Results and implications of the first global effort to identify ecologically or biologically significant marine areas

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Abstract

In 2004, the Parties to the Convention on Biological Diversity (CBD) took up a call from the United Nations (UN) for area-based planning, including marine protected areas, resulting in a global effort to describe ecologically or biologically significant marine areas (EBSAs). We summarize those results, assess their consistency and evaluate the regional workshop process. From 2011 to 2014 the Secretariat of the CBD held nine regional workshops involving experts from 92 countries and 79 regional or international bodies and covering 250 million km^2, two-thirds of the world ocean area. There was a wide variety in the 204 areas meeting the internationally agreed criteria for EBSAs, including differences in size (5.5 km^2 and 11.1M km^2) and the criteria on which they were selected. The highly participatory regional workshops that provided easy and consistent access to the relevant information and their formal recognition by the Conference of Parties to the CBD, has resulted in these 204 areas meeting the EBSA criteria (referred to as "EBSAs") that represent the only global internationally recognized suite of marine sites considered to be relatively more important from a biodiversity standpoint than their surroundings. This comes at a critical juncture in international negotiations. The UN Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction recently recommended moving forward with a new implementing agreement under the UN Convention on the Law of the Sea. The EBSA process provides a benchmark for internationally agreed scientific advice to support the international community in developing this new (and supporting existing) agreement.

Introduction

In 2004, the Parties to the Convention on Biological Diversity (CBD) took up a call from the United Nations (UN) for area-based planning, including marine protected areas, resulting in a global effort to describe ecologically or biologically significant marine areas (EBSAs). Originally driven by the commitment to establish marine protected areas in areas beyond national jurisdiction, this initiative has since broadened to inform marine spatial planning and other activities, both within and beyond national jurisdiction (Dunn et al. 2014).

From 2011 to 2014, the Secretariat of the CBD held nine regional workshops involving experts from 92 countries and 79 regional or international bodies. These workshops covered 250 million km^2, or two-thirds of the world ocean area, and described 204 areas in national and international waters meting the internationally agreed criteria for EBSAs (referred to as "EBSAs") (Fig. 1). EBSAs are being used by countries to support marine spatial planning in national waters and are ready to inform developing international negotiations on managing areas beyond national jurisdiction.

In 2015, the UN resolved to negotiate a new implementing agreement for biodiversity beyond national jurisdiction. A Preparatory Committee has been tasked to meet from 2015 to 2017 to make substantive recommendations to the General Assembly on elements of a draft text of an international legally-binding instrument under the UN Convention on the Law of the Sea. EBSAs therefore have an important role to play in future deliberations on biodiversity within and beyond national jurisdictions. It was agreed at the tenth meeting of the Conference of Parties to the CBD

(COP 10) in 2010 that EBSAs may require enhanced conservation and management measures, including through marine protected areas and impact assessments. A new instrument under the Law of the Sea could support the conservation and sustainable use of EBSAs.

In this paper, we describe the process that led to those workshops, the workshops themselves, and review the results, including some options for how EBSAs might one day be used to inform management of biodiversity in areas beyond national jurisdiction.

Policy Background

The United Nations Conference on Environment and Development (the Rio "Earth Summit") set forth Agenda 21, which calls on States to "*identify marine ecosystems exhibiting high levels of biodiversity and productivity and other critical habitat areas*" (UN 1992). The second Earth Summit confirmed the need to "*maintain the productivity and biodiversity of important and vulnerable marine and coastal areas, including in areas within and beyond national jurisdiction*" (UN 2002). Responding to these calls, the Convention on Biological Diversity (CBD) initiated a process in 2004 to develop and apply a criteria suite to describe ecologically or biologically significant marine areas (EBSAs) "*in need of protection, in open ocean waters and deep sea habitats*", which were agreed at COP 9 in 2008 (Table 1). Describing these areas was acknowledged as an important first step to use available scientific knowledge and methods to identify areas that might be included in a system of protected areas, or prioritised under other management approaches by competent international or national authorities (Dunn et al. 2014).

In 2010, Parties to the CBD, other Governments and relevant organizations were invited to use the agreed criteria suite:

> "*… to organize… a series of regional workshops, … with a primary objective to facilitate the description of ecologically or biologically significant marine areas through application of scientific criteria in annex I of decision IX/20 as well as other relevant compatible and complementary nationally and intergovernmentally agreed scientific criteria*"… (COP 10/29 para 32).

Regional Workshops

Nine EBSA workshops were convened by the CBD Secretariat between November 2011 and April 2014. All Parties to the CBD with interests in region covered by the particular workshop, along with relevant regional organisations were invited to nominate experts to attend– resulting in 122 country attendances and 112 organisation attendances (Table 2). Additional workshops have since been held in North-Eastern and North-Western Indian Ocean (data not reviewed by CBD COP, so not included here) and the Secretariat is working to organize additional workshops to cover the remaining ocean areas.

The geographic coverage of each workshop was determined by participants based on bioregional information presented at the workshop. The Exclusive Economic Zones (EEZs) of individual Parties present were included in the workshop boundaries only when Parties wished them to be. EEZs were typically excluded where an existing spatial management process was designed to achieve similar

objectives (e.g. Key Ecological Features in Australia, Canadian EBSA programs, marine bioregional planning in India, environmental values in Norwegian marine areas). EBSAs were not identified in the EEZs of countries not attending the workshop unless prior approval had been given; transboundary EBSAs were indicated with dashed lines where they overlapped the EEZ of a country not agreeing to describe EBSAs within their EEZ.

