ISSN 2321–340X

Journal of Aquatic Biology & Fisheries | Vol. 5 | 2017 | pp. 1-6

OCEAN HEALTH INDEX (OHI) AND ITS IMPERATIVE FOR INDIA

Ajmal Khan, S.

Centre of Advanced Study in Marine Biology, Faculty of Marine Sciences
Annamalai University, Parangipettai, 608 502, Tamil Nadu
Email: seyedajmal@gmail.com

INTRODUCTION

For billions around the world, especially the world's poorest, the oceans and their resources mean food, jobs and protection. The oceans also provide a range of ecosystem services, including sustaining the economies. According to the Food and Agricultural Organization (FAO), the fisheries and aquaculture assure livelihoods of 10-12 percent of the world's population with more than 90 percent of those employed by capture fisheries working in small-scale operations in developing countries. Oceans are equally important for food security. In 2012, fisheries produced roughly 160 million tons of fish and generated over US$129 billion in exports while securing access to nutrition for billions of people and accounting for 16 percent of total global animal protein. Coastal areas within 100 km of the ocean account for an estimated 61 percent of the world's total Gross National Product (GNP) and are of particular importance for developing countries. In 54 coastal and island countries up to two thirds of total national territory is ocean. Overall, the ocean ecosystems are crucial for the economic growth of the world nations besides food production. Thus the Oceans and their resources have a vast potential to unlock the growth and wealth of the nations and their people.

Regarding the other benefits accruing from the oceans, the hydrologic cycle is very important. It is dependent on the vast amounts of water evaporated by solar energy from the oceans covering over 70% of the Earth's surface, and deposited as rain on the land. Without this vast reservoir of open water, the earth would quickly become a desert. The oceans also provide a sink for nutrients eroded from the land and carry out about 50% of global primary production and support the greatest biodiversity on the planet. They are also one of the largest carbon reservoirs in the Earth system, holding up to 54 times more carbon than the atmosphere thus playing a key role in the global carbon cycle. The oceans therefore regulate the earth system, transferring heat around the world and moderate the climate and weather systems. Only a healthy ocean can deliver sustainability a range of benefits to people now and in the future. That way the health of the ocean assumes greater importance. How healthy are our oceans? A newly developed measurement tool, the Ocean Health Index (OHI), answers that question for every coastal country in the world.

The Ocean Health Index was developed during 2009-2012 to fill the need for a quantifiable and easily communicated method to define, measure, and evaluate 'ocean health'. The publication of Halpern et al. (2012) has presented both the scientific framework and the first assessment of ocean health at the global scale. This Index is helpful in measuring how sustainably people/nations are using the oceans.The Index provides a uniform way with which to measure the health of ocean ecosystems around the world. The Index offers various metrics to allow decision-makers to determine the appropriate balance of priorities among multiple uses to ensure that oceans can continue to sustainably deliver a range of benefits and services to people now and in the future. That way this index facilitates advancing of a comprehensive ocean policy. Earlier up to the year 2013, the health of only the coastal stretches and Exclusive Economic Zone (EEZ) areas were studied. Now the focus has broadened to include the entire oceanic area including the Antarctica.

What is Ocean Health Index (OHI)?

The Ocean Health Index (OHI) is a tailorable marine assessment framework to comprehensively and quantitatively evaluate ocean health. Determining how healthy oceans are and for the future requires an assessment approach that evaluates current conditions comprehensively from social, economic, and environmental perspectives. The OHI defines a healthy ocean as one that sustainably delivers a range of benefits to people. The OHI measures progress towards a suite of key societal 'goals' representing the benefits and services people expect healthy oceans to provide. By analyzing these goals together and scoring them from 0 to 100, OHI assessments provide an integrated picture of the state of the ecosystem that can be communicated to a wide range of audiences.

With this index developed by an interdisciplinary team of scientists (Halpern *et al*., 2012), global assessments have been repeated every year since 2012 (Halpern *et al*., 2015). The OHI framework is standardized yet tailorable to different contexts and spatial scales. This is possible because the core framework of how goals are scored does not change while the goal models themselves are developed with local information and local decisions specific to the context.

What is Ocean Health Index+ (OHI+)

OHI+ assessments are independently-led assessments using the OHI framework that are conducted by any group external to the OHI team. Groups have full responsibility of all aspects of the assessments, including decisions, information collection, analysis, and reporting. The OHI team provides Toolbox software as well as technical support and general guidance.

