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A global map to aid the identification and screening of critical habitat for marine industries

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ABSTRACT

Marine industries face a number of risks that necessitate careful analysis prior to making decisions on the siting of operations and facilities. An important emerging regulatory framework on environmental sustainability for business operations is the International Finance Corporation's Performance Standard 6 (IFC PS6). Within PS6, identification of biodiversity significance is articulated through the concept of "Critical Habitat", a definition developed by the IFC and detailed through criteria aligned with those that support internationally accepted biodiversity designations. No publicly available tools have been developed in either the marine or terrestrial realm to assess the likelihood of sites or operations being located within PS6-defined Critical Habitat. This paper presents a starting point towards filling this gap in the form of a preliminary global map that classifies more than 13 million km^2 of marine and coastal areas of importance for biodiversity (protected areas, Key Biodiversity Areas [KBA], sea turtle nesting sites, cold- and warm-water corals, seamounts, seagrass beds, mangroves, saltmarshes, hydrothermal vents and cold seeps) based on their overlap with Critical Habitat criteria, as defined by IFC. In total, 5798×10^3 km^2 (1.6%) of the analysis area (global ocean plus coastal land strip) were classed as *Likely Critical Habitat*, and 7526×10^3 km^2 (2.1%) as *Potential Critical Habitat*; the remainder (96.3%) were *Unclassified*. The latter was primarily due to the paucity of biodiversity data in marine areas beyond national jurisdiction and/or in deep waters, and the comparatively fewer protected areas and KBAs in these regions. Globally, protected areas constituted 65.9% of the combined Likely and Potential Critical Habitat extent, and KBAs 29.3%, not accounting for the overlap between these two features. Relative Critical Habitat extent in Exclusive Economic Zones varied dramatically between countries. This work is likely to be of particular use for industries operating in the marine and coastal realms as an early screening aid prior to in situ Critical Habitat assessment; to financial institutions making investment decisions; and to those wishing to implement good practice policies relevant to biodiversity management. Supplementary material (available online) includes other global datasets considered, documentation and justification of biodiversity feature classification, detail of IFC PS6 criteria/scenarios, and coverage calculations.

1. Introduction

The goods and services provided by the global ocean play an integral role in supporting human wellbeing, yet they are coming under increasing pressure from anthropogenic exploitation [1]. Given a future of an increasing human population and synergistic impacts from climate change and other stressors, minimizing the impacts of marine industries is of critical importance if functional marine and coastal ecosystems are to be maintained and sustainable development achieved. Consequently, there is growing political and societal pressure on the users of the marine environment to conduct their operations in a more responsible and sustainable way, and minimise

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their risks and impacts through careful evidence-based planning. From a business perspective, the increasing loss of biodiversity, and recognition that industry plays a role in this, is responsible for an increased focus on assessing and managing the biodiversity risks associated with their actions. Avoidance of biodiversity impacts before they occur is the most cost effective and politically straightforward approach to conservation for both industry and financial sectors.

Of critical importance to this process is the development of biodiversity maps, models, assessment methods and tools relevant to the spatial and temporal scales and the social, political and economic contexts within which these industries operate. Unfortunately the number of such effective tools is still very limited. Software to assess the biodiversity and ecological value of terrestrial, freshwater and marine sites, such as the Local Ecological Footprint Tool [2] and the Integrated Biodiversity Assessment Tool [3] exist, but, while pertinent, these are not directly designed for individual environmental policy frameworks. Systematic conservation planning software such as Marxan [4] and MarineMap [5], and ecosystem services mapping tools such as InVEST [6], can be used for spatial planning but similarly do not relate to policy standards. Databases and metrics such as the Ocean Biogeographic Information System (OBIS) [7], AquaMaps [8], the BirdLife marine e-atlas [9], and the Ocean Health Index [10], could potentially feed into such approaches, but are not in and of themselves sufficient.

Part of the reason for this lack of methodologies and tools is the challenge represented by the limited sampling of the oceans [11] and the difficulty of accessing and compiling existing data at regional to global scales. For example, although knowledge of global patterns of biodiversity is available for limited numbers of taxa (e.g. [12]), present understanding is taxonomically and spatially biased, and knowledge of patterns at the fine scales relevant to management implementation remains very limited [13].

