Aichi Target 11 was not simply a re-affirmation of earlier targets. Rather, in the development of the targets there was considerable discussion about new elements. These included the need for equitably managed sites, placed within a wider framework, and above all, the clear identification of the importance of conserving ecosystem services.

In order to better direct marine conservation efforts, there is therefore an urgent need to develop better measures to target and prioritize the protection of ecosystem services. We need to understand the distribution of ecosystem services and the potential benefits to these services that could be achieved through the implementation of MPAs and equivalent areas. Just as the CBD Secretariat and other international agencies have invested heavily in the development and promotion of

marine biogeographic classifications to aid assessments of representation in MPA networks,<sup>62</sup> and are currently investing in the identification of EBSAs to help prioritize biodiversity conservation, similar and equally strong approaches and initiatives are needed to ensure that human benefits are maximized.

We believe that applying such an approach will highlight a need for greater attention to the development of conservation measures close to centres of population where reliance on marine ecosystem services is high. This may look quite different from some existing prioritization efforts that have directed considerable attention towards the designation of large pristine sites. Of course the challenges and costs of marine conservation are greater in locations where pressures are high, but the potential social and economic benefits are great, and investments in such sites should see good returns.

While MPAs will always be central to marine conservation, such conservation will not be achieved solely through the application of MPAs. Both Target 11 and the other associated Aichi Targets point clearly to the need to place MPAs in a wider framework of conservation approaches. For this reason, tracking progress also requires a broader vision. More extensive and detailed information is needed on the spatial extent, and on the ecological and social efficacy, of management measures across all ocean space, not just the limited areas set aside as MPAs.

Successful and sustainable marine spatial management depends on a twin-track approach of MPAs couched within broader management settings. The aim of such management includes both maintaining biodiversity and enabling socio-economic development. The Aichi Targets firmly underline the tight linkage between the two. The vision behind Aichi is clear, and while better metrics are needed to assess progress, it is also necessary to change the way conservation efforts, particularly MPAs, are planned and implemented, to genuinely and effectively account for the needs of human societies. Progress is being made, notably at local levels with movements such as LMMAs, but also with increasing dialogue and interaction between fisheries and conservation agencies in a few places. The challenge ahead is how to scale up these efforts so that clear and tangible benefits in some locations can be communicated, and knowledge is transferred in order to accelerate uptake and implementation world-wide. A simplistic pursuit of simple MPA coverage targets is unlikely to help these efforts, and could even undermine progress.

62. M. Spalding et al., "Global Coastal and Marine Biogeographic Regionalization as a Support Tool for Implementation of CBD Programmes of Work. COP8 Information Document 34," Convention on Biological Diversity, Eighth Ordinary Meeting of the Conference of the Parties to the Convention on Biological Diversity Information Documents (Montreal, Canada, 2006). See also UNESCO, n. 34 above.

Annex I.—Protected areas coverage in coast and shelf waters (Marine Ecoregions of the World subdivisions) summarised to Realm and Province

