Supplementary material of: Martin, C. S., Tolley, M. J., Farmer, E., Mcowen, C. J., Geffert, J. L., Scharlemann, J. P. W., Thomas H. L., van Bochove J. H., Stanwell-Smith D., Hutton, J. M., Lascelles, B., Pilgrim, J. D., Ekstrom, J. M. M., Tittensor, D. P. (2015) A global map to aid the identification and screening of critical habitat for marine industries. Marine Policy 53: 45-53. doi:10.1016/j.marpol.2014.11.007

Contents:

1 Appendix S1. Global data layers relevant to marine and coastal biodiversity and considered for inclusion into the Critical Habitat map.

Category	**Dataset title**	**Contact organisation**	**Selected for inclusion**	**Main reason (if not selected)**
Biogenic habitat	World Atlas of Mangroves (2010)	UNEP World Conservation Monitoring Centre	No	Used an alternative dataset that was created using a globally-consistent methodology
Biogenic habitat	Global Distribution of Mangroves (1997)	UNEP World Conservation Monitoring Centre	No	Used an alternative dataset that was created using a globally-consistent methodology
Biogenic habitat	Global Distribution of Seagrasses (2005)	UNEP World Conservation Monitoring Centre	Yes	
Biogenic habitat	Global Distribution of Cold-water Corals (2005)	UNEP World Conservation Monitoring Centre	Yes	
Biogenic habitat	Global Distributions of Habitat Suitability for Framework-Forming Cold-Water Corals (2011)	School of Ocean Sciences, University of Bangor	Yes	
Biogenic habitat	Global Distribution of Habitat Suitability for Stony Corals on Seamounts (2009)	UNEP World Conservation Monitoring Centre	No	Used an alternative dataset that had continuous spatial coverage
Biogenic habitat	Global Distributions of Habitat Suitability for Cold-Water Octocorals (2012)	Institute of Zoology, Zoological Society of London	Yes	
Biogenic habitat	Global Distribution of Mangroves USGS (2011)	UNEP World Conservation Monitoring Centre	Yes	
Biogenic habitat	Global Distribution of Saltmarsh (2013)	UNEP World Conservation Monitoring Centre	Yes	
Biogenic habitat	Global Distribution of Coral Reefs (2010)	UNEP World Conservation Monitoring Centre	Yes	
Species habitat	Global Distribution of Marine Turtle Nesting Sites (1999)	UNEP World Conservation Monitoring Centre	Yes	
Species habitat	Global Distribution of Marine Turtle Nesting Sites (2011)	State of the World's Sea Turtles	No	Used an alternative dataset (line vectors rather than point data)
Species habitat	Global Distributions of Habitat Suitability for Marine Turtle Nesting Sites (2012)	State of the World's Sea Turtles	No	Used an alternative dataset (not modelled)

Category	Dataset title	Contact organisation	Selected for inclusion	Main reason (if not selected)
Species distribution	Spatial Data for the Red List of Threatened Species (2013)	International Union for Conservation of Nature	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Species distribution	Tagging of Pacific Predators in the Pacific Ocean (2013)	Tagging of Pacific Predators	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Species distribution	Global Distribution of Marine Turtles (2010)	State of the World's Sea Turtles	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Species distribution	Marine Animal Tracking (2013)	Ocean Tracking Network, Dalhousie University	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Species distribution	Global Register of Migratory Species (2004)	Zoologisches Forschungsinstitut und Museum Alexander Koenig	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Species distribution	Global Shark Distribution Database (2009)	Dalhousie University	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Species distribution	Standardized Distribution Maps for >17,300 Marine Species (2013)	Aquamaps	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Species distribution	Marine Species Datasets of the World's Oceans (2013)	Ocean Biogeographic Information System, Intergovernmental Oceanographic Commission (UNESCO)	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Biodiversity metric	Global Marine Turtle Species Richness (2002)	UNEP World Conservation Monitoring Centre	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Biodiversity metric	Global Patterns of Marine Biodiversity (2010)	UNEP World Conservation Monitoring Centre	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Biodiversity metric	Global Map of Hurlbert's Index of Biodiversity (2010)	Ocean Biogeographic Information System, Intergovernmental Oceanographic Commission (UNESCO)	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Biodiversity metric	Global Map of Shannon's Index of Biodiversity (2010)	Ocean Biogeographic Information System, Intergovernmental Oceanographic Commission (UNESCO)	No	Did not align sufficiently with CH criteria / scenarios and associated guidance

Category	Dataset title	Contact organisation	Selected for inclusion	Main reason (if not selected)
Biodiversity metric	Global Seagrass Species Richness (2003)	UNEP World Conservation Monitoring Centre	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Area of biodiversity importance	World Database on Protected Areas (2013)	UNEP World Conservation Monitoring Centre	Yes	
Area of biodiversity importance	Areas of Particular Environmental Interest (2012)	International Seabed Authority	No	Not published in GIS format at the time of the analysis
Area of biodiversity importance	Global Distribution of Particularly Sensitive Sea Areas (2012)	International Maritime Organization	No	Not published in GIS format at the time of the analysis
Area of biodiversity importance	Global Distribution of Vulnerable Marine Ecosystems	Food and Agriculture Organization of the United Nations	No	Not published at the time of the analysis
Areas of biodiversity importance	Global Distribution of EBSAs	Secretariat of the Convention on Biological Diversity	No	Not published at the time of the analysis
Area of biodiversity importance	Global Distribution of KBAs, IBAs and AZEs (2013)	Birdlife International	Yes	
Biogeographic classification	Global Distribution of Hydrothermal Vent Fields (2013)	InterRidge, Peking University	Yes	
Biogeographic classification	Global Distribution of Hydrothermal Vents (2010)	University of Southampton, National Oceanography Centre	No	Used an alternative dataset (more complete)
Biogeographic classification	The Global 200 Ecoregions (2002)	World Wildlife Fund	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Biogeographic classification	Global Seamount Database (2011)	School of Ocean and Earth Science and Technology, University of Hawaii	No	Used an alternative dataset (more complete)
Biogeographic classification	Global Distribution of Seamounts and Knolls (2011)	Institute of Zoology, Zoological Society of London	Yes	
Biogeographic classification	Global Distribution of Cold Seeps (2010)	University of Southampton, National Oceanography Centre	Yes	

Category	Dataset title	Contact organisation	Selected for inclusion	Main reason (if not selected)
Biogeographic classification	Large Marine Ecosystems of the World (2002)	National Oceanic and Atmospheric Administration	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Biogeographic classification	Longhurst Biogeographical Provinces (2006)	Flanders Marine Institute	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Biogeographic classification	A Proposed Biogeography of the Deep Oceans (2013)	University of Hawaii	No	Not made available in GIS format for the analysis
Biogeographic classification	Marine Ecoregions of the World (2007)	UNEP World Conservation Monitoring Centre	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Biogeographic classification	Pelagic Provinces of the World (2012)	UNEP World Conservation Monitoring Centre	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Biogeographic classification	Global Seafloor Geomorphic Map	GRID-Arendal	No	Not published at the time of the analysis
Biogeographic classification	SeamountsOnline: an OnlineInformation System for Seamount Biology (2009)	San Diego Supercomputer Center, University of California	No	Used an alternative dataset (more complete)
Ecological status and impact	Global Data for the Ocean Health Index (2012)	National Centre for Ecological Analysis and Synthesis, University of California	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Ecological status and impact	A Global Map of Human Impacts to Marine Ecosystems (2008)	National Centre for Ecological Analysis and Synthesis, University of California	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Environment descriptor	Mean Sea Surface Productivity in June and December 2003-2007 (2008)	UNEP World Conservation Monitoring Centre	No	Did not align sufficiently with CH criteria / scenarios and associated guidance
Environment descriptor	Mean Annual Sea Surface Temperature 2003-2007 (2008)	UNEP World Conservation Monitoring Centre	No	Did not align sufficiently with CH criteria / scenarios and associated guidance

Appendix S2. Documentation and justification of biodiversity feature classification. Included here are Figures S1-S11 (maps for each biodiversity feature). IFC PS6: International Finance Corporation Performance Standard 6.

1. Key Biodiversity Areas

Justification(s) for alignment with IFC PS6 criteria for Critical Habitat:

Key Biodiversity Areas (KBAs) are marine, freshwater and terrestrial *sites which contribute significantly to the global persistence of biodiversity at the genetic, species and ecosystem levels*. The KBA network encompasses sites of high biodiversity value of global significance, including Important Bird Areas (IBAs) and Alliance for Zero Extinction (AZE) sites (Scenario B[1],[2]). Although designated at national level, KBA identification follows a set of globally accepted and standardised criteria and thresholds: threatened biodiversity[3], geographically-restricted biodiversity, outstanding ecological integrity and/or outstanding biological processes, such as migratory or congregatory sites (Eken et al. 2004). As it is data-driven and species-based, the KBA process can transparently support the identification of marine key biodiversity areas (e.g. Edgar et al. 2008a, Bass et al. 2010, Ambal et al. 2012, Lascelles et al. 2012), and help minimise political bias in the planning of marine protected area networks for biodiversity conservation (Edgar et al. 2008b). Marine KBA identification is complete or in progress in several regions (Foster et al. 2012), including the Philippines (completed; Ambal et al. 2012).

AZEs are an important subset of KBAs (Eken et al. 2004) and are delineated because they contain at least 95% of the known population of one or more Critically Endangered or Endangered species (IUCN 2013). They are therefore indicative of where a species' extinction may be imminent if degradation of that area occurs, or threats to the population exist (Langhammer et al. 2007). In 2008, only 22% of the 588 designated AZEs were completely covered by protected areas, and 51% remain entirely unprotected (Bertzky et al. 2012).

IBAs are key sites for the conservation of bird species, identified by BirdLife International. Often small in size, these sites frequently form part of a protected area network and are, as far as possible, different in character, habitat or ornithological importance from the surrounding area. Inventories of IBAs have now been produced for most of the terrestrial and freshwater regions of the world, and recent work has seen the programme expand into the coastal and marine environments. IBAs are designated on the basis of criteria relating to globally threatened species, restricted-range species, biome-restricted species or congregations. For seabirds, a global marine IBA directory was launched in 2012[4]. These sites are identified based on the presence of more than threshold numbers of (1) globally threatened species and/or (2) congregations (areas holding >1% of the global or, in some cases, biogeographic population) (BirdLife International 2010a and b). The types of site that qualify

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[1] See Supplementary Material Table S1 for detailed IFC PS6 criteria for Critical Habitat.
[2] "Scenario B. Internationally and/or nationally recognized areas of high biodiversity value. Example: "[...] the majority of KBAs, which encompass inter alia Ramsar Sites, IBAs, IPAs and AZEs".
[3] As defined by the IUCN Red List of Threatened Species and the IUCN Red List of Ecosystems.
[4] Sites can be consulted at: http://maps.birdlife.org/marineIBAs/default.html.

as marine IBAs include seabird breeding colonies, foraging areas around breeding colonies, non-breeding (usually coastal) concentrations, migratory bottlenecks and feeding areas for pelagic species.

To improve the standardisation of KBA identification further, the IUCN[5] Species Survival Commission and the World Commission on Protected Areas have convened a Joint Task Force on 'biodiversity and protected areas', one of the objectives of which is to consolidate scientific stakeholder consensus on the criteria and thresholds for KBA identification[6] (see IUCN 2012). With this move towards increasingly standardised underlying criteria, KBAs represent a useful system for identifying areas of comparable importance for biodiversity at a global scale. KBAs hence form an important part of the global conservation community's response to the loss of threatened biodiversity (Brooks et al. 2006).

Work is also currently being carried out in collaboration with the EBSAs[7] community and the Global Ocean Biodiversity Initiative (GOBI), under the auspices of the Convention on Biological Diversity (CBD; United Nations 1992), to ensure synergies between KBAs and EBSAs, those open-ocean waters and deep-sea habitats in need of protection (Ardron et al, 2009, GOBI 2010). Although there is no official endorsement from the CBD for KBAs (but see Foster et al. 2012), it is suggested that KBAs could become a list of potential EBSAs (CBD Secretariat 2012), in the same way that marine IBAs already are for EBSAs (Birdlife International 2009), and freshwater IBAs for the Ramsar Convention (Ramsar Convention Secretariat 1971).

KBAs are referenced by IFC PS6 as qualifying as Critical Habitat under Scenario B for all sites where the criteria for designation of the KBA align with one or more of the five criteria for Critical Habitat. This includes all KBA triggers, other than where sites are identified purely on the presence of Vulnerable species, and some overlap occurs with Criteria 1, 2 and 3. The AZE criterion for presence of 95% of a species' population reflects Tier 1 sub-criterion for Criterion 2. As such, KBAs with the appropriate triggers are designated as Likely Critical Habitat in our categorisation, whilst sites purely triggered by Vulnerable species are designated as Potential Critical Habitat as they may still contain biodiversity values that reflect Critical Habitat.

Selected dataset(s):

The selected dataset is a global shapefile of KBAs of the world (Birdlife International and Conservation International 2013), including IBAs and AZEs. The dataset contains >12,000 polygons and >960 points of KBA presence (terrestrial and marine sites), and represents the best available global dataset. All sites (terrestrial or marine) that spatially overlapped with the analysis mask were included in the analyses, including a total of >2,100 'marine' sites (most of which are marine IBAs). The identification and delineation of KBAs are on-going processes, particularly in the marine realm, and updated versions featuring newly designated sites will be released in the future.

[5] International Union for Conservation of Nature.
[6] Task Force Objective 2: To consolidate a standard for the identification of sites contributing significantly to the global persistence of biodiversity (www.iucn.org/about/work/programmes/gpap_home/gpap_biodiversity/gpap_wcpabiodiv/gpap_pabiodiv/key_biodiversity_areas/). The consolidated standard for KBA identification is to be launched at the World Parks Congress in September 2014.
[7] Ecologically and Biologically Significant Areas.

Birdlife International, Conservation International (2013). Global distribution of Key Biodiversity Areas. Cambridge (UK): Birdlife. URL: www.birdlife.org

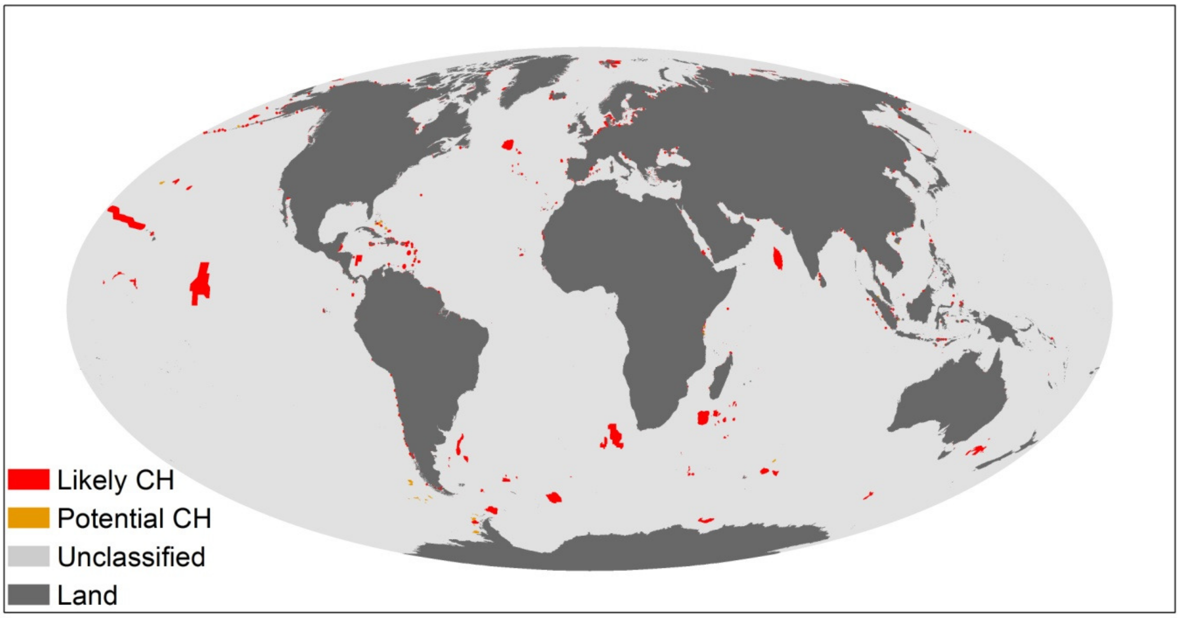

Figure S1: Global map of Key Biodiversity Areas with a marine component. CH: Critical Habitat.

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Foster MN, Brooks TM, Cuttelod A, de Silva N, Fishpool LDC, Radford EA, Woodley S (2012). The identification of sites of biodiversity conservation significance: progress with the application of a global standard. Journal of Threatened Taxa 4: 2733–2744

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Lascelles BG, Langham GM, Ronconi RA, Reid JB (2012). From hotspots to site protection: Identifying Marine Protected Areas for seabirds around the globe. Biological Conservation 156: 5-14

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Ramsar Convention Secretariat (2013) The Ramsar Convention manual: a guide to the Convention on Wetlands (Ramsar, Iran, 1971), 6th ed. Gland (Switzerland): Ramsar Convention Secretariat. 112 pp.

United nations (1992). Convention on Biological Diversity. Rio de Janeiro (Brazil), 05 June 1992

2. Protected areas

Justification(s) for alignment with IFC PS6 criteria for Critical Habitat:
Protected areas are a key tool for preserving habitat integrity and species diversity (Geldmann et al. 2013). For the purpose of this analysis, protected areas follow the IUCN definition as "clearly defined geographical spaces, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley (Ed.) 2008). Marine Protected Areas (MPAs) are an important management tool for maintaining coastal and maritime biodiversity, and safeguarding areas that are important for our natural and cultural marine heritage (Dudley (Ed.) 2008). Between 1990 and 2012, marine protection increased from 1.2 to 5.4% in areas of potential jurisdiction (i.e. typically extending from the coastline to 200 nautical miles), with protection in territorial waters (up to 12 nautical miles) increasing from 4.6 to 9.7% (United Nations 2013). Currently, MPAs cover about 2.3% of the global ocean area (Spalding et al. 2013) and this spatial extent is expanding in response to increasing pressure on national and international bodies to preserve biodiversity and ecosystem services. The most notable example of this is the recent 'Aichi Target 11' (CoP/CBD 2010) set by the Convention on Biological Diversity (CBD; United Nations 1992) to increase global MPA coverage to 10% by 2020. Marine protection of areas beyond national jurisdiction, i.e. the high seas, remains very low at 0.17% (Spalding et al. 2013).

