

A Tool to Navigate Overlaps in Fragmented Ocean Governance

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Abstract

Implementation of marine ecosystem-based management requires improved understanding of existing governance, including gaps and overlaps resulting from fragmented management. Focusing on overlaps, this paper presents a technique using text analysis to assist in the identification of agencies and laws involved in overlaps from a system perspective. The overlaps analysis uses term frequency counts on ocean laws and regulations in conjunction with relevant agency authority. Such information delivered in a transparent user-friendly presentation can help policymakers and other constituents of ecosystem-based management to find existing overlaps as a step to facilitate improved coordination.

Keywords: ecosystem-based management; overlap; marine law; jurisdiction

1. Introduction

It is well-established that the fragmented approach of sector-based marine management is a major contributor to deteriorating ocean health. Major gaps and overlaps created by this approach impede the achievement of ocean management goals [1, 2]. We focus here on overlaps in the two forms that commonly arise: *jurisdictional overlap* occurs where two or more statutes or regulations govern some aspect of the same resource or activity in the same geographic space [1]; *functional overlap* arises when two or more statutes or regulations separately cover intersecting activities. When ships strike whales in United States waters, for instance, the laws

maintaining shipping routes and speeds unintentionally affect the effectiveness of laws protecting marine mammals [3]. Both types of overlap may occur under a single agency or among agencies within or across scales of management [4]. Strategically developed, overlaps can provide benefits, such as resource sharing or complementary skills [5]. However, without coordination or consistency, overlaps can create obstacles to effective and efficient regulation of the marine environment.

In reaction to the problems caused by fragmented ocean management, public, private and non-profit entities have begun to adopt and implement an ecosystem-based approach to management [6] as a more integrated system that takes into account relationships within ecosystems and the diverse roles of humans [7, 8]. Ecosystem-based management (EBM) includes two key underlying principles: a) increased collaboration between ocean management agencies; and b) participation of stakeholders on behalf of all relevant interests in the target ecosystem [8, 9]. Therefore, to implement EBM, agency personnel, policymakers, and other stakeholders must be able to make decisions from an informed position about ecosystem properties and targets, and current management systems [10, 11]. This creates the need for access to baseline information about overlaps, including what agencies (through what laws) are involved in any piece of the ecosystem.

Traditional qualitative methods to identify overlaps are performed on a case-by-case basis making them time-intensive, particularly as the number of legal documents and authorities increases [4]. Tools that help to rapidly identify problematic overlaps and show paths to mitigation could help meet these challenges and assist the transition into well-informed and well-coordinated EBM [6].

We present a quantitative method that generates quick and easy access to baseline information about the agencies, laws, and regulations involved in any piece of the ecosystem. We show how text analysis, even in a simple form, can systematically provide syntheses of ocean management overlaps. The analysis serves two main purposes for those directly involved in EBM: first, it helps find where overlaps (including redundancies and inconsistencies) exist in the present, and thus assist in resolving conflicting and/or confusing management situations; second, it can identify where proposed policy, regulation, or management practice would create an overlap (and with what agency and law). The latter information is useful in order to facilitate strategic development of proposed policy that could build on existing policy and/or entail collaboration with the relevant agencies or purposeful contradiction of existing policy. The fast, quantitative assessment resulting from the technique in this way contributes two different perspectives on information essential to successful implementation of EBM.

2. Text Analysis Applied to Ocean Governance Questions

The rapid growth of digital information has led scientists increasingly to apply a range of information retrieval techniques to a wide variety of complex data analysis problems [12, 13]. Interpretation of satellite data, for example, has revolutionized understanding of the oceans, land, and atmosphere despite its coarse resolution. Can information retrieval also generate overviews

of ocean governance, helping policymakers and EBM program constituents identify and prevent potentially problematic overlaps in governance and move toward ecosystem-based management (EBM)? Text analysis, referred to as text mining in computer science, “seeks to extract useful information from data sources through the identification and exploration of interesting patterns” [12]. Here, we illustrate a use of this tool with an example involving marine mammals and shipping, and discuss its potential in addressing a wide range of marine governance issues. The whale-ship strikes case highlights the challenges of overlaps that need to be addressed to truly integrate ecosystem thinking and approaches into ocean management.