| Realm Province                    | Total Area (km <sup>2</sup> ) | MPA coverage (km <sup>2</sup> ) | Proportion in MPAs | Proportion in MPAs 2010 |
|-----------------------------------|-------------------------------|---------------------------------|--------------------|-------------------------|
| Arctic                            | 7,618,499                     | 486,488                         | 6.39%              | 4.87%                   |
| Arctic                            | 7,618,499                     | 486,488                         | 6.39%              |                         |
| Temperate Northern Atlantic       | 4,176,804                     | 538,568                         | 12.89%             | 1.58%                   |
| Black Sea                         | 170,333                       | 9,029                           | 5.30%              |                         |
| Cold Temperate Northwest Atlantic | 890,207                       | 44,662                          | 5.02%              |                         |
| Lusitanian                        | 307,470                       | 28,697                          | 9.33%              |                         |
| Mediterranean Sea                 | 689,783                       | 55,585                          | 8.06%              |                         |
| Northern European Seas            | 1,746,866                     | 182,519                         | 10.45%             |                         |
| Warm Temperate Northwest Atlantic | 372,146                       | 218,076                         | 58.60%             |                         |
| Temperate Northern Pacific        | 3,029,848                     | 177,410                         | 5.86%              | 2.45%                   |
| Cold Temperate Northeast Pacific  | 557,439                       | 112,010                         | 20.09%             |                         |
| Cold Temperate Northwest Pacific  | 1,619,462                     | 25,757                          | 1.59%              |                         |
| Warm Temperate Northeast Pacific  | 186,962                       | 23,943                          | 12.81%             |                         |
| Warm Temperate Northwest Pacific  | 665,985                       | 15,700                          | 2.36%              |                         |
| Tropical Atlantic                 | 2,175,404                     | 242,267                         | 11.14%             | 6.42%                   |
| Gulf of Guinea                    | 376,773                       | 15,542                          | 4.12%              |                         |
| North Brazil Shelf                | 505,930                       | 36,972                          | 7.31%              |                         |
| St. Helena and Ascension Islands  | 1,263                         | 2                               | 0.13%              |                         |
| Tropical Northwestern Atlantic    | 1,019,164                     | 162,751                         | 15.97%             |                         |
| Tropical Southwestern Atlantic    | 198,504                       | 19,101                          | 9.62%              |                         |
| West African Transition           | 73,770                        | 7,900                           | 10.71%             |                         |
| Western Indo-Pacific              | 2,246,223                     | 108,919                         | 4.85%              | 1.75%                   |
| Andaman                           | 315,171                       | 13,842                          | 4.39%              |                         |
| Bay of Bengal                     | 289,807                       | 4,240                           | 1.46%              |                         |
| Central Indian Ocean Islands      | 79,363                        | 25,922                          | 32.66%             |                         |
| Red Sea and Gulf of Aden          | 286,367                       | 31,375                          | 10.96%             |                         |
| Somali/Arabian                    | 393,170                       | 11,453                          | 2.91%              |                         |
| West and South Indian Shelf       | 389,568                       | 8,780                           | 2.25%              |                         |
| Western Indian Ocean              | 492,777                       | 13,307                          | 2.70%              |                         |

*(Continued)*

## Annex 1.—(Cont.)

| Realm Province                       | Total Area (km <sup>2</sup> ) | MPA coverage (km <sup>2</sup> ) | Proportion in MPAs | Proportion in MPAs 2010 |
|--------------------------------------|-------------------------------|---------------------------------|--------------------|-------------------------|
| Central Indo-Pacific                 | 5,917,682                     | 511,861                         | 8.65%              | 7.17%                   |
| Eastern Coral Triangle               | 231,275                       | 4,738                           | 2.05%              |                         |
| Java Transitional                    | 67,268                        | 2,553                           | 3.79%              |                         |
| Lord Howe and Norfolk Islands        | 9,308                         | 2,355                           | 25.30%             |                         |
| Northeast Australian Shelf           | 292,417                       | 245,346                         | 83.90%             |                         |
| Northwest Australian Shelf           | 306,319                       | 8,454                           | 2.76%              |                         |
| Sahul Shelf                          | 1,322,713                     | 11,598                          | 0.88%              |                         |
| South China Sea                      | 544,931                       | 15,740                          | 2.89%              |                         |
| South Kuroshio                       | 42,684                        | 3,250                           | 7.61%              |                         |
| Sunda Shelf                          | 1,845,551                     | 72,011                          | 3.90%              |                         |
| Tropical Northwestern Pacific        | 58,456                        | 2,141                           | 3.66%              |                         |
| Tropical Southwestern Pacific        | 210,387                       | 51,314                          | 24.39%             |                         |
| Western Coral Triangle               | 986,374                       | 92,361                          | 9.36%              |                         |
| Eastern Indo-Pacific                 | 151,147                       | 29,922                          | 19.80%             | 19.59%                  |
| Central Polynesia                    | 16,643                        | 4,247                           | 25.52%             |                         |
| Easter Island                        | 716                           | 148                             | 20.63%             |                         |
| Hawaii                               | 31,690                        | 24,147                          | 76.20%             |                         |
| Marquesas                            | 4,659                         | 41                              | 0.89%              |                         |
| Marshall, Gilbert and Ellis Islands  | 49,561                        | 1,163                           | 2.35%              |                         |
| Southeast Polynesia                  | 47,879                        | 175                             | 0.37%              |                         |
| Tropical Eastern Pacific             | 255,738                       | 28,690                          | 11.22%             | 10.84%                  |
| Galapagos                            | 16,694                        | 16,694                          | 100.00%            |                         |
| Tropical East Pacific                | 239,044                       | 11,996                          | 5.02%              |                         |
| Temperate South America              | 1,705,859                     | 48,877                          | 2.87%              | 0.36%                   |
| Juan Fernández and Desventuradas     | 1,827                         | 19                              | 1.02%              |                         |
| Magellanic                           | 988,448                       | 40,677                          | 4.12%              |                         |
| Tristan Gough                        | 1,888                         | 746                             | 39.53%             |                         |
| Warm Temperate Southeastern Pacific  | 150,497                       | 2,705                           | 1.80%              |                         |
| Warm Temperate Southwestern Atlantic | 563,199                       | 4,731                           | 0.84%              |                         |
| Temperate Southern Africa            | 285,228                       | 16,489                          | 5.78%              | 2.54%                   |
| Agulhas                              | 122,750                       | 3,388                           | 2.76%              |                         |

