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Marine World Heritage: creating a globally more balanced and representative list

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ABSTRACT

1. The World Heritage Convention provides the potential for a comprehensive policy framework that allows for identification, management, governance, and protection of the world's most outstanding natural marine areas.

2. Benefits of World Heritage (WH) listing include increased international attention and technical cooperation, governmental support and improvements to management, and enhanced funding opportunities.

3. There are currently only 46 (of 981 or 4.7%) World Heritage Sites (WHS) that have been inscribed for their outstanding marine values, and these marine WHS (mWHS) represent predominantly tropical as opposed to temperate and polar ecosystems.

4. Forty-seven (76%) of the world's 62 nearshore biogeographic provinces do not contain any mWHS or contain a low (<1%) coverage that is unlikely to capture the full range of values and features present in these provinces. A large proportion of the world's offshore provinces, representing 40% of the global ocean, do not contain any mWHS.

5. To fulfill the World Heritage Committee's Global Strategy for a Representative, Balanced and Credible World Heritage List, States are encouraged to increase efforts to identify and nominate marine sites of potential Outstanding Universal Value (OUV), especially in biogeographic regions that are not yet represented, or underrepresented, on the WH List.

6. However, as the criteria and guidance for the Convention are based primarily on terrestrial systems, further guidance on using them in the marine context is provided here. It is proposed that physical oceanographic features be considered under criterion (viii) 'geology and oceanography', while biological oceanographic features be considered under criterion (ix) 'ecological and biological processes'. Use of criteria (vii) 'superlative phenomena' and (x) 'species' can follow current guidance for terrestrial systems.

7. Potential approaches that can help address gaps in biogeographic representation of marine WHS and create a more balanced and representative marine World Heritage List are outlined here.

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KEY WORDS: marine protected areas (MPAs); Outstanding Universal Value; World Heritage Convention; marine ecosystems; marine features; biogeographic representation

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THE WORLD HERITAGE CONVENTION AND MARINE ECOSYSTEMS

The primary mission of the *Convention concerning the Protection of the World Cultural and Natural Heritage* is to identify and protect the world's natural and cultural heritage, and was adopted by the General Conference of UNESCO in 1972. 'Outstanding Universal Value' (OUV) is the central concept of the Convention, and is defined as 'cultural and/or natural significance, which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity. As such, the permanent protection of this heritage is of the highest importance to the international community as a whole' (UNESCO, 2012). To be deemed of OUV, a property (the official term used for WHS) must meet one or more of 10 criteria, as well as satisfy several conditions of integrity, protection and management (UNESCO, 2012).

Currently, about 2.9% of Earth's coastal and marine areas have some form of protected status (Spalding *et al.,* 2013), and only 0.01% of the global area is fully protected from extractive uses (Laffoley and Langley, 2010). The World Heritage Convention is a high profile global conservation agreement with a unique role in motivating protection of sites of global significance. However, the Convention has not been applied to its full potential in the marine environment, offering an opportunity to develop guidance for its application to oceans and seas. In addition, the context for marine conservation has changed significantly since the Convention was adopted in 1972; at that time the boundaries of coastal states extended to 12 nautical miles (nm) from coastal baselines. In 1982 ratification of the United Nations Law of the Sea established new boundaries extending coastal state sovereign jurisdiction to 200 nm, and where applicable to the natural prolongation of continental shelves to 350 nm.

As of March 2014, the World Heritage List contained 981 terrestrial and marine sites, including 759 cultural, 193 natural, and 29 mixed (cultural and natural) properties in 160 countries. Of these, 46 are formally recognized by UNESCO's World Heritage Marine Programme for their marine natural values (Figure 1; UNESCO, 2014), i.e. 4.7% of all sites, and 20% of natural and mixed sites. On the positive side, the area included in these marine sites is 56.5% of the area of all WHS, due to the very large size of some marine listings, notably Papahānaumokuākea, the Phoenix Islands Protected Area, Papahānaumokuākea, and the Great Barrier Reef, which are, by a considerable margin, the three largest World Heritage Sites.

Only about 40% of the world's ocean are within the jurisdiction of countries. The remainder is thus beyond the current influence of the Convention. The purpose of this study is to present a revised interpretation of the World Heritage natural criteria for marine systems, highlight the gaps in representation of mWHS, and outline approaches that address these gaps to create a more balanced and representative marine World Heritage List. Finally, the study also identifies areas of future work needed to progress these issues.

POTENTIAL BENEFITS OF WORLD HERITAGE LISTING

Inscription on the World Heritage List can support the conservation of marine sites in several ways (Hillary and Kokkonen, 2003; Thorsell, 2003; Ehler and Douvere, 2011; UNESCO, 2012). World Heritage status usually results in an increase in public awareness, both nationally and internationally, of the site and its outstanding value. It places these sites on the radar of potential donors, campaigning organizations, and decision makers in public and private sectors. Inscription can also lead to increases in available funding for conservation and management from government budgets, non-governmental organizations, bilateral and multilateral agencies, UNESCO's World Heritage Fund, and increased revenues from tourism.

The Convention has various instruments to ensure that sites maintain its rigorous standards of integrity, management and protection (UNESCO, 2012). These include reactive and periodic monitoring and reporting mechanisms, requests by the World Heritage Committee for field missions, the List of World Heritage in Danger for sites whose values are threatened, and finally the option to delist sites if they have lost their OUV. The Convention also requires sites to develop and implement adequate management systems and plans, with conservation measures and monitoring mechanisms that ensure

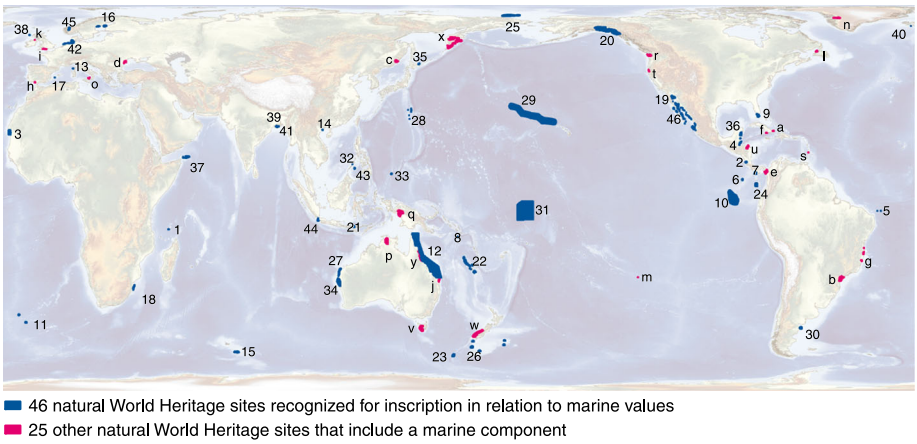

Figure 1. Global distribution of the 46 natural and mixed World Heritage Sites that are formally inscribed for marine values (UNESCO, 2014) and 25 other natural and mixed World Heritage sites with significant marine/coastal areas or coastal features (Spalding, 2012).

