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Elicited preferences for components of ocean health in the California Current

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ABSTRACT

As resource management efforts move towards more comprehensive approaches that span multiple sectors and stakeholder groups, decision makers are faced with the challenge of deciding how important each group is, and how much weight their concerns should have, when making decisions. These decisions must be made transparently if they are to have credibility. This paper describes a systematic approach to eliciting such preferences, illustrated through a regional application of the Ocean Health Index in the California Current. The Index provides an ideal case study as it includes a comprehensive set of goals designed to assess the benefits people derive from coasts and oceans. The approach leverages the strengths of two different methods for eliciting preferences, one based on random utility theory and the other on analytical deliberative methodologies. Results showed that the methods were accessible to individuals with diverse backgrounds and, in this case, revealed surprising consensus about fundamental values that may have been missed in deliberations around a specific action, rather than evaluating a spectrum of management priorities. Specifically, individuals, even extractive users, assigned higher weights to cultural and conservation goals compared to extractive ones. The approach offers a general procedure for eliciting explicit preferences through constructive deliberations among diverse stakeholders.

1. Introduction

Resource management and conservation decisions are increasingly being made at broad scales across multiple stakeholder groups with diverse interests. In the marine realm, such deliberations have focused on ecosystem-based management and marine spatial planning, in contrast with traditional sectoral management that focuses on, for example, solely fisheries or water quality. Accommodating diverse interests requires addressing many outcomes with the scientific sophistication that sectoral management applies to just a few. Presented here is a general approach, described below, that transparently elicits these preferences in a systematic way that captures how human actions impact ecosystems and addresses the goals of decision makers.

The approach is grounded in multi-criteria decision making (MCDM), which offers systematic ways to elicit individuals' utility functions over multiple outcomes such that they can be combined into an overall preference ordering among decision options [1,2]. Unlike statistical procedures, such as Principal Component Analysis (PCA) and Nonmetric Multidimensional Scaling (NMDS), MCDM relies on disciplined judgment, allowing for incorporation of expert opinion of a more comprehensive set of issues and values in a quantitative and transparent way [3–5].

There are many situations in which managers and policy makers would benefit from an understanding of the relative values of different attributes, or criteria, related to decisions they face. For instance, in fisheries, managers must negotiate multiple objectives related to food production, generation of economic wealth, and viability of fishing communities, among others [6]. How should these different attributes be weighted in order to accurately represent the desires of stakeholders? In the realm of tourism, stakeholders seek economic wealth and livelihoods, preservation of the aesthetic value of destination sites, clean

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beaches, and conservation of iconic species. Structured elicitation and MCDM offer a way forward for informing such deliberations.

To anticipate one frequent concern, it is noted that there is no escape from the influence of weighting on outcomes of a decision. Even equal weighting reflects a strong position, namely that all outcomes (e.g., biodiversity, cultural preservation and economic growth) are just as important across the range of possible outcomes. Although one might reach that conclusion, assuming it from the outset is inconsistent with informed, reflective decision making. Moreover, when no explicit choice is made in defining weights, and equal weighting is adopted, the result ultimately is determined by how, and how many, criteria are defined. Eliciting weights has the advantage of transparency and avoids gaming outcomes through the lumping or splitting of criteria.

Rather than broadly describe the approach, here these methods are illustrated with a regional application in the California Current of the recently developed Ocean Health Index [7]. The Ocean Health Index assesses the condition of coupled human-natural ecosystems along ten publicly held goals (described below). Producing an overall index requires combining scores for each of the ten goals, where the weights assigned to those goals by stakeholders within the region are expected to be unequal.

2. Methods

2.1. Case study region

The California Current spans the west coast of the United States, encompassing three States and four marine ecoregions [8] as well as the federal waters that extend out to 200 nautical miles (Fig. 1). The region spans densely populated and heavily used coastal areas, such as Los Angeles, San Francisco Bay and southern Puget Sound, as well as remote, sparsely populated coastlines such as the Olympic Peninsula, Washington and the Lost Coast, California. The coastline includes small fishing communities, regions of suburban sprawl, large areas of coastal agriculture, increasing numbers of aquaculture facilities, world-class surf and scuba diving sites, coastal military bases, and Native American reservations and land rights. It is also one of the most scientifically studied marine regions of the world, and has active and strong conservation communities.

