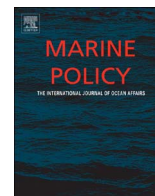




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## Local and regional experiences with assessing and fostering ocean health



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## ABSTRACT

During the international symposium on “Regional Applications and Nexus of the Ocean Health Index” at The University of Tokyo in Japan in July 2015, a range of experts, practitioners and researchers discussed the potential for assessing the current state of ocean health at different scales, as well as changes over time. Discussions focused on how the successful assessment and implementation of projects aimed at fostering ocean health and resilient coastal ecosystems strongly depends on a multi-stakeholder approach and local leadership. In addition, recent examples of regional independent assessments conducted using the Ocean Health Index were introduced, with an accompanying explanation of how the Index goals can be adjusted, specified or weighted in line with a local context or policy direction. This manuscript introduces key points raised during the symposium as well as relevant supplementary materials.

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## 1. Introduction

There is increasing recognition of the importance and urgency of achieving the long-term conservation and sustainable use of marine ecosystem services [1]. This is evident, among other things, in the adoption of the Convention on Biological Diversity (CBD) Aichi Biodiversity Target 11 in 2010: “by 2020, at least 17% of terrestrial and inland water areas and 10% of coastal and marine areas [...] are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas” [2]. Likewise, in 2015 one of the 17 Sustainable Development Goals (SDGs) was specifically dedicated to the oceans: to “conserve and sustainably use the oceans, seas and marine resources for sustainable development” (SDG 14), and the UN

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member states officially agreed to the development of a legally-binding instrument on the conservation and sustainable use of marine biological diversity in areas beyond national jurisdiction (ABNJ) [3,4]. The crucial role of the oceans as a global carbon sink similarly guarantees their place on the agenda in the UN Framework Convention on Climate Change (UNFCCC) talks that will take place in late 2015 in Paris [5,6].

Despite the massive scale of oceans, and the global recognition of benefits derived from them, coastal communities and seascapes are shaped by local conditions, cultures and industries [7] and are increasingly witnessing exogenous pressures such as overfishing, the effects of climate change, pollution, and biodiversity loss. Locally successful projects aimed at fostering sustainable ocean management may falter when scaled up to national or international frames of reference [8]. The interconnectedness of marine systems, however, requires that focus be both local and global, while the strong human impact that shapes coastal areas demands that activities and assessments consider both social and ecological characteristics [9].

Building on these considerations, an international symposium was held at The University of Tokyo on July 1, 2015 on “Regional Applications and Nexus of the Ocean Health Index”, during which a broad range of decision-makers, practitioners and researchers discussed current paradigms of sustainable ocean management as well as the potential for assessing ocean health at multiple scales and levels. Co-organized by the five-year collaborative project on the “New Ocean Paradigm on its Biogeochemistry, Ecosystem and Sustainable Use” (NEOPS) and Conservation International (CI), the symposium featured presentations extending from the theoretical considerations of choosing an appropriate frame of reference for ocean assessments, to examples of coupled socio-ecological coastal ecosystems in Japan called *satoumi*, to the latest developments in implementing regional ocean assessments based on the Ocean Health Index (OHI) framework.

## 2. Creating an appropriate frame of reference

Oceans, by their very nature, are fluid, which makes it particularly challenging to establish an appropriate frame of reference for implementing activities aimed at fostering healthy ocean ecosystems. In a geopolitical sense, the United Nations Convention on the Law of the Sea (UNCLOS) provided a clear frame of reference by formalizing the Exclusive Economic Zones (EEZ) around the world in 1982 [10]. In most cases, the EEZ extends 200 nautical miles from coastal boundaries, enclosing areas in which each respective national jurisdiction has the right to make decisions, among other things, “for the purpose of exploring and exploiting, conserving and managing the natural resources” [10]. However, since most decision-making about ocean and coastal resources takes place at sub-national scales, the physical movement of fish stocks, ocean garbage, material cycles and nutrients, among other things, renders the EEZ largely impractical for many models of dynamic ocean systems. Likewise, different ethnic groups and cultures do not always align with national boundaries, meaning that the socio-ecological linkages that shape coastal areas will also not necessarily match political boundaries.