ID	Name	Country
1	Aldabra Atoll	Seychelles
2	Area de Conservación Guanacaste	Costa Rica
3	Banc d'Arguin National Park	Mauritania
4	Belize Barrier Reef Reserve System	Belize
5	Brazilian Atlantic Islands: Fernando de Noronha and Atol das Rocas Reserves	Brazil
6	Cocos Island National Park	Costa Rica
7	Coiba National Park and its Special Zone of Marine Protection	Panama
8	East Rennell	Solomon Islands
9	Everglades National Park	USA
10	Galápagos Islands	Ecuador
11	Gough and Inaccessible Islands	United Kingdom
12	Great Barrier Reef	Australia
13	Gulf of Porto: Calanche of Piana, Gulf of Girolata, Scandola Reserve	France
14	Ha Long Bay	Viet Nam
15	Heard and McDonald Islands	Australia
16	High Coast / Kvarken Archipelago	Sweden; Finland
17	Ibiza, Biodiversity and Culture	Spain
18	iSimangaliso Wetland Park	South Africa
19	Islands and Protected Areas of the Gulf of California	Mexico
20	Kluane / Wrangell-St Elias / Glacier Bay / Tatshenshini-Alsek	USA; Canada
21	Komodo National Park	Indonesia
22	Lagoons of New Caledonia: Reef Diversity and Associated Ecosystems	France
23	Macquarie Island	Australia
24	Malpelo Fauna and Flora Sanctuary	Colombia
25	Natural System of Wrangel Island Reserve	Russian Federation
26	New Zealand Sub-Antarctic Islands	New Zealand
27	Ningaloo Coast	Australia
28	Ogasawara Islands	Japan
29	Papahānaumokuākea	USA
30	Península Valdés	Argentina
31	Phoenix Islands Protected Area	Kiribati
32	Puerto-Princesa Subterranean River National Park	Philippines
33	Rock Islands Southern Lagoon	Palau
34	Shark Bay, Western Australia	Australia
35	Shiretoko	Japan
36	Sian Ka'an	Mexico
37	Socotra Archipelago	Yemen
38	St Kilda	United Kingdom
39	Sundarbans National Park	India
40	Surtsey	Iceland
41	The Sundarbans	Bangladesh
42	The Wadden Sea	Netherlands; Germany
43	Tubbataha Reefs Natural Park	Philippines
44	Ujung Kulon National Park	Indonesia

(Continues)

Figure 1. (Continued)

45	West Norwegian Fjords – Geirangerfjord and Nærøyfjord	Norway
46	Whale Sanctuary of El Vizcaino	Mexico
a	Alejandro de Humboldt National Park	Cuba
b	Atlantic Forest Southeast Reserves	Brazil
c	Central Sikhote-Alin	Russian Federation
d	Danube Delta	Romania
e	Darien National Park	Panama
f	Desembarco del Granma National Park	Cuba
g	Discovery Coast Atlantic Forest Reserves	Brazil
h	Doñana National Park	Spain
i	Dorset and East Devon Coast	United Kingdom
j	Fraser Island	Australia
k	Giant's Causeway and Causeway Coast	United Kingdom
l	Gros Morne National Park	Canada
m	Henderson Island	United Kingdom
n	Ilulissat Icefjord	Denmark
o	Isole Eolie (Aeolian Islands)	Italy
p	Kakadu National Park	Australia
q	Lorentz National Park	Indonesia
r	Olympic National Park	USA
s	Pitons Management Area	Saint Lucia
t	Redwood National and State Parks	USA
u	Río Plátano Biosphere Reserve	Honduras
v	Tasmanian Wilderness	Australia
w	Te Wahipounamu – South West New Zealand	New Zealand
x	Volcanoes of Kamchatka	Russian Federation
y	Wet Tropics of Queensland	Australia

the safeguarding of the sites' OUV (UNESCO, 2012). The implementation of these instruments often involves international experts and expert groups that provide capacity building and training to local site management teams.

Before inscription, the evaluation process for new World Heritage proposals can also lead to substantial conservation benefits as countries seek to meet the integrity, protection and management requirements. A study of 150 World Heritage nominations from 1992 to 2002 found that recommendations made during the evaluation process considerably improved the status of 35 sites (Thorsell, 2003). These improvements included: extension of the size of the protected area (17 sites), major improvements to site management (12), additional funding secured (11), legal regime strengthened (9), and the prevention of major threats to site integrity such as unsustainable development projects (5). All this shows how the Convention can serve as a catalyst to securing conservation action 'on the ground' (or in the water) before and after inscription.

APPLYING THE WORLD HERITAGE CRITERIA TO MARINE SYSTEMS

The World Heritage Convention has six criteria for assessing OUV for cultural heritage (i)–(vi) and four for natural heritage (vii)–(x). The terminology for OUV and the criteria are written in the Convention texts (Table 1), although the challenge for marine applications is that these are biased towards terrestrial systems. In particular, the main physical component of the ocean, the properties and dynamics of sea water, and its ramifications on biotic processes and biodiversity, are poorly covered (Obura *et al.,* 2012). Consequently, to assist countries and experts in extending the marine WH List, guidance on consistent application of the criteria was developed by Abdulla *et al.* (2013). Following past practice in other thematic areas (e.g. geology and karst systems, Dingwall *et al.,* 2005; Williams, 2008), 16 broad marine themes that encompass the majority of marine features that can be considered were identified (Table 2).

The most notable additions for marine themes are those related to oceanography, and guidance that their physical components be considered under criterion (viii). Traditionally it has been called the 'geological criterion' as it deals with earth processes, but it also is the most appropriate criterion for physical aspects of ocean processes such as water masses, ocean currents, waves, coastal and land–sea interactions and ice. The biological elements of oceanography are most appropriately addressed

Table 1. Outstanding Universal Value (OUV) and the four natural criteria used for assessing natural sites in the World Heritage Convention

Outstanding Universal Value	Natural criteria
Outstanding: The site should be *exceptional*. The World Heritage Convention sets out to define the geography of the superlative – the most outstanding natural and cultural places on Earth. Universal: The scope of the Convention is *global* in relation to the significance of the properties to be protected as well as its importance to all people of the world. Sites cannot be considered for OUV from only a national or regional perspective. Value: This implies clearly defining the *worth* of a property, ranking its importance based on clear and consistent standards, including the recognition and assessment of its integrity. Integrity: For a site to be regarded as being of OUV it must not only meet one or more of the World Heritage criteria, but also meet rigorous requirements regarding its integrity and its protection and management.	vii. Contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance; viii. Be outstanding examples representing major stages of Earth's history, including the record of life, significant ongoing geological processes in the development of landforms, or significant geomorphic or physiographic features; ix. Be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals; x. Contain the most important and significant natural habitats for *in situ* conservation of biological diversity, including those containing threatened species of OUV from the point of view of science or conservation.