World Heritage sites and Ramsar sites
In 1972, UNESCO[8] adopted the 'World Heritage Convention' to identify and protect the world's natural and cultural heritage that represents "outstanding universal value"; UNESCO 1972). World Heritage sites, specifically those for natural heritage, must be able to meet one or more of the four criteria that specifically relate to natural features, which are globally outstanding examples of: (1) *natural phenomenon or natural beauty*; (2) *major stages of earth's history*; (3) *significant, on-going ecological and biological processes in the evolution and development of terrestrial, freshwater, coastal and marine ecosystems and communities of plants and animals*; and (4) *natural habitats for* in situ *conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation* (World Heritage Centre 2012, Bertsky et al. 2013).

The 'Ramsar Convention', adopted in 1971, identifies and protects wetlands *on account of their international significance in terms of ecology, botany, zoology, limnology or hydrology* and *wetlands of international importance to waterfowl at any season* (Ramsar Convention Secretariat 1971 and 2103). Wetlands, including coastal and marine habitats, must meet at least one of nine criteria that indicate the site is either: (1) *a representative, rare or unique wetland type within the appropriate biogeographic region*; or (2) *of international importance for conserving biodiversity (species and ecological communities, waterbirds, fish, or other taxa)*. Category (2) relates to the conservation of rare, threatened, restricted species, as well as significant life cycle stages, populations or aggregations of individuals.

[8] United Nations Educational, Scientific and Cultural Organisation.

Given the global significance and exceptional values of natural World Heritage and Ramsar (wetland of international importance) sites, these sites have been listed in IFC PS6 as representing Critical Habitat under Scenario B[9] and are therefore designated as Likely Critical Habitat in our classification.

Protected areas where an IUCN management category is reported/specified

At the 2nd World Parks Conference in 1972, IUCN was called upon to define the various purposes of protected areas, including MPAs, and to develop suitable standards for their classification (Elliott 1974). In 1994, IUCN established the first formal protected area definition and classification system (IUCN 1994) which was later revised in 2008 to the definition that exists today (see above). A site must first fulfil the 2008 IUCN definition of a protected area before being allocated to one of six categories (I-VI) according to the primary management objective that applies to at least 75% of the site (Dudley (Ed) 2008).

It should be noted that the IUCN protected area management categories are defined according to the management objective associated with the protected area, not the biodiversity value of the site. Whilst all protected areas meeting the IUCN definition could, in theory, be attributed to one of the six management categories, this process is not undertaken comprehensively nor uniformly across the same country (if at all) by many national authorities designating protected areas. Almost one third of national-level protected areas recorded in the World Database on Protected Areas (WDPA) do not have a management category reported by the relevant national authority (UNEP-WCMC 2012). Hence, as the application of IUCN management categories is the responsibility of the states, this information remains subjective and based on interpretations of category names, which vary across and within countries. Despite these limitations, distinction made between protected areas on the basis of their IUCN management categories is specified by IFC and was hence followed in this analysis. Local-scale assessments are hence required to alleviate this risk.

Interestingly, IFC PS6 refers to *legally protected areas*. Since the IUCN definition allows for protected areas that are not legally designated (such as community recognised MPAs), this distinction may be worth consideration in detailed Critical Habitat assessments at a site-scale to decide on the relevance of individual protected areas to the Critical Habitat attribution.

Protected areas with IUCN management categories Ia (strict nature reserve), Ib (wilderness area) and II (national park) are stated in IFC PS6 as qualifying under Scenario B[10] as Critical Habitat and are designated Likely Critical Habitat in our categorisation. IUCN management categories III-VI[11] may also qualify "depending on the biodiversity values inherent to those sites" (Scenario B), and these are therefore designated as Potential Critical Habitat reflecting the need for further investigation into the biodiversity values present at those sites before a decision can be made on alignment with Critical Habitat criteria.

Other protected areas

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[9] "Scenario B. Internationally and/or nationally recognized areas of high biodiversity value. Examples: [...] UNESCO natural World Heritage sites, [...] Ramsar Sites [...]"

[10] "Scenario B. Internationally and/or nationally recognized areas of high biodiversity value. Examples: areas that meet the criteria of the IUCN's Protected Area Management Categories Ia, Ib and II, although areas that meet criteria for Management Categories III-VI may also qualify depending on the biodiversity values inherent to those sites".

[11] III: natural monument or feature; IV: habitat/species management area; V: protected landscape/seascape; VI: protected area with sustainable use of natural resources.

There are additional protected area designations, such as the European Union's *Natura 2000 network* (designated under the Habitats and Birds Directives; CEC 1992, European Parliament and CEU 2010), as well as a number of designations made under International conventions, such as the Barcelona Convention's *Specially Protected Areas of Mediterranean Importance* (SPAMIs; Barcelona Convention Secretariat 1995[12]) and the OSPAR Convention's *Marine Protected Areas* in the northeast Atlantic (OSPAR Commission 1992[13]), that are not directly referenced in IFC PS6. These are categorised Potential Critical Habitat, highlighting the need for further investigation into the criteria behind these designations and how well they align with IFC PS6 criteria for Critical Habitat. All remaining protected areas were categorised Potential Critical Habitat, and these included those national-level sites for which an IUCN management category was not available ("not reported, not specified").

Selected dataset(s):

The World Database on Protected Areas (IUCN and UNEP-WCMC 2013) has been in existence since 1981, and is the most comprehensive global database on terrestrial and marine protected areas. In this georeferenced dataset, sites classed as "marine" (i.e. reported as such by national authorities) consisted of >7,500 polygons and >1,700 points, to which to which sites spatially overlapping with the coastal land strip part of the analysis mask were added.

IUCN , UNEP-WCMC (2013). The World Database on Protected Areas (WDPA). August 2013 Release. Cambridge (UK): UNEP World Conservation Monitoring Centre. URL: www.protectedplanet.net

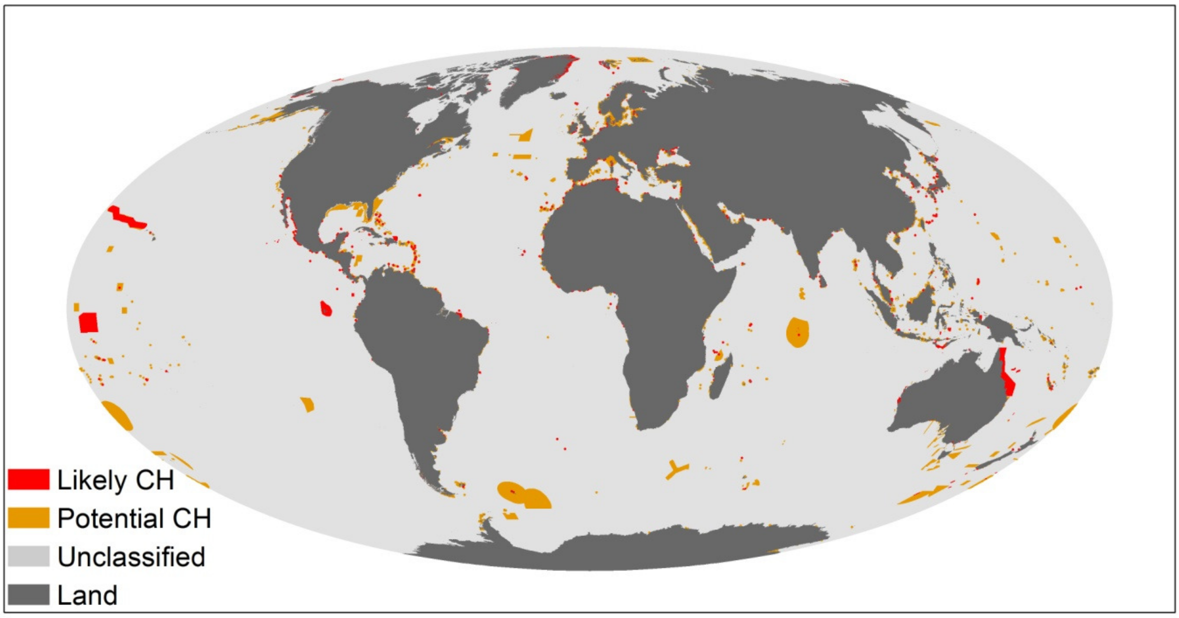

Figure S2: Global map of protected areas with a marine component. CH: Critical Habitat.

[12] Specifically the protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol). See http://rac-spa.org/sites/default/files/protocole_aspdb/protocol_eng.pdf

[13] Specifically OSPAR Recommendation 2003/3 on a Network of Marine Protected Areas. See www.ospar.org/documents/dbase/decrecs/recommendations/03-03e_consolidated%20rec%202003-3.doc

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United nations (1992). Convention on Biological Diversity. Rio de Janeiro (Brazil), 05 June 1992

United Nations (2013). The millennium development goals report 2013. New York (USA): United Nations. 64 pp.

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3. Sea turtle nesting sites

Justification(s) for alignment with IFC PS6 criteria for Critical Habitat:
Of the seven existing species of sea turtles, three are classified as Critically Endangered (hawksbill turtle *Eretmochelys imbricata*, Kemp's ridley turtle *Lepidochelys kempii* and leatherback turtle *Dermochelys coriacea*), two as Endangered (green turtle *Chelonia mydas* and loggerhead turtle *Caretta caretta*), one as Vulnerable (olive ridley turtle *Lepidochelys olivacea*), and one as Data Deficient (flatback turtle *Natator depressus*) in IUCN's Red List of Threatened Species (IUCN 2013). The range of global threat levels indicates varying population dynamics across species, but also masks disparate population trends across different regions of the world (Seminoff and Shanker 2008; Godfrey and Godley 2008). For instance, the Marine Turtle Specialist Group of the IUCN highlighted steep declines in the populations of leatherback turtles and loggerhead turtles in the Pacific (Mast et al. 2006), but encouraging trends were recorded in Kemp's ridley turtles (Tamaulipas and Vera Cruz, Mexico), and low but steady nesting populations of hawksbill turtles (Buck Island, Caribbean) (Heppell et al. 2003).

Sea turtles are air-breathing, but spend most of their lives at sea. All species lay their eggs on land, typically on sandy beaches. Sea turtles may migrate hundreds or even thousands of kilometres between established feeding and breeding sites (Plotkin 2003; Hays et al. 2004; Limpus et al. 2009), and display a strong degree of nest site fidelity (Heppell et al. 2003). Nesting beaches where Critically Endangered turtles are known to nest therefore align well with Criterion 1[14], as they represent sites of known, regular occurrences of individuals and populations of Critically Endangered species. During the breeding/nesting seasons, both sexes typically aggregate in the waters close to the nesting beaches (Hamann et al. 2003; Bonin et al. 2006). Nesting beaches and their surrounding water are hence relevant to Criterion 3[15], although only major nesting grounds would demonstrate clear alignment with this criterion. Kemp's ridley and olive ridley turtles can exhibit mass nesting events, during which thousands of females come up to nest at the same time on the same beaches (Miller 1997; Valverde et al. 2012). Such congregatory behaviour is of relevance to Criterion 3[16], but would need to be investigated further, based on the local population numbers relative to the global populations.

Fisheries bycatch is regarded as the main threat to sea turtles globally (Wallace et al. 2013). As slow growing species, with relatively late sexual maturity (between 7 and 30 years, depending on the species; Heppell et al. 2003), they are particularly vulnerable to the impacts of bycatch (Zydelis et al. 2008) and the degradation of breeding and nesting habitats. It is hence essential that nesting sites are preserved, both in quality and surface area. Nesting beaches are however under threat (Criterion 4[17]) from a variety of factors. Human exploitation of eggs and hunting of nesting females is a significant threat in many areas (Campbell 2003; Shanker 2004, and references therein). The development of coastal areas is linked with increased pollution, water quality degradation, erosion and overexploitation of natural resources (Lotze et al. 2006). Noise and light pollution can disturb nesting females and disorientate emerging hatchlings on their way to the sea, and vehicle use can cause compaction and destroy nests (Demetropoulos 2000; Witherington 1997). Feral pigs and dogs cause

[14] "Criterion 1. Habitats of significant importance to Critically Endangered (CE) and/or Endangered (EN) species. [...] Tier 2: habitat that supports the regular occurrence of a single individual of an IUCN Red-listed CR species [...]".
[15] "Criterion 3. Habitats supporting globally significant concentrations of migratory species [...]. ".
[16] "Criterion 3. Habitats supporting globally significant concentrations of [...] congregatory species"
[17] "Criterion 4. Highly threatened and/or unique ecosystems. Defined as: at risk of significantly decreasing in area or quality".

significant nesting losses in some areas (Márquez-M. 2004), and litter may prevent hatchling movement and cause deleterious effects to adult turtles (Ramos et al. 2012). The temperature-sensitive sex determination and migratory behaviour of sea turtles make them particularly vulnerable to the impacts of climate change (Poloczanska et al. 2009). Increased nesting beach temperatures have been shown to skew the sex ratio of hatchlings, and increasing sea level can destroy nests (Limpus 2006). Finally, sea level rise is recognised as a significant threat to turtle nesting sites, with a 0.5 m rise in sea level predicted to result in a loss of up to 32% of the total current beach area of a Caribbean island, with lower, narrower beaches being the most vulnerable (Fish et al. 2005).

Major nesting grounds are likely to qualify under Criterion 3, but further investigation would be required to identify them based on local population numbers: as a result, all nesting beaches were by default coded Potential Critical Habitat in our categorisation. As not all nesting beaches suffer the same level of threat, all were classed as Potential Critical Habitat with regards to Criterion 4, to reflect this uncertainty. Nesting beaches where Critically Endangered sea turtle species are known to nest clearly qualify under Criterion 1, and were hence designated as Likely Critical Habitat in our categorisation.

Selected dataset(s):

The selected dataset is a global shapefile of sea turtle nesting sites (UNEP-WCMC 1999). Information covers the period from 1949 to 1993 and was obtained from published and unpublished literature, and through liaison with turtle fieldworkers. The dataset contains >13,700 lines of sea turtle nesting beach presence. This dataset is the only line dataset of observed nesting occurrence, but is no longer being maintained. Other global datasets of nesting sites do exist (e.g. point datasets from the State of the World's Sea Turtles[18], which will be considered for future updates of the layer), but line format was preferred at this time, due to the precautionary principle in terms of a screening tool.

UNEP-WCMC (1999). Global distribution of sea turtle nesting sites. Cambridge (UK): UNEP World Conservation Monitoring Centre. URL: http://data.unep-wcmc.org

[18] http://seaturtlestatus.org/learn/maps/all

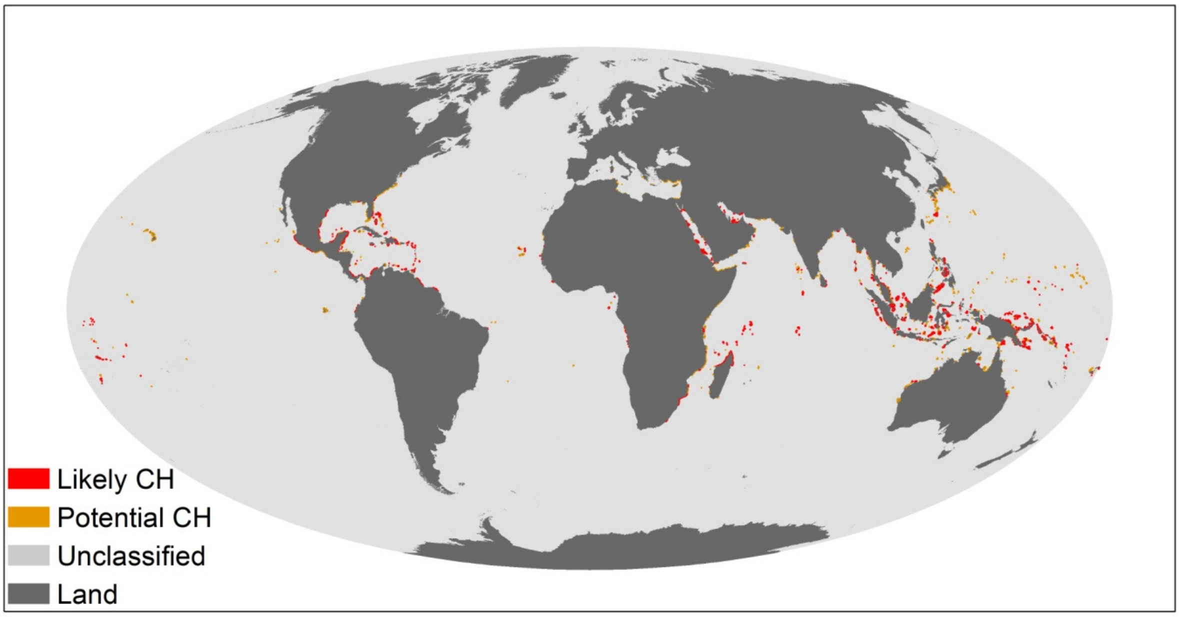

Figure S3: Global map of sea turtle nesting sites. CH: Critical Habitat.

References:

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Campbell LM (2003). Contemporary culture, use, and conservation of sea turtles. In: The biology of sea turtles, Volume 2 (PL Lutz, JA Musick, J Wineken). Boca Raton (Florida): CRC Press. 455 pp.