Efforts have also been undertaken to define ocean provinces based on other factors like biogeography (e.g. Longhurst Biogeographical Provinces, Large Marine Ecosystems, Marine Ecoregions of the World) [11–13]. Recognizing that different research or management activities may require the definition of ocean regions based on different sets of criteria, one of the intended outputs of the NEOPS project is a set of 80–100 ocean maps for different types of nutrients, plankton and other factors [14]. The Ocean Health Index (OHI) has taken a multi-level approach to this challenge by creating global assessments to measure ocean health across ten primary goals for the EEZs, supplemented by a high seas assessment with just four of these goals [15]. The primary purpose of these annual global assessments is to track and highlight global broad-scale patterns, as well as identify global data gaps to motivate improved information management to foster healthier oceans [16]. Global analyses use uniform datasets and methods for all areas assessed, providing information for global comparisons. While this information can be used at multinational and global scales (e.g. Sustainable Development Goals, Transboundary Water Assessments, Multilateral engagements, etc.), global datasets and the resulting scores are less useful for policy at smaller spatial scales. Assessments using the OHI framework at finer scales allow for exploration of variables and factors affecting ocean health at the scales where most management decisions are made. This is described in further detail under Section 6.

One example presented during the symposium that illustrates these boundary issues and the nexus of human-nature linkages was the case of the Maldives. The country’s fisheries are heavily

focused on tuna, which are fished using pole-and-line methods, virtually eliminating the potential for bycatch [17]. Furthermore, the government considers employment and sustainability in the fishing sector to be the top priorities, far ahead of the sector’s contribution to GDP [18]. The fishery is also closely linked with social and cultural preferences, as tuna is a substantial part of the local diet [19]. Placed within a global context, however, the tuna fisheries in the Maldives are under pressure. As highly migratory fish, different tuna species move freely in and out of the EEZ of the country and across the EEZ of other countries as well as ABNJ [20]. As a vast archipelago, the nation also struggles to effectively monitor an EEZ that extends across nearly 1,000,000 square kilometers. National management priorities are at odds with those of distant water fishing fleets, meaning that effective interventions or assessment focused within the EEZ would fail to catch the trans-boundary scope of the challenge and potential implications [21].

## 3. Social linkages and public perceptions of marine ecosystem services

A recurring theme throughout the symposium was the importance of considering social aspects when assessing issues of sustainable ocean management. Public perceptions of the benefits derived from the ocean can drive sustainable and unsustainable practices, as well as people’s commitment to supporting activities aimed at ensuring ocean health [22]. Surveys conducted in Japan and the USA have shown that such perceptions are far from uniform both internationally and domestically, and may be grounded in cultural differences [23,24]. Recent research conducted in the USA, in particular, suggests that the public considers the ocean as a global commons shared by all – similar perhaps to the atmosphere – and that unsustainable action by one nation can negate more restrained action by other nations [24]. This would suggest that commitments to sustaining ocean ecosystems may be seen by the public as altruistic if many countries are freeriding on such efforts. Likewise, a comparison with political indices indicated that perceptions of the ocean’s indispensability for human well-being as well as support for actions to support sustainable ocean management cut across political party lines, and that even proximity to oceans does not necessarily impact people’s perceptions [24].

Japan has a long history of nurturing coupled socio-ecological systems, where long periods of human-nature interactions have shaped landscapes and seascapes into diverse mosaics of different types of use [7]. These systems are known as *satoyama* (village in the mountains) and *satoumi* (village by the ocean), and conjure images of landscapes and seascapes where biological and cultural diversity are tightly interlinked, resulting in communities living in close harmony with their local surroundings, where extensive use is made of locally available and renewable resources, locally-specific agrobiodiversity is sustained, and human activities and traditions are in sync with local ecological cycles [25,26]. The human-nature balance inherent to traditional management paradigms in *satoyama* and *satoumi* resonates among some in increasingly urbanized Japan, making it an important concept to spur local and regional action to recognize, protect and revitalize such areas [7]. Key to the socio-ecological systems concept is that humans are considered an integral and even potentially positive element of landscapes and seascapes. Biodiversity-rich terraced rice fields, for instance, are highly labor-intensive and require continuous human intervention, while in northeastern Japan, fishermen have centuries-long traditions of managing forests along the watershed of rivers feeding into the ocean waters where they fish, as they recognized a correlation between well-managed watersheds and marine fish catches [27]. Under Section 4, a detailed example of a *satoumi* seascape in Japan’s Hinase District is provided. Other

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