A second factor that makes development of methodologies challenging is that there is no obvious way either to select or combine different data layers to generate decision-support tools for industry. Combining data layers can be subjective and result in controversy for both tools and metrics (for example [10,14]). Using international standards [15,16] to define and constrain the selection and integration of data layers can help to address these issues, and results in an approach better tailored to the necessary industry decisions.

The key emerging standard for business is the International Finance Corporation's Performance Standard 6 (IFC PS6) on Biodiversity Conservation and Sustainable Management of Living Natural Resources [17], applicable to certain large-scale development projects financed by the IFC (a member of the World Bank Group) and to project finance $\geq$ $10 million of the 80 financial institutions adopting the Equator Principles [18]. IFC, the largest global development institution focused exclusively on the private sector in developing countries, released revised versions of their eight performance standards in January 2012, following three years of consultation with international experts to improve the requirements. The revised PS6 has rapidly gained recognition within the extractives industry as a benchmark for biodiversity management and a baseline for assessing potential risks and impacts of activities and structuring mitigation responses [19]. In part or whole, it is beginning to be adopted voluntarily outside of compliance with financial lending requirements [20]. National governments and the conservation community are increasingly backing adoption and implementation of PS6 by industry, such as through the decisions adopted at the Convention on Biological Diversity's 11th Conference of the Parties in 2012 that encourage business to consider IFC's Performance Standards (Decision XI/7, paragraph 2) [21] and, in doing so, infer recognition of IFC PS6 as a credible biodiversity standard. PS6 is becoming established as the key international framework for private sector biodiversity management, currently championed by the extractives sector [20].

Within PS6, high biodiversity value is identified through the concept of 'Critical Habitat', which is based on five criteria and an additional two "scenarios" (named as such in this analysis and detailed in the associated Guidance Note 6 [22]) where these criteria might be applicable (Table 1; Supplementary material Table S1). Critical Habitat is designated when it is of significant importance to certain species, threatened or unique ecosystems, or key evolutionary processes. For development within Critical Habitat, adherents must demonstrate mitigation actions which achieve net gains of biodiversity values for which the Critical Habitat is designated [17].

Under the requirements of IFC's PS6, a Critical Habitat assessment within a defined Discrete Management Unit (DMU) needs to be undertaken to identify the presence of qualifying biodiversity values. The associated guidance document defines a three-step process for this assessment covering (i) stakeholder consultation and literature review, (ii) in-field data collection, and (iii) data analysis and interpretation. Whilst there is a strong focus on the site-specific field research element of such an assessment to ensure that the in situ presence of biodiversity values is accurately recorded, the relevance of desktop analyses, in particular with reference to assessing the relative biodiversity conservation importance and distinctiveness of a site at a regional or global scale, is also highlighted.

Currently no publicly available tools have been developed in either the marine or terrestrial realms to assess the likelihood of sites or operations being located within PS6-defined Critical Habitat, although broadly-applicable methods have been developed during local-scale environmental impact assessments and PS6 adherence requirements (e.g. [23,24]). The map presented herein uses global biodiversity data layers with the aim of supporting businesses in the identification of biodiversity features relevant to Critical Habitat criteria, and therefore of significance to the development of mitigation strategies. Whilst global-scale data alone are insufficient to map Critical Habitat comprehensively, mitigation planning (particularly avoidance of impacts) is often necessary early on in the project lifecycle (before or just after investment) prior to on the ground access to conduct detailed field surveys. A key reason behind the development of the approach described herein is that, pragmatically, companies benefit from biodiversity information about sites in advance of having on-ground access.

Table 1
Critical Habitat designation under the International Finance Corporation's Performance Standard 6 (IFC PS6) is based on five criteria and an additional two scenarios where these criteria might be applicable. See [17,22] and Supplementary material Table S1 for further detail. For full details on alignment of the selected biodiversity data layers with criteria/scenarios, see the Supplementary material Appendix S2. 'Critically Endangered'/'Endangered' species: as listed in [31].

IFC PS6 criteria and scenarios	Description
Criterion 1	Habitat of significant importance to Critically Endangered and/or Endangered species
Criterion 2	Habitat of significant importance to endemic and/or restricted-range species
Criterion 3	Habitat supporting globally significant concentrations of migratory species and/or congregatory species
Criterion 4	Highly threatened and/or unique ecosystems
Criterion 5	Areas associated with key evolutionary processes
Scenario A	Other recognized high biodiversity values that might also support a Critical Habitat designation
Scenario B	Internationally and/or nationally recognized areas of high biodiversity value that in general will likely qualify as Critical Habitat