Demetropoulos A (2000). Impact of tourism development on marine turtle nesting: strategies and actions to minimise impact. 20th meeting of the Standing Committee of the Convention on the Conservation of European Wildlife and Natural Habitats, Strasbourg (France)

Fish MR, Cote IM, Gill JA, Jones AP, Renshoff S, Watkinson AR (2005). Predicting the Impact of Sea-Level Rise on Caribbean Sea Turtle Nesting Habitat. Conservation Biology 19: 482-491

Godfrey MH, Godley BJ (2008). Seeing past the red: flawed IUCN global listings for sea turtles. Endangered Species Research 6: 155-159

Hamann M, Limpus CJ, Owens DW (2003). Reproductive cycles of males and females. In: The biology of sea turtles, Volume 2 (PL Lutz, JA Musick, J Wineken). Boca Raton (Florida, USA): CRC Press. 455 pp.

Hays GC, Houghton JDR, Myers AE. (2004). Pan-Atlantic leatherback turtle movements. Nature 429: 522

Heppell SS, Snover ML, Crowder LB (2003). 11. Sea turtle population ecology. In: The biology of sea turtles, Volume 2 (PL Lutz, JA Musick, J Wineken). Boca Raton (Florida, USA): CRC Press. 455 pp.

IUCN (2013). IUCN Red List of Threatened Species. Version 2013.1. URL: www.iucnredlist.org

Limpus CJ (2006). Impacts of climate change on marine turtles: a case study. In: Migratory species and climate change: impacts of a changing environment on wild animals (UNEP/CMS). Bonn (Germany): UNEP / CMS Secretariat. 64 pp.

Limpus CJ, Bell I, Miller JD (2009). Mixed stocks of Green turtles foraging on Clack Reef, Northern Great Barrier Reef identified from long term tagging studies. Marine Turtle Newsletter 123: 3-5

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Márquez-M, R (2004). Sea turtles population dynamics, with special emphasis on sources of mortality and relative importance of fisheries impacts - Atlantic Ocean. In: FAO Fisheries Report No. 738 (pp. 1-26). Rome (Italy): FAO

Mast RB, Hutchinson BJ, Pilcher NJ (2006). The burning issues for global sea turtle conservation: The hazards and urgent priorities in sea turtle conservation. Indian Ocean Turtle Newsletter 3: 29-31

Miller JD (1997). Reproduction in sea turtles. In: The biology of sea turtles (PL Lutz, JA Musick, Eds.). Boca Raton (Florida, USA): CRC Press.

Poloczanska ES, Limpus CJ, Hays GC. (2009). Vulnerability of marine turtles to climate change. Advances in Marine Biology 56: 151-211

Plotkin P (2003). Adult migrations and habitat use. In: The biology of sea turtles, Volume 2 (PL Lutz, JA Musick, J Wineken). Boca Raton (Florida, USA): CRC Press. 455 pp.

Ramos J, Pincetich C, Adams L, Comer Santos K, Hage J, Arauz R (2012). Quantification and Recommended Management of Man-Made Debris Along the Sea Turtle Nesting Beach at Playa Caletas, Guanacaste, Costa Rica. Marine Turtle Newsletter 134: 12-17

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Shanker K (2004). Marine turtle status and conservation in the Indian Ocean. In: FAO Fisheries Report No. 738 (pp. 85-134). Rome (Italy): FAO

Valverde RA, Orrego CM, Tordoir MT, Gómez FM, Solís DS, Hernández RA, Gómez GB, Brenes LS, Baltodano JP, Fonseca LG, Spotila JR (2012). Olive Ridley mass nesting ecology and egg harvest at ostional beach, Costa Rica. Chelonian Conservation and Biology 11: 1-11

Wallace BP, Kot CY, DiMatteo AD, Lee T, Crowder LB, Lewison RL (2013). Impacts of fisheries bycatch on marine turtle populations worldwide: toward conservation and research priorities. Ecosphere: 4: 1-49

Witherington BE (1997). The problem of photopollution for sea turtles and other nocturnal animals. In: Behavioral approaches to conservation in the wild (JR Clemmons, Buchholz R (Eds.). Cambridge (UK): Cambridge University Press. 404 pp.

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4. Cold-water corals

Justification(s) for alignment with IFC PS6 criteria for Critical Habitat:
There are four main groups of cold-water corals: stony, i.e. reef-forming, corals (scleractinians), soft corals (named octocorals due to their 8-fold symmetry), black corals (anthipatharians) and hydrocorals (stylasterids) (Roberts et al. 2006), found over a wide range of latitudes, from tropical to polar regions and from the shallows to the deep sea. Their distribution is largely defined by water temperatures, which must generally be between 4° and 12°C. These conditions are found in relatively shallow waters (approximately 50 to 1,000 m) at high latitudes, and at great depths (up to 4,000 m) beneath warm water masses at low latitudes (Roberts et al. 2006). Cold-water corals can occur as isolated colonies (i.e. small patches of free-living individuals), or they can form large reefs covering up to several kilometres, or even massive carbonate mounds up to 300 m in height (Roberts et al. 2006). Although octocorals are not reef-forming, they can form complex single- or multi-species assemblages, particularly in combination with the other three groups of cold-water corals. These communities can create a significantly heterogeneous structural biogenic habitat, that is relatively dense (e.g. densities of six colonies per square-metre have been recorded in waters off Alaska), and reaching heights of several metres above the seabed (Freiwald et al. 2004, Stone 2006).

Despite suffering from a lack of information on both distribution and diversity, cold-water corals are one of the most three-dimensionally complex habitats in the deep sea. They produce unique assemblages by being 'ecosystem engineers' that provide habitat structure for other species, including specialist fauna, in the deep ocean (Roberts et al. 2009). For instance, up to 1,300 associated species have been found living on *Lophelia pertusa* reefs (Roberts et al. 2006). It has been suggested that cold-water coral biodiversity may be comparable to that found on warm-water coral reefs although, for practical reasons associated with the difficulty in sampling deep sea areas, few quantitative studies of ecosystem function and regional comparisons have been possible (Roberts et al. 2006; Scenario A[19]). Large numbers of species in the deep ocean remain unknown to science (Mora et al. 2011), and cold-water corals may be associated with a distinctive fauna (Henry and Roberts 2007). As habitats potentially supporting high densities of undescribed and restricted-range species, cold-water corals might thus fulfil Scenario A[20] and Criterion 4[21]. Compensating for knowledge gaps posed by the relative inaccessibility of cold water corals, substantial progress in mapping cold water coral distribution has been achieved through the use of habitat suitability models (e.g. Tittensor et al. 2009, Davies and Guinotte 2011, Yesson et al. 2012a).

Cold-water corals are fragile and extremely slow-growing (with some reefs being tens of thousands of years old), making them particularly vulnerable to disturbance and environmental change, for instance deep-water trawling and ocean acidification (Roberts et al. 2006; thus with links to Criterion 4[22]). This vulnerability, combined with the high levels of biodiversity they may promote, make them an important focus for marine conservation. Cold-water corals have received protective measures under

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[19] "Scenario A. Other recognised high biodiversity value that might also support a CH designation. Examples: [...] areas with especially high levels of species diversity [...]".
[20] "Scenario A. Other recognized high biodiversity values that might also support a CH designation. Examples: [...] Areas of high scientific value such as those containing concentrations of species new [...] to science".

[22] "Criterion 4. Highly threatened and/or unique ecosystems. Defined as: at risk of significantly decreasing in area or quality [...]".

national and international jurisdictions, e.g. Norway's Marine Resources Act (1999) requiring precaution and care when fishing close to known reefs, Canada's Northeast Channel Coral Conservation Area (2002) and *Lophelia* Coral Conservation Area (2004), the UK's Biodiversity Action Plan (BRIG 2008), and the OSPAR Convention (OSPAR Commission 1992 and 2008). They are hence also relevant to protected area designations which would qualify under Scenario B[23].

Cold-water coral species have not yet been assessed under the IUCN Red List of Threatened Species (IUCN 2013), so information on Criterion 1[24] is not yet available; nor is there information on Criterion 2[25], given the lack of information on species distributions in the deep ocean; nor Criteria 3[26] and 5[27]; and as yet there is limited information on the associated biodiversity, though it is likely elevated relative to the surrounding habitat. Given the uncertainties associated with cold-water corals, and precisely how they fit into the IFC PS6 framework, known locations (i.e. observed occurrences) of reef-forming corals are precautionarily designated as Likely Critical Habitat through likely satisfying Criterion 4 and Scenario A (whilst being of relevance to Scenario B). Areas with a very high probability (>90%) of cold-water coral presence (i.e. highly suitable habitat) are designated as Potential Critical Habitat, along with known locations of non reef-forming corals, through likely satisfying the criteria listed above.

Selected dataset(s):

One stony (Davies and Guinotte 2011) and one soft (Yesson et al. 2012b) cold-water coral datasets were selected. Freiwald et al. (2005), a global shapefile of observed corals, was also selected and contained both stony (>5,000 points) and soft corals (1,500 points). Davies and Guinotte (2011) is a global raster map (grid size *ca.* 1 km^2) that shows the predicted (modelled) habitat suitability for five reef-forming coral species. Yesson et al. (2012b) consists of global raster maps (grid size 30×30 arc-seconds) indicating the predicted habitat suitability for seven suborders of octocorals found deeper than 50 m. For both Davies and Guinotte (2011) and Yesson et al. (2012b), maps present a relative habitat suitability index ranging from 0 (unsuitable) to 100 (highly suitable). Finally, a global shapefile of observed soft cold-water coral occurrences (>12,500 points) that were used as input to the habitat suitability model developed by Yesson et al. (2012b), were also included. Combined, these datasets represent the best available global dataset.

Davies AJ, Guinotte JM (2011). Global habitat suitability for framework-forming cold-water corals. PLoS ONE 6: e18483

Freiwald A, Rogers A, Hall-Spencer J. (2005). Global distribution of cold-water corals (version 2). Update of the dataset used in Cold-water Coral Reefs by Freiwald et al. (2004). Cambridge (UK): UNEP World Conservation Monitoring Centre. URL: http://data.unep-wcmc.org

Yesson C, Taylor ML, Tittensor DP, Davies AJ, Guinotte J, Baco A, Black J, Hall-Spencer JM, Rogers AD (2012b). Global raster maps indicating the habitat suitability for 7 suborders of cold water octocorals (Octocorallia found deeper than 50 m). In supplement to: Yesson et al. (2012a). PANGAEA, Data Publisher for Earth & Environmental Science. URL: doi.pangaea.de/10.1594/PANGAEA.775081

[23] "Scenario B. Internationally and/or nationally recognized areas of high biodiversity value. Examples: Areas that meet the criteria of the IUCN's Protected Area Management Categories Ia, Ib and II, although areas that meet criteria for Management Categories III-VI may also qualify depending on the biodiversity values inherent to those sites; [...]".

[24] "Criterion 1. Habitats of significant importance to Critically Endangered (CE) and/or Endangered (EN) species".

[25] "Criterion 2. Habitats of significant importance to endemic and/or restricted-range species".

[26] "Criterion 3. Habitats supporting globally significant concentrations of migratory species and/or congregatory species".

[27] "Criterion 5. Areas associated with key evolutionary processes".

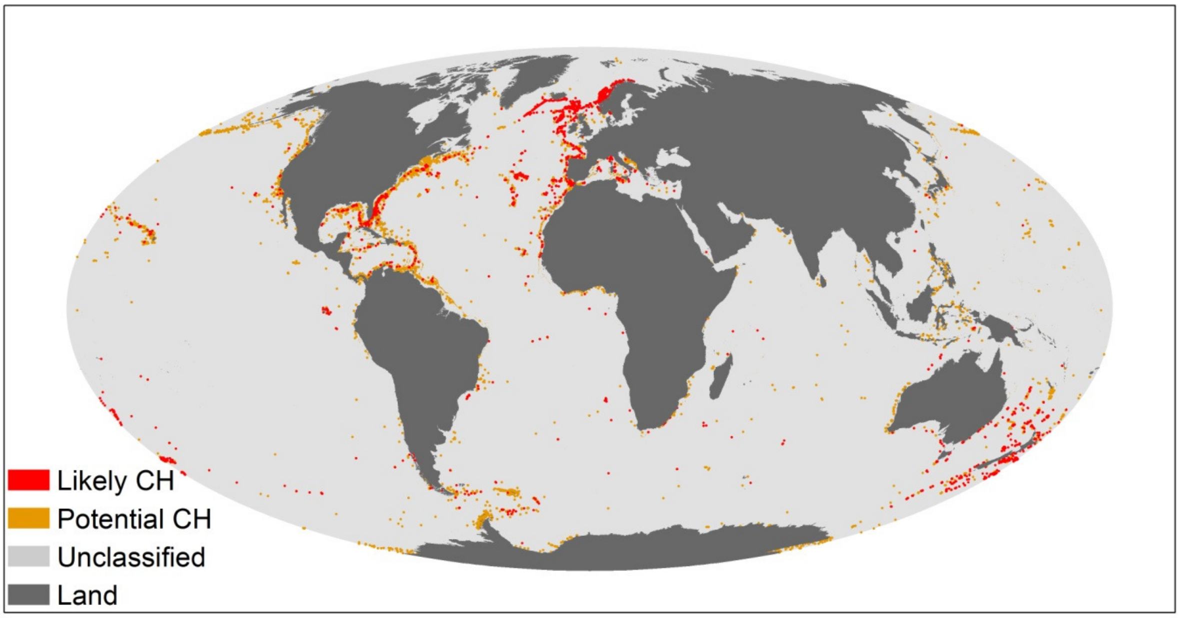

Figure S4: Global map of cold-water corals (observed occurrences, and modelled high probability of occurrence). CH: Critical Habitat.

References:

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Davies AJ, Guinotte JM (2011). Global habitat suitability for framework-forming cold-water corals. PLoS ONE 6: e18483

Freiwald A, Fosså JH, Grehan A, Koslow JA, Roberts JM (2004). Cold-water coral reefs: out of sight – no longer out of mind. Biodiversity Series 22, Cambridge (UK): UNEP-World Conservation Monitoring Centre. 86 pp.

Henry L-A, Roberts JM (2007). Biodiversity and ecological composition of macrobenthos on cold-water coral mounds and adjacent off-mound habitat in the bathyal Porcupine Seabight, NE Atlantic. Deep Sea Research Part I: Oceanographic Research Papers 54: 654-672

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OSPAR Commission (1992). Oslo and Paris Conventions for the protection of the marine environment of the North-East Atlantic. Paris (France), on 22 September 1992

OSPAR Commission (2008). OSPAR List of Threatened and/or Declining Species and Habitats (Reference Number: 2008-6). London (UK): OSPAR Commission. 4 pp.

Roberts JM, Freiwald A, Cairns S (2009). Cold water corals: the biology and geology of deep-sea coral habitats. Cambridge (UK): Cambridge University Press. 352 pp.

Roberts JM, Wheeler AJ, Freiwald A (2006). Reefs of the deep: the biology and geology of cold-water coral ecosystems. Science 312: 543-547

Stone R (2006). Coral habitat in the Aleutian Islands of Alaska: depth distribution, fine-scale species associations, and fisheries interactions. Coral Reefs 25: 229-238

Tittensor DP, Baco AR, Brewin PE, Clark MR, Consalvey M, Hall-Spencer JM, Rowden AA, Schlacher T, Stocks KI, Rogers AD (2009). Predicting global habitat suitability for stony corals on seamounts. Journal of Biogeography 36: 1111-1128

Yesson C, Taylor ML, Tittensor DP, Davies AJ, Guinotte J, Baco A, Black J, Hall-Spencer JM, Rogers AD (2012a). Global habitat suitability of cold-water Octocorals. Journal of Biogeography 39, 1278-1292

5. Warm-water coral reefs

Justification(s) for alignment with IFC PS6 criteria for Critical Habitat:

A coral polyp is a relatively simple organism, typically composed of a small cylindrical body, topped with a ring of tentacles which are used to capture food from surrounding water. A large number of corals have evolved to build large colonies based around a communal skeleton. Reef-forming corals (scleractinians) are those that lay down stony skeletons of calcium carbonate. Warm-water coral reefs are the most biodiverse of marine habitats per unit area, with diversity comparable to rainforests but an area only 5% of the size (Knowlton et al. 2010, Reaka-Kudla 1997; Scenario A[28]). Most of this diversity is not due to the corals themselves (there being fewer than 1,500 species of stony corals; Kitahara et al. 2010) but rather due to the multitude of organisms that depend on the coral reef ecosystem (Knowlton et al. 2010). Reef species diversity has indeed been estimated at anywhere from 600,000 to more than 9 million species worldwide (Plaisance et al. 2011). In addition, coral reefs are considered to be evolutionary engines, acting as 'cradles' of speciation (Kiessling et al. 2010; Criterion 5[29]). Warm-water coral reefs are highly restricted in their geographic distribution, needing areas of warm, shallow, stable waters to produce the copious quantities of limestone necessary for reef formation. Warm-water coral reef species diversity is concentrated in the central Indo-Pacific (the "Coral Triangle"), and decreases with increasing distance from the Indo-Australian archipelago (Hughes et al. 2002). Due to their restricted distribution, coral reefs occupy an area of only 260,000 - 600,000 km^2, less than 0.1% of the earth's surface, or 0.2% of the ocean's surface (Reaka-Kudla 2005; Criterion 4[30]).