Participants' preparedness varied between workshops, from no prior engagement to holding preparatory meetings aimed at identifying potential EBSAs in their national waters and, in one region, attending a capacity building workshop to explain the EBSA initiative, share data and encourage early EBSA identification (http://www.cbd.int/marine/doc/soi-brochure-2012-en.pdf). All regional workshops started with a one-day training session.

A technical team helped access global, regional and national data (see Supplementary Materials), and introduced the EBSA criteria with guidelines and examples on their application based on the agreed interpretation (Table 1). The participating Parties and organisations developed EBSA descriptions, ranking each one against the EBSA criteria. Every EBSA description was discussed in plenary, assessed against all criteria, modified where necessary, archived on a Geographic Information System and fully documented before being submitted for approval in final plenary. Feedback in plenary, including that of the two technical teams, maintained consistency in how the criteria were applied. Officially, described areas had to meet only one of the seven criteria to be submitted to the COP; in practise the technical team supported Parties to rank each area against all criteria (insufficient information, low, medium or high) to assist in further interpretation, including identifying changing interpretation over time or different interpretations by the two technical teams.

The eleventh and twelfth meetings of the Conference of the Parties welcomed the 204 EBSAs described by the nine regional workshops (only the 203 with agreed boundaries are discussed here; Fig. 2). Following COP decisions, summary reports describing areas that met the criteria for EBSAs were submitted to the United Nations General Assembly and relevant Working Groups (UNGA 2013).

Characteristics of EBSAs described by the regional workshops

The EBSAs varied in size between 5.5 km^2 and 11.1M km^2 (Figure 3). Of the 203 described EBSAs, the boundaries of 109 were solely within one national jurisdiction, 28 included the jurisdiction of more than one country but did not extend into Areas Beyond National Jurisdiction (ABNJ), 35 crossed between national jurisdictions and the ABNJ, and 31 were solely within ABNJ (Table 2 and Fig. 4).

Workshops covering larger ocean areas tended to describe more EBSAs (r^2=0.37), but did not attract more countries (r^2=0.06) or organisations (r^2=0.03). Experts at the regional workshops ranked larger EBSAs as being more important for the survival and recovery of threatened and endangered species and habitats, and concluded that EBSAs further from shore were less likely disturbed by human activities and would have a comparatively higher degree of naturalness (Edgar et al. 2014; Supplemental Table 4). Conversely, EBSAs closer to shore were more likely to show greater biological diversity and productivity and more likely to be important for particular juvenile life history stages that are frequently associated with breeding or nursery areas in shallower waters, consistent with Heincke's Law (MacPherson & Duarte 1991; Beck et al. 2001). There were no significant differences between the two expert teams in workshop results, nor any trend in time (Unpublished data).

The Western South Pacific, Southeast Atlantic and Southern Indian Ocean workshops scored relatively close to, or under the median on all criteria (Fig. 5). These workshops also covered some of the largest regions and described the most EBSAs (Table 2). Apart from this none of the other workshops showed a clear grouping.

The Arctic environment was ranked by experts as most distinct from other environments assessed by regional workshops, due to its reduced importance for biological diversity and reduced importance for threatened and endangered species and habitat, but also because of its increased importance due to the presence of vulnerable and fragile habitats that support important life history stages of species. It is possible that the strong seasonal habitat characteristics and habitat use accounted for some of these differences.

Comparing the rankings provided by other regional workshops produces some expected trends. Biological productivity was ranked for higher importance in the Eastern Tropical and Temperate Pacific than the Western South Pacific, as would be expected from the stronger seasonal upwelling and associated increased primary production and fisheries biomass in this region (Pennington et al. 2006).

The Western South Pacific and the Arctic were ranked comparatively highly for naturalness, consistent with Halpern et al.'s (2008) global assessment of marine impact from17 sources of anthropogenic change. Areas that were considered to be highly impacted included several that agreed with regional expert opinion – inshore areas, the Northwest Atlantic, the Mediterranean, and the North Pacific – but the wider Caribbean and Western Mid-Atlantic areas were considered highly impacted by Halpern et al. (2008) but not by the regional workshops. Conversely, whereas Halpern et al. (2008) found the Eastern Tropical and Temperate Pacific, the Southeast Atlantic and the Southern Indian oceans to be relatively lowly impacted, regional experts found these areas to be relatively highly impacted (Fig. 5; Supplemental Table 4).

The consistent CBD presence and coordinated technical support from a broad range of experts (including the consistent presence of global organisations like BirdLife International and the Global Oceans Biodiversity Initiative) provided consistency between the regional workshops, despite the lack of overlap of regional experts. The differences between relative workshop rankings and regional expertise bear closer examination, particularly for the level of naturalness or human impact. They may be artefacts of an expert process, or alternatively indicate a difference between regional expert opinion accumulated over a lifetime and available data taken from an arbitrary point in time (Pinnegar & Engelhard 2008; Papworth 2009).

Evaluation of criteria used to identify EBSAs

The frequency with which each EBSA criterion was ranked as high was generally consistent (51-70%; Table 3) with the exception of the criterion for naturalness which was only ranked high for 31% of the EBSAs (Table 3). Special importance for life history stages of species was the criterion ranked high most frequently, with uniqueness or rarity also frequently ranked highly. There were insufficient data to rank EBSAs against individual criteria in 8 to 12% of the occurrences, except for the Uniqueness criterion where workshop experts provided rankings for 99% of the EBSAs, perhaps because this criterion can be met with only physical data (Table 3). This suggests that the criteria

were all accessible and interpretable to the experts and could generally be ranked against available data.

