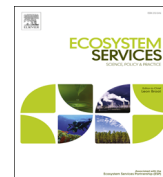




ELSEVIER

Contents lists available at ScienceDirect

Ecosystem Services

journal homepage: www.elsevier.com/locate/ecoser

Measuring indicators of ocean health for an island nation: The ocean health index for Fiji

Elizabeth R. Selig^{a,*}, Melanie Frazier^b, Jennifer K. O'Leary^{b,c}, Stacy D. Jupiter^d, Benjamin S. Halpern^{b,e,f}, Catherine Longo^b, Kristin L. Kleisner^g, Loraini Sivo^h, Marla Ranelletti^b

^a Betty and Gordon Moore Center for Science and Oceans, Conservation International, 2011 Crystal Drive, Suite 500, Arlington, VA 22202, USA

^b National Center for Ecological Analysis and Synthesis, 735 State Street, Santa Barbara, CA 93101, USA

^c Hopkins Marine Laboratory, Stanford University, 120 Oceanview Boulevard, Pacific Grove, CA 93950, USA

^d Fiji Country Program, Wildlife Conservation Society, 11 Ma'afu Street, Suva, Fiji

^e Bren School of Environmental Science and Management, University of California – Santa Barbara, Santa Barbara, CA 93106, USA

^f Imperial College London, Silwood Park Campus, UK

^g Fisheries Centre, University of British Columbia, 2202 Main Mall, Vancouver, BC, Canada V6T 1Z4

^h Fiji Country Program, Conservation International, 3 Ma'afu Street, Suva, Fiji

ARTICLE INFO

Article history:

Received 5 June 2014

Received in revised form

6 November 2014

Accepted 14 November 2014

Keywords:

Data-limited assessment

Fiji

Fisheries

Ocean health

Socio-ecological assessment

ABSTRACT

People depend on the ocean to provide a range of ecosystem services, including sustaining economies and providing nutrition. We demonstrate 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 looks 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, we can better understand potential trade-offs between goals. Our approach for measuring ocean health in Fiji highlights pathways for improvements and approaches that may help guide other data-limited countries in assessing ocean health.

© 2015 Published by Elsevier B.V.

1. Introduction

Oceanic island nations like Fiji are highly reliant on healthy oceans for a wide range of benefits to their people. Fiji has a rich, strong cultural relationship with the ocean and has traditionally relied on marine resources for subsistence and livelihoods (Teh et al., 2009). Nationally, approximately 40% of animal protein in the Fijian diet is derived from marine sources (FAOSTAT, 2012). Tourism from vacationers alone generated \$574 million USD for the Fijian economy in 2011 (Fiji Bureau of Statistics). Approximately 5–30% of reef tourism revenue in Fiji is connected to marine protected areas (Pascal and Seidl, 2013). However, Fiji's marine environment is recognized to be under threat from increased fishing pressures (Teh et al., 2009), and land-based sources of pollution related to

agricultural, forestry, and urban development (Jenkins et al., 2010; Dadhich and Nadaoka, 2012). In response to the need to manage these pressures across sectors, approaches to management in Fiji have increasingly focused on ecosystem-based approaches, recognizing not only the interconnected nature of ecological systems (Clarke and Jupiter, 2010), but also the feedback loops that exist between people and linked ridge-to-reef units over which indigenous Fijians have customary claims (Ruddle et al., 1992). This shift to a management approach based on coupled socio-ecological systems also more directly addresses the nutritional, cultural and economic importance of the marine environment to Fiji. To address these broad management goals, integrated ecological and socioeconomic assessments of the ocean health of Fijian waters are needed to determine how current status relates to the various goals that contribute to a healthy ocean ecosystem.

We developed a Fiji-specific application of an integrated assessment framework for determining ocean health. Our assessment utilizes a framework designed to assess ocean health, defined as

* Corresponding author.

E-mail address: eselig@conservation.org (E.R. Selig).

the delivery of a range of benefits to people now and in the future (Halpern et al., 2012). The ocean health index (OHI) approach assesses 10 goals (several of which are comprised of two sub-goals) that people have for a healthy ocean (Table 1). The goals are 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 (Halpern et al., 2012). The framework is 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 (Halpern et al., 2012).