OHI+ assessments are often conducted at smaller, sub-national spatial scales. An advantage of working at this scale is the availability of higher quality information and a better knowledge of system processes, which allow models to better capture the philosophy of the goals in the local context. At the same time, targets (reference points) can be set with more refined knowledge of preferences or priorities of local people or governments at spatial scales where management decisions are made.

Resulting scores can be used to identify policy priorities, maximize cost-effectiveness, and explore management scenarios. It is also possible to use the OHI framework as a planning tool even before final assessment scores have been calculated. The process of planning an OHI+ assessment is useful because it provides a framework to evaluate and understand current policy and requires creating an inventory of information and knowledge that spans disciplines, space and time.

Who evaluates the OHI?

The Index is a collaborative effort, made possible through contributions from more than 65 scientists/ ocean experts and partnerships between organizations including the National Center for Ecological Analysis and Synthesis, Sea Around Us, Conservation International, National Geographic and the New England Aquarium.

Methodology

The goals are to obtain the maximum flows of ecological, social, and economic benefits. Each goal measures the delivery of specific benefits with respect to a sustainable target. A goal is given a score of 100 if its maximum sustainable benefits are gained in ways that do not compromise the ocean's ability to deliver those benefits in the future. Lower scores indicate that more benefits could be gained or that current methods are harming the delivery of future benefits.

Goals

The goal is to obtain the maximum flows of ecological, economical and social benefits. For the global study, participating scientists, economists and sociologists reviewed existing studies of what people want and expect from the ocean, then grouped them into ten categories called 'goals.' Independent assessments at smaller scales could choose a different number of goals.Four dimensions are measured and scored for each goal. Present STATUS is a goal's current value compared to its reference point. TREND is the average percent change of a goal's status over the most recent five years. PRESSURES are the ecological and social factors that decrease status. RESILIENCE includes the

ecological factors and social initiatives (policies, laws, etc.) that increase status by reducing or eliminating pressures. Scores for the Trend, Pressures and Resilience dimensions are combined as LIKELY FUTURE STATUS, an indicator of what the status score is likely to be in five years.

The GOAL SCORE is the average of the scores for Present Status and Likely Future Status. Status (including Trend) thus makes up 83% of the goal score, while Pressures and Resilience each contribute 8.5%. Despite the small percentage it contributes to the score, resilience is the only way for humans to reduce pressures, increase goal scores and improve ocean health.

Region scores

A region's score is the average of its goal scores. Goal scores are weighted equally in global assessments, but independent assessments could weight them differently depending on local conditions and values.

Global score

The global score is the area-weighted average of scores for all assessed regions. 'Global EEZ score' or Global regional score' refers to the overall score for countries, territories and Antarctica. 'Global score' is the overall score for those regions plus areas beyond national jurisdiction (High Seas).

The goals and sub-goals

The ten goals include 1. Food provision (sustainable harvest of seafood from wild-caught fisheries and mariculture), 2. Artisanal fishing opportunity (the opportunity for small-scale fishers to supply catch for their families, members of their local communities, or sell in local markets), 3. Natural products (the natural resources that are sustainably extracted from living marine resources), 4. Carbon storage (the condition of coastal habitats that store and sequester atmospheric carbon), 5. Coastal livelihoods and economies (coastal and ocean-dependent livelihoods (job quantity and quality) and economies (revenues) produced by marine sectors), 6. Tourism and recreation (the value people have for experiencing and enjoying coastal areas through activities such as sailing, recreational fishing, beach-going, and bird watching), 7. Sense of place (the conservation status of iconic species (e.g., salmon, whales) and geographic locations that contribute to cultural identity), 8. Clean waters (the degree to which ocean regions are free of contaminants such as chemicals, eutrophication, harmful algal blooms, disease pathogens and trash, 9. Biodiversity (the conservation status of native marine species and key habitats that serve as a proxy for the suite of species that depend upon them and 10. Coastal protection (the amount of protection provided by marine and coastal habitats serving as natural buffers against incoming waves).

The eight sub-goals include 1. Fisheries (sustainable harvest of seafood from wild-caught fisheries, 2. Mariculture (sustainable harvest of seafood from mariculture practices), 3. Habitat (status of key habitats that serve as a proxy for the suite of species that depend upon them), 4. Species condition (the conservation status of native marine species), 5. Iconic species (conservation status of iconic species that contribute to cultural identity), 6. Lasting special places (conservation status of geographic locations that contribute to cultural identity, 7. Livelihoods (coastal and ocean-dependent livelihoods (job quantity and quality) produced by marine sectors and 8. Economies (coastal and ocean-dependent economies (revenues) produced by marine sectors.