Rankings against individual EBSA criteria were often significantly correlated and positive (Spearman rank correlations from 0.13 to 0.41; Supplemental Table 3). Several patterns emerge. Naturalness is correlated with Uniqueness, Fragility and Biodiversity as would be expected because the more species-based criteria and Productivity would tend to indicate exploitable populations. Biodiversity and Fragility are correlated with all the other criteria, potentially indicating some redundancy in these criteria. Lastly, Productivity is correlated with Life History, Endangered & Threatened Species, Fragility and Biodiversity criteria, but not Uniqueness or Naturalness, suggesting that productive areas are not that uncommon in the oceans but are areas likely to be already exploited.

The EBSA criteria are not unique, with many of the criteria (or close facsimiles) appearing in other international processes (Gilman et al. 2011; Table 1). The most commonly occurring criteria (Uniqueness, Life History and Endangered & Threatened Species) were also three criteria most frequently ranked high in the workshops (Table 4), although a comparative lack of data on Endangered and Threatened Species compared to other (often commercial) species is apparent in the lower rankings of this criterion. The next three criteria (Fragility, Productivity and Diversity) appear 2-3 times in other processes and were ranked high in about half of the EBSAs. These criteria all require some level of scientific knowledge, and with only a small fraction of oceanic biodiversity (especially offshore and deep sea areas) mapped (Webb et al. 2014) it is not surprising that much of the information on the marine environment comes from its commercial exploitation.

Naturalness is a criterion in 3 other international processes, but was highly ranked in less than a third of the EBSAs, indicating the difficulty that participants had in identifying such areas; perhaps not too surprising given the importance of exploited areas in providing information. Areas of high conservation value are often identified, at least in part, from data collected during exploitation, contributing to the overlap of areas valued by more than one sector and a tendency for protected areas (CBD Aichi Target 11) to be placed outside areas potentially contributing to other activities (CBD Aichi Target 7) (Spalding et al. 2013).

Lessons learned

Data accessibility

Synthesis and mapping of scientific data proved problematic for all workshops, regardless of developing country status. The absence of a common global data network presented a challenge in identifying data sets; data sets were typically identified through existing scientific networks and any additional contacts identified in preparatory meetings. It is likely that important data sets were missed in the first round of regional workshops and this underscores the need for a continuing process with improved data infrastructure.

The ability of states to meet and report on CBD Aichi Targets and other international agreements in the face of increasing use of marine areas including the high seas (Halpern et al. 2008, Merrie et al. 2014) depends on their ability to make informed and systematic decisions about the state of, and pressures on, the environment under their jurisdiction (Ban et al. 2013). Yet some scientists are unwilling to provide access to what they see as 'their' data, especially before publication (Huang et

al. 2012), despite the data collection typically having been supported through public funds. The withholding of data undermines national and international agreements and prevents progress toward conservation targets and sustainable use of resources both within and beyond national jurisdiction (Costello et al. 2013). Thus groups that have collaborated to provide global datasets on seabirds (Birdlife International 2013), seamounts (Clark et al. 2011), biodiversity through the Ocean Biogeographic Information System (Halpin et al. 2006), or geomorphology (Harris & Whiteway 2011) had more influence on the choice of EBSAs and their boundaries than did turtle or marine mammal researchers where global analyses are lacking, and helped reduce the reliance on commercial fisheries data from regional bodies or historical whaling data (Smith et al. 2012). Improving scientist's capacity and willingness to share data would enhance understanding and management of the biodiversity of the world's ocean (Thessen & Patterson 2011); recognizing data authors is an emerging approach with potential (Chavan et al. 2013).

Important data gaps

There are significant data gaps and deficiencies resulting from low data collection and/or poor data sharing, including the open ocean and southern hemisphere regions (Webb et al. 2010). Filling these gaps is a high priority that requires new resources and effort.

Biogeographic classifications used to support spatial planning have been developed for the ocean surface and seabed environments, based primarily on physical data (UNESCO 2009), but data have been so sparse for the pelagic water column below 200 m depth (Webb et al. 2010) that these areas are only rarely included in monitoring and management schemes or in conservation planning (Robison 2009). New data from the Census of Marine Life (Williams et al. 2010), and other national and international efforts are now contributing to a biogeographic classification for the mesopelagic (~200 m-1000 m), and identifying major patterns that might be expected in the bathypelagic (>1000 m).

Globally consistent biological data collections are starting to become available (e.g. Edgar et al. 2014; O'Hara et al. 2014); however, while areas such as seamounts (e.g. Clark et al., 2011), shallow reefs (Edgar et al. 2014) and the continental shelves (Harris & Baker 2012) have been studied to a greater or lesser extent, there is little information for the haydal and abyssal regions. When biologically-based biogeographies are compared to those derived from physical data, the differences are clear (O'Hara et al. 2011). This together with the increased understanding of the mesopelagic suggests that it is time to update the Global Open Oceans and Deep Seabed Biogeographic Classification (UNESCO 2009) that may not capture the distributions of phyla that we are starting to understand better.