The ocean health index approach has been applied in several case studies, notably for the west coast of the US (Halpern et al., 2014), and at the state level in Brazil (Elfes et al., 2014). The national-scale application of the ocean health index for Fiji represents a relatively data-limited case study, although more data are available for Fiji than many other Pacific island nations. Local applications of the index like the one we have done for Fiji provide additional information that is important for management. The global application of the ocean health index is designed to assess the overall health of the ocean and to compare across countries' Exclusive Economic Zones (EEZs). Consequently, it lacks the resolution required for a high degree of accuracy at more local scales and is of limited use in tracking progress towards meeting national goals. However, the ocean health index framework is flexible and can be

applied at finer scales, incorporating the best available local information and management targets. Wherever possible, we used Fiji-specific data and management targets based on national policies and targets that Fiji has established to track progress towards meeting those goals. This analysis is intended to be a “how-to” to illustrate how the ocean health index can be applied in data-limited countries.

This analysis demonstrates not only that a comprehensive index of ocean health can be calculated even when data are limited, but also the utility of doing so even when scores themselves do not change dramatically. Data-limited applications of the ocean health index approach may be particularly relevant because the social dimension of ocean health can be critical for consideration in areas that are often data-limited, but have a high reliance on ecosystems for human well-being (Koehn et al., 2013). In many cases, the scores themselves may not change that much, either due to the fact that global results are used when data are not available, similar models are used, or simply that the scores are robust to changes in both model or data. Nonetheless, adapting the ocean health index framework to incorporate local data and relevant models will ensure that results are more useful for management. Confidence may also be increased when results are relatively robust to changes in the model or data. Another outcome of a data-limited assessment is to help highlight key data gaps, which we highlight for Fiji, but which may also be relatively common in other contexts. We also discuss potential management applications of the Index framework

Table 1
Summary of changes made to the Fiji goal models and data relative to the global 2013 analysis. For goals comprised of sub-goals (food provision, biodiversity, sense of place, and coastal livelihoods and economies) the data and model are provided for the sub-goals (indented).

Goal or sub-goal	Benefit measured	Data	Model
Food provision	Sustainable food production		
Fisheries, wild capture	Sustainability of harvested wild-capture seafood	Global	Catch-MSY model with different taxonomic reporting penalties
Mariculture	Sustainability and productivity of mariculture	Updated harvest data	Global
Artisanal fishing opportunities	Availability of fish to those who needed them (i.e., stock status of artisanally fished stocks)	Global (updated list of artisanally fished stocks)	Replaced model with the catch-MSY model to assess status of taxa that are artisanally fished
Biodiversity	Conservation of species and habitats for their existence value		
Species	Conservation of species for their existence value	Global	Global
Habitat	Conservation of habitats for their existence value	Updated coral cover data	Global
Clean waters	Clean ocean waters free of trash and pollution	Global	Global
Sense of place	Conservation of relevant places and species for their cultural value		
Lasting special places	Conservation of relevant places for their cultural value	Traditional fisheries management areas and closure boundaries	Weighted management and closure areas by the ecological effectiveness of their management strategy and relative extent. Area-weighting of offshore/inland areas (rather than average)
Iconic species	Conservation of species for their cultural value	Updated iconic species list and data	Global
Coastal livelihoods & economies	Employment (livelihoods) and revenues (economies) from marine sector		
Livelihoods	Livelihoods from marine sector	Global	Global
Economies	Revenues from marine sector	Global	Global
Tourism & recreation	Number of tourists and quality of their experience	Global	Global
Coastal protection	Conservation of key protective habitats	Updated coral cover data	Global
Carbon storage	Conservation of key carbon storing habitats	Global	Global
Natural products	Amount of non-food sustainably harvested natural products	Global	Global

Download English Version:

<https://daneshyari.com/en/article/6556702>

Download Persian Version:

<https://daneshyari.com/article/6556702>

[Daneshyari.com](https://daneshyari.com)