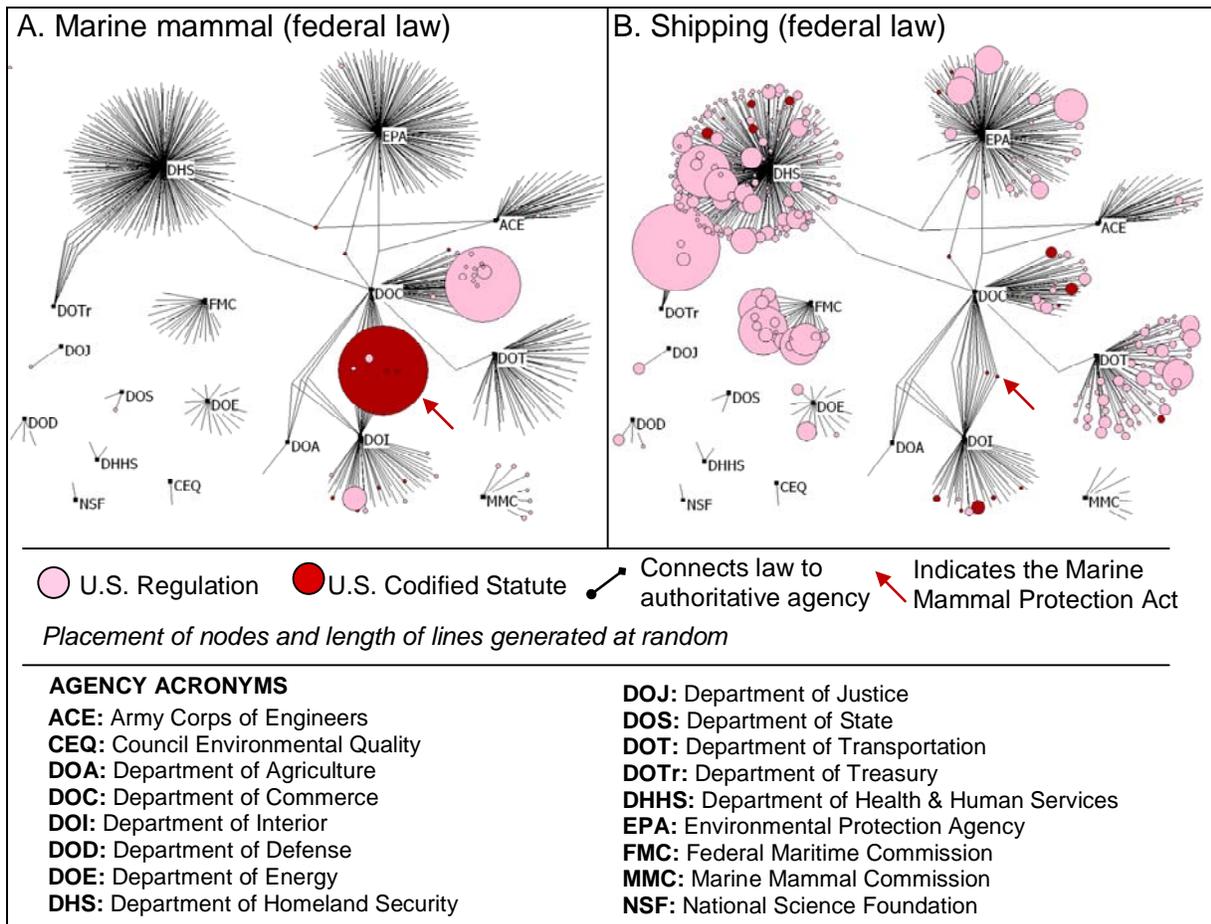
The common approach to text analysis is to count the number of times key terms appear in the texts being reviewed. One apparent limitation of text analysis of laws and regulations is that it does not capture agency responsibility. The need to incorporate agency responsibility into an overlap analysis became clear from feedback provided by managers, ocean users, and researchers who participated in multiple iterations of the tool. Term count data alone produce long lists of laws relating to each topic. Such lists are difficult to synthesize without the context of the responsible agencies. We have therefore gone beyond basic term counting in order to incorporate agency responsibility into the analysis. This shows the existing or potential overlaps results of text analysis in relation to the specific agencies involved [14]. Including agencies also facilitates visualization of the data, giving it the potential to serve as user-friendly tool to a wide variety of ocean stakeholders, policymakers, and marine policy scholars.