Reefs are also one of the most endangered habitats on the planet (Bellwood et al. 2004), facing dramatic declines in abundance as a result of bleaching and diseases driven by elevated sea surface temperatures, with extinction risk further exacerbated by local-scale anthropogenic disturbances (e.g. coral mining, agricultural and urban runoff, pollution, fisheries). The proportion of corals threatened with extinction has increased dramatically in recent decades and exceeds that of most terrestrial groups, with one-third of reef-forming corals facing elevated extinction risk from climate change and local impacts (Carpenter et al. 2008; Criterion 4[31]). Specifically, 25 reef-forming coral species are listed as Endangered by the IUCN Red List of Threatened Species, and five are listed as Critically Endangered (Carpenter et al. 2008; IUCN 2013). Conserving coral reef biodiversity and the capacity of reefs to generate essential services to local people is a global priority (Moberg and Folke 1999), and coral reefs are increasingly the focus of biodiversity conservation prioritisation schemes, and are included in the rationale for Key Biodiversity Area and marine protected area designations (some of which qualify under Scenario B[32]), e.g. the Great Barrier Reef Marine Park. Finally, coral reefs are the preferred habitat of a number of Critically Endangered and Endangered species (e.g. Russell 2004;

[28] "Scenario A. Other recognised high biodiversity value that might also support a CH designation. Examples: [...] areas with especially high levels of species diversity [...]".
[29] "Criterion 5. Areas associated with key evolutionary processes. Defined by: the physical features of a landscape that might be associated with particular evolutionary processes; [...]. Examples: [...] Landscapes with high spatial heterogeneity are a driving force in speciation as species are naturally selected on their ability to adapt and diversify; [...]".
[30] "Criterion 4. Highly threatened and/or unique ecosystems. Defined as: [...]; with a small spatial extent; [...]".
[31] "Criterion 4. Highly threatened and/or unique ecosystems. Defined as: at risk of significantly decreasing in area or quality [...]".
[32] "Scenario B. Internationally and/or nationally recognized areas of high biodiversity value. Examples: Areas that meet the criteria of the IUCN's Protected Area Management Categories Ia, Ib and II, although areas that meet criteria for Management Categories III-VI may also qualify depending on the biodiversity values inherent to those sites; [...]; The majority of Key Biodiversity Areas (KBAs) [...]".

Allen and Donaldson 2007). Some Critically Endangered and Endangered species also depend on coral reef fish as food during key stages of their life cycle (e.g. Baum 2007).

Warm-water coral reefs fulfil Criteria 4 and 5 and Scenario A, and are of relevance to Scenario B, and as such are designated red in our categorisation.

Selected dataset(s):

The selected dataset is a global shapefile of warm-water coral reefs (UNEP-WCMC et al. 2010). The dataset contains 320,000+ polygons of warm-water coral reef presence, and represents the best available global dataset.

UNEP-WCMC, WorldFish Centre, WRI and TNC (2010). Global distribution of coral reefs, compiled from multiple sources, including the Millenium Coral Reef Mapping Project. Includes contributions from Institute of Marine Remote Sensing (University of South Florida) and Institut de Recherche pour le Développement (IRD). Cambridge (UK): UNEP World Conservation Monitoring Centre. URL: http://data.unep-wcmc.org

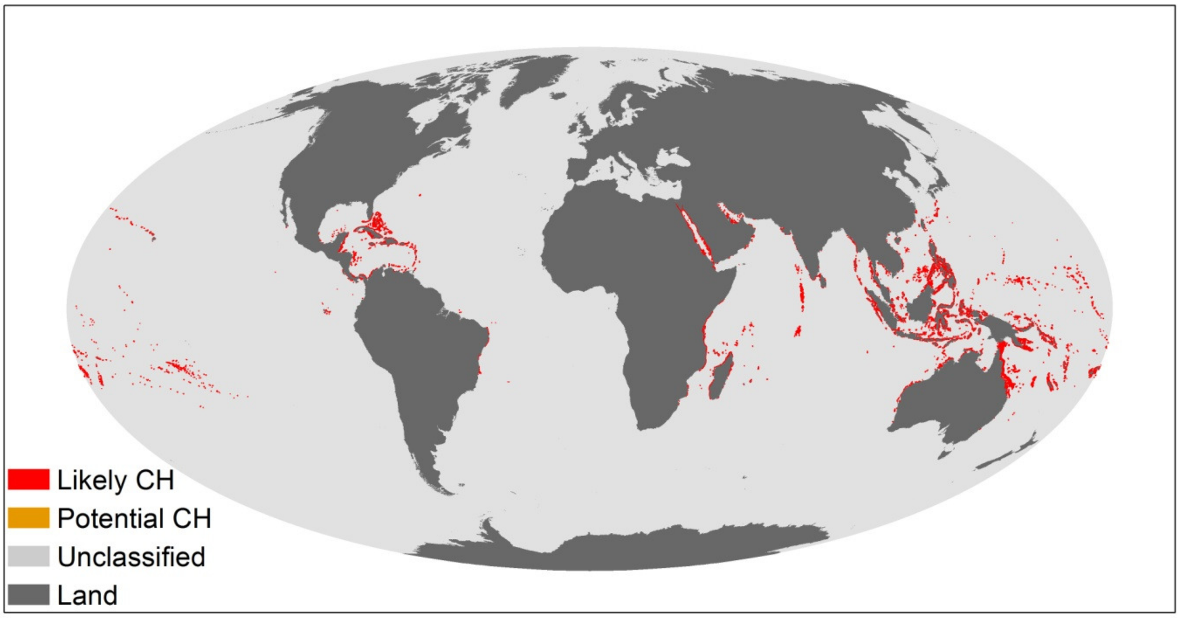

Figure S5: Global map of warm-water coral reefs. CH: Critical Habitat.

References:

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Bellwood DR, Hughes TP, Folke C, Nystrom M (2004). Confronting the coral reef crisis. Nature 429: 827-833

Carpenter KE, Abrar M, Aeby G, Aronson RB, Banks S, Bruckner A, Chiriboga A, Cortés J, Delbeek JC, et al. (2008). One-third of reef-building corals face elevated extinction risk from climate change and local impacts. Science 321: 560-563

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Kiessling W, Simpson C, Foote M (2010). Reefs as cradles of evolution and sources of biodiversity in the Phanerozoic. Science 327: 196-198

Kitahara MV, Cairns SD, Stolarski J, Blair D, Miller DJ (2010). A comprehensive phylogenetic analysis of the Scleractinia (Cnidaria, Anthozoa) based on mitochondrial CO1 sequence data. PLoSone 5: e11490

Knowlton N, Brainard RE, Fisher R, Moews M, Plaisance L., Caley M J (2010). Coral reef biodiversity. In: Life in the World's Oceans: Diversity, Distribution, and Abundance (Ed. AD McIntyre). Oxford (UK): Wiley-Blackwell. 384 pp.

Moberg F, Folke C. (1999). Ecological goods and services of coral reef ecosystems. Ecological Economics 29: 215-233

Plaisance L, Caley MJ, Brainard RE, Knowlton N (2011). The diversity of coral reefs: what are we missing? PLoS ONE 6: e25026

Reaka-Kudla ML (1997). The global biodiversity of coral reefs: a comparison with rain forests. In: Biodiversity II: Understanding and Protecting Our Biological Resources (Eds. ML Reaka-Kudla, DE Wilson, EO Wilson), pp. 83-108. Washington, DC: Joseph Henry Press. 560 pp.

Reaka-Kudla, ML (2005) II.5 Biodiversity of Caribbean coral reefs. In: Caribbean Marine Biodiversity: The known and the unknown (Eds. P Miloslavich and E Klein). Lancaster (Pennsylvania): DEStech Publications. 310 pp.

Russell B (Grouper & Wrasse Specialist Group) (2004). *Cheilinus undulatus*. In: IUCN Red List of Threatened Species, version 2013.1 (Ed. IUCN). URL: www.iucnredlist.org

6. Seamounts

Justification(s) for alignment with IFC PS6 criteria for Critical Habitat:
Seamounts, or undersea mountains, are widespread and prominent topographical features of volcanic origin that rise up to heights of 1,000 m or more from the ocean floor (Rogers 1994). The total number of seamounts remains unknown, but current estimates suggest numbers from 30,000 to 100,000 seamounts globally (Wessel 2001, Yesson et al. 2011a). Found in all oceans, seamounts can be associated with increased biological productivity, due to the upwelling of nutrients caused by currents and eddies near the surface of the structure (Rogers 2004). Moreover, their volcanic substrate can provide appropriate conditions for the development of epifaunal communities[33] of sponges and cold-water corals (Rogers 1994), which together attract many open ocean and deep-sea species of fish, sharks, turtles, marine mammals and seabirds (Rogers 2004; Morato *et al*. 2010). However, it should be recognized that seamounts vary substantially in terms of their physical structure (Rogers 2004) and their associated biological communities, particularly given their different sizes, summit depths, and distance from coastlines.

There has been considerable debate in the scientific literature about the level of endemism and biodiversity associated with seamounts (de Forges et al. 2000, McClain 2007, Rowden et al. 2010). Following a six year programme of study as part of the Census of Marine Life[34], the evidence suggested that, while seamounts do not always support high levels of endemism, they are plausibly hotspots of species richness and aggregation (Scenario A[35]) and they may support distinct communities (Criterion 4[36]).

Seamounts are included in the OSPAR Commission's *List of Threatened and/or Declining Species and Habitats* (OSPAR Commission 2008); the purpose of this list is to guide the OSPAR Commission in setting priorities for its work on the conservation and protection of marine biodiversity, and hence may be relevant to protected area designations which would qualify under Scenario B[37]. Seamounts are known to be at elevated risk of fishing disturbance from bottom trawling (Rowden et al. 2010; Criterion 4[38]). Evidence from other studies also suggests that seamounts can be hotspots of pelagic biodiversity in the open ocean, conforming to Scenario A[39], and have higher catch rates of some highly migratory species from longline fisheries (Morato et al. 2010; IUCN 2013). They can also provide refugia from habitat disruption due to climate change, specifically for the effects of ocean acidification (Tittensor et al. 2010; Scenario A[40]).

[33] Communities living on the surface of a substrate.
[34] www.coml.org
[35] "Scenario A. Other recognized high biodiversity values that might also support a CH designation. Examples: [...]other areas with especially high levels of species diversity [...]".
[36] "Criterion 4. Highly threatened and/or unique ecosystems. Defined as: [...] containing unique assemblages of species including assemblages or concentrations of biome-restricted species [...]".
[37] "Scenario B. Internationally and/or nationally recognized areas of high biodiversity value. Examples: Areas that meet the criteria of the IUCN's Protected Area Management Categories Ia, Ib and II, although areas that meet criteria for Management Categories III-VI may also qualify depending on the biodiversity values inherent to those sites; [...];]".
[38] "Criterion 4. Highly threatened and/or unique ecosystems. Defined as: at risk of significantly decreasing in area or quality [...]".
[39] "Scenario A. Other recognized high biodiversity values that might also support a CH designation. Examples: [...]other areas with especially high levels of species diversity [...]".
[40] "Scenario A. Other recognized high biodiversity values that might also support a CH designation. Examples: areas required for the reintroduction of CR and EN species and refuge sites for these species (habitat used during periods of stress (e.g. flood, drought or fire)".

Therefore, while it is feasible that seamounts fulfil Criterion 4, and Scenarios A and B, given the uncertainties in our scientific knowledge (Figure 1 of the main text) and their inherent variability, we designate them as Potential Critical Habitat in our categorisation.

Selected dataset(s):

The selected dataset (Yesson et al. 2011b) is a global shapefile of seamounts. Seamount occurrence was predicted based on bathymetry of 30 arc-sec resolution. Model validation indicated that the methodology could identify 94% of seamounts, though could overestimate seamount numbers along ridges and in areas where faulting and seafloor spreading creates highly complex topography. The dataset contains >33,400 points of seamount presence, and represents one of the most complete and available global datasets.

Yesson C, Clark MR, Taylor M, Rogers AD (2011b). List of seamounts in the world ocean. In Supplement to: Yesson et al. (2011a). PANGAEA, Data Publisher for Earth & Environmental Science. URL: doi.pangaea.de/10.1594/PANGAEA.757562

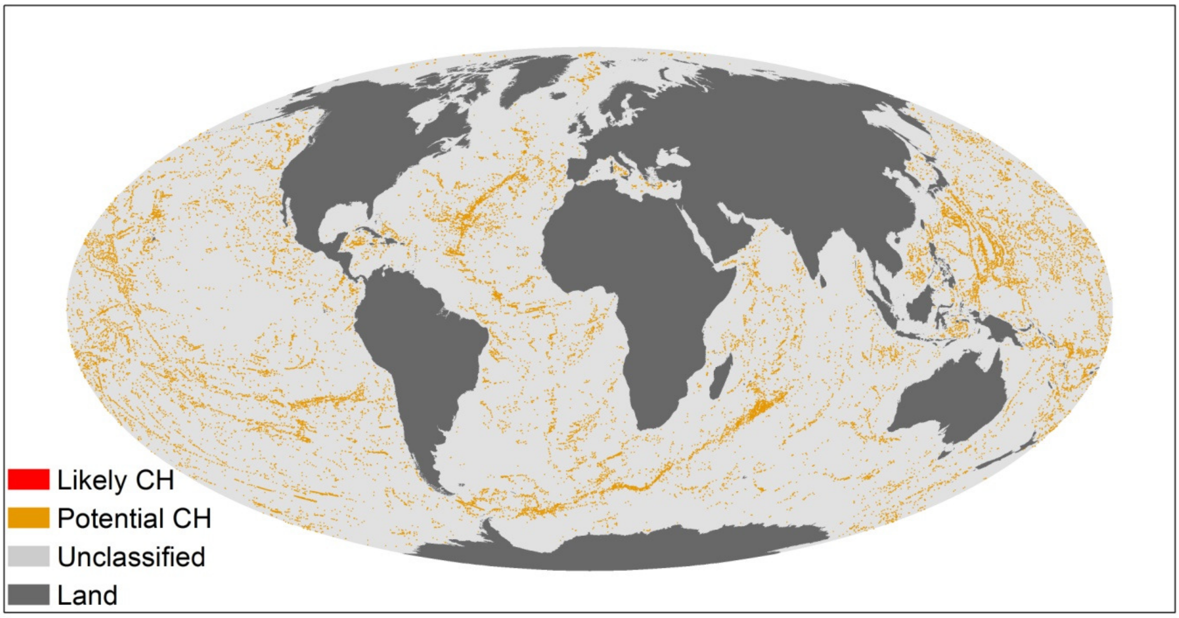

Figure S6: Global map of seamounts. CH: Critical Habitat.

References:

de Forges BR, Koslow JA, Poore GCB (2000). Diversity and endemism of the benthic seamount fauna in the southwest Pacific. Nature 405: 944-947

IUCN (2013). IUCN Red List of Threatened Species. Version 2013.1. URL: www.iucnredlist.org

McClain CR (2007). Seamounts: identity crisis or split personality? Journal of Biogeography 34: 2001-2008

Morato T, Hoyle SD, Allain V, Nicol SJ (2010). Seamounts are hotspots of pelagic biodiversity in the open ocean. Proceedings of the National Academy of Sciences 107: 9707-9711

OSPAR Commission (2008). OSPAR List of Threatened and/or Declining Species and Habitats (Reference Number: 2008-6). London (UK): OSPAR Commission. 4 pp.

Rogers AD (1994). The biology of seamounts. Advances in Marine Biology 30: 305-350

Rogers AD (2004). The biology, ecology and vulnerability of seamount communities. Cambridge (UK): International Union for Conservation of Nature and Natural Resources and British Antarctic Survey. 12 pp.

Rowden AA, Dower JF, Schlacher TA, Consalvey M, Clark MR (2010). Paradigms in seamount ecology: fact, fiction and future. Marine Ecology 31: 226-241

Tittensor DP, Baco AR, Hall-Spencer JM, Orr JC, Rogers AD (2010). Seamounts as refugia from ocean acidification for cold-water stony corals. Marine Ecology 31: 212-225

Wessel P (2001). Global distribution of seamounts inferred from gridded Geosat/ERS-1 altimetry. Journal of Geophysical Research 106: 19431-19441

Yesson C, Clark MR, Taylor M, Rogers AD (2011a). The global distribution of seamounts based on 30-second bathymetry data. Deep Sea Research Part I: Oceanographic Research Papers 58: 442-453

7. Seagrass beds

Justification(s) for alignment with IFC PS6 criteria for Critical Habitat:
Seagrasses are a unique group of flowering plants that grow in the shallow coastal waters of most continents (den Hartog 1970). Seagrasses can form vast aggregations, or meadows, which alter the flow of water, nutrient cycling and food web structure of the local environment (Hemminga and Duarte 2000). Additionally, the meadows provide numerous ecological services, acting as essential habitat (e.g. spawning, nursery, refuge and foraging areas) for many animals, including commercially and recreationally important fishery species (de la Torre-Castro and Rönnbäck 2004; Watson et al. 1996), whilst providing a major source of food for a range of large herbivores (Carruthers et al. 2002; Seminoff 2004; IUCN 2013). Furthermore, the benefits provided by a healthy seagrass meadow extend beyond the local area, through exporting key nutrients (e.g. nitrogen and phosphate) and organic carbon to other parts of the oceans, including some to the deep-sea where it provides a critical supply of organic matter in an extremely food-limited environment (Suchanek et al. 1985). For the above reasons, these "blue carbon" habitats have an economic value attributed to such services estimated at US$ 34,000 per hectare per year, a figure greater than many other habitats (Short et al. 2011). As outlined above, these habitats are of great importance for a range of reasons, and as such are recommended to be included in regional marine conservation priorities, e.g. in the Indo-Pacific (Unsworth and Cullen, 2010; Criterion 4[41]).

Seagrasses and the associated ecosystem services they provide are, however, under direct threat from a host of anthropogenic factors: a synthesis of 215 published studies showed that seagrass habitat globally has been lost at a rate of 7% per year since 1990 (Waycott et al. 2009). If such declines continue, seagrass beds will exceed thresholds for being considered as highly threatened (Critically Endangered or Endangered) under proposed IUCN ecosystem Red List categories and criteria (Rodriguez et al. 2010; Criterion 4[42]). As seagrasses require some of the highest light levels of any plant group worldwide, the primary threat is loss of water clarity and quality, often brought about by eutrophication and sediment loading stemming from reclamation, shoreline hardening, and dredging within coastal regions (Orth et al. 2006). Additionally seagrass meadows are threatened by a multitude of environmental factors that are currently changing or will change in the future including rising sea levels, changing tidal regimes, UV radiation damage, sediment oxygen depletion and deprivation, increases in sea temperatures and increases in the occurrence of storm and flooding events (Björk et al. 2008).