Table 2. Geological, physical oceanographic and biological themes with potential for Outstanding Universal Value under the World Heritage Convention. Consistent with recent practice to use criterion (vii) only when one of the other criteria is satisfied, Abdulla *et al.* (2013) listed superlative phenomena as the last of 16 themes for the marine environment. Accordingly, criterion (vii) is tabulated after criterion (x)

Criterion (viii)		Criterion (ix)	Criterion (x)	Criterion (vii)
Geology	Oceanography	Ecological and biological processes	Species and biodiversity	Superlative phenomena and/or exceptional beauty
1) Plates and tectonic features	5) Water masses	10) Biogeochemical cycles and productivity	13) Diversity of marine life	16) Marine phenomena and spectacles
2) Hotspots, seamounts	6) Ocean currents	11) Connectivity	14) Biogeography and components of diversity	
3) Sedimentary processes (slope, rise and deep seabed, submarine canyons)	7) Waves and other phenomena	12) Marine ecosystem processes and services	15) Threatened and flagship species	
4) Vents, seeps, and other hydrogeological features	8) Coastal processes and land–sea interactions 9) Ice			

under criterion (ix), on ecological and biological processes, while species aspects are most appropriately addressed under criterion (x). The detailed guidance on applying biological marine themes to the criteria (Abdulla *et al.,* 2013) was developed to be largely consistent with most recent guidance for terrestrial applications (Bertzky *et al.,* 2013).

To illustrate the necessity of the new guidance, the OUV statements in the Western Indian Ocean (WIO) regional study (Obura *et al.,* 2012) were analysed to see how well they met this guidance (Table 3). OUV statements with respect to criteria (vii) and (viii) were consistent with the guidance (92%). This reflects the focus of the WIO study on incorporating oceanographic features in its arguments, and that experience was incorporated in Abdulla *et al.* (2013). However, OUV statements with respect to criteria (ix) and (x) were consistent with the guidance for only 35 and 39% of the statements, respectively. Using the new guidance in Abdulla *et al.* (2013), 61% of OUV statements were reclassified to the other biological criterion. Notably, the specific wording of each statement did not need changing and the inconsistency was due to a lack of clarity in identifying which criterion to assign a feature to. The clear guidance in Abdulla *et al.* (2013) for marine systems and Bertzky *et al.* (2013) for terrestrial systems should contribute significantly to greater consistency in how criteria (ix) and (x) are used and assessed in the marine environment.

Table 3. Draft statements of Outstanding Universal Value from the Western Indian Ocean study (Obura *et al.,* 2012) reclassified according to the guidance in the global thematic study (Abdulla *et al.,* 2013)

		viii		ix			x		
		n	corr	n	corr	recl	n	corr	recl
1	Mozambique channel	3	100%	4	25%	75%	4	75%	25%
1.1	Quirimbas-Mnazi bay	2	100%	2	50%	50%	7	29%	71%
1.2	NW Madagascar	2	100%	5	60%	20%	7	100%	0%
1.3	Comoros-Glorieuses crescent	4	100%	2	0%	100%	8	0%	100%
1.4	Iles Eparses	2	100%	3	67%	33%	7	86%	14%
1.5	Bazaruto-Tofo	3	67%	4	25%	75%	7	0%	100%
1.6	Madagascar-South	2	100%	5	40%	60%	2	0%	100%
All (1)	Mozambique channel all	18	94%	25	40%	56%	42	43%	57%
2	Saya de Malha	4	75%	1	0%	100%	1	0%	100%
3.1	Lamu-Kiunga	1	100%	4	25%	75%	4	0%	100%
3.2	Antongil Bay	1	100%	1	0%	100%	2	50%	50%
All	All	24	92%	31	35%	61%	49	39%	61%

'n'- number of statements; 'corr'- percentage of statements correct; 'recl'- percentage of statements reclassified to the other biological criterion.

CURRENT GLOBAL DISTRIBUTION OF mWHS

The UNESCO World Heritage Marine Programme has recognized 46 natural and mixed World Heritage sites as marine World Heritage Sites (mWHS; UNESCO, 2014). The marine values and features of these 46 sites are listed as being of OUV under natural criteria (vii), (viii), (ix) and/or (x). The 46 mWHS are distributed across 35 countries and represent all continents (Figure 1). They occur from the Arctic to the Southern Ocean although a large proportion occurs in the tropics (30 sites; 65%). The largest mWHS are in the Pacific Ocean and include the Phoenix Islands Protected Area (Kiribati), Papahãnaumokuãkea (USA), the Great Barrier Reef (Australia), and the Galapagos Islands (Ecuador). Large mWHS elsewhere include the Wadden Sea (Netherlands and Germany) and Ningaloo Reef (Australia). The country with the highest number of mWHS is Australia (five sites), followed by the USA (three sites), and the UK, Indonesia, Costa Rica and France all with two sites each (Figure 1).

Twenty-five additional sites are not formally recognized for their marine values but contain significant marine/coastal areas (e.g. Pitons Management Area in Saint Lucia) or coastal features (e.g. Dorset and East Devon Coast in the UK) (Spalding, 2012). Although these 25 sites are shown in Figure 1, they have not been included in any of the analyses that are presented here.

Marine biogeographic classifications help to assess gaps in current mWHS coverage

The World Heritage Committee launched its Global Strategy in 1994 with the central aim of developing a representative, balanced and credible World Heritage List (UNESCO, 1994). The Strategy's core objective is to establish a set of WHS that reflect the diversity of cultural and natural areas that qualify as of OUV. Motivating site nominations from underrepresented regions is key to the success of this strategy. Once designated, establishing effective management measures at the site is critical to adequate protection of these WH features.

Biogeographic classification systems were used to assess the coverage of the current set of mWHS and to identify gaps in global coverage. However, the outstanding nature of a site remains the key requirement for inscription on the World Heritage List and not representativeness (Badman *et al.,* 2008). Unlike the Convention on Biological Diversity or UNESCO's Man and Biosphere Programme, the World Heritage Convention seeks to recognize only the most outstanding areas globally, not an ecologically representative network of protected areas (Spalding, 2012). Gaps in the current coverage of mWHS in biogeographic regions can be useful in guiding the search for outstanding sites towards regions with distinctive features that have not yet been included on the World Heritage List. Nevertheless a region being identified as a gap region

does not alone qualify a site nomination for World Heritage listing.

