California Current Large Marine Ecosystem: Publicly Available Dataset of State and Federal Laws and Regulations

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INTRODUCTION

Historically, governments have managed ocean uses within single sectors (fishing, mining, dredging, and shipping) dealing with problems such as fishery declines, hypoxia, conflicting uses, and wetland loss on a case by case basis as they arise [1]. Such a fragmented approach, widely recognized as a major contributor to the deterioration of ocean ecosystems, has created gaps, inconsistencies, conflicts, and overlaps within and across scales of management [2]. A large and growing movement of government agencies, global to local non-governmental organizations, scholars, and resource-users has begun to transition the current fragmented system of governance into an ecosystem-based management (EBM) system [3-5]. EBM is an integrated cross-sector approach where decisions account for ecosystem processes, functions, and services.

The specific strategies to implement EBM will vary by place [3, 6]; however, all such efforts require improved knowledge of ecological systems, but also relevant institutional arrangements guiding human interactions with the ecosystem [7-9].

The need for data on ocean management

In the past few years, scientists have made significant progress to advance understanding of marine ecosystems through modeling, data collection, and synthesis efforts [10, 11]. However, relatively little data exists to support comparable systematic analyses of human dimensions of the oceans across multiple sectors of management [6]. Such an imbalance of knowledge can be dangerous given that EBM programs will not be created with a blank slate of governance. Understanding the complex fragmented system of ocean management must also be given priority. This type of knowledge can inform the diversity of EBM stakeholders, policymakers, and others so they may strategically restructure or design new management systems. It may also assist in future EBM program evaluations [8, 12].

Institutions and interactions among them are often as complex as ecological systems [13]. As such, rigorous quantitative techniques designed to complement traditional methodologies, such as case studies, could improve our understanding of ocean management and shed light on the complex and dynamic human environmental relationships. Thus, just as developing synthesis techniques to understand ecological phenomena requires large ecological datasets, development of analogous techniques for analysis of management systems necessitates a dataset to represent how marine-related uses, activities, and resources are managed across a full suite of sectors.

This paper presents a unique dataset that makes cross-sector analyses of ocean management possible across multiple scales (federal and state) and geopolitical jurisdictions (California, Oregon, Washington, federal United States, and federal Mexico) in the California Current, which facilitate answering critical questions about fragmented ocean management. Since collection of data to represent governance across the full suite of sectors and across multiple scales poses a formidable challenge [7], it is reasonable to begin with the laws and regulations that are used to guide and regulate ocean and coastal related activities. These laws and regulations are public domain, pertain to all sectors, available for multiple scales of management (e.g. federal and state), and serve as an important component of governance [7]. Thus, a manageable database containing all ocean-related laws and regulations for a given area can allow the development of techniques that quantitatively, objectively and comprehensively examine extant fragmented ocean management, as recommended by the Joint Ocean Committee [8].

The compilation described here, now available online to the public through a basic search engine (http://www.cclme.org), serves as a model from which other regions could build similar datasets to support the transition to EBM. While statutes and regulations cannot represent every aspect of ocean management, they do play a major role in shaping how a resource or activity is managed and their compilation can provide a dataset that crosses sectors and geopolitical jurisdictions to represent governance of oceans as a whole. Following an explanation of the criteria to compile the statutes and regulations, the Applications section offers suggestions on

developing techniques to identify and measure problems of fragmentation, as well as other practical uses for the dataset.

METHODS OF SELECTION

The identification and collection of the corpus of laws and regulations was conducted from November 2005 through November 2006. To generate a collection consistent across jurisdictions, three criteria determined inclusion of documents: geographic scope, scale of social organization, and type of law. Digital text versions of laws and regulations were manually collected for the relevant national and state levels of the California Current Large Marine Ecosystem, including state laws from Washington, Oregon and California, as well as national level laws of the United States and Mexico.

Geographic scope

The Large Marine Ecosystem (LME) concept framed the geographic boundary delineation for the project scope. LMEs "are regions of ocean space encompassing coastal areas from river basins and estuaries to the seaward boundaries of continental shelves, enclosed and semi-enclosed seas, and the outer margins of the major current systems," [14]. Located from the Washington State-Canada border to just south of Baja California, the California Current LME extends seaward to approximately 300-600 nautical miles from the continent (Figure 1). The California Current LME includes some of the most well-documented marine ecosystems in the world [15] and EBM efforts from small to large scales in this region are increasing [8, 16, 17].

Scale of social organization

The second criterion was that the laws be limited to national and state levels relevant to the geographic scope. Additional levels of management certainly exist within the geographic scope, such as county, regional, and city, but due to time constraints, it was not feasible to comprehensively identify and gather laws from the hundreds of smaller-scale jurisdictions.

Type of law

The third criterion was that laws must be codified statutes or administrative code (regulations). Codified versions of state and federal laws and regulations were used because these are publicly available in digital format, and codes are updated regularly for each relevant jurisdiction.