Estimating biodiversity (goal 9) is a challenge: many species have not been identified, others are rare or difficult to find, and still others may shift from place to place in response to seasonal or climatic changes in their environment. While this is difficult on land, estimating marine biodiversity is vastly tougher — the ocean is bigger, darker, and more protective of her secrets than the densest rainforest. But a solid picture of marine biodiversity is critical if we hope to create effective protections for important marine life and understand the potential impacts of climate change on fragile ecosystems.

The IUCN publishes maps created by marine experts, who use their knowledge to outline the places where a species is likely to be found. The AquaMaps team uses an algorithm to model species ranges, using data about each species' preferences for depth, salinity, temperature, and such. Combining of the two sets of maps was found to be greatly helpful in extending

the number of species that could be included in the OHI model of biodiversity. The interactive web application developed, lays a species map from IUCN on top of the AquaMaps map of the same species. Examination of the paired maps for dozens of species showed interesting patterns. Metrics to quantify "alignment" between the maps was developed and this facilitated examining the hypotheses why certain species get well-aligned and others not.

It is important to realize that it is impossible to create a perfect species range map, but we can make informed decisions based on the best data available. It is hoped that investigations will help encourage closer collaboration among species experts and computer modellers to increase the quantity and quality of marine species range maps, and help other researchers use these two datasets more effectively to promote and preserve the health of our marine ecosystems.

Goal 9 on Biodiversity estimates how successfully the richness and variety of marine life is being maintained around the world. People value the existence and intrinsic value of a diverse array of species as well as their contributions to resilient ecosystem structure and function. Sub-Goals: this goal contains two sub-goals: species evaluates the conservation status of marine species and habitat evaluates the condition of key habitats that support high numbers of species.

OHI scores

An Index score for 221 countries and territories, including the Antarctic region, and 15 sections of the high seas is calculated using existing global data.

The global scale OHI was 71% (out of 100%) for the world oceans during 2016. The score varied from 91 in Howland island and Baker island to 44 in Libya. Nine countries/territories scored lower than 50. Indian's position was 130 with its OHI score of 66. The year 2015 showed continued low global scores for the Food Production (58), and Natural Products (52). On the other end of the spectrum, Biodiversity (88) and Coastal Protection (87) had the highest scores though their distance from a perfect score of 100 is clear indicating that species and habitats remain well below the target goal for sustainability.

Regional-Scale Ocean Health Index assessment

Various countries like United States of America, Canada, Brazil, Fiji, Colombia, Ecuador, Israel, China etc. (around 22) have started making use of the OHI. These countries have assessed the health of the waters under their national jurisdiction. However here the outcome of two case studies one from a data rich country Brazil and the other the data deficient island country is discussed.

A Regional-Scale Ocean Health Index for Brazil

Brazil has one of the largest and fastest growing economies and one of the largest coastlines in the world, making human use and enjoyment of coastal and marine resources of fundamental importance to the country. Integrated assessments of ocean health were felt needed to understand the condition of a range of benefits that humans derive from marine systems and to evaluate where attention should be focused to improve the health of these systems. The first such assessment was done for Brazil at both national and state levels. The Ocean Health Index framework, evaluated ten public goals for healthy oceans. Despite refinements of input data and model formulations, the national score of 60 (out of 100) was highly congruent with the previous global assessment for Brazil of 62. Variability in scores among coastal states was most striking for goals related to mariculture, protected areas, tourism, and clean waters. Extractive goals, including Food Provision, received low scores relative to habitat-related goals, such as Biodiversity. This study demonstrated the applicability of the Ocean Health Index at a regional scale, and its usefulness in highlighting existing data and knowledge gaps and in identifying key policy and management recommendations. To improve Brazil's ocean health, this study suggested that future actions should focus on: enhancing fisheries management, expanding marine protected areas, and monitoring coastal habitats.