Seagrass beds likely fulfil Criterion 4 at the global scale, and hence are designated Likely Critical Habitat in our categorisation.

Selected dataset(s):
The selected dataset (UNEP-WCMC and Short 2005) is a global shapefile of seagrasses created from multiple sources and representing an update of the data used in Green and Short (2003). The dataset

[41] "Criterion 4. Areas determined to be [...] of high priority/significance based on systematic conservation planning techniques carried out at the landscape and/or regional scale by governmental bodies, recognized academic institutions and/or other relevant qualified organizations (including internationally-recognized NGOs)."
[42] "Criterion 4. Highly threatened and/or unique ecosystems. Defined as: [...] at risk of significantly decreasing in area or quality [...]".

contains >41,600 polygons and >9,100 points of seagrass presence, and represents the best available global dataset.

UNEP-WCMC, Short FT (2005). Global distribution of seagrasses (version 2). Cambridge (UK): UNEP World Conservation Monitoring Centre. URLs: http://data.unep-wcmc.org

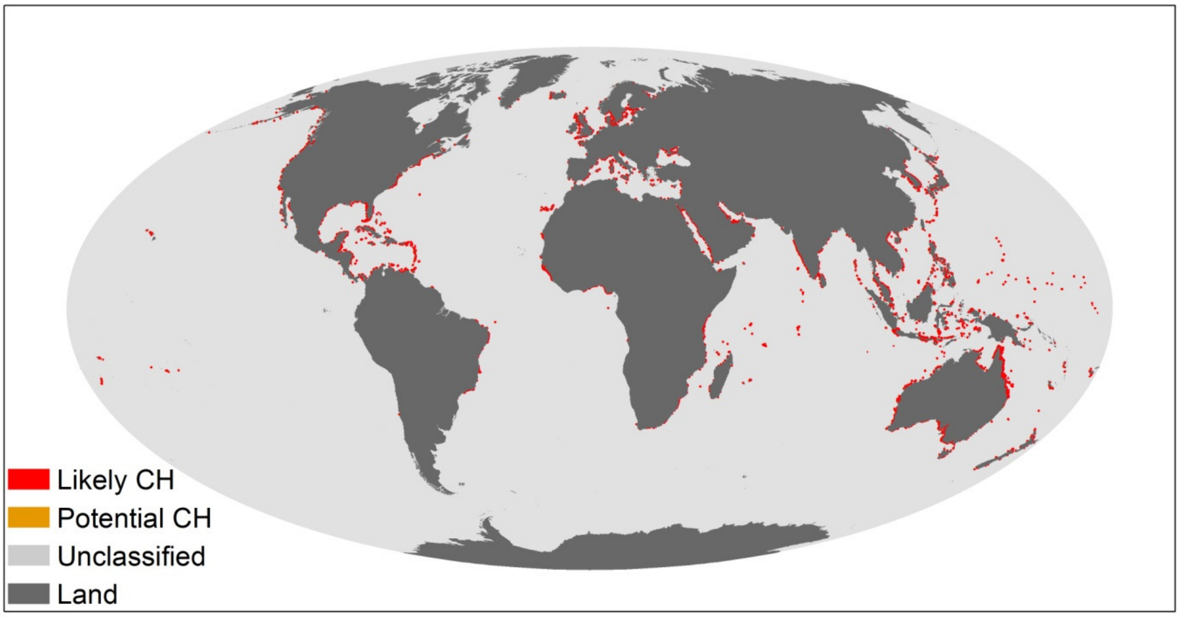

Figure S7: Global map of seagrass beds. CH: Critical Habitat.

References:

Björk M, Short F, McLeod E, Beer S (2008). Managing Seagrasses for Resilience to Climate Change. Gland (Switzerland): International Union for the Conservation of Nature. 56 pp.

Carruthers TJB, Dennison WC, Longstaff BJ, Waycott M, Abal E, McKenzie LJ, Lee Long WJ (2002). Seagrass habitats of northeast Australia: models of key processes and controls. Bulletin of Marine Science 71: 1153-1169

de la Torre-Castro M, Rönnbäck P (2004). Links between humans and seagrasses - an example from tropical East Africa. Ocean and Coastal Management 47: 361-387

den Hartog C (1970). The seagrasses of the world. Volume 59, issues 1-4. Amsterdam (The Netherlands): North-Holland Publishing Company. 276 pp.

Green EP, Short FT (2003). World atlas of seagrasses. Prepared by the UNEP World Conservation Monitoring Centre. Berkeley (USA): University of California. 332 pp.

Hemminga MA and Duarte CM (2000). Seagrass Ecology. Cambridge (UK): Cambridge University Press. pp. 298

IUCN (2013). IUCN Red List of Threatened Species. Version 2013.1. URL: www.iucnredlist.org

Orth RJ, Carruthes TJB, Dennison WC, Durate CM, et al. (2006). A global crisis for seagrass ecosystems. BioScience: 56: 987-996

Rodríguez JP, Rodríguez-Clark KM, Baillie JE, Ash N, Benson J, et al. (2011). Establishing IUCN red list criteria for threatened ecosystems. Conservation Biology 25: 21–29.

Seminoff JA (Southwest Fisheries Science Center, US) (2004). *Chelonia mydas*. In: IUCN Red List of Threatened Species, version 2013.1. URL: www.iucnredlist.org

Short FT, Polidoro B, Livingstone SR, Carpenter KE, Bandeira S, Bujang JS, Calumpong HP, et al. (2011). Extinction risk assessment of the world's seagrass species. Biological Conservation 144: 1971-1961

Suchanek TH, Williams SL, Ogden JC, Hubbard DK, Gill IP (1985). Utilization of shallow-water seagrass detritus by Carribbean deep-sea macrofauna: δ13C evidence. Deep Sea Research Part A. Oceanographic Research Papers 32: 201-214

Unsworth RKF, Cullen LC (2010). Recognising the necessity for Indo-Pacific seagrass conservation. Conservation Letters 3: 63-73

Watson R, Coles R, Lee Long W (1996). Simulation estimates of annual yield and landed value for commercial penaeid prawns from a tropical seagrass habitat, Northern Queensland, Australia. Marine and Freshwater Research 44: 211-219

Waycott M, Duarte CM, Carruthers TJB, Orth RJ, Dennison WC, Olyarnik S, Calladine A, et al. (2009) Accelerating loss of seagrasses across the globe threatens coastal ecosystems. Proceedings of the National Academy of Sciences of the USA 106: 12377-12381

8. Mangroves

Justification(s) for alignment with IFC PS6 criteria for Critical Habitat:
Mangroves are trees or large shrubs which grow within the intertidal zone and have special adaptations to survive in this environment. To cope with the high salinity and anaerobic soil, many mangrove species have a number of mechanisms to remove or exclude salt from their tissues and certain species have evolved the ability to actively secrete salt from their leaves, as well as developing aerial roots to transport oxygen to their underground roots (Spalding et al. 2010). Although mangroves are widely distributed in 123 tropical and sub-tropical nations and territories, they are in fact rare at the global scale, covering less than 1% of all tropical forests worldwide (FAO 2006, van Lavieren et al. 2011; Spalding et al. 2010; Criterion 4[43]). In addition to providing important habitats for a variety of terrestrial, estuarine and marine species, including the Critically Endangered hawksbill turtle (*Eretmochelys imbricata*; Mortimer and Donnelly 2008, Gaos et al. 2012), mangroves provide at least US$ 1.6 billion each year in ecosystem services (Costanza et al. 1997). These services include supporting fisheries by providing important fish nurseries, filtering pollutants and contaminants from coastal waters and protecting coastal communities against storms, floods and erosion (Murray et al. 2011; Scenario A[44]). Mangroves are also recognised as one of the three key blue carbon habitats and are among the most carbon-rich forests in the tropics. They are able to sequester 6 to 8 tonnes of carbon dioxide equivalent per hectare per year (Murray et al. 2011). These rates are about two to four times greater than rates observed in mature tropical forests (Lewis et al. 2006).

Over the last century, there has been extensive loss and degradation of mangrove habitats due to coastal development, pollution, aquaculture, and logging for timber and fuel wood. As a result, 20% of the total area of mangroves was lost between 1980 and 2005 (Spalding et al. 2010, Crooks 2010) and mangrove habitat continues to decline at an estimated rate of 1-2% annually (FAO 2003). Mangrove thus approaches thresholds for being considered as highly threatened (Endangered) under proposed IUCN ecosystem Red List categories and criteria (Rodriguez et al. 2010; Criterion 4[45]). Of the remaining mangrove stands, it is estimated that 52% are degraded due to shrimp/fish culture, 26% due to forest use, and 11% due to freshwater diversion (Valiela et al. 2001). As a result, mangroves and the species that depend on them are at an elevated risk of extinction. Of the 70 true mangrove species, three are Endangered, and two Critically Endangered (Polidoro et al. 2010, IUCN 2013). Furthermore, more than 40% of assessed mangrove-endemic vertebrates are globally threatened due to extensive habitat loss (Luther and Greenberg 2009; Criterion 4[46]).

A number of neotropical migratory bird species (e.g. whimbrel, *Numenius phaeopus*) also rely on mangroves as wintering and roosting sites along their migratory routes. For instance, over 50 million migratory shorebirds use the *East Asia-Australian flyway* to migrate from the Arctic Circle through Southeast Asia to Australia and New Zealand, and back. This includes ten Endangered waterbird species, and four Critically Endangered ones, many of which stop to forage at numerous wetlands

[43] "Criterion 4. Highly threatened and/or unique ecosystems. Defined as: [...] with a small spatial extent [...]".
[44] "Scenario A. Other recognised high biodiversity value that might also support a CH designation. Examples: [...] Landscape and ecological processes (e.g. [...] areas critical to erosion control, disturbance regimes (e.g. [...] flood) required for maintaining critical habitat [...]".
[45] "Criterion 4. Highly threatened and/or unique ecosystems. Defined as: [...] at risk of significantly decreasing in area or quality [...]".
[46] "Criterion 4. Highly threatened and/or unique ecosystems. Defined as: [...] containing unique assemblages of species including assemblages or concentrations of biome-restricted species [...]".

including mangroves (Kirby et al. 2008, Partnership for the East Australian Flyway 2013, IUCN 2013; Criterion 3[47]). Due to their role in supporting endemic, restricted-range and migratory bird species, mangroves are a key habitat at more than 300 Important Bird Areas (IBAs) in the Americas alone (Mangrove Alliance 2013; Scenario B[48]).

Mangroves likely fulfil Criterion 4 at the global scale, and are also likely to qualify under criterion 3 and scenarios A and B. They are therefore designated as Likely Critical Habitat in our categorisation.

Selected dataset(s):

The selected dataset is a shapefile of the global distribution of mangroves, compiled by the US Geological Survey (USGS; Giri et al. 2011). It was created using classification techniques based on approximately 1,000 Landsat images (remotely-sensed). Classification results were then validated using existing geographical datasets and published information. The dataset contains >1,400,000 polygons of mangrove presence, and represents one of the best available global datasets.

Giri C, Ochieng E, Tieszen LL, Zhu Z, Singh A, Loveland T, Masek J, Duke N (2011). Status and distribution of mangrove forests of the world using earth observation satellite data. Global Ecology and Biogeography 20: 154-159. URL: http://data.unep-wcmc.org

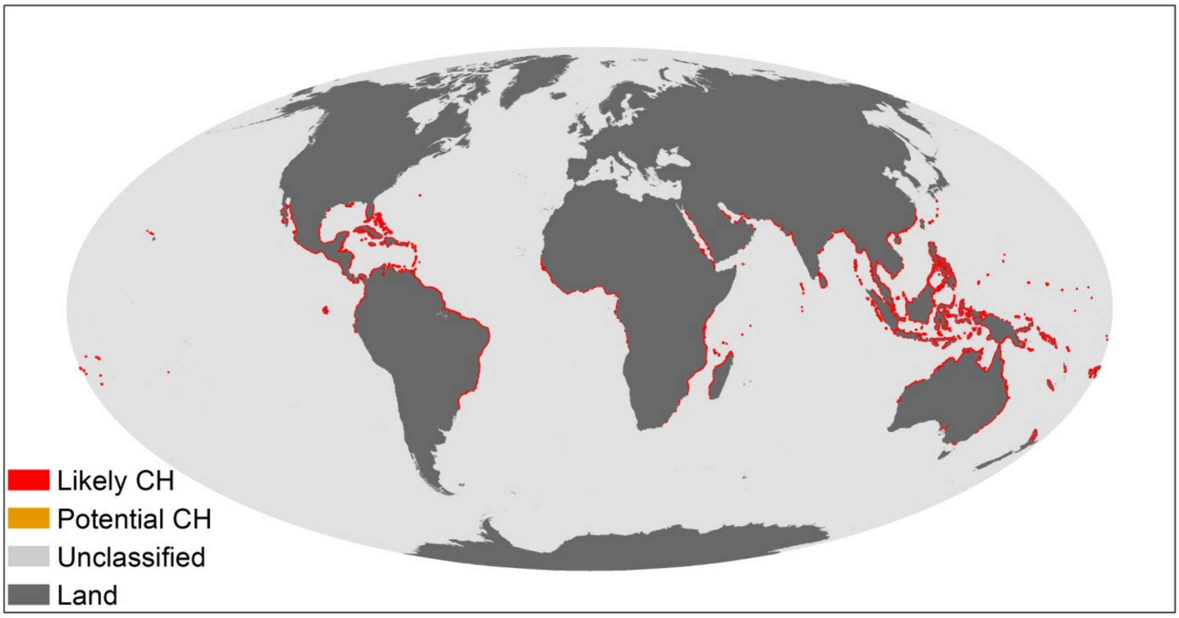

Figure S8: Global map of mangroves. CH: Critical Habitat.

References:

Anderson R, Moraes-Barros N, Voirin B (2011). *Bradypus pygmaeus*. In: IUCN Red List of Threatened Species, version 2013.1 (Ed. IUCN). URL: www.iucnredlist.org

[47] "Criterion 3. Habitats supporting globally significant concentrations of migratory species and/or congregatory species".

[48] "B. Internationally and/or nationally recognized areas of high biodiversity value. Examples: [...] The majority of Key Biodiversity Areas (KBAs), which encompass [...], Important Bird Areas (IBA) [...]".

Costanza R, d'Arge R, de Groot R, Farber S, Grasso M, et al. (1997). The value of the world's ecosystem services and natural capital. Nature 387: 253-260

Crooks S, Herr D., Tamelander T, Laffoley D, Vandever J (2011). Mitigating climate change through restoration and management of coastal wetlands and near-shore marine ecosystems. Challenges and opportunities. Environment Department Paper 121. Washington (DC): World Bank. pp. 69

FAO (2003). Status and trends in mangrove area extent world- wide. By Wilkie ML and Fortuna S. Forest Resources Assessment Working Paper No. 63. Rome (Italy): Forest Resources Division of the Food and Agricultural Organization of the United Nations

FAO (2006). Global forest resources assessment 2005: progress towards sustainable forest management. FAO Forestry Paper 147. Rome (Italy): Food and Agricultural Organization of the United Nations. 350 pp.

Gaos AR, Lewison RL, Yañez IL, Wallace BP, Liles MJ, Nichols WJ, Baquero A, Hasbún CR, Vasquez, M, Urteaga J, Seminoff JA (2012). Shifting the life-history paradigm: discovery of novel habitat use by hawksbill turtles. Biology Letters 8: 54-56

IUCN (2013). IUCN Red List of Threatened Species, version 2013.1. URL: www.iucnredlist.org

Kirby JS, Stattersfield AJ, Butchart SHM, Evans MI, Grimmett RFA, Jones VR, O'Sullivan J, Tucker GM, Newton I (2008). Key conservation issues for migratory land- and waterbird species on the world's major flyways. Bird Conservation International 18: S49-S73

Lewis SL, Lopez-Gonzalez G, Sonké B, Affum-Baffoe K, Baker TR, Ojo LO, et al. (2009). Increasing carbon storage in intact African tropical forests. Nature 457: 1003-1006

Luther D, Greenburg R (2009). Mangroves: a global perspective on the evolution and conservation of their terrestrial vertebrates. Bioscience 59: 602-612

Mangrove Alliance (2013). Facts. What are mangroves? URL: www.birdlife.org/mangrove-alliance/facts

Mortimer JA, Donnelly M (IUCN SSC Marine Turtle Specialist Group) (2008). *Eretmochelys imbricata*. In: IUCN Red List of Threatened Species, version 2013.1 (Ed. IUCN). URL: www.iucnredlist.org

Murray BC, Linwood P, Jenkins WA, Sifleet S (2011). Green payments for blue carbon economic incentives for protecting threatened coastal habitats. Nicholas Institute Report NI R 11-04. Durham (USA): Duke University, Nicholas Institute for Environmental Policy Solutions. 50 pp.

Partnership for the East Australian Flyway (2013). URL: www.eaaflyway.net

Polidoro BA, Carpenter KE, Collins L, Duke NC, Ellison AM, et al. (2010). The loss of species: mangrove extinction risk and geographic areas of global concern. PLoS one 5: e10095

Rodríguez JP, Rodríguez-Clark KM, Baillie JE, Ash N, Benson J, et al. (2011). Establishing IUCN red list criteria for threatened ecosystems. Conservation Biology 25: 21–29.

Spalding M, Kainuma M, Collins L (2010). World atlas of mangroves. London (UK) and Washington (USA): Earthscan. 319 pp.