Biogeographic classification and biodiversity prioritization schemes have been iteratively improved over the last 50 years, with a focus on terrestrial biodiversity and conservation priorities (Udvardy, 1975; Olson *et al.,* 2001; Brooks *et al.,* 2006, 2010). Classification schemes for the marine environment are less mature as datasets are sparser, impeded by the difficulty of obtaining data from distant offshore and deep sea areas. As an indication of how depauperate marine datasets are, Mora *et al.* (2011) estimate that approximately 91% of species in the ocean are not yet described. This study uses the latest iterations of marine classification schemes that use oceanography and taxonomy as the main determinants of biogeography (Spalding *et al.,* 2007, 2012), to assess coverage of mWHS in nearshore and, pelagic areas and identify gap regions that may harbour sites of potential OUV.

Gaps in current mWHS coverage in nearshore and pelagic provinces

For nearshore waters the Marine Ecoregions of the World classification scheme (MEOW; Spalding *et al.,* 2007) identifies 62 provinces in 12 broad realms which provide a useful framework for assessing the coverage of the current mWHS that lie within coastal and shelf waters shallower than 200 m. As of 2013, mWHS occur in only 34 of the provinces or 55% of the total (some sites straddle provinces so can occur in two or more provinces). Therefore, the 46 mWHS do not adequately and fully represent the distinct biodiversity and other natural values of all 62 provinces (Figure 2 and Table 4). The highest number of mWHS occur in four provinces: the Northern European Seas (five sites), the Tropical East Pacific (four sites), and the Tropical North-western Atlantic and Western Coral Triangle (three sites each). Eight provinces have two sites each and 22 provinces have only one site each. Twenty-eight provinces (45%) do not contain any mWHS and are subsequently referred to as 'gap provinces' in this study (Figure 2 and Table 5). These 28 gap provinces are a primary priority for enhancing the current biogeographic coverage of mWHS as they represent a substantial and distinct proportion of global ocean area and nearshore biodiversity. In addition, the majority of provinces with mWHS (19 of 34 provinces or 56%) have less than 1% coverage (Figure 3 and Table 4), so the potential to capture an adequate cross-section of the marine values and features in these provinces is relatively low (see discussion on gap provinces and representation of mWH themes and features). These provinces need to be considered as a secondary priority for enhancing the current coverage of mWHS.

Pelagic or deep waters cover the majority of the planet, approximately 60–66%. Here we use Spalding *et al.* (2012), which provides a classification of offshore waters in the upper 200 m of the water column and is based on known taxonomic

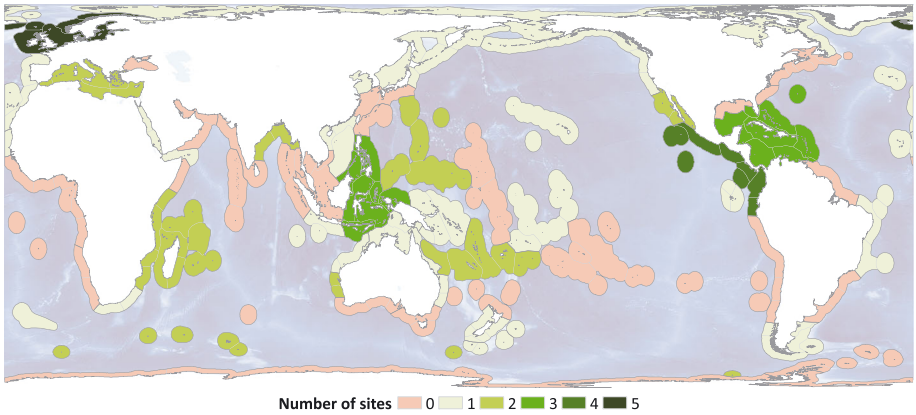

Figure 2. Number of marine World Heritage Sites (n = 46) within each nearshore province (defined by Spalding *et al.,* 2007). The results are for coastal and shelf waters shallower than 200 m but are displayed on province boundaries drawn out to 200 nm offshore (or to the 200 m isobath where this lies further offshore), although only those areas out to the 200 m isobath are used in analyses.

Table 4. Summary of the current distribution and coverage of 46 marine World Heritage Sites (mWHS) within the nearshore provinces defined by the Marine Ecoregions of the World (MEOW) classification scheme (Spalding *et al.,* 2007)

MEOW province	Province area (km^2)	Number of mWHS	Total marine area of mWHS	Percentage of province covered by mWHS
Agulhas	122,745	1	31	<0.1%
Arctic	7,592,680	1	9,231	0.1%
Bay of Bengal	289,800	2	766	0.3%
Central Polynesia	16,635	1	1,469	8.8%
Cold Temperate North-east Pacific	557,407	1	2,337	0.4%
Cold Temperate North-west Pacific	1,619,423	1	214	<0.1%
East Central Australian Shelf	69,091	1	4,698	6.8%
Eastern Coral Triangle	231,235	1	519	0.2%
Galapagos	16,690	1	16,690	100.0%
Hawaii	31,681	1	20,364	64.3%
Java Transitional	67,266	1	645	1.0%
Lusitanian	307,450	1	339	0.1%
Magellanic	988,434	1	49	<0.1%
Mediterranean Sea	689,715	2	114	<0.1%
North-east Australian Shelf	292,412	1	244,959	83.8%
Northern European Seas	1,746,815	5	12,185	0.7%
North-west Australian Shelf	306,313	1	4,911	1.6%
Red Sea and Gulf of Aden	286,347	1	1,234	0.4%
Sahul Shelf	1,322,709	1	0.1	<0.1%
South China Sea	544,909	1	396	0.1%
Southern New Zealand	241,023	1	2,143	0.9%
Subantarctic Islands	93,088	2	6,925	7.4%
Subantarctic New Zealand	36,386	1	8,980	24.7%
Tristan Gough	1,887	1	715	37.9%
Tropical East Pacific	239,031	4	4,038	1.7%
Tropical North-western Atlantic	1,019,097	3	4,714	0.5%
Tropical North-western Pacific	58,438	2	985	1.7%
Tropical South-western Atlantic	198,476	1	129	0.1%
Tropical South-western Pacific	210,346	2	16,254	7.7%
Warm Temperate Northeast Pacific	186,946	2	12,905	6.9%
West African Transition	73,765	1	6,123	8.3%
West Central Australian Shelf	90,920	2	15,642	17.2%
Western Coral Triangle	986,668	3	1,674	0.2%
Western Indian Ocean	492,743	2	1,040	0.2%

biogeography and on the major oceanographic drivers of ecological patterns. This scheme identifies 37 pelagic provinces, nested into a system of four broad realms. The system is also divided into seven biomes, which are spatially disconnected but united by common abiotic conditions that create similar communities. Currently, 19 of the existing mWHS include pelagic waters (Figure 4), in 13 of the 37 (35%) pelagic provinces (Table 6). The total area covered by the sites in these provinces is very low (less than 1%) with the exception of the Non-Gyral South-west Pacific and the Eastern Tropical Pacific with approximately 1.2% covered by mWHS. Twenty-four pelagic provinces (65%) do not contain any mWHS (Figure 4 and Table 6) suggesting a major biogeographic gap in pelagic waters, as these provinces represent distinct biogeography and constitute approximately 40% of the world's ocean. It is important to note, however, that a majority of these areas are currently beyond the jurisdiction of the World Heritage Convention (but see discussion on Areas Beyond National Jurisdiction).

A ROADMAP FOR A MORE REPRESENTATIVE AND BALANCED MARINE WORLD HERITAGE LIST

The World Heritage Convention has the potential to play a critical role in the conservation of outstanding marine areas. It already covers 17% of the total area of all recorded marine protected areas (MPAs), including several of the world's largest MPAs (Abdulla *et al.,* 2013; Spalding *et al.,* 2013). However, the marine WH network is

Table 5. Overview of the 28 'gap provinces', nearshore provinces (defined by the Marine Ecoregions of the World (MEOW) classification scheme in Spalding *et al.,* 2007) without marine World Heritage Sites

MEOW gap province	Province area (km^2)
Sunda Shelf	1,845,151
Cold Temperate North-west Atlantic	890,193
Warm Temperate North-west Pacific	665,953
Warm Temperate South-western Atlantic	563,194
North Brazil Shelf	505,941
Continental High Antarctic	495,365
Somali/Arabian	393,156
West and South Indian Shelf	389,565
Gulf of Guinea	376,759
Warm Temperate North-west Atlantic	372,141
South-west Australian Shelf	335,458
Andaman	315,148
South-east Australian Shelf	241,497
Black Sea	170,325
Scotia Sea	162,646
Benguela	161,541
Warm Temperate South-eastern Pacific	150,489
Central Indian Ocean Islands	79,350
Marshall, Gilbert and Ellis Islands	49,546
Northern New Zealand	49,349
South-east Polynesia	47,860
South Kuroshio	42,674
Lord Howe and Norfolk Islands[1]	9,306
Marquesas	4,656
Juan Fernández and Desventuradas	1,826
St. Helena and Ascension Islands	1,263
Amsterdam-St Paul	933
Easter Island	716

[1]Lord Howe Island Group (Australia), inscribed on the World Heritage List in 1982, was not recognized by UNESCO as one of the 46 marine World Heritage sites at the time of this analysis (UNESCO, 2014).

far from being complete, and additional efforts are required to ensure that the benefits of the Convention can reach other outstanding marine areas.

Ideally, spatial analyses support the selection of priority sites from what may be a bewildering array of possibilities. Three key concepts of systematic conservation planning can guide the selection of priority sites for biodiversity conservation and their integrity: irreplaceability, vulnerability and representativeness (Margules and Pressey, 2000). Irreplaceability (or uniqueness, rarity, naturalness) has been identified as the most important of these for OUV (Schmitt, 2011), and representativeness the least important (Badman *et al.,* 2008). A precondition for these analyses is the availability of spatial data on a global scale on species and ecosystem distributions and status.

The sparseness and resolution of spatial data for many marine habitats, specifically the open ocean and deep sea, hinders such spatial analyses for the marine context. Other approaches may therefore be needed to assess gaps in these little studied areas and identify potential candidate sites. Identifying a comprehensive list of possible priority sites within the nearshore and pelagic provinces is beyond the scope of this study. However, the broad approaches outlined in this section may guide States Parties, marine conservationists, managers and scientists in the development of processes for identifying priority sites of potential OUV within the gap provinces (noting that not all gap provinces may hold sites of OUV).

Potential approaches to identifying sites with OUV

Previous studies of potential candidate sites for the WH List have been based on expert knowledge (IUCN, 1982), data analysis (Bertzky *et al.,* 2013), or a combination of both (Bertzky and Kenney, 2011).

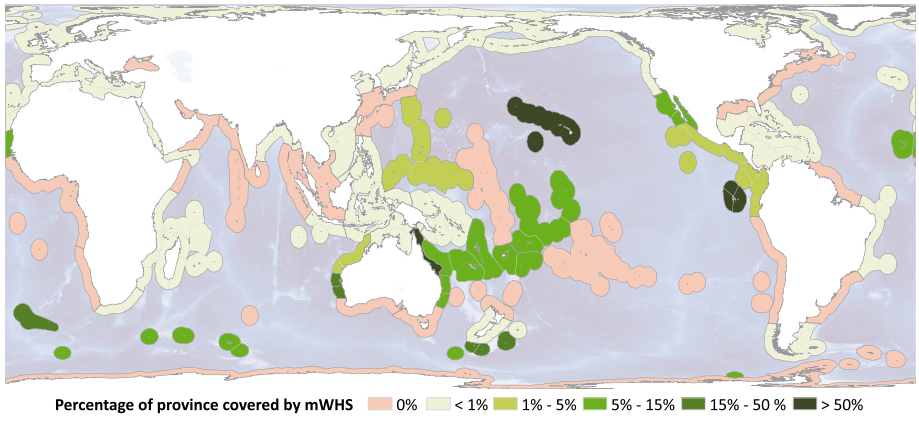

Figure 3. Percentage area of nearshore provinces (defined by Spalding *et al.,* 2007) covered by marine World Heritage Sites. The results presented here are for coastal and shelf waters shallower than 200 m but for visual clarity, are displayed on province boundaries drawn out to 200 nm offshore (or to the 200 m isobath where this lies further offshore), although only those areas out to the 200 m isobath are used in analyses.

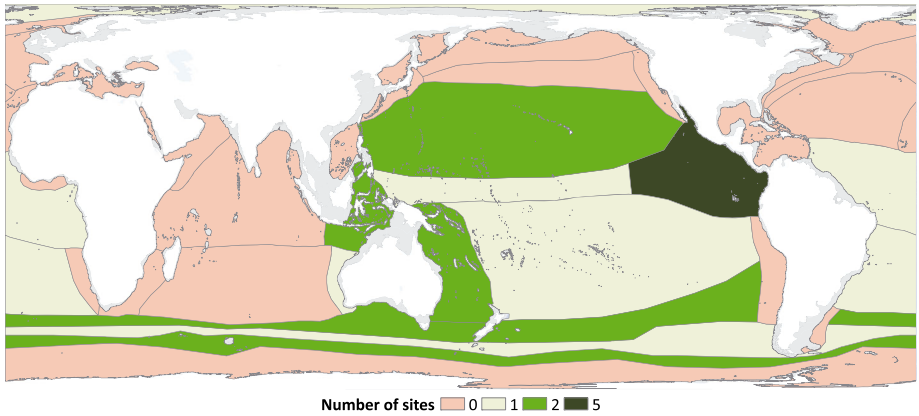

Figure 4. Number of marine World Heritage Sites within each pelagic province (defined by Spalding *et al.,* 2012). Continental shelf areas (shallower than 200 m) covered by the Marine Ecoregions of the World (MEOW) provinces are displayed in pale grey.

Table 6. Summary of the current distribution and coverage of 46 marine World Heritage Sites (mWHS) within the pelagic provinces (defined by Spalding *et al.,* 2012)

Pelagic province	Province area (km^2)	Number of mWHS	Total marine area of mWHS (km^2)	Percentage of province covered by mWHS
Eastern Tropical Pacific	11,799,017	5	136,651	1.2%
North Central Pacific Gyre	36,331,956	2	344,411	0.9%
Subtropical Convergence	21,872,207	2	2,352	<0.1%
Antarctic Polar Front	14,117,828	2	4,556	<0.1%
Non-gyral Southwest Pacific	7,814,425	2	96,372	1.2%
Indonesian Through-Flow	3,573,997	2	441	<0.1%
South Central Pacific Gyre	78,516,025	1	393,313	0.5%
Subantarctic	16,821,257	1	2,319	<0.1%
Equatorial Atlantic	16,101,195	1	1	<0.1%
South Central Atlantic Gyre	14,770,301	1	1,237	<0.1%
Equatorial Pacific	9,198,066	1	13,420	0.2%
Arctic	7,779,311	1	1,452	<0.1%
Leeuwin Current	1,365,676	1	153	<0.1%
Antarctic	30,523,686	0	0	0.0%
Indian Ocean Monsoon Gyre	19,157,940	0	0	0.0%
Indian Ocean Gyre	18,533,767	0	0	0.0%
North Central Atlantic Gyre	12,187,114	0	0	0.0%
Subarctic Pacific	8,219,637	0	0	0.0%
North Pacific Transitional	7,358,785	0	0	0.0%
North Atlantic Transitional	6,193,817	0	0	0.0%
Subarctic Atlantic	4,300,527	0	0	0.0%
Inter American Seas	3,331,685	0	0	0.0%
Humboldt Current	3,123,960	0	0	0.0%
Somali Current	2,609,832	0	0	0.0%
Agulhas Current	2,117,950	0	0	0.0%
Mediterranean	1,839,108	0	0	0.0%
Canary Current	1,804,980	0	0	0.0%
South China Sea	1,594,687	0	0	0.0%
California Current	1,466,336	0	0	0.0%
Benguela Current	1,342,788	0	0	0.0%
Gulf Stream	1,179,593	0	0	0.0%
Kuroshio	1,063,752	0	0	0.0%
Sea of Japan/East Sea	741,478	0	0	0.0%
Malvinas Current	690,115	0	0	0.0%
Guinea Current	630,337	0	0	0.0%
Black Sea	292,185	0	0	0.0%
Red Sea	229,962	0	0	0.0%

Given the current limitations of global marine datasets, especially for biodiversity, it may not yet be possible or appropriate to identify potential candidate sites in marine systems globally through a purely data-driven approach such as the irreplaceability analysis used in the study on terrestrial biodiversity (Bertzky *et al.,* 2013; Le Saout *et al.,* 2013). However, expert-driven or combined approaches have a long history of successful application in the WH context, and have triggered many WH nominations in the past.

In the marine context, these approaches could be particularly useful if applied at regional scales, where it is easier to bring together relevant expert knowledge with available datasets. Whatever approach is taken, any assessment of potential candidate sites should seek to consider, at least at the outset, the full set of the 16 marine themes (Table 2), as this provides a useful framework for identifying relevant marine features of potential OUV under each of the natural WH criteria.

A comprehensive, expert-driven approach has been piloted in the Western Indian Ocean region (Obura *et al.,* 2012), identified as a gap province in this analysis with <1% nearshore area covered in existing mWHS. The pilot study followed three main steps to identify potential candidate sites in the province (Obura *et al.,* 2012):

1. identification of the appropriate biogeographic scale for the assessment (the study used the boundary of the Western Indian Ocean province as defined by Spalding *et al.,* 2007);
2. identification of key physical and biological features that are of potential OUV and distinguish the region compared with others globally (the study identified the Mozambique Channel and the Mascarene Plateau as the primary, globally unique features); and
3. identification of sites in the region that best represent these features and that are of sufficient size and integrity to meet the Convention's standards (the study identified a series of sites for the Mozambique Channel, one site for the Mascarene Plateau, and several other potential candidate sites in the region).

Expert workshops can be used in any of the steps outlined above to facilitate data collection, analysis, and validation of results. While the Western Indian Ocean study was initially carried out by a small expert team, preliminary results were then reviewed through a workshop with regional experts and individual consultations (Obura *et al.,* 2012).

Building on available global datasets as well as better resolved regional and national datasets, regional expert assessments should produce tables and maps of key features and potential candidate sites at the marine province level. The results should be cross-validated by comparisons with regional assessments for other marine provinces in the broader region and, if possible, globally.

Different datasets and analyses may have to be used in the assessment for continental shelf, pelagic, and deep sea areas. For example, seamounts may be an important feature to consider in pelagic and deep sea waters in pelagic provinces, whereas coastal habitats such as coral reefs are of limited use to identify priority sites for marine features in pelagic provinces.

There are a number of important global datasets that can inform regional assessments, although they were not developed specifically to identify potential WH sites. With regard to biodiversity, these include the IUCN Red List of Threatened Species (IUCN, 2014) and emerging datasets on Ecologically or Biologically Significant Areas (EBSAs; CBD, 2009; also see http://www.cbd.int/ebsa/), marine Important Bird Areas (IBAs; BirdLife International, 2010; also see http://maps.birdlife.org/marineIBAs/default.html), and other marine Key Biodiversity Areas (KBAs; Edgar *et al.,* 2008). In addition, there are global datasets with reasonable coverage for a number of critical habitats (e.g. seamounts, coral reefs, seagrass beds and saltmarshes), and initial assessments of priority areas for marine biodiversity conservation globally (Selig *et al.,* 2014). All these datasets can be used to prioritize gap provinces and potentially even specific marine protected areas within these provinces, but should be supplemented by regional datasets and analyses.

Regional assessments should also be informed by the detailed guidance on the preparation of WH nominations which is available from the World Heritage Centre (UNESCO, 2011). This guidance covers the so-called comparative analyses, which assess the significance of candidate sites in their

national, regional and global context. These analyses often build on, and are greatly facilitated by, comprehensive regional assessments as proposed here.

Existing World Heritage studies, summarized in the next section, are another important but often overlooked source of information on potential candidate areas.

Potential candidate areas identified in previous studies

Over the past 30 years, IUCN, UNEP-WCMC and UNESCO have produced a number of global and regional studies on natural and mixed (natural and cultural) WHS that assessed the coverage of, and/or gaps, in the WHS network. Some of these studies included marine systems together with terrestrial and/or freshwater systems (IUCN, 1982; Thorsell *et al.,* 1997; Magin and Chape, 2004), others were specifically targeted at the marine environment (Hillary *et al.,* 2003; Obura *et al.,* 2012; Abdulla *et al.,* 2013). A number of these studies attempted to identify potential candidate areas at a finer scale than broad ecoregions or main habitat types.

The five relevant global and regional theme studies produced by IUCN, UNEP-WCMC and/or UNESCO (IUCN, 1982; Thorsell *et al.,* 1997; Hillary *et al*., 2003; Bertzky and Kenney, 2011; Obura *et al.,* 2012) were reviewed to compile a list of potential candidate areas with notable marine values that may merit consideration for WH nomination (Table 7). More information on the candidate sites and their values can be found in the original studies referenced in the table. Given the limitations of the four studies, including the limited geographic coverage of two of them (Bertzky and Kenney, 2011; Obura *et al.,* 2012), the list represents a non-exhaustive selection that should be considered as a starting point only. Some of the sites listed in Table 7 may have been rejected, deferred or referred by the WH Committee in the past, which would have implications for their re-nomination (it was beyond the scope of this study to review all past decisions of the WH Committee for such cases). However, the vast majority of the sites have not yet been assessed by IUCN (the responsible advisory body to the Committee) against the natural criteria and the protection, management and integrity requirements of the Convention, and thus they should be considered alongside the priority provinces in the global and regional follow-up.

Gap provinces and representation of mWH themes and features

Earlier prioritization for mWHS focused on tropical systems (Hillary *et al.,* 2003), and within this, the identification of sites belies a focus on shallow ecosystems and biodiversity patterns. The vast majority of sites included coral reef, mangrove and seagrass ecosystems and focused on biological criteria, with little reference to physical features except in their contribution to, for example, reef growth and biodiversity, and in some cases to upwelling. From the marine thematic structure presented here and in Abdulla *et al.* (2013) (Table 2), themes 11–16 were invoked but no primary mention was made of themes 1–10.

In an example of a regional approach to assessing marine themes and features of potential OUV, the Western Indian Ocean study (Obura *et al.,* 2012), identifies two types of sites: (a) large serial sites in which the geology and oceanography may qualify on their own under criterion (viii); and (b) smaller more 'traditional' sites in which a biological phenomenon of potential OUV occurs, mixed with species-related characteristics. The main example of the former, the Mozambique Channel, with unique oceanographic features resulting from its geological structure, was suggested as a serial site in which each piece supports a biological phenomenon of potential OUV, but the grouping of the sites together presents the most pressing argument for features across biological, geological and oceanographic themes. Overall, themes 1, 2, 5, 6 and 8 were invoked under criterion (viii), with the full range of themes from 10–16 across the multiple locations. An example of the latter, the sardine run in Kwazulu-Natal, South Africa, is in temperate waters. It is a superlative biological phenomenon driven by physical processes (under themes 6, 8, 10, 12 and 16) that attracts many rare or threatened species, but is based on an unremarkable fish in biodiversity terms (the sardine). A second example, Antongil Bay in NE

Table 7. Overview of potential candidate areas with notable marine values that may merit consideration for World Heritage nomination (compiled from IUCN, 1982; Thorsell *et al.,* 1997; Hillary *et al.,* 2003; Bertzky and Kenney, 2011; Obura *et al.,* 2012). The list does neither include areas that were noted in these studies primarily as potential extensions to existing World Heritage Sites nor areas that have already been inscribed on the World Heritage List. Only the sites on the A List in Hillary *et al.* (2003) are included in the list

Name of area or site	State Party or country	Reference
Africa		
Comoros – Glorieuses Crescent	Comoros and France	Obura *et al.* (2012)
Bazaruto Archipelago – Tofo Southern Madagascar		
Conkouati-Douli, Loango and Mayumba National Parks	Congo, Republic of and Gabon	Bertzky and Kenney (2011)
São Tomé and Príncipe and Annobón Island	Equatorial Guinea and São Tomé and Príncipe	Hillary *et al.* (2003)
French Southern Territories: Crozet, Kerguelen, Saint Paul and Amsterdam	France	Obura *et al.* (2012)
Iles Éparses (Scattered Islands)	France	Hillary *et al.* (2003); Obura *et al*. (2012)
Densu Delta, Muni, Sakumo, Songor and Keta Lagoons	Ghana	Hillary *et al.* (2003)
Bijagós Archipelago	Guinea-Bissau	Thorsell *et al.* (1997); Hillary *et al.* (2003), Bertzky and Kenney (2011)
Kiunga Marine National Reserve	Kenya	Obura *et al.* (2012)
Antongil Bay (Northeast Madagascar)	Madagascar	Obura *et al.* (2012)
North and Northwest Madagascar (Nosy Tanikely, Nosy Be)	Madagascar	Hillary *et al.* (2003), Obura *et al*. (2012)
Mascarene Plateau: Saya de Malha Bank	Mauritius and Seychelles	Obura *et al.* (2012)
Bazaruto Archipelago – Tofo	Mozambique	Hillary *et al.* (2003)
Maputo Bay – Ponto do Ouro	Mozambique	Hillary *et al.* (2003)
Quirimbas – Mnazi Bay Complex	Mozambique and Tanzania	Hillary *et al.* (2003), Obura *et al*. (2012)
Skeleton Coast	Namibia	Hillary *et al.* (2003)
Niger Delta and Cross River Barrier Lagoon System	Nigeria	Hillary *et al.* (2003)
Kwazulu-Natal Sardine Run	South Africa	Obura *et al.* (2012)
Rufiji River Delta – Mafia-Songo Songo	Tanzania	Hillary *et al.* (2003)
Arab States / Middle East		
Southern Red Sea	Djibouti, Eritrea, Saudi Arabia and Yemen	Thorsell *et al.* (1997); Hillary *et al.* (2003), Bertzky and Kenney (2011)
Northern Red Sea (e.g. Ras Muhammad National Park)	Egypt, Israel and Saudi Arabia	IUCN (1982); Thorsell *et al.* (1997); Hillary *et al.* (2003)
Hawar Islands and Jubail Wildlife Sanctuary	Bahrain and Saudi Arabia	Hillary *et al.* (2003)
Southeast Oman	Oman	Hillary *et al.* (2003)
Sanganeb Marine National Park (Central Red Sea)	Sudan	IUCN (1982); Bertzky and Kenney (2011)
Southern Gulf	United Arab Emirates	Hillary *et al.* (2003)
Asia		
Andaman and Nicobar Islands	India	IUCN (1982); Thorsell *et al.* (1997)
Banda / Lucipara Cluster	Indonesia	Hillary *et al.* (2003)
Berau Islands	Indonesia	Hillary *et al.* (2003)
Raja Ampat Region	Indonesia	Hillary *et al.* (2003)
Teluk Cenderawasih Marine National Park	Indonesia	Thorsell *et al.* (1997)
Taka Bone Rate Atoll	Indonesia	Thorsell *et al.* (1997)
Semporna / Tawi-tawi Chain	Malaysia	Hillary *et al.* (2003)
North Borneo / Balabac Strait/ Turtle Island Cluster	Malaysia and Philippines	Hillary *et al.* (2003)
Irrawaddy River Floodplain and Delta	Myanmar	Thorsell *et al.* (1997)
Chagos Archipelago	UK	Thorsell *et al.* (1997)
Spratly Island Group	Under dispute by South China Sea nations	Hillary *et al.* (2003)
Caribbean and Central America		
Andros Island Barrier Reef	Bahamas	Thorsell *et al.* (1997)
Anegada Island and Surrounding Waters	UK	IUCN (1982)
San Andres Archipelago	Colombia	Hillary *et al.* (2003)
Southern Cuba Coral Archipelago (e.g. Jardines de la Reina and Zapata Swamp)	Cuba	Thorsell *et al.* (1997); Hillary *et al.* (2003)
Gulf de Fonseca	El Salvador, Honduras and Nicaragua	Thorsell *et al.* (1997)
Usumacinta Delta and Tabasco Lagoons	Mexico	Thorsell *et al.* (1997)
Southern Caribbean Islands	Netherlands and Venezuela	Hillary *et al.* (2003)
Miskito Coast and Lowlands	Nicaragua	Thorsell *et al.* (1997)

(*Continues*)

Table 7. (Continued)

Name of area or site	State Party or country	Reference
Oceania / Pacific		
Line Islands Cluster	Cook Islands, France, Kiribati and USA	Hillary *et al.* (2003)
Great Astrolobe Reef	Fiji	Thorsell *et al.* (1997)
Pohnpei-Kosrae Island Cluster	Micronesia, Federated States of	Hillary *et al.* (2003)
Milne Bay	Papua New Guinea	Hillary *et al.* (2003)
New Hanover and Manus Cluster	Papua New Guinea	Hillary *et al.* (2003)
Sepik and Ramu Floodplains	Papua New Guinea	Thorsell *et al.* (1997)
Marovo Lagoon and Arnavon Islands	Solomon Islands	Hillary *et al.* (2003)
North America		
Eclipse Sound / Bylot Island	Canada	IUCN (1982)
Revillagigedo and Clipperton Islands	France and Mexico	Hillary *et al.* (2003)
Point Reyes National Seashore	USA	IUCN (1982)
Virginia Coast Reserve	USA	IUCN (1982)
South America		
Chilean Fjordlands	Chile	Thorsell *et al.* (1997)

Madagascar, provides a feeding and nursery ground for multiple threatened species (for example, among mammals – the dugong (*Dugong dugon*), a pinniped (*Arctocephalus tropicalis*), and 11 species of cetaceans, including humpback whales (*Megaptera novaeangliae*), southern right whales (*Eubaleana australis*), sperm whales (*Physeter macrocephalus)*, and beaked whales (*Ziphius cavirostris*)), but its main value may be its oceanographic (themes 6 and 8) and ecological processes (themes 10 and 12). Applying this approach across the gap provinces identified (Tables 5 and 6), as well as within provinces that already have mWHS, may provide countries with a more nuanced and powerful approach to identifying features of Outstanding Universal Value, and to ensure the focus of mWH nominations is based on the best, rather than representation.

Areas Beyond National Jurisdiction

The World Heritage Convention is specifically targeted at areas under national jurisdiction. However, the approach recognized by the Convention can potentially be applied to Areas Beyond National Jurisdiction (ABNJs, alternatively, termed the 'high seas'). The World Heritage Convention currently does not apply to ABNJs, which constitute about 60–66% of the ocean's surface including most of the area of the pelagic provinces, and a much larger proportion of the three-dimensional biome in the ocean. Yet the high seas probably include areas that could meet the natural criteria for OUV of World Heritage. Information compiled through the regional workshops facilitated by the CBD to describe Ecologically and Biologically Significant Areas (EBSAs) may offer a first step in assessing the potential for applying the World Heritage criteria for OUV to high seas areas.

However, no mechanism currently exists in the World Heritage Convention for the identification and designation of sites in ABNJs. There is an opportunity therefore to reflect on the use of the tools of the World Heritage Convention to identify high seas sites of OUV that intergovernmental institutions or groups of States can conserve and protect multilaterally. This would need to be consistent with international law relevant to the high seas, as provided for in the UN Convention on the Law of the Sea (UNCLOS). Currently, discussions at the United Nations on a possible new instrument under UNCLOS for conservation and sustainable use of marine biodiversity in ABNJs may provide a possible vehicle to address this gap.

CONCLUSIONS AND FUTURE WORK

This study has shown that many large marine areas with distinct values have not yet been assessed for OUV and are not currently represented on the marine WH List. In order to fulfill the World Heritage Committee's Global Strategy for a

Representative, Balanced and Credible World Heritage List (UNESCO, 1994), States Parties are encouraged to increase their efforts, with the support of the UNESCO World Heritage Centre, IUCN, and regional and global marine scientists and conservationists, to identify and nominate marine sites of potential OUV, especially in biogeographic regions that are not yet represented, or are underrepresented, on the WH List.

This analysis has identified a first set of gap provinces with no mWHS coverage, and also provinces with minimal mWHS coverage. These biogeographic regions should be prioritized for follow-up at the regional level, where sites of potential OUV could be identified using the approaches outlined in this paper. Although not all gap provinces may hold sites that meet the rigorous standards of the Convention, a more systematic approach to the nomination and designation of mWHS, as proposed here, is expected to lead to a more representative and balanced World Heritage List with substantial benefits for marine conservation. The global thematic study (Abdulla *et al.,* 2013) and this paper provide necessary guidance for the nomination and designation of new mWHS.

However, questions remain on what thematic features are unrepresented or underrepresented, how many WHS are needed to adequately protect features of OUV, and in provinces where there are already WHS, are these sites enough to protect the features of OUV? As immediate next steps for this study, it is important to review the nomination dossiers of each of the mWHS to identify what thematic features are missing from the current mWH List. These missing features should be cross-referenced with those contained in the potential candidate sites of Table 7 and matches identified. Candidate sites with unrepresented or underrepresented features and that are found in gap provinces should be identified as priority sites for nomination and evaluation as potential mWHS. These sites can be used to fill some of the biogeographic and features gaps currently found on the mWH List. Designation of candidate sites as mWHS will enhance the representation and consequently the management and protection of underrepresented marine features of OUV.

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