Annex 1.—(Cont.)

| Realm Province                | Total Area (km <sup>2</sup> ) | MPA coverage (km <sup>2</sup> ) | Proportion in MPAs | Proportion in MPAs 2010 |
|-------------------------------|-------------------------------|---------------------------------|--------------------|-------------------------|
| Amsterdam-St Paul             | 934                           | 681                             | 73.00%             |                         |
| Benguela                      | 161,545                       | 12,419                          | 7.69%              |                         |
| Temperate Australasia         | 1,027,363                     | 69,982                          | 6.81%              | 5.49%                   |
| East Central Australian Shelf | 69,093                        | 14,889                          | 21.55%             |                         |
| Northern New Zealand          | 49,352                        | 1,864                           | 3.78%              |                         |
| Southeast Australian Shelf    | 241,501                       | 20,264                          | 8.39%              |                         |
| Southern New Zealand          | 241,031                       | 3,331                           | 1.38%              |                         |
| Southwest Australian Shelf    | 335,465                       | 13,083                          | 3.90%              |                         |
| West Central Australian Shelf | 90,922                        | 16,551                          | 18.20%             |                         |
| Southern Ocean                | 787,635                       | 67,470                          | 8.57%              | 3.58%                   |
| Continental High Antarctic    | 495,464                       | 39                              | 0.01%              |                         |
| Scotia Sea                    | 162,684                       | 38,973                          | 23.96%             |                         |
| Sub-Antarctic Islands         | 93,097                        | 19,476                          | 20.92%             |                         |
| Sub-Antarctic New Zealand     | 36,390                        | 8,981                           | 24.68%             |                         |

**Annex 2.—Protected areas coverage in offshore waters, including pelagic waters that are continuous and non-overlapping with the MEOW ecoregions, and the benthic provinces that lie below the pelagic systems and are subdivided into bathyal and abyssal**

| PROVINCE                 | Total Province Area (km <sup>2</sup> ) | MPA coverage (km <sup>2</sup> ) | Proportion Protected |
|--------------------------|--|---------------------------------|----------------------|
| <b>PELAGIC</b>           |  |                                 |                      |
| Agulhas Current          | 2,117,940                              | 16                              | 0.00%                |
| Antarctic                | 29,122,360                             | 1,072,947                       | 3.68%                |
| Antarctic Polar Front    | 14,117,819                             | 394,885                         | 2.80%                |
| Arctic                   | 7,801,078                              | 48,025                          | 0.62%                |
| Benguela Current         | 1,342,784                              | 1                               | 0.00%                |
| Black Sea                | 292,027                                | 0                               | 0.00%                |
| California Current       | 1,466,076                              | 34,529                          | 2.36%                |
| Canary Current           | 1,804,972                              | 1,353                           | 0.07%                |
| Eastern Tropical Pacific | 11,806,714                             | 144,635                         | 1.23%                |
| Equatorial Atlantic      | 16,101,173                             | 238                             | 0.00%                |
| Equatorial Pacific       | 9,199,274                              | 123,869                         | 1.35%                |

(Continued)