2.2. Ocean Health Index

The Index measures the sustainable delivery now and in the future of ten publicly-held goals for coupled human-natural systems. It consists of extractive goals (food provision, natural products and artisanal fishing opportunities), supporting goals (coastal protection and carbon storage), cultural goals (tourism and recreation and sense of place), economic goals (livelihoods and economies), and conservation goals (clean water and biodiversity). Each goal is assessed by its current status relative to an established reference value intended to represent a societal objective and its likely future state, which is indicated through the recent trend in each goal and the cumulative pressures from human activities and existing governance, social and ecological factors that build resilience. In the initial global calculation of the index, it was assumed each goal contributed equally, but it was acknowledged that this assumption rarely holds true. The goal of the work presented here was to try to get an initial sense of how the importance (i.e., weight) of goals varies across stakeholder groups. Establishing the goal weights for any particular region would require a much more elaborate stakeholder process, and suggest that the approach here might be used as a template.

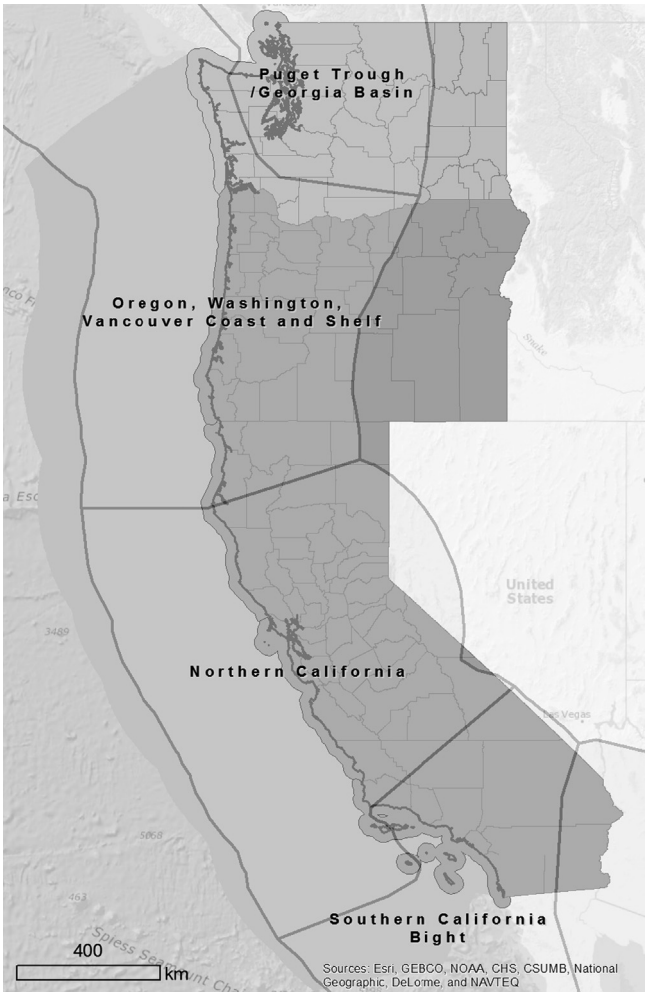

Fig. 1. A map of the California Current and jurisdictional and ecoregion boundaries.

2.3. Eliciting expert judgment

Two methods were used to elicit preferences based on the tradeoffs that would likely emerge from management decisions within the California Current. The first, based on random utility theory, asked people to rank 7 scenarios representing possible states of the California Current, characterized in terms of the 10 goals with hypothetical but realistic values spanning the range of possibilities (see Table 1 for a sample survey). The ranking was done in private and meant to reflect their personal view regarding the "health" of the ocean.

The second method, based on analytical deliberation, involved convening these experts in a workshop where they could discuss their views – and possibly change them, based on what they learned from others and additional reflection. The workshop was moderated based on principles from psychology and decision science, with the goal of deliberation, rather than consensus [9–12]. Readers familiar with the Delphi method would see common features. After the deliberations, experts ranked the scenarios again.

Probabilistic inversion was used to determine the implicit weights underlying those rankings [1,13]. This approach assumes that weights for the ten goals of the Ocean Health Index combine to create a single overall value of ocean health as a simple linear model. The weights are derived so as to most closely reproduce the proportion of experts ranking each scenario as first, second, third, etc. in the sets of scenarios they were given (see Table 1 and