3. Mapping Seascapes of Ocean Law

The resulting diagrams, as shown in Figure 1 for the topics ‘marine mammal’ and ‘shipping,’ display multiple dimensions of the legal information simultaneously. Each document in the collection of federal United States ocean and coastal related laws¹ (red) and regulations (pink) is represented in the network diagrams by a circular node. A line from each of these nodes links it to a small square node representing its authoritative agency or agencies. Document nodes resize according to the frequency of term counts for each topic [14]. Large nodes indicate laws with a high frequency of topic references. The nodes representing laws and regulations that do not reference the selected term or phrase disappear from the diagram, but document-agency connecting lines remain in place. The diagrams create a graphical portrayal or “seascape” of legal and agency involvement for the marine-related topic(s) under study. Interpretation of such legislative seascapes produces baseline governance overviews helpful in identifying key legal and agency involvement.

¹ Federal United States statutes and regulations relevant to the ocean and coastal region along the West Coast of the U.S. for the year 2006 were used in this analysis. The full collection is available for searching and viewing at <http://www.cclme.org>.

Figure 1. Mapping seascapes of U.S. federal laws and agencies directly involved in management of marine mammals (A) and shipping (B). Laws (red circular nodes) linked with lines to their statutory implementing agencies. Regulations (pink circular nodes) link to their author agency. Relative frequency of a term in each law is represented by varying node size. Arrow indicates Marine Mammal Protection Act in A and B under the shared primary authority of the U.S. Department of Commerce and the U.S. Department of Interior. Diagrams generated in NetDraw [27] using a table of agency authority for each law combined with term frequency data.



3.1 Jurisdictional overlap

The network diagrams reveal relational patterns and multiple dimensions not captured by other types of representation [14]. The diagrams reflect, for instance, that the key statute

involved in the topic ‘marine mammal’ is the Marine Mammal Protection Act, which is under the dual regulatory authority of the Departments of Commerce and Interior (arrow Fig. 1a). The diagram also shows multiple regulations for the topic. If a key statute covering all the regulating agencies were not in place, these regulations would carry a high potential for problematic jurisdictional overlap. The existence, however, of one key statute assigning dual authority has likely prevented the development and promulgation of inconsistent regulations. Thus, for this topic, jurisdictional overlap seems “positive,” producing low potential for inconsistent regulation (Fig.1a). However, widening the scope by including the term ‘whale,’ would make the diagram change to reflect the significance of the Endangered Species Act and other documents. A picture of much more complicated jurisdictional overlap would then emerge because the number of statutes and regulations increases.

By comparison, Figure 1b shows a high degree of potentially problematic jurisdictional overlap for ‘shipping’ as this topic appears in the regulations of many agencies without an apparent key statute. This absence of a lead agency or bridging statute sets the stage for regulatory conflict over management of shipping. In addition, transaction costs of interagency coordination often rise with the number of bargaining players [10]. Therefore, the overall high number of agencies and regulations involved in shipping may indicate its management suffers from a lack of coordination, as confirmed by the U.S. Commission on Ocean Policy (2004). Beyond the exposure of potential problematic jurisdictional overlap, identification of the responsible agencies can help direct efforts to coordinate and so avoid conflict.