Engagement and capacity building

The regional workshops were designed to be highly participatory with all workshop participants engaging in smaller regional or national groups identifying EBSAs. To begin with this surprised some participants who were more accustomed to receiving technical advice that they could take away with them and (hopefully) apply. Effective engagement was promoted by minimizing the number of formal presentations and presenting as much regional information as possible in the form of large disposable paper maps that covered the conference room walls. This ensured that everyone had

easy access to the same information and worked with each other as they clustered around the maps to discuss particular issues.

When participants met prior to the regional workshop, coordinated by themselves or through the Sustainable Ocean Initiative (http://www.cbd.int/marine/doc/soi-brochure-2012-en.pdf), they were better prepared to propose and discuss EBSAs, especially in national waters. Prior meetings assisted participants better understand the EBSA process, work together with the technical team to identify local datasets, assist each other in accessing and using geographic information systems, and support each other where English was not their first language.

In many regions, the workshops provided valuable capacity building opportunities and provided participants with an improved understanding of their EEZs and beyond. Workshops also identified and made available a large number of previously unknown datasets. All regional datasets were made available to participants online and on smart-drives with self-extracting mapping freeware for countries where internet costs remain unreliable and/or prohibitively expensive.

The regional workshops were most productive when supported by a strong regional program. The support of the South Pacific Regional Environment Program, and the Nairobi and Abidjan conventions provided invaluable support and were key to the success of subsequent workshops. Strong regional programs provided the focus and consistency to assist the regional workshops make relevant and lasting contributions to the region, especially developing regions. The absence of strong regional groups was noted as limiting for some workshops.

What's next for the EBSA process?

The regional workshops to describe areas meeting the EBSA criteria as developed and agreed by the Conference of Parties to the CBD have covered 68% of the global oceans in a little over 2 years. Covering national, transboundary or areas beyond national jurisdiction, EBSAs will inform area-based management of the marine environment under a variety of existing and developing jurisdictions.

The EBSAs indicate areas that may require enhanced conservation and management, including through marine protected areas (MPAs) and environmental impact assessments (CBD COP 10). Some Parties have already used the EBSAs developed in regional workshops to inform national MPA processes or to secure international funding to support national processes. However, the EBSA program was initiated to support area-based management in areas beyond national jurisdiction. It is anticipated that EBSAs would inform any MPA process agreed to through the developing implementing agreement under UN Convention on the Law Of the Sea, but their role does not depend on a new agreement; existing agreements will be improved by the EBSA information. For example, the Conference of Parties to the Convention on Migratory Species has recognised the value of the EBSA process to identifying habitats and ecological networks important to the lifecycles of migratory species (Kot et al. 2015) and requested that their members and participants actively participate in the EBSA process (CMS COP11/Resolution 11.25).

The Central Pacific Equatorial Productivity Zone EBSA is an important area for the South Pacific tuna longline fleet and overlays the Clipperton-Clarion Fracture Zone – one of the first targets for deep

sea mining. An expert-based process proposed an MPA network to safeguard biodiversity and ecosystem function at depth (Wedding et al. 2013), but the upper ocean used by fishers and identified as an EBSA were not included, despite the necessity of surface activities to extract seabed minerals. The International Seabed Authority now has the information and the international consensus to consider the impact of surface activities on this pelagic system in their environmental impact assessments.

Criteria used to identify EBSAs are not unique (Table 1) and the EBSA process is now starting to inform those other processes. Many regional workshops have included Regional Fisheries Management Associations/Organisations who are identifying Vulnerable Marine Ecosystems as areas for bottom fishers to avoid. The EBSAs that identify relevant habitat can inform this process and perhaps sometime in the future be incorporated into a formal management rule that strengthens their current "move-on" rule (Ardron et al. 2014).

Systematic management of ABNJ is currently lacking in almost all instances and will require both the more effective implementation of existing agreements and most likely new agreements to become a reality (Ban et al. 2014). The EBSA program described here provides one now established approach to assist the international community's progress in this direction. For example, progress against CBD Aichi Target 11 that calls for "ecologically representative… systems of protected areas and other effective area-based conservation measures, and integrated into the wider… seascapes" can now be assessed in part by how many overlap with EBSAs. However, EBSAs vary in their attributes and supporting data and are currently neither comprehensive nor fully representative; each workshop identified the need for further effort to build towards a more systematic approach. These gaps, along with considerations of the size of the EBSA and the reason for its description must be addressed when considering EBSAs in national or regional planning process, or even when comparing EBSAs (e.g. see Kot et al. 2015). This would be supported by an updated global biogeography, and would also profit from increased socio-cultural considerations that are frequently omitted from scientific advice to managers (Daw et al. 2015).

The recommendation to start negotiating a new implementing agreement under the UN Convention on the Law Of the Sea to manage biodiversity beyond national jurisdiction represents a hard-fought recognition by Parties to the UN of the need to improve management of an area representing half of our planet. A concurrent mobilisation of the international scientific community is required if considered and agreed scientific advice is to be ready as the global community needs it. This requires increased global and sectoral scientific collaboration, improved sharing of data and the means to access it at appropriate levels of aggregation, a new global ocean biogeography, and lastly international processes that promote agreed systematic scientific evaluation of the oceans' resources incorporating ecological, economic and socio-cultural concerns. The EBSA program reported on here provides an international standard for others to build and improve upon.

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Supporting information

Data identified at three spatial levels (global, regional and national) were made available to the participants during and after each workshop. Details of the data provided, sources and ongoing access are provided as Supporting Information. Statistical methods are provided as Supporting Information.