## Annex 2.—(Cont.)

| PROVINCE                    | Total Province Area (km <sup>2</sup> ) | MPA coverage (km <sup>2</sup> ) | Proportion Protected |
|-----------------------------|--|---------------------------------|----------------------|
| Guinea Current              | 626,188                                | 0                               | 0.00%                |
| Gulf Stream                 | 1,190,474                              | 51,191                          | 4.30%                |
| Humboldt Current            | 3,123,950                              | 351                             | 0.01%                |
| Indian Ocean Gyre           | 18,533,760                             | 3,296                           | 0.02%                |
| Indian Ocean Monsoon Gyre   | 19,157,870                             | 620,895                         | 3.24%                |
| Indonesian Through-Flow     | 3,594,813                              | 45,984                          | 1.28%                |
| Inter-American Seas         | 3,339,242                              | 140,470                         | 4.21%                |
| Kuroshio                    | 1,064,470                              | 11                              | 0.00%                |
| Leeuwin Current             | 1,365,671                              | 244                             | 0.025                |
| Malvinas Current            | 685,365                                | 0                               | 0.00%                |
| Mediterranean               | 1,844,484                              | 64,576                          | 3.50%                |
| Non-gyral Southwest Pacific | 7,814,970                              | 215,110                         | 2.75%                |
| North Atlantic Transitional | 6,193,791                              | 309,903                         | 5.00%                |
| North Central Atlantic Gyre | 12,187,095                             | 20,085                          | 0.16%                |
| North Central Pacific Gyre  | 36,331,917                             | 720,591                         | 1.98%                |
| North Pacific Transitional  | 7,388,208                              | 0                               | 0.00%                |
| Red Sea                     | 230,929                                | 596                             | 0.26%                |
| Sea of Japan/East Sea       | 741,738                                | 80                              | 0.01%                |
| Somali Current              | 2,609,947                              | 11,205                          | 0.43%                |
| South Central Atlantic Gyre | 14,770,289                             | 22,864                          | 0.15%                |
| South Central Pacific Gyre  | 41,536,470                             | 1,193,496                       | 2.87%                |
| South China Sea             | 1,595,689                              | 17,223                          | 1.08%                |
| Sub-Antarctic               | 16,821,595                             | 271,965                         | 1.62%                |
| Sub-Arctic Atlantic         | 4,319,373                              | 438                             | 0.01%                |
| Sub-Arctic Pacific          | 8,220,796                              | 17,397                          | 0.21%                |
| Subtropical Convergence     | 21,872,193                             | 413,280                         | 1.89%                |
| Subtotal                    | 332,333,505                            | 5,961,748                       | 1.79%                |
| <b>BATHYAL</b>              |  |                                 |                      |
| Antarctic                   | 6,239,495                              | 153,769                         | 2.46%                |
| Arctic                      | 4,675,701                              | 2,478                           | 0.05%                |
| Cocos Plate                 | 4,760,805                              | 129,406                         | 2.72%                |
| Indian                      | 14,351,188                             | 292,345                         | 2.04%                |

(Continued)



## Annex 2.—(Cont.)

| PROVINCE                       | Total Province Area (km <sup>2</sup> ) | MPA coverage (km <sup>2</sup> ) | Proportion Protected |
|--------------------------------|--|---------------------------------|----------------------|
| Nazca Plate                    | 1,186,925                              | 12                              | 0.00%                |
| New Zealand Kermadec           | 4,313,037                              | 492,423                         | 11.42%               |
| North Atlantic                 | 8,467,979                              | 293,269                         | 3.46%                |
| North Pacific                  | 1,383,672                              | 156,705                         | 11.33%               |
| Northern North Atlantic        | 3,424,116                              | 117,564                         | 3.43%                |
| Northern North Pacific         | 3,254,660                              | 47,047                          | 1.45%                |
| SE Pacific Ridges              | 7,567,978                              | 126,177                         | 1.67%                |
| South Atlantic                 | 6,128,669                              | 61,444                          | 1.00%                |
| Sub-Antarctic                  | 7,348,581                              | 636,148                         | 8.66%                |
| West Pacific                   | 10,140,311                             | 119,032                         | 1.17%                |
| Subtotal                       | 83,243,118                             | 2,627,819                       | 3.16%                |
| <b>ABYSSAL</b>                 |  |                                 |                      |
| Angola and Sierra Leone Basins | 7,438,812                              | -                               |                      |
| Arctic                         | 1,333,575                              | -                               |                      |
| Argentine Basin                | 5,605,402                              | -                               |                      |
| Brazil Basin                   | 6,896,187                              | 14,201                          | 0.21%                |
| Central Pacific                | 18,395,991                             | 287,234                         | 1.56%                |
| East Antarctic Indian          | 25,462,970                             | 573,009                         | 2.25%                |
| East Pacific Basins            | 14,277,171                             | 31,402                          | 0.22%                |
| Indian                         | 39,238,257                             | 581,220                         | 1.48%                |
| North Atlantic                 | 26,893,246                             | 82,860                          | 0.31%                |
| North Central Pacific          | 33,745,581                             | 460,017                         | 1.36%                |
| North Pacific                  | 14,588,870                             | 273                             | 0.00%                |
| South Pacific                  | 30,947,245                             | 773,685                         | 2.50%                |
| West Antarctic                 | 12,060,344                             | 19,862                          | 0.16%                |
| West Pacific Basins            | 1,242,108                              | 11,995                          | 0.97%                |
| Subtotal                       | 238,125,759                            | 2,835,757                       | 1.19%                |