Collection Specifications

United States

NOAA Coastal Services Center's Digital Legislative Atlas provided the list used to determine the United States Code portion of the document collection. These documents were downloaded off the internet from the U.S. Office of Law Revision. The national regulations were chosen from the Federal Code of Regulations with a search on "marine" and "ocean." The States of California, Oregon, and Washington sit within the California Current LME boundaries. The California Coastal Conservancy had created a list of codified statutes relevant to the coast and ocean for the Ocean Protection Council. These documents were gathered from the California Code website (http://www.leginfo.ca.gov). To select the codified statutes for Oregon and Washington states, a list was generated and compiled by searching terms "marine," "ocean," and

"coast" on the appropriate government websites (http://www.leg.state.or.us/ors/, http://search.leg.wa.gov/pub/textsearch) To determine relevant regulations for each state, relevant the administrative code sites were queried using the terms "marine," "ocean," and "coast" (http://www.oal.ca.gov/,http://apps.leg.wa.gov/wac/).

Mexico (Federal)

For the Mexico laws the terms "mar," "costa," "marina," "navegación," and "Pacifico" were searched. These statute and regulation documents are downloadable in full document form from the internet (http://www.disputados.mx.gob). Mexico's marine waters are under the jurisdiction of the federal government [18]; therefore, no Mexican state laws were compiled for this project.

APPLICATIONS

The resulting compilation of 1,466 laws and regulations is publicly available for viewing and searching online. The document collection affords several types of opportunities including educational, management and policy, and legal informatics research.

Educational

Most readily, this free online resource can be useful for teaching marine policy courses. Professors could have students choose single issues, for instance, and compare the regulations around the topic within and across jurisdictions and scales of management. For courses oriented around ecosystem-based management, students could query the database to examine whether key relationships between ecosystem components are explicitly addressed in statutes and regulations. In this way it can provide an educational tool for students to explore and navigate through the fragmented nature of ocean management.

Management and Policy

Updated regularly, a compilation of ocean laws and regulations can serve as a tool to provide direct access for resource users and other stakeholders of all the laws and regulations that exist to address a topic of interest. Collaborative efforts could be developed with an on-going law collection program, such as the Cornell Legal Information Institute (http://www.law.cornell.edu/) or the Government Printing Office, to create regular updates. Stakeholders coming from diverse backgrounds should be able to access baseline information about the extant roles government agencies play in managing the coast and oceans across multiple sectors and multiple scales of management.

Updates of the collection would also create a compilation about governance for multiple time periods, which could contribute to time series analysis, tracking the shift toward incorporating ecosystem concepts into governance, as suggested by Juda and Hennessey (2001). Scholars could integrate time series analysis of governance data with ecological and biophysical data to examine feedbacks between the systems.

In its current form, the compilation can also provide data to answer a number of ocean and coastal governance questions such as identification of gaps and overlaps that have arisen from sector-based management. In addition, if coupled with ecological data, the law and regulations compilation could also assist in the examination of the many types of connections and feedbacks between governance and ecological systems:

- To examine regulatory impact on communities dependent on coastal and ocean resources
- To explore different approaches to managing the same resource across jurisdictions
- To find overlapping jurisdictions among government agencies [19]

Governance Research

The compilation also provides a unique dataset for developing quantitative techniques to examine ocean management issues. Text analysis, one type of quantitative content analysis, is commonly used by a variety of disciplines to find patterns in large datasets using term frequencies and other more advanced techniques. Such methods have proved useful in a variety of forums, including law, cultural anthropology, political science, and mass media [20-23]. To promote exploratory research on the presented ocean management dataset, term frequencies of the document collection [24], a commonly used format in text analysis, are freely available to researchers through the Knowledge for Biocomplexity project through the National Center for Ecological Analysis and Synthesis (NCEAS) [25].

Future Research

The text corpus dataset of laws and regulations is a necessary dataset to help improve understanding the human dimensions of the oceans. Compiling laws and counting terms is certainly not the end goal, but it is a step toward strengthening social dimension data and research related to EBM decision-making. Development of quantitative analyses applying text analysis techniques is a natural first step to systematically study ocean governance structures. Furthermore, these data should be aligned, analyzed, and presented geographically, aligned with spatial jurisdictions and then with socioeconomic, cultural values, and ecological data layers [12]. Integrating data across disciplinary boundaries is critical to making this dataset useful, as well as others, for those involved in EBM initiatives.

CONCLUSION

Until now there has not been a comprehensive set of laws across all sectors and multiple jurisdictions. Consequently, no analysis has assessed interactions among marine management systems in a comprehensive, objective and quantitative way. The collection of ocean relevant laws spanning political borders and ecosystems is a critical step to assist the task of comprehensively evaluating problems of fragmentation to support EBM efforts. As analyses prove useful, a more systematic corporate or government-driven collection should be conducted in the future to update this collection, as well as to generate a similar compilation for other regions.

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