Literature cited

Ardron JA, et al. 2014. A systematic approach towards the identification and protection of vulnerable marine ecosystems. Marine Policy.

Ban NC, et al. 2014. Systematic Conservation Planning: A better recipe for managing the High Seas for biodiversity conservation and sustainable use. Conservation Letters **7**:41-54.

Beck MW, et al. 2001. The identification, conservation, and Management of estuarine and marine nurseries for fish and invertebrates. Bioscience **51**:633-41.

Birdlife International 2013. http://www.birdlife.org/sites/default/files/attachments/IBA-monitoring-Factsheet-BirdLife-International.pdf (accessed 27 February 2015).

Chavan V, Penev L, Hobern D. 2013. Cultural change in data publishing is essential. Bioscience **63**:419-20.

Clark MR, Watling L, Rowden A, Guinotte JM, Smith CR. 2011. A global seamount classification to aid the scientific design of marine protected areas. Ocean and Coastal Management **54**(1):19-36.

Costello MJ, Michener WK, Gahegan M, Zhang Z-Q, Bourne PE. 2013. Biodiversity data should be published, cited, and peer reviewed. Trends in Ecology & Evolution **28**:454-61.

Daw TM, Coulthard S, Cheung WWL, Brown K, Abunge C, Galafassi D, Peterson GD, McClanahan TR, Omukoto JO, Munyi L. 2015. Evaluating taboo trade-offs in ecosystems services and human well-being. Proceedings of the National Academy of Sciences **112**:6949-54.

Dunn DC, et al. 2014. The Convention on Biological Diversity's Ecologically or Biologically Significant Areas: Origins, development, and current status. Marine Policy **49**:137-45.

Edgar GJ, et al. 2014. Global conservation outcomes depend on marine protected areas with five key features. Nature **506**:216-20.

Gilman E, Dunn DC, Read A, Hyrenbach KD, Warner R. 2011. Designing criteria suites to identify discrete and networked sites of high value across manifestations of biodiversity. Biodiversity Conservation **20**: 3363–3383.

Halpern BS, et al. 2008. A global map of human impact on marine ecosystems. Science **319**:948-52.

Halpin PN, Read AJ, Best BD, Hyrenbach KD, Fujioka E, Coyne MS, Crowder LB, Freeman SA, Spoerri C. 2006. OBIS-SEAMAP: developing a biogeographic research data commons for the ecological studies of marine mammals, seabirds, and sea turtles. Marine Ecology Progress Series **316**:239-46.

Harris PT, Baker EK. 2012. Seafloor geomorphology as benthic habitat: GeoHAB atlas of seafloor geomorphic features and benthic habitats. Elsevier, London. 900 + xii pages.

Harris PT, Whiteway T. 2011. Global distribution of large submarine canyons: Geomorphic differences between active and passive continental margins. Marine Geology **285**:69-86.

Huang X, Hawkins BA, Lei F, Miller GL, Favret C, Zhang R, Qiao G. 2012. Willing or unwilling to share primary biodiversity data: results and implications of an international survey. Conservation Letters **2012**:1-8.

Kot CY, Halpin P, Cleary J, Dunn D. 2014. A Review Of Marine Migratory Species and the Information Used to Describe EBSAS. Marine Geospatial Ecology Lab, Duke University for the Convention on Migratory Species.
http://www.cms.int/sites/default/files/document/COP11_Inf_23_EBSA_final_report.pdf

Macpherson E, Duarte CM. 1991. Bathymetric trends in demersal fish size: is there a general relationship? Marine Ecology Progress Series **71**:103-12.

Merrie A, Dunn DC, Metian M, Boustany AM, Takei Y, Ota Y, Christensen V, Halpin PN, Österblom H. 2014. Human use trends and potential surprise in the global marine common. Global Environmental Change **27**:19-31.

O'Hara TD, Rowden AA, Bax NJ. 2011. A southern hemisphere bathyal fauna is distributed in latitudinal bands. Current Biology **21**:226-30.

O'Hara TD, Hugall AF, Thuy B, Moussalli A. 2014. Phylogenomic resolution of the class Ophiuroidea unlocks a global microfossil record. Current Biology **24**:1-6.

Papworth SK, Rist J, Coad L, Milner-Gulland EJ. 2009. Evidence for shifting baseline syndrome in conservation. Conservation Letters **2**:93-100.

Pennington JT, Mahoney KL, Kuwahara VS, Kolber DD, Calienes R, Chavez FP. 2006. Primary production in the eastern tropical Pacific: A review. Progress in Oceanography **69**:285-317.

Pinnegar J, Engelhard G. 2008. The "shifting baseline" phenomenon: a global perspective. Reviews in Fish Biology and Fisheries **18**:1-16.

Robison B. 2009 Conservation of deep pelagic biodiversity. Conservation Biology **23**:847-58.

Smith TD, Reeves RR, Josephson EA, Lund JN. 2012. Spatial and seasonal distribution of American whaling and whales in the age of sail. PLoS ONE **7** (e34905).

Spalding MD, Meliane IN, Milam A, Fitzgerald C, Hale LZ. 2013. Protecting Marine Spaces: Global Targets and Changing Approaches. Ocean Yearbook Online **27**:213-48.

Thessen A, Patterson D. 2011. Data issues in the life sciences. ZooKeys **150**:15-51.

UN 1992. United Nations Conference on Environment & Development, Agenda 21. Rio de Janerio, Brazil, 1992; §17.85.