3.2 Functional overlap

Viewed together, the two network diagrams also facilitate examination of a problematic functional overlap produced by sector-based decision-making. They show how mining text of laws can reveal which federal laws and regulations govern two intersecting issues - shipping and marine mammals – and, again significantly, through which agencies. The graphical results (Fig.1a) display the highest concentration of marine mammal related regulation and statutory authority by the Departments of Commerce and Interior. This contrasts with prominent overlapping jurisdiction of shipping through regulations stemming from several agencies (Fig.1b). This overview could assist policymakers and managers in deciding which agency or suite of agencies should be involved in resolving the problem at this scale of management. Functional overlap analysis of the same kind could apply to laws at the state and international levels for the continued crisis of Right Whales in the North Atlantic [3, 15], as well as the emerging problem of ship strikes on whales in the Southern California Bight [16]. Thus, generating baseline legislative and agency data about functional overlap could help facilitate strategic management decisions necessary at different policy levels to alleviate impacts on threatened cetacean populations.

4. Discussion

4.1 Applications

Text analysis of management related documents can help direct efforts to improve coordination both within and across levels of management assisting ecosystem-based efforts, such as marine protected area designation, marine spatial planning, and others. The redesign of marine protected areas (MPAs) off California presently managed by several agencies, for example, requires identification of existing management and human uses in the State's waters [17]. An overview of jurisdictional overlap among these agencies on selected MPA issues and goals could prove useful to managers and policymakers. Mapping of laws to agencies involved in functional overlap for topics linked ecologically may also help improve agency coordination in the MPA process.

Marine spatial planning involves even more comprehensive cross-sector evaluation of existing management than marine protected area planning. It must go beyond living marine resource protection to incorporate the full suite of interest groups, human uses, and existing management systems [18]. Accessible, interpretable, and transparent legal and agency jurisdiction information combined with ecosystem data is critical to the marine spatial planning process [11].

4.2 Limitations and strengths of technique

We recognize limitations exist to the use of a text analysis tool to understand ocean management issues. It does not:

- analyze all elements of governance (e.g., indigenous practices; non-governmental and community organizations) unless associated documents are included to represent such elements
- replace valuable legal knowledge or management experience and interpretation of law

Baseline overviews of extant laws and regulations could help the transition toward EBM by:

- providing a fast, quantitative method to supplement, complement, and help direct expert management assessment
- identifying potentially incompatible and inconsistent statutes and regulations
- identifying where coordination should exist between or among agencies
- tracking feedbacks between governance and ecosystem services (given baseline ecosystem information) to improve understanding of complex interdependencies within socio-ecological systems

4.3 Opportunities for a deeper understanding of ocean governance

Given the potential benefits, further development is underway [14]. Advances in information retrieval provide opportunities to design tools that go beyond simple analysis of the pattern and frequency of terms and phrases [12]. Developments will likely include:

- Use of text analysis with geographic information system (GIS) tools to address how laws and regulations vary by season and in geographic scope.²
- Aligning spatial legal data with spatial ecological layers
- Using hierarchical synonyms and term groupings [19] to develop a system where an analysis of federal law and agencies incorporates multiple terms to represent a single concept. For example, using the term 'marine mammal,' a more advanced text mining tool would show that whales fall under the statute and regulations of the U.S. Marine Mammal Protection Act, as well as the U.S. Endangered Species Act.

Increased sophistication will also stem from techniques developed by researchers specifically investigating problems in the automatic generation of information from laws [20-22]. The quantitative, systematic techniques of text analysis under development can be applied to a broad set of management scenarios involving jurisdictional and functional overlaps. They can help navigate governance and help identify overlaps in different domains as seen already in application development for construction and water quality law [21].

5. Conclusion

Although the methods of implementing EBM vary widely and are still being developed [23], it necessarily entails working with extant governance [10, 24] and therefore resolution of problematic overlaps [25, 26]. Whether and how to address overlaps in management remains guided by societal and political values, and management tradeoffs. A widely accessible synthesis tool, however, could serve as a starting point for decision-makers and the full suite of stakeholders within and across scales of management to glean baseline governance information about any topic or set of topics in ocean management. Text analysis to find potential overlaps