Fiji a trailblazer in using OHI under a data limited scenario

A Fiji-specific application of an integrated assessment framework for determining ocean health was developed (Selig et al., 2015). The assessment

utilized a framework designed to assess ocean health, defined as the delivery of a range of benefits to people (Halpern et al., 2012) and assessed 10 goals (several of which comprised of two sub-goals) that people have for a healthy ocean. The goals were calculated from indicators of the current status of the goal, its recent trend, the pressures or impacts that may be affecting it, and the resilience measures that could mitigate those impacts. The framework was designed to assess progress across a portfolio of benefits, identify potential focal areas for improvement, and assess trade-offs between goals if recalculated over time. It was demonstrated how a global ocean health index framework can be applied to a data-limited scenario and modified to incorporate the objectives and context of a developing island nation like Fiji. Although these changes did not have a major effect on the total index value, two goals had substantial changes. The artisanal opportunities goal increased from 46 to 92 as a result of changes to the model for Fiji, which looked at the stock status of artisanally-caught species. The lasting special places sub-goal decreased from 96 to 48, due to the use of Fiji-specific data and reference points that allow policymakers to track progress towards national goals. Fiji scored high for the tourism and recreation goal, but low for the production-oriented natural products goal and mariculture sub-goal, which may reflect national values and development priorities. By measuring ocean health across a portfolio of goals and re-calculating scores over time, potential trade-offs between goals could be understood. The approach adopted for measuring ocean health in Fiji highlighted pathways for improvements and approaches that may help guide other data-limited countries in assessing ocean health.

Need for a Regional-Scale Ocean Health Index Assessment for India

India is a maritime country of yore. Indian fishermen have been exploiting the marine resources since time immemorial. As a developing nation the country's marine fisheries are in the process of attaining full development. India's marine fish production has increased more than seven times, from 0.53 million tonnes in 1950 to 3.9 million tonnes in 2012, even as exports of marine fish and fish products increased from Rs. 35 crores in 1970 to Rs. 33,000 crores in 2014. About 80-88% of the estimated potential yield of 4.41 million tonnes is under exploitation. A recent national assessment of fish stock status indicated that 74% of the resources studied are in healthy condition with few stocks in depleted and collapsed status. The resources support the livelihoods of nearly 4 million fisher folk having 0.99 million active fishers. . There are about 239,000 fishing crafts engaged in marine capture fisheries, of which 59,000 are mechanized crafts, 76,000 motorized and the rest non-mechanized. In mechanized sector, there are about 29,000 trawlers. Though fishing is concentrated mainly in the depth zone up to 100 m, trawlers operate up to 400 m depth zone (Mohamed et al., 2017). With quite a large number of technical manpower and institutes concentration on the marine realm-Ministry of Earth Sciences-Centre for Marine Living Resources and Ecology (CMLRE), National Institute of Ocean Technology (NIOT), Indian National Centre for Ocean Information Services, (INCOIS), Ministry of Agriculture - Central Marine Fisheries Research Institute, Central Institute of Fisheries Technology (CIFT), Ministry of Environment, Forest and Climate Change-National Biodiversity Authority (NBA), Zoological Survey of India (ZSI), Botanical Survey of India (BSI), Ministry of Science and Technology-National Institute of Oceanography (NIO), Department of Biotechnology) besides scores of other ministries and departments, universities notwithstanding, India has a very rich knowledge base and expertise. It is also one among the fastest growing economies in the world. As the Indian seas and their resources mean so much to the country, India should also go for a Regional-Scale Ocean Health Index Assessment. Instead of looking for reasons why it has not done it so far, it is suffice to mention that it is highly required to develop framework and policies for obtaining sustainable benefits from the Indian seas.

References

Halpern, B.S., Longo, C., Hardy, D., McLeod, K.L., Samhouri, J.F. and Katona, S.K., 2012. An index to assess the health and benefits of the global ocean. *Nature*, 488: 615–620.

Halpern, B.S., Longo, C., Stewart Lowndes, J.S., Best, B.D., Frazier, M., Katona, S.K., 2015. Patterns and

emerging trends in global ocean health. PLoS ONE, http://ohi-science.org/.

Mohamed, K.S., Vijayakumaran, K., Zacharia, P.U., Sathianandan, T.V., Maheswarudu, G., Kripa, V., Narayanakumar, R. and Rohit, P., Joshi, K.K., Sankar, T.V., Leela Edwin, Ashok Kumar, K., Bindu, J., Nikita Gopal and Pravin, P. 2017. Indian Marine Fisheries Code: Guidance on a Marine Fisheries Management Model for India. CMFRI Marine Fisheries Policy Series 4: 120 pp.

Selig, E.R., Frazier, M., O'Leary, J.K., Jupiter, S.D., Halpern, B.S., Longo, C., Kleisner, K.L., Sivo, L. and Ranelletti, M. 2015. Measuring indicators of ocean health for an island nation: The ocean health index for Fiji. *Ecosystem Services*, http://dx.doi.org/10.1016/j.ecoser.2014.11.007.