UN 2002. Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4 September 2002; A/CONF.199/20 supra note 1, §30(d) & 32(c).

UNESCO 2009. Global Open Oceans and Deep Seabed (GOODS) – Biogeographic Classification. In: IOC Technical Series 84. UNESCO-IOC, Paris. Available from http://www.iode.org/components/com_oe/oe.php?task=download&id=7094&version=1.0&lang=1&format=1

UNGA 2013. Letter dated 19 March 2013 from the Executive Secretary of the Convention on Biological Diversity addressed to the Secretary General. UNGA A/67/838. Available from http://www.un.org/ga/search/view_doc.asp?symbol=A/67/838 accessed August 13, 2014

Webb TJ, Vanden Berghe E, O'Dor R. 2010. Biodiversity's big wet secret: The global distribution of marine biological records reveals chronic under-exploration of the deep pelagic ocean. PLoS ONE **5** (e10223).

Wedding LM, Friedlander AM, Kittinger JN, Watling L, Gaines SD, Bennett M, Hardy SM, Smith CR. 2013. From principles to practice: a spatial approach to systematic conservation planning in the deep sea. Proceedings of the Royal Society B: Biological Sciences **280**.

Williams MJ, Ausubel J, Poiner I, Garcia SM, Baker DJ, Clark MR, Mannix H, Yarincik K, Halpin PN. 2010. Making marine life count: A new baseline for policy. PLoS Biology **8** (e1000531).

Table 1. CBD scientific criteria for ecologically or biologically significant areas (EBSAs) (CBD COP 9/20, Annex 1), with examples summarized from www.cbd.int/marine/doc/azores-brochure-en.pdf and including the number of times that similar criteria appear in other international mechanisms* (from Dunn et al. 2014)

	CBD Scientific Criteria	Definition
1	Uniqueness or rarity	Area contains either (i) unique, rare or endemic species, populations or communities; and/or (ii) unique rare or distinct habitats or ecosystems; and/or unique or unusual geomorphological or oceanographic features
2	Special importance for life-history stages of species	Area that is required for a population to survive and thrive
3	Importance for threatened, endangered or declining species and/or habitats	Area containing habitat for the survival and recovery of endangered, threatened, declining species, or area with significant assemblages of such species
4	Vulnerability, Fragility, Sensitivity or Slow recovery	Area that contains a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery
5	Biological Productivity	Area containing species, populations or communities with comparatively higher natural biological productivity
6	Biological Diversity	Area contains comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity
7	Naturalness	Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation

* FAO Vulnerable Marine Ecosystems, IMO Particularly Sensitive Sea Areas, UNESCO World Heritage S, RAMSAR, Birdlife International Bird Areas, IUCN Key Biodiversity Areas

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Table 2. Details, participation and location of the nine regional workshops convened by the CBD Executive Secretary between 2011 and 2014 and the areas meeting the CBD EBSA criteria. (One of the 204 EBSAs accepted by CPD COP does not have precise geographical boundaries and it is not included in this table or further analyses)

Regional Workshop	Date	Host Country	Countries	IGOs and NGOs	Area ($km*10^6$)	EBSAs	Areas within a single national jurisdiction
Western South Pacific (WSP)[a]	Nov 2011	Fiji	15	10	58	26	9
Wider Caribbean & Western Mid-Atlantic (CAR)[b]	Feb 2012	Brazil	23	15	26	20	9
Southern Indian Ocean (SIO)[c]	July 2012	Mauritius	16	20	50	39	22
Eastern Tropical & Temperate Pacific (ETTP)[d]	Aug 2012	Ecuador	13	12	43	21	12
North Pacific (NP)[e]	Feb 2013	Russia	8	7	34	20	15
South-Eastern Atlantic (SEA)[f]	April 2013	Namibia	17	15	29	44	31
Arctic[g]	March 2014	Finland	7	13	8	11	9
Northwest Atlantic (NWA)[h]	March 2014	Canada	2	5	3	7	0
Mediterranean (MED)[i]	April 2014	Spain	21	16	3	15	2
Total			122	112	253	203	109

[a] http://www.cbd.int/doc/?meeting=RWEBSA-WSPAC-01

[b] http://www.cbd.int/doc/?meeting=RWEBSA-WCAR-01

[c] http://www.cbd.int/doc/?meeting=EBSA-SIO-01

[d] http://www.cbd.int/doc/?meeting=EBSA-ETTP-01

[e] http://www.cbd.int/doc/?meeting=EBSA-NP-01

[f] http://www.cbd.int/doc/?meeting=EBSA-SEA-01

[g] http://www.cbd.int/doc/?meeting=EBSAWS-2014-01

[h] http://www.cbd.int/doc/?meeting=EBSAWS-2014-02

[i] http://www.cbd.int/doc/?meeting=EBSAWS-2014-03

Table 3. The percentage of EBSAs ranked high against agreed CBD scientific criteria across the 9 regional workshops.

CBD Scientific Criterion	Average %	Min %	Max %	Insufficient data %
Uniqueness or rarity	62	40	86	1
Special importance for life history stages of species	70	54	91	8
Importance for threatened, endangered or declining, species and/or habitats	55	29	87	10
Vulnerability, fragility, sensitivity or slow recovery	51	31	82	9
Biological productivity	51	29	82	12
Biological diversity	52	34	80	12
Naturalness	31	10	64	10

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Figure legends

Figure 1. Areas used by the nine CBD regional workshops to propose areas that meet the EBSA criteria. The 13.5 million km^2 area of the NE Atlantic identified with a hatched ellipse has been the subject of workshops organised by regional organisations and is not included in the analyses in this paper. Area names are provided in Table 2.