Valiela I, Bowen JL, York JK (2001). Mangrove forests: one of the world's threatened major tropical environments. BioScience 51: 807-815

van Lavieren H, Spalding M, Alongi D, Kainuma M, Clüsener-Godt M, Adeel Z (2012). Securing the future of mangroves. A Policy Brief. UNU-INWEH, UNESCO-MAB with ISME, ITTO, FAO, UNEP-WCMC and TNC. Hamilton (Canada): United Nations University, Institute for Water, Environment and Health (UNU-INWEH). 53 pp.

9. Saltmarshes

Justification(s) for alignment with IFC PS6 criteria for Critical Habitat:
Saltmarshes, also called saltwater marshlands or saline marshes, are ecosystems located in the intertidal zone[49] of sheltered marine and estuarine coastlines which are dominated by salt tolerant grasses, herbs and low shrubs. Saltmarshes are of ecological importance as they underpin the estuarine food web, but are also significant for human well-being and economics as they provide a range of ecosystem services, such as coastal defence, nutrient cycling, immobilisation of pollutants and carbon sequestration (UNEP 2006). Saltmarshes are one of three key coastal blue carbon habitats, recognized for their ability to store carbon within above- and below-ground biomass and sediments (Laffoley and Grimsditch (Eds.) 2009). With an average annual carbon sequestration rate of 6 to 8 tonnes of carbon dioxide equivalent per hectare (Murray et al. 2011), saltmarshes sequester carbon at a rate two to four times greater than that recorded for mature tropical forests (Lewis et al. 2009). Saltmarshes also serve as nesting, nursery and feeding grounds for numerous species of birds, fish, molluscs and crustaceans, including commercially important species such as herring (*Clupea harengus*) (Jones et al. 2011; Hughes 2004).

Despite providing essential ecosystem services, saltmarshes have not traditionally been a habitat of high priority for conservation and have lost between 25% and 50% of their global historical coverage (Nellemann et al. 2009, Crooks et al. 2011). The rate of loss is currently around 1-2% per year (Duarte et al. 2008), and thus saltmarsh approaches thresholds for being considered as highly threatened (Endangered) under proposed IUCN ecosystem Red List categories and criteria (Rodriguez et al. 2010; Criterion 4[50]). Salt marsh habitats are threatened by climate change-induced sea level rise as their capacity to migrate landward is often restricted by infrastructure, embankments or topography, resulting in loss due to “coastal squeeze” (Hughes 2004). Habitat loss is also driven by local-scale anthropogenic activities, such as drainage for agriculture and mosquito control, development of coastal infrastructure and ports, coastal ecosystem eutrophication, conversion to salt ponds, and infill for coastal development (Deegan et al. 2012, UNEP 2006).

The significance of saltmarsh habitat is recognised at national and regional levels, but also internationally, for instance through the ‘Ramsar Convention’, adopted in 1971 (Ramsar Convention Secretariat 1971). There are 38 wetlands of international importance, equivalent to a surface area of 3 million hectares, which are dominated by intertidal marshes (Ramsar and Wetlands International 2013; sites which are reflected under Scenario B[51]). Coastal saltmarshes have been identified as habitats requiring protection under the European Union’s ‘Habitats’ (CEC 1992) and ‘Birds’ (European Parliament and CEU 2010) directives (and, as such, are relevant to Natura 2000 protected area designations which may qualify under Scenario B[52]), as well as within national biodiversity action plans such as the UK Biodiversity Action Plan (BRIG 2008; Criterion 4[53]).

[49] The area of a seashore that is covered at high tide and uncovered at low tide.
[50] “Criterion 4. Highly threatened and/or unique ecosystems. Defined as: [...] at risk of significantly decreasing in area or quality [...]”.
[51] “Scenario B. International and/or nationally recognized areas of high biodiversity value. Examples: [...] Ramsar Sites [...]”.
[52] “Scenario B. Internationally and/or nationally recognized areas of high biodiversity value”.
[53] “Criterion 4. Highly threatened and/or unique ecosystems. Defined as: [...] areas [...] of high priority/significance [...] that are recognized as such in existing regional or national plans, such as the NBSAP [...]”.

Saltmarshes may well qualify as highly threatened under Criterion 4 and are of relevance to Scenario B. They are therefore precautionarily designated as Likely Critical Habitat in our categorisation.

Selected dataset(s):

The selected dataset (UNEP-WCMC 2013) is a global shapefile of coastal saltmarshes in the intertidal zone (or "tidal saltmarshes"). The dataset contains >370,000 polygons and >2,100 points of saltmarsh presence, and represents the best available global dataset to date. Efforts are currently underway to include additional spatial data from Canada and Russia, where saltmarshes are known to be particularly extensive.

UNEP-WCMC. Global distribution of saltmarshes. Unpublished dataset. Cambridge (UK): UNEP World Conservation Monitoring Centre

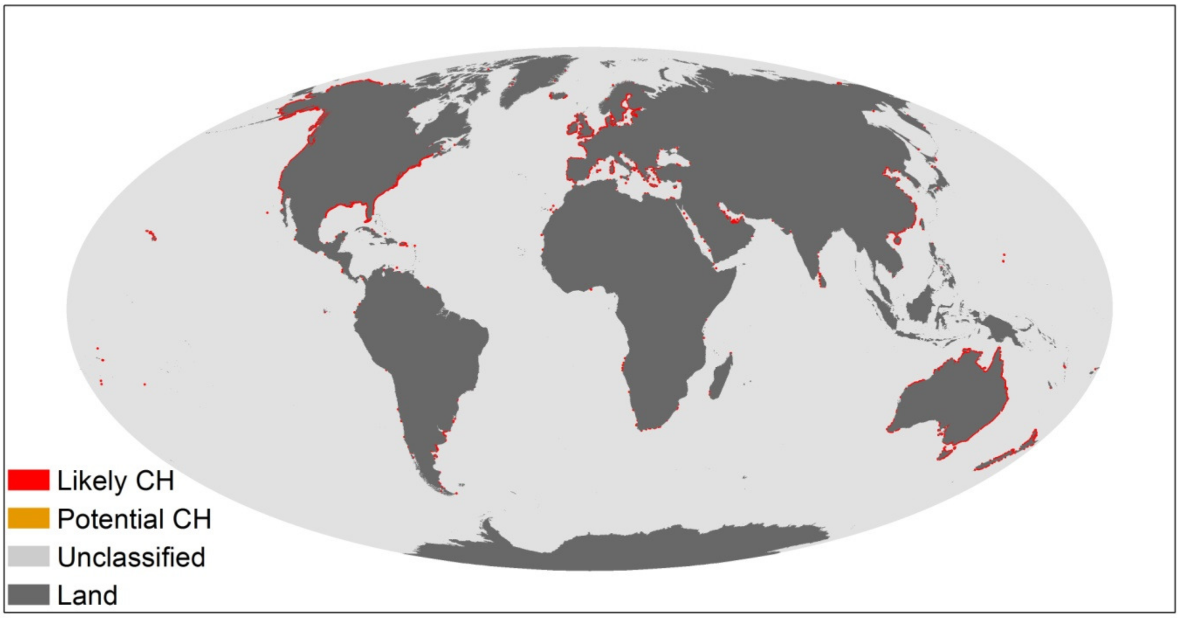

Figure S9: Global map of saltmarshes. CH: Critical Habitat.

References:

BRIG (Biodiversity Reporting and Information Group) (Ed. A. Maddock) (2008). UK biodiversity action plan priority habitat descriptions. Peterborough (UK): Joint Nature Conservation Committee. 103 pp.

CEC (Council of the European Communities) (1992). Council directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora. Official Journal of the European Communities (1992): L 206/7

Crooks S, Herr D., Tamelander T, Laffoley D, Vandever J (2011). Mitigating climate change through restoration and management of coastal wetlands and near-shore marine ecosystems. Challenges and opportunities. Environment Department Paper 121. Washington (DC): World Bank. 69 pp.

Deegan LA, Johnson DS, Warren RS, Peterson BJ, Fleeger JW, Fagherazzi S, Wollheimt WM (2012). Coastal eutrophication as a driver of salt marsh loss. Nature 490: 388-391

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European Parliament and CEU (Council of the European Union) (2010). Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds. Official Journal of the European Communities (2010): L 20/7

Hughes RG (2004). Climate change and loss of saltmarshes: consequences for birds. Ibis 146 (S1) 1: 21-28

IUCN (2013). IUCN Red List of Threatened Species. Version 2013.1. URL: www.iucnredlist.org

Jones L, Angus S, Cooper A, Doody P, Everard M, Garbutt A, Gilchrist P, Hansom J, Nicholls P, Pye K, Ravenscroft N, Rees S, Rhind P, Whitehouse A (2011). Chapter 11: Coastal margins. In: The UK National Ecosystem Assessment Technical Report. UK National Ecosystem Assessment, Cambridge (UK): UNEP-WCMC. 411-457 pp.

Laffoley D, Grimsditch G (Eds.) (2009). The management of natural coastal carbon sinks. Gland (Switzerland): International Union for Conservation of Nature. 53 pp.

Murray BC, Linwood P, Jenkins WA, Sifleet S (2011). Green payments for blue carbon economic incentives for protecting threatened coastal habitats. Nicholas Institute Report NI R 11-04. Durham (USA): Duke University, Nicholas Institute for Environmental Policy Solutions. 50 pp.

Nellemann C, Corcoran E, Duarte CM, Valdes L, De Young C, Fonseca L, Grimsditch G (Eds.) (2009). Blue carbon. A rapid response assessment. Nairobi (Kenya): United Nations Environment Programme, and Arendal (Norway): GRID-Arendal. 80 pp.

Lewis SL, Lopez-Gonzalez G, Sonké B, Affum-Baffoe K, Baker TR, Ojo LO, et al. (2009). Increasing carbon storage in intact African tropical forests. Nature 457: 1003-1006

Ramsar and Wetlands International (2013). Ramsar Sites Database. URL: http://ramsar.wetlands.org/Database/AbouttheRamsarSitesDatabase/tabid/812/Default.aspx

Ramsar Convention Secretariat (1971). Convention on wetlands of international importance especially as waterfowl habitat. Ramsar, 2.2.1971, as amended by the Protocol of 3.12.1982 and the Amendments of 28.5.1987. Ramsar (Iran), 02 February 1971

Rodríguez JP, Rodríguez-Clark KM, Baillie JE, Ash N, Benson J, et al. (2011). Establishing IUCN red list criteria for threatened ecosystems. Conservation Biology 25: 21–29.

UNEP (2006). Marine and coastal ecosystems and human wellbeing: A synthesis report based on the findings of the Millennium Ecosystem Assessment. Nairobi (Kenya): UNEP. 76 pp. URL: www.unep.org/pdf/Completev6_LR.pdf

10. Hydrothermal vents

Justification(s) for alignment with IFC PS6 criteria for Critical Habitat:
First discovered in 1977, deep-sea hydrothermal vents are typically small-scale sites that emit geothermally heated water. They form as a result of volcanic activity on the ocean floor, and are found in regions of high tectonic activity and intersections of continental plates. Fluids rich with dissolved metals and minerals, and which can reach temperatures of 400°C, are released from the vents and can support very densely populated ecosystems, where faunal density and biomass are comparatively much greater than on the surrounding seafloor (Baker et al. 2010). Hydrothermal vents support a unique fauna of chemosynthetic[54] microbes (bacteria and archaea), that in turn supports evolutionary and ecologically unique communities of shrimps, crabs, tube worms, clams, and other species that exist in no other habitat on earth (van Dover 2000). Within and around hydrothermal vents, researchers have discovered >500 new animal species (Scenario A[55]), over 80% of which are endemic to vents (van Dover 2000; Criterion 5[56]); given their limited extent, this also suggests that they fulfil Criterion 2. This high rate of endemism is a likely result of the unusual physiological adaptations necessary for survival in such an extreme environment, meaning that these species are highly evolutionary distinct (e.g. chemosynthetic organisms dependent on the sulphur produced, Beatty et al. 2005; Criterion 5[57]). In addition, a very high proportion of species are likely to be extremely rare, often comprising only a few recorded observations of individuals (Baker et al. 2010).

Marine protected areas have been established at deep-sea hydrothermal fields, notably in Canadian and Portuguese waters (UNEP-WCMC 2008), and their representation within protected areas is likely to increase further over coming years (van Dover 2012; Scenario B[58]). Hydrothermal vents (associated with oceanic ridges) are also included in the OSPAR Commission's *List of Threatened and/or Declining Species and Habitats* (OSPAR Commission 2008), the purpose of which is to guide the OSPAR Commission in setting priorities for its work on the conservation and protection of marine biodiversity. At the international scale, the biodiversity importance of hydrothermal vents is recognised as examples of ecosystems meeting EBSA criteria under the Convention on Biological Diversity, and examples of Vulnerable Marine Ecosystems (VMEs) under the UN Food and Agricultural Organisation (Scenario B; Van Dover et al. 2012).

Given that hydrothermal vents satisfy Criteria 2 and 5 and Scenario A, and are relevant to Scenario B, we include them as Likely Critical Habitat in our categorisation.

Selected dataset(s):

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[54] Chemosynthesis is the equivalent to photosynthesis, but organisms produce energy from chemicals (e.g. sulphur) in the absence of sunlight.
[55] "Scenario A. Other recognized high biodiversity values that might also support a CH designation. Examples: [...] Areas of high scientific value such as those containing concentrations of species new and/or little known to science".
[56] "Criterion 5. Areas associated with key evolutionary processes. Defined by: the physical features of a landscape that might be associated with particular evolutionary processes [...]. Examples: [...] Areas of high endemism often contain flora and/or fauna with unique evolutionary histories [...]".
[57] "Criterion 5. Areas associated with key evolutionary processes. Defined by: [...] subpopulations of species that are phylogenetically or morphogenetically distinct and may be of special conservation concern given their distinct evolutionary history. Examples: Isolated areas (e.g., islands, mountaintops, lakes) are associated with populations that are phylogenetically distinct [...]".
[58] "Scenario B. Internationally and/or nationally recognized areas of high biodiversity value".

The selected dataset (Beaulieu et al. 2013) is a global shapefile of hydrothermal vents created using the 'InterRidge vents database', which provides a comprehensive list of active and inferred active (unconfirmed) submarine hydrothermal vent fields. The dataset contains 596 points of hydrothermal vent presence, and represents the best available global dataset.

Beaulieu SE, Baker ET, German CR, Maffei A. An authoritative global database for active submarine hydrothermal vent fields, Geochemistry, Geophysics, Geosystems 2013;14:4892–4905

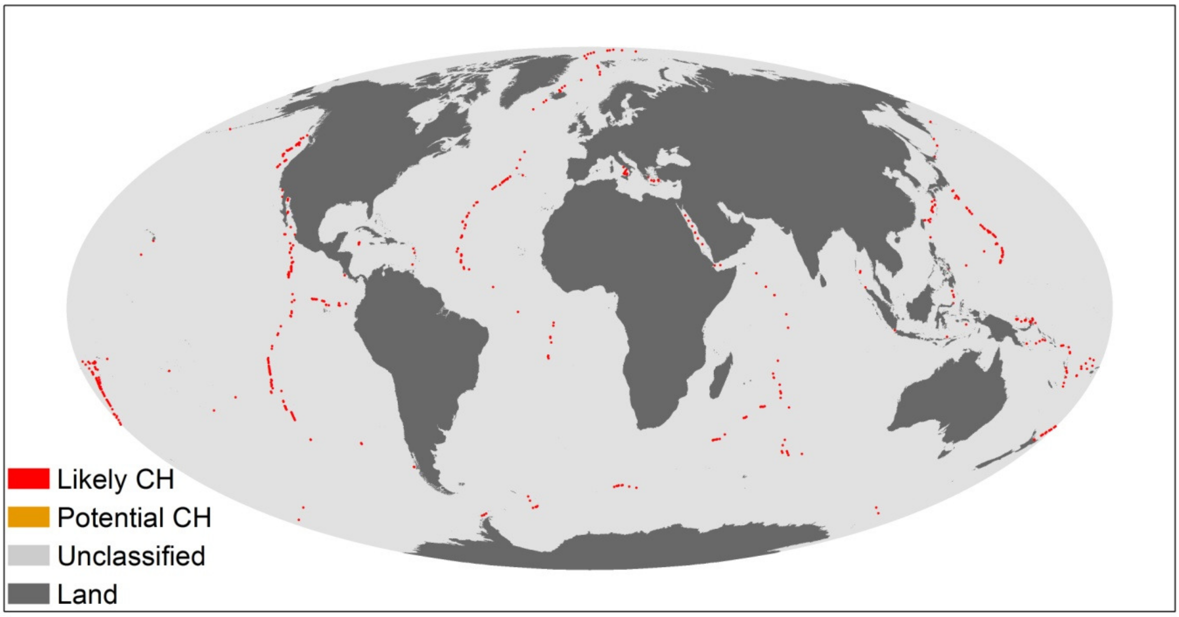

Figure S10: Global map of hydrothermal vents. CH: Critical Habitat.

References:

Baker MC, Ramirez-Llodra EZ, Tyler PA, German CR, Boetius A, Cordes EE, Dubilier N, Fisher CR, Levin LA, Metaxas A, Rowden AA, Santos RS, Shank TM, Van Dover CL, Young CM, Warén A (2010). Biogeography, ecology, and vulnerability of chemosynthetic ecosystems in the deep sea. In: Life in the world's oceans: diversity, distribution, and abundance (Ed. AD McIntyre). Oxford (UK): Wiley-Blackwell. 384 pp.

Beatty JT, Overmann J, Lince MT, Manske AK, Lang AS, Blankenship RE, Van Dover CL, Martinson TA, Plumley FG (2005). An obligately photosynthetic bacterial anaerobe from a deep-sea hydrothermal vent. Proceedings of the National Academy of Sciences 102: 9306-9310

OSPAR Commission (2008). OSPAR List of Threatened and/or Declining Species and Habitats (Reference Number: 2008-6). London (UK): OSPAR Commission. 4 pp.