Figure 2. Areas identified as meeting EBSA criteria in each of the nine regional workshops. EBSAs described against different criteria can overlap or adjoin as indicated by their outlines.

Figure 3. Histogram of the areas of EBSAs described by the 9 regional workshops.

Figure 4. Proportion of defined EBSAs in each workshop that were within national waters, included at least 2 nations waters, included national and international waters, and occurred entirely in Areas Beyond National Jurisidiction. Number of EBSAs identified in each workshop are in brackets. Workshop abbreviations are given in Table 2.

Figure 5. Radar plots of the median ranking against each of the seven internationally agreed criteria for describing EBSA for the 9 workshops.

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Fig. 1

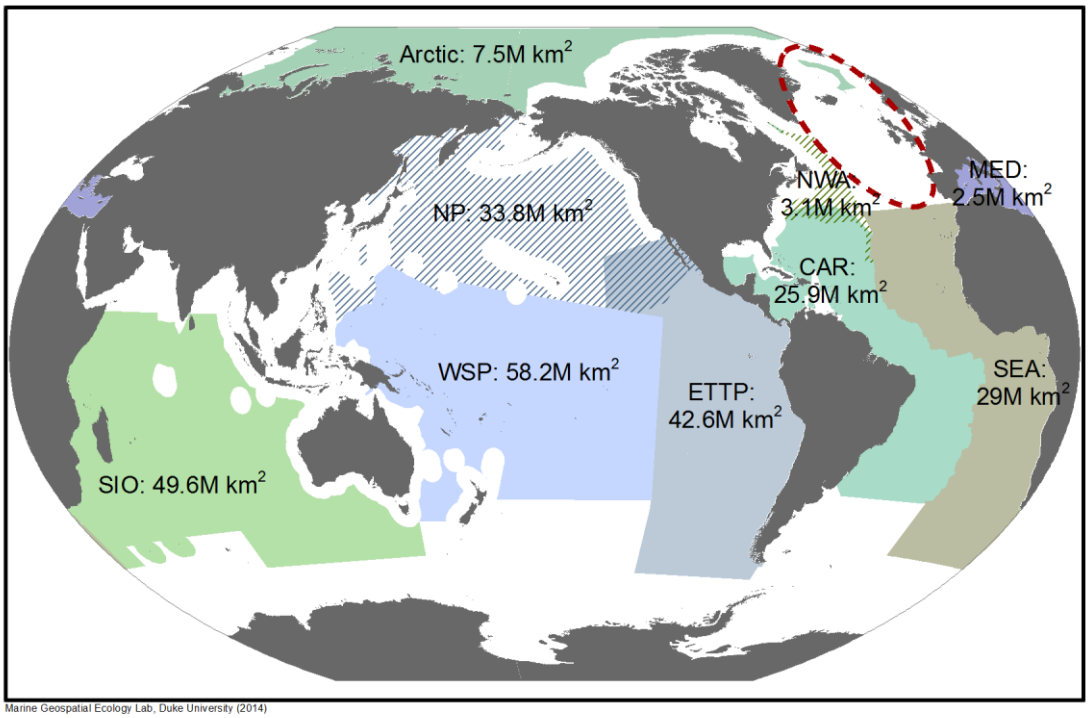

Fig. 2

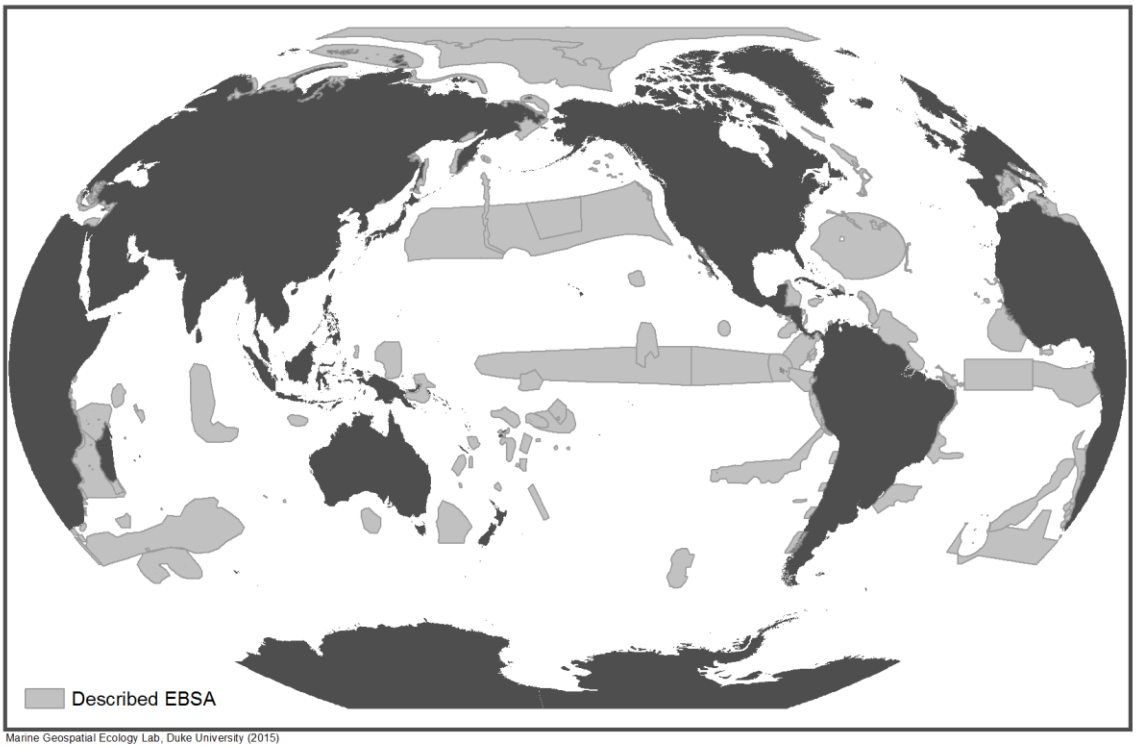

Fig. 3

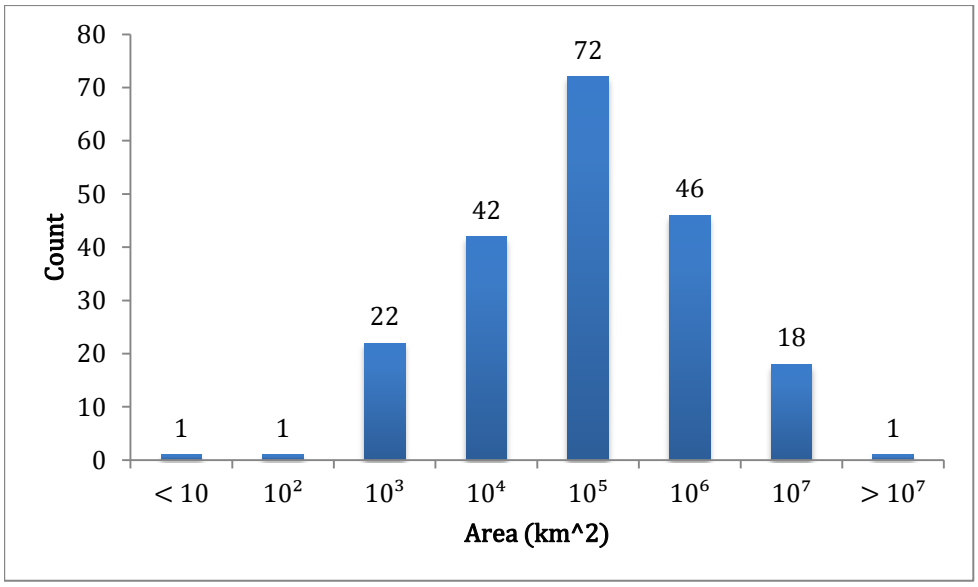

Fig. 4

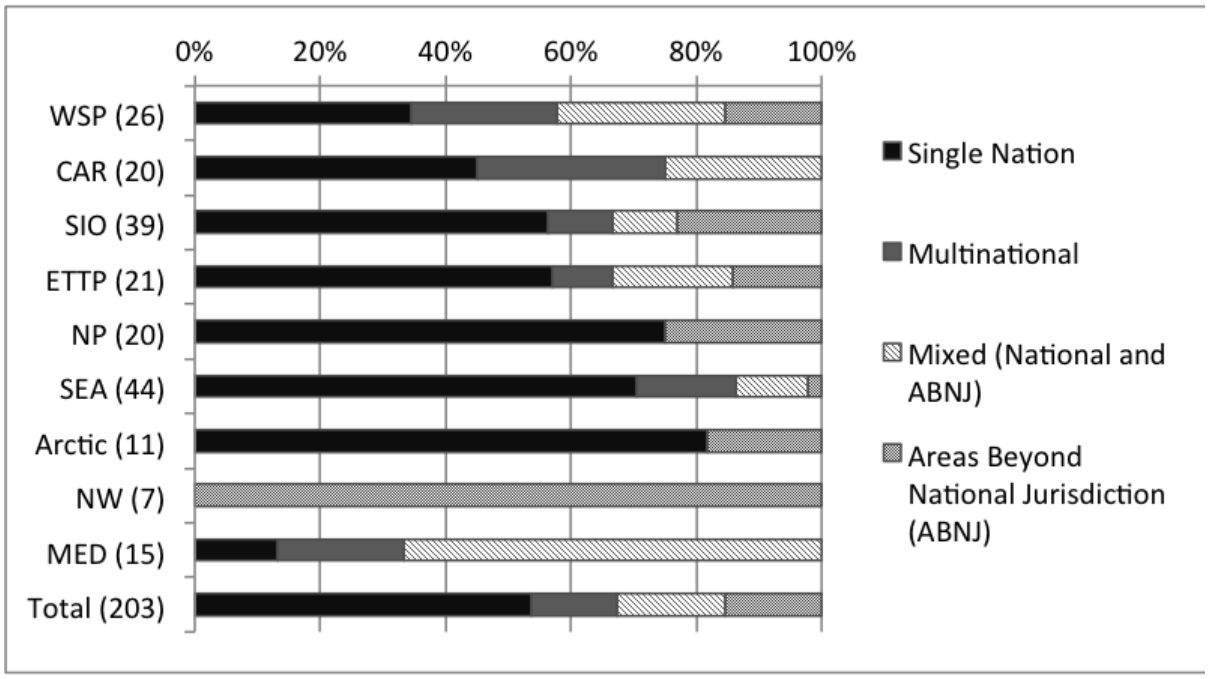

Fig. 5