UNEP-WCMC (2008). National and regional networks of marine protected areas: a review of progress. Cambridge (UK): UNEP World Conservation Monitoring Centre. 156 pp.

van Dover CL (2000). The ecology of deep-sea hydrothermal vents. Princeton (NJ): Princeton University Press. 352 pp.

van Dover CL (2012). Hydrothermal vent ecosystems and conservation. Oceanography 25: 313-316

Van Dover CL, Smith CR, Ardron J, Dunn D, Gjerde K, Levin L, Smith S, The Dinard Workshop Contributors (2012). Designating networks of chemosynthetic ecosystem reserves in the deep sea. Marine Policy 36: 378-381

11. Cold seeps

Justification(s) for alignment with IFC PS6 criteria for Critical Habitat:
Cold seep ecosystems are found where sulphur and methane emerge from seafloor sediments without an appreciable temperature rise (Levin 2005). Also known as cold vents, seeps form by a variety of processes related to over-pressuring (e.g. of sediments, or from mineral dehydration reactions and gas hydrate dynamics; Tunnicliffe et al. 2003). These environments, and the communities associated with them, are among the most recently discovered marine habitats: the first system was found in 1983 on the Florida escarpment in the Gulf of Mexico (Paull et al. 1984). Since this discovery, active seeps have been reported from all oceans of the world, the highest number occurring within active subduction zones in the Pacific Ocean, along the margins of Alaska, Oregon, California, Central America, Peru, Japan and New Zealand (Levin 2005).

From an ecological perspective, the chemicals released by seeps support a number of chemosynthetic[59] species, from single-celled organisms (archaea and bacteria) that live in the surrounding sediment and utilize the methane produced (Orphan et al. 2002), to communities of large invertebrate taxa including clams, mussels or worms, the populations of which are sustained by the surrounding symbiotic[60] bacteria (Levin 2005). However, despite the relatively high biomass found within these regions, the species diversity is frequently low (Levin 2005, Seitzinger et al. 2010, Vanreusel et al. 2010) as relatively few species have evolved the physiological and morphological adaptations required to survive in such a challenging environment (McArthur and Tunnicliffe 1998, Hourdez and Lallier 2006), leading to a unique and distinct evolutionary assemble relative to the surrounding seabed; Criterion 5[61]). Consequently, a large proportion of species found in cold seep ecosystems are endemic to them (Sibuet and Olu 1998), with 40% endemicity in seeps for both mega epifauna and macro infauna (Baker et al. 2010a) (Criterion 2[62]). Furthermore, a large number of seep species are found at present at only one geographical site (Criterion 4[63]; Bergquist et al. 2003).

Seeps occur most frequently near ocean margins, from intertidal to hadal (deeper than 6,000 m) depths. Due to the financial and technological challenges of carrying out research in deep-sea regions, our knowledge of the systems and the species found there has remained relatively poor. For instance, of the 500 putative species described from hydrothermal vent and cold seep environments, not a single one has had its complete life cycle described (Scenario A[64]; Tyler and Young 1999). Finally, the biodiversity importance of cold seeps is increasingly being recognised, for instance as examples of ecosystems meeting EBSA criteria under the Convention on Biological Diversity, and examples of Vulnerable Marine Ecosystems (VMEs) under the UN Food and Agricultural Organisation (Scenario B; Van Dover et al. 2012).

[59] Chemosynthesis is the equivalent to photosynthesis, but organisms produce energy from chemical (e.g. sulphur) in the absence of sunlight.
[60] Symbiosis is the relationship between two different species of organisms that are interdependent.
[61] "Criterion 5. Areas associated with key evolutionary processes. [...] Defined by: [...] subpopulations of species that are phylogenetically or morphogenetically distinct and may be of special conservation concern given their distinct evolutionary history Isolated areas. Examples: Isolated areas (e.g., islands, mountaintops, lakes) are associated with populations that are phylogenetically distinct [...]".
[62] "Criterion 2. Habitats of significant importance to endemic and/or restricted-range species."
[63] "Criterion 4. Highly threatened and/or unique ecosystems. Defined as: [...] containing [...] concentrations of biome-restricted species".
[64] "Scenario A. Other recognized high biodiversity values that might also support a CH designation. [...] Areas of high scientific value such as the containing concentrations of species new and/or little known to science".

Cold seeps fulfil at least Criteria 4 and 5 and Scenario A, and possibly Criterion 2 and Scenario B. As such, they are designated Likely Critical Habitat in our categorisation.

Selected dataset(s):

The selected dataset (Baker et al. 2010b) is a global shapefile of cold seeps that were studied in terms of their biology, as part of the Chemosynthetic Ecosystem Science (ChEss) project, Census of Marine Life programme (www.coml.org). The dataset contains 188 points of seep presence, and represents the best available global dataset.

Baker MC, Ramirez-Llodra E, Perry D (2010b). ChEssBase: an online information system on species distribution from deep-sea chemosynthetic ecosystems. Version 3. Chemosynthetic Ecosystem Science (ChEss) project. Southampton (UK): National Oceanography Centre. URL: www.noc.soton.ac.uk/chess

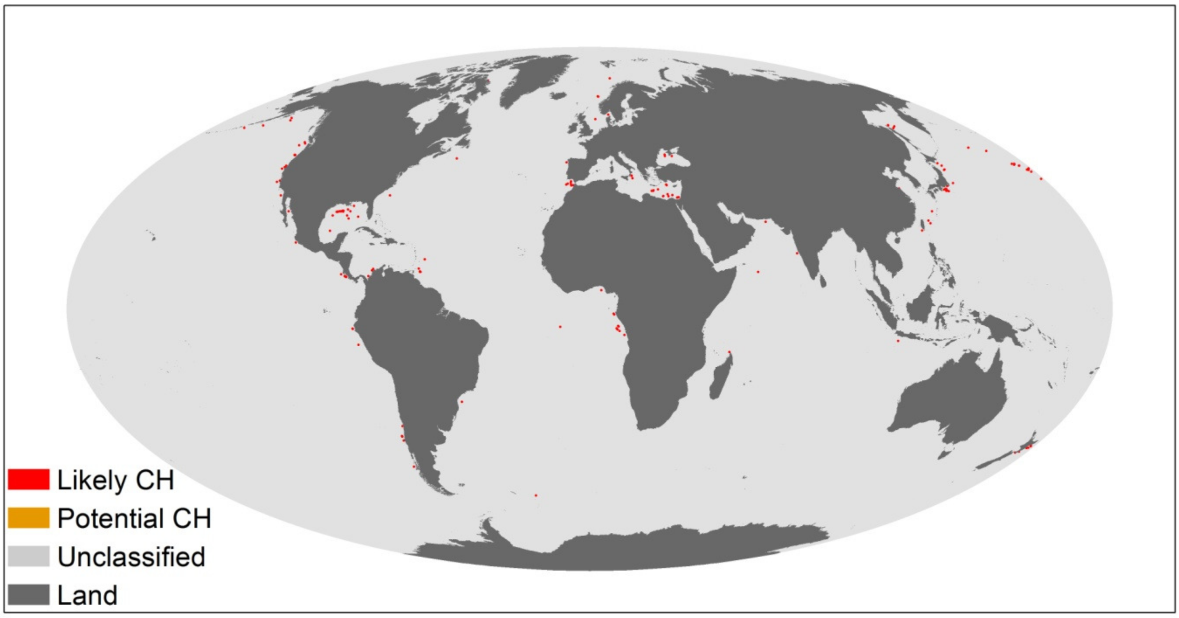

Figure S11: Global map of cold seeps. CH: Critical Habitat.

References:

Baker MC, Ramirez-Llodra EZ, Tyler PA, German CR, Boetius A, Cordes EE, Dubilier N, Fisher CR, Levin LA, Metaxas A, Rowden AA, Santos RS, Shank TM, Van Dover CL, Young CM, Warén A (2010a). Biogeography, ecology, and vulnerability of chemosynthetic ecosystems in the deep sea. In: Life in the world's oceans: diversity, distribution, and abundance (Ed. AD McIntyre). Oxford (UK): Wiley-Blackwell. 384 pp.

Bergquist DC, Ward T, Cordes EE, McNelis T, Howlett S, Kosoff R, Hourdez S, et al. (2003). Community structure of vestimentiferan-generated habitat islands from Gulf of Mexico cold seeps. Journal of Experimental Marine Biology and Ecology 289: 197-222

Hourdez S, Lallier FH (2006). Adaptations to hypoxia in hydrothermal-vent and cold-seep invertebrates. Reviews in Environmental Science and Bio/Technology 6: 143-159

Levin LA (2005). Ecology of cold seep sediments: interactions of fauna with flow, chemistry and microbes. In: Oceanography and Marine Biology: An Annual Review vol. 50 (Eds. RN Gibson, RJA Atkinson, JDM Gordon, RN Hughes). London (UK): CRC Press. 584 pp.

McArthur AG, Tunnicliffe V (1998). Relics and antiquity revisited in the modern vent fauna. Geological Society, London, Special Publications 148: 271-291

Orphan VJ, House CH, Hinrichs K-U, McKeegan KD, DeLong EF (2002). Multiple archaeal groups mediate methane oxidation in anoxic cold seep sediments. Proceedings of the National Academy of Sciences of the USA 99: 7663-7668

Tyler PA, Young CM (1999). Reproduction and dispersal at vents and cold seeps. Journal of the Marine Biological Association of the UK 79: 193-208

Paull CK, Hecker B, Commeau R, Freeman-Lynde RP, Neumann C, Corso WP, Golubic S, et al. (1984). Biological communities at the Florida escarpment resemble hydrothermal vent taxa. Science 226: 965-7

Seitzinger SP, Mayorga E, Bouwman F, Kroeze C, Beusen HW, Billen G, Van Drecht G, et al. (2010). Global river nutrient export: A scenario analysis of past and future trends. Global Biogeochemical Cycles 24: GB0A08

Sibuet M, Olu K (1998). Biogeography, biodiversity and fluid dependence of deep-sea cold-seep communities at active and passive margins. Deep-Sea Research Part II 45: 517-567

Tunnicliffe V, Juniper SK, Sibuet M (2003). Reducing environments of the deep-sea floor. In: Ecosystems of the Deep Oceans (Ed. PA Tyler). Amsterdam (The Netherlands): Elsevier. 582 pp.

Van Dover CL, Smith CR, Ardron J, Dunn D, Gjerde K, Levin L, Smith S, The Dinard Workshop Contributors (2012). Designating networks of chemosynthetic ecosystem reserves in the deep sea. Marine Policy 36: 378-381

Vanreusel A, de Groote A, Gollner S, Bright M (2010). Ecology and biogeography of free-living nematodes associated with chemosynthetic environments in the deep sea: a review. PLoS one, 5: e12449

Figure S12. Surface areas (in km^2) covered by Likely and Potential Critical Habitats in each 2,000 m bathymetric contour. The composite Critical Habitat (CH) layer is shown, along with each of the eleven biodiversity features.

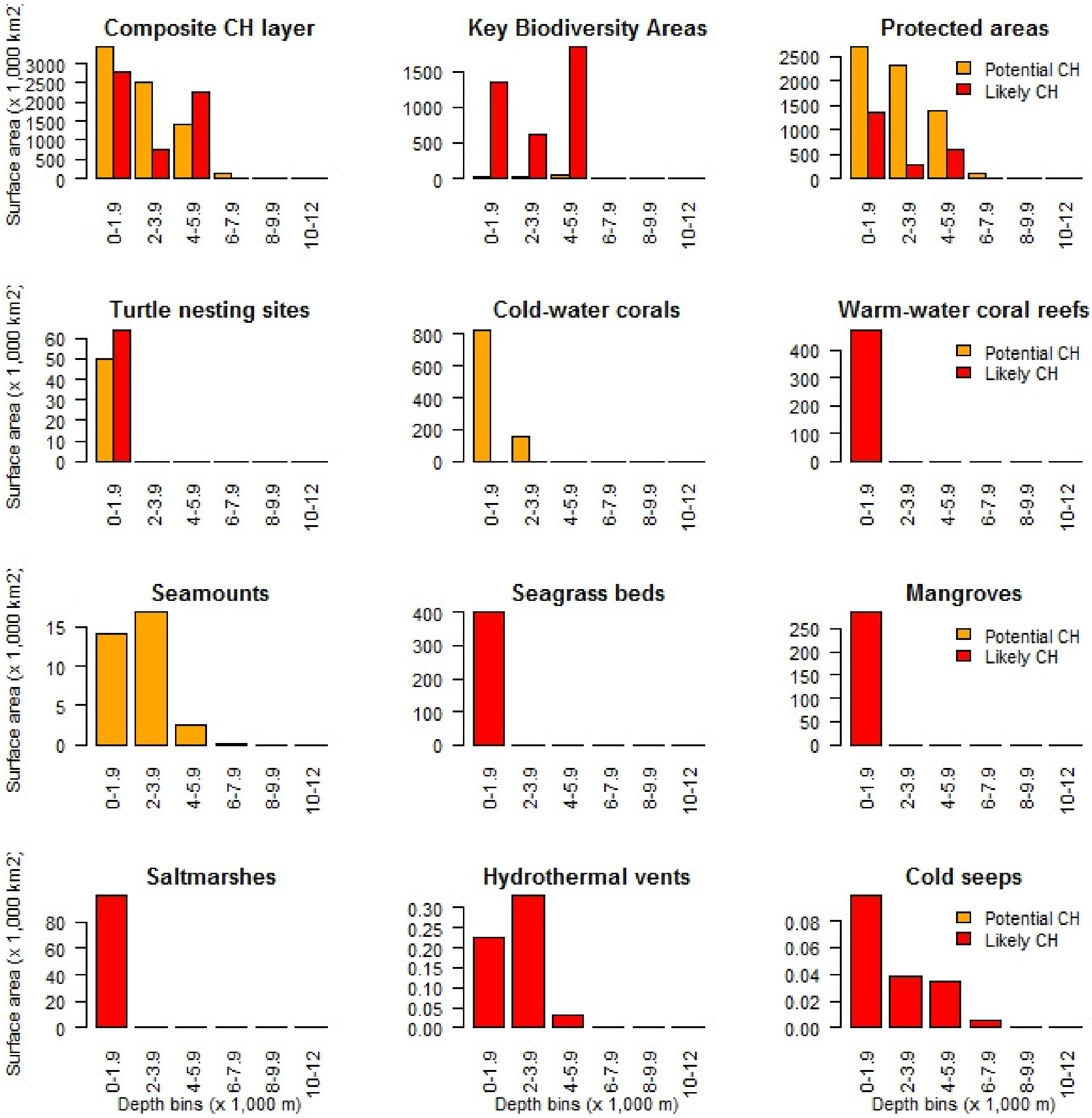

Table S1. Detailed IFC PS6 criteria, and additional scenarios (named as such in this analysis) for Critical Habitat. Adapted from [17] and [22] and used in the footnotes of Supplementary Material Appendix S2.

Criterion 1. Habitats of significant importance to Critically Endangered (CE) and/or Endangered (EN) species

Tier 1 sub-criteria for Criterion 1 are defined as follows:

- habitat required to sustain ≥ 10% of the global population of an IUCN Red-listed CR or EN species where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species;
- habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management sites globally for that species.

Note that all Alliance for Zero Extinction (AZE) sites would automatically qualify as Tier 1 Critical Habitat per Criterion 1 as the AZE threshold is set at 95% of CR and EN species (in a discrete management unit).

Tier 2 sub-criteria for Criterion 1 are defined as follows:

- habitat that supports the regular occurrence of a single individual of an IUCN Red-listed CR species and/or habitat containing regionally-important concentrations of an IUCN Red-listed EN species where that habitat could be considered a discrete management unit for that species;
- habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species;
- as appropriate, habitat containing nationally/regionally-important concentrations of an EN, CR or equivalent national/regional listing.

Here, *regular occurrence* is defined as occurring continuously in the habitat (e.g., physical residence), seasonally or cyclically (e.g., migratory sites) or episodic (e.g., temporary wetlands). Regular occurrence does not include vagrancies, marginal occurrence and historical records or unconfirmed anecdotal evidence, but it does include migratory species in transit.

The many endemic, restricted-range, and scientifically undescribed species that have not yet been evaluated by the IUCN are also relevant.

Criterion 2. Habitats of significant importance to endemic and/or restricted-range species

An *endemic* species is defined as one that has ≥ 95% of its global range inside the country or region of analysis, but this definition mainly refers to plants.

A *restricted-range* species is defined as follows: extent of occurrence of 50,000 km^2 or less for terrestrial vertebrates; (provisionally) 100,000 km^2 or less for marine systems; freshwater systems - 20,000 km^2 for crabs, fish, and molluscs, 50,000 km^2 for odonates (dragonflies and damselflies), other taxa unknown.

Tier 1 sub-criterion for Criterion 2 is defined as follows:

- habitat known to sustain ≥ 95% of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species (e.g., a single-site endemic).

Tier 2 sub-criterion for Criterion 2 is defined as follows:

- habitat known to sustain ≥ 1% but < 95% of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment.

Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy. This measure may exclude discontinuities or disjunctions within the overall distributions of taxa (e.g., large areas of obviously unsuitable habitat). Extent of occurrence can often be measured by a minimum convex polygon (the smallest polygon in which no internal angle exceeds 180 degrees and which contains all the sites of occurrence).

The many endemic, restricted-range, and scientifically undescribed species that have not yet been evaluated by the IUCN are also relevant.

Criterion 3. Habitats supporting globally significant concentrations of migratory species and/or congregatory species

Migratory species are defined as any species of which a significant proportion of its members cyclically and predictably move from one geographical area to another (including within the same ecosystem).

Congregatory species are defined as species whose individuals gather in large groups on a cyclical or otherwise regular and/or predictable basis (e.g. species that form colonies; species that form colonies for breeding purposes and/or where large numbers of individuals of a species gather at the same time for non-breeding purposes such as foraging and , roosting; species that move through bottleneck sites where significant numbers of individuals of a species pass over a concentrated period of time, such as during migration; species with large but clumped distributions where a large number of individuals may be concentrated in a single or a few sites while the rest of the species is largely dispersed, such as wildebeest distributions; source populations where certain sites hold populations of species that make an inordinate contribution to recruitment of the species elsewhere [especially important for marine species]).

Tier 1 sub-criterion for Criterion 3 is defined as follows:

- habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 95% of the global population of a migratory or congregatory species at any point of the species' life-cycle where that habitat could be considered a discrete management unit for that species.

Tier 2 sub-criteria for Criterion 3 are defined as follows:

- habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1% but < 95% of the global population of a migratory or congregatory species at any point of the species' life-cycle and where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment;
- for birds, habitat that meets BirdLife International's criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance;
- for species with large but clumped distributions, a provisional threshold is set at ≥ 5% of the global population for both terrestrial and marine species;
- source sites that contribute ≥ 1% of the global population of recruits.

Criterion 4. Highly threatened and/or unique ecosystems

Highly threatened or unique ecosystems are those:

- that are at risk of significantly decreasing in area or quality;
- with a small spatial extent; and/or
- containing unique assemblages of species including assemblages or concentrations of biome-restricted species.

Areas determined to be irreplaceable or of high priority/significance based on systematic conservation planning techniques carried out at the landscape and/or regional scale by governmental bodies, recognized academic institutions and/or other relevant qualified organizations (including internationally-recognized Non-Governmental Organizations NGOs) or that are recognized as such in existing regional or national plans, such as the NBSAP[65], would also qualify as Critical Habitat per Criterion 4.

An example of a *unique ecosystem* would be one that occurs in very limited numbers in the region, such as the only lowland dipterocarp forest.
An example of a *highly threatened* ecosystem would be one that is losing a high percentage of its area each year.

Highly threatened or unique ecosystems are defined by a combination of factors that determine their importance for conservation action. The prioritization of rare and endangered ecosystems employs similar factors to those used for the IUCN Red List of Threatened Species. The ecosystem prioritization factors include long-term trend, rarity, ecological condition, and threat. All of these values contribute to the relative biodiversity and conservation value of the particular ecosystem.

Criterion 5. Areas associated with key evolutionary processes

This criterion is defined by:
- the physical features of a landscape that might be associated with particular evolutionary processes; and/or
- subpopulations of species that are phylogenetically or morphogenetically distinct and may be of special conservation concern given their distinct evolutionary history. The latter includes Evolutionarily Significant Units (ESUs) and Evolutionarily Distinct and Globally Endangered (EDGE) species.

Potential examples of spatial features associated with evolutionary processes:
- *Isolated areas* (e.g., islands, mountaintops, lakes) are associated with populations that are phylogenetically distinct.
- Areas of high *endemism* often contain flora and/or fauna with unique evolutionary histories (note overlap with Criterion 2, endemic and restricted-range species).
- Landscapes with high spatial *heterogeneity* are a driving force in speciation as species are naturally selected on their ability to adapt and diversify.
- *Environmental gradients*, also known as ecotones, produce transitional habitat which has been associated with the process of speciation and high species and genetic diversities.
- *Edaphic interfaces* are specific juxtapositions of soil types (e.g., serpentine outcrops, limestone and gypsum deposits), which have led to the formation of unique plant communities characterized by both rarity and endemism.
- *Connectivity* between habitats (e.g., biological corridors) ensures species migration and gene flow, which is especially important in fragmented habitats and for the conservation of metapopulations. This also includes biological corridors across altitudinal and climatic gradients and from “crest to coast”.
- Sites of demonstrated importance to *climate change adaptation* for either species or ecosystems are also included in this criterion.

Scenario A. Other recognized high biodiversity values that might also support a Critical Habitat designation

Examples:
- areas required for the reintroduction of CR and EN species and refuge sites for these species (e.g. habitat used during periods of stress such as flood, drought or fire);
- ecosystems of known special significance to EN or CR species for climate adaptation purposes;
- concentrations of Vulnerable (VU) species in cases where there is uncertainty regarding the listing, and the actual status of the species may be EN or CR;
- areas of primary/old-growth/pristine forests and/or other areas with especially high levels of species diversity;
- landscape and ecological processes, such as water catchments, areas critical to erosion control, disturbance regimes (e.g., fire, flood), that are required for maintaining Critical Habitat;

[65] National Biodiversity Strategies and Action Plans.

- habitat necessary for the survival of keystone species;
- areas of high scientific value such as those containing concentrations of species new and/or little known to science.

Scenario B. Internationally and/or nationally recognized areas of high biodiversity value that in general will likely qualify as Critical Habitat

Examples:

- areas that meet the criteria of the IUCN's Protected Area Management Categories Ia, Ib and II, although areas that meet criteria for Management Categories III-VI may also qualify depending on the biodiversity values inherent to those sites;
- UNESCO natural World Heritage sites that are recognized for their Global Outstanding Value;
- the majority of Key Biodiversity Areas (KBAs), which encompass *inter alia* Ramsar Sites, Important Bird Areas (IBA), Important Plant Areas (IPA) and AZE;
- areas determined to be irreplaceable or of high priority/significance based on systematic conservation planning techniques carried out at the landscape and/or regional scale by governmental bodies, recognized academic institutions and/or other relevant qualified organizations (including internationally-recognized NGOs);
- Areas identified by the client as High Conservation Value (HCV) using internationally recognized standards, where criteria used to designate such areas is consistent with the high biodiversity values listed in the five Critical Habitat criteria.

Table S2. Surface areas (x 10^3 km^2) left Unclassified, or covered by Likely and Potential Critical Habitats. The figures are also given relative (%) to the total analysis area (global ocean and coastal land strip), i.e. Unclassified zones plus combined Likely and Potential Critical Habitats. Figures are given for the composite Critical Habitat (CH) layer and for each of the eleven biodiversity features separately. - : not applicable.

	Unclassified	**Potential CH**	**Likely CH**
Composite CH layer	349,576.0	7,526.3	5,798.3
	96.3%	2.1%	1.6%
Key Biodiversity Areas	358,993.8	97.9	3,808.9
	98.9%	~ 0%	1.0%
Protected areas	354,117.1	6,566.7	2,216.9
	97.6%	1.8%	0.6%
Sea turtle nesting sites	362,786.1	50.3	64.2
	~ 100%	~ 0%	~ 0%
Cold-water corals	361,908.9	988.3	3.4
	99.7%	0.3%	~ 0%
Warm-water coral reefs	362,426.6	-	474.0
	99.9%	-	0.1%
Seamounts	362,867.2	33.4	-
	99.99%	0.01%	-
Seagrass beds	362,500.2	-	400.4
	99.9%	-	0.1%
Mangroves	362,615.9	-	284.7
	99.9%	-	0.1%
Saltmarshes	362,800.8	-	99.9
	~ 100%	-	~ 0%
Hydrothermal vents	362,900.1	-	0.6
	100%	-	~ 0%
Cold seeps	362,900.4	-	0.2
	~ 100%	-	~ 0%

Supplementary material of: Martin, C. S., Tolley, M. J., Farmer, E., Mcowen, C. J., Geffert, J. L., Scharlemann, J. P. W., Thomas H. L., van Bochove J. H., Stanwell-Smith D., Hutton, J. M., Lascelles, B., Pilgrim, J. D., Ekstrom, J. M. M., Tittensor, D. P. (2015) A global map to aid the identification and screening of critical habitat for marine industries. Marine Policy 53: 45-53. doi:10.1016/j.marpol.2014.11.007

Table S3. Contributions of each biodiversity feature to Likely and Potential Critical Habitat coverage. The figures are given relative (%) to the total area of Critical Habitat (i.e. combining Likely and Potential Critical Habitats, and excluding Unclassified areas). - : not applicable.

	Potential CH	**Likely CH**	**Potential/Likely CH**
Key Biodiversity Areas	0.7	28.6	29.3
Protected areas	49.3	16.6	65.9
Sea turtle nesting sites	0.4	0.5	0.9
Cold-water corals	7.4	~ 0	7.4
Warm-water coral reefs	-	3.6	3.6
Seamounts	0.3	-	0.3
Seagrass beds	-	3.0	3.0
Mangroves	-	2.1	2.1
Saltmarshes	-	0.7	0.7
Hydrothermal vents	-	~ 0	~ 0
Cold seeps	-	~ 0	~ 0

Table S4. Combined Likely and Potential Critical Habitat coverage in individual Exclusive Economic Zones (EEZs). The figures are given relative (%) to the total area of each EEZ.

EEZ	Potential/Likely CH
Monegasque EEZ	100.00
Mayotte EEZ	99.87
British Indian Ocean Territory EEZ	99.80
Slovenian EEZ	97.91
Bosnian and Herzegovinian EEZ	86.82
South Georgian EEZ	73.72
Iraqi EEZ	71.01
Kiribati EEZ (Phoenix Group)	55.04
German EEZ	51.27
Gibraltarian EEZ	47.95
Belizean EEZ	45.26
Belgian EEZ	40.43
Danish EEZ	36.93
South African EEZ (Prince Edward Islands)	36.18
Australian EEZ (Macquarie Island)	34.76
French EEZ	31.93
Singaporean EEZ	31.39
Lithuanian EEZ	28.15
New Zealand EEZ	27.17
Polish EEZ	26.86
United States EEZ	26.10
Eritrean EEZ	23.12
Dutch EEZ	22.62
Grenadian EEZ	21.96
Estonian EEZ	21.01
Chilean EEZ (Easter Island)	21.00
Latvian EEZ	19.81
Saint Vincent and the Grenadines EEZ	18.80
Surinamese EEZ	18.74
Guinea Bissau EEZ	18.68
Spanish EEZ	18.63
Italian EEZ	18.45
Bahraini EEZ	17.95
Finnish EEZ	17.40
United Arab Emirates EEZ	16.99
Cameroonian EEZ	16.95
Ecuadorean EEZ (Galapagos)	16.65
Jordanian EEZ	16.62

EEZ	**Potential/Likely CH**
French Guiana EEZ	16.57
United States Exclusive EEZ (Hawaii)	16.54
Mauritanian EEZ	16.17
Heard and McDonald Islands EEZ	15.66
Palmyra Atoll EEZ	15.60
Kuwaiti EEZ	15.47
Western Saharan EEZ	15.46
Venezuelan EEZ	15.26
Saudi Arabian EEZ	15.07
Disputed Sudan-Egypt	14.98
Guinean EEZ	13.81
Swedish EEZ	13.07
Saba EEZ	12.61
Moroccan EEZ	12.28
Howland and Baker Island EEZ	12.05
Colombian EEZ	11.75
Portuguese EEZ	11.66
Saint-Martin EEZ	11.56
Jarvis Island EEZ	11.35
Australian EEZ	11.00
Dominican Republic EEZ	10.70
Guyanese EEZ	10.65
Cuban EEZ	10.58
Sudanese EEZ	10.00
Sint-Maarten EEZ	9.72
Nicaraguan EEZ	9.35
Dominican EEZ	9.35
Wake Island EEZ	9.16
Jersey EEZ	9.12
American Samoa EEZ	8.85
Saint Lucia EEZ	8.72
Trinidad and Tobago EEZ	8.65
Romanian EEZ	8.62
Irish EEZ	8.60
United Kingdom EEZ	8.54
Bangladeshi EEZ	8.47
Senegalese EEZ	8.43
Johnston Atoll EEZ	8.23
Djiboutian EEZ	7.91
Ukrainian EEZ	7.79
United States Exclusive EEZ (Alaska)	7.77
Guadeloupe and Martinique EEZ	7.26
Honduran EEZ	7.20

EEZ	Potential/Likely CH
Bahamas EEZ	7.08
Gambian EEZ	6.91
Beninese EEZ	6.63
Qatari EEZ	6.57
Democratic Republic of the Congo EEZ	6.39
Protected Zone established under the Torres Strait Treaty	6.22
Norwegian EEZ	6.03
Egyptian EEZ	5.89
Spanish EEZ (Canary Islands)	5.82
Nigerian EEZ	5.59
Greenlandic EEZ	5.40
Barbados EEZ	5.37
Tunisian EEZ	4.86
Indonesian EEZ	4.71
Northern Mariana Islands and Guam EEZ	4.65
East Timor EEZ	4.49
Tanzanian EEZ	4.39
Haitian EEZ	4.12
Albanian EEZ	4.11
Turks and Caicos EEZ	4.11
Bonaire EEZ	4.10
Aruban EEZ	4.05
Sierra Leonian EEZ	3.97
Panamanian EEZ	3.94
Puerto Rican EEZ	3.93
Philippines EEZ	3.90
Croatian EEZ	3.79
Russian EEZ	3.57
Comoran EEZ	3.54
Bulgarian EEZ	3.47
Mozambican EEZ	3.38
Greek EEZ	3.25
Congolese EEZ	3.22
British Virgin Islands EEZ	3.20
Portuguese EEZ (Azores)	3.15
Sint-Eustasius EEZ	3.06
Brazilian EEZ	3.04
Antigua and Barbuda EEZ	3.04
Thailand EEZ	3.02
Antarctic 200NM zone beyond the coastline	2.98
Malaysian EEZ	2.93
Vietnamese EEZ	2.93

EEZ	Potential/Likely CH
Kenyan EEZ	2.90
Chinese EEZ	2.72
Mexican EEZ	2.66
Iranian EEZ	2.53
Turkish EEZ	2.47
Madagascan EEZ	2.45
Yemeni EEZ	2.38
Saint Kitts and Nevis EEZ	2.38
Colombia - Jamaica (Joint Regime)	2.34
South African EEZ	2.22
Algerian EEZ	2.20
Canadian EEZ	2.16
Papua New Guinean EEZ	2.13
Anguilla EEZ	2.09
Cape Verdean EEZ	2.02
Jamaican EEZ	2.02
Bruneian EEZ	1.95
Glorioso EEZ	1.93
Oecussi Ambeno EEZ	1.90
South Korean EEZ	1.90
Chilean EEZ (disputed - Peruvian point of view)	1.89
Namibian EEZ	1.89
Cayman Islands EEZ	1.85
Chilean EEZ (disputed - Chilean point of view)	1.83
Myanmar EEZ	1.80
Montenegrin EEZ	1.80
New Caledonian EEZ	1.75
Cambodian EEZ	1.75
Fijian EEZ	1.68
Togolese EEZ	1.58
Guatemalan EEZ	1.53
Ghanaian EEZ	1.48
Maldives EEZ	1.36
Japanese EEZ	1.32
Peruvian EEZ (disputed - Chilean point of view)	1.26
Samoan EEZ	1.23
Crozet Islands EEZ	1.23
Spratly Islands EEZ	1.22
Peruvian EEZ (disputed - Peruvian point of view)	1.22
Maltese EEZ	1.21
Costa Rican EEZ	1.20
Pakistani EEZ	1.18
Gabonese EEZ	1.17

EEZ	Potential/Likely CH
Kerguelen Islands EEZ	1.11
Uruguayan EEZ	1.05
Russia-Japan conflict zone	0.96
Solomon Islands EEZ	0.95
El Salvador EEZ	0.93
Georgian EEZ	0.93
Tongan EEZ	0.92
Taiwanese EEZ	0.90
Omani EEZ	0.88
Sri Lankan EEZ	0.87
Cypriote EEZ	0.85
Amsterdam Island & St. Paul Island EEZ	0.83
Montserrat EEZ	0.80
Ivory Coast EEZ	0.74
Ecuadorean EEZ	0.74
Icelandic EEZ	0.74
Argentinean EEZ	0.68
Indian EEZ	0.67
Guernsey EEZ	0.65
Curaþaoan EEZ	0.63
Indian EEZ (Andaman and Nicobar Islands)	0.62
Vanuatu EEZ	0.59
Portuguese EEZ (Madeira)	0.57
Tristan Da Cunha EEZ	0.55
North Korean EEZ	0.53
Palau EEZ	0.52
Paracel Islands EEZ	0.52
Marshall Islands EEZ	0.51
Wallis and Futuna EEZ	0.41
Kiribati EEZ	0.41
Micronesian EEZ	0.41
Bermudian EEZ	0.39
Liberian EEZ	0.38
Equatorial Guinean EEZ	0.37
Israeli EEZ	0.32
Somali EEZ	0.31
French Polynesian EEZ	0.31
Seychellois EEZ	0.30
Tuvaluan EEZ	0.30
Jan Mayen EEZ	0.28
Angolan EEZ	0.24
Libyan EEZ	0.24
Faeroe Islands EEZ	0.20

EEZ	Potential/Likely CH
Syrian EEZ	0.19
Norfolk Island EEZ	0.18
Mauritian EEZ	0.18
Falkland Islands EEZ	0.17
Saint-Pierre and Miquelon EEZ	0.16
Sao Tome and Principe EEZ	0.15
Juan de Nova EEZ	0.14
Tokelau EEZ	0.14
Conflict Zone	0.12
Christmas Island EEZ	0.09
Lebanese EEZ	0.09
Japan - South Korea Conflict Zone	0.09
Bassas da India EEZ	0.09
Kiribati EEZ (Line Group)	0.08
Cocos Islands EEZ	0.07
Cook Islands EEZ	0.07
RÚunion EEZ	0.06
Ile Europa EEZ	0.04
Area of overlap between Australian Seabed Jurisdiction and Indonesian EEZ Jurisdiction	0.04
Bouvet Island EEZ	0.03
Ascension EEZ	0.03
Niue EEZ	0.03
Pitcairn EEZ	0.02
Clipperton Island EEZ	0.02
St. Helena EEZ	0.02
Brazilian EEZ (Trindade)	0.01
Ile Tromelin EEZ	0.01
Nauruan EEZ	0.01
Area en controversia (disputed - Peruvian point of view)	0.01
Joint Japan - Korea	0.00
Azerbaijanis EEZ	0.00
Joint Development Area Australia - East Timor	0.00
Kazakh EEZ	0.00
Nigeria - Sao Tome and Principe Joint	0.00
Turkmen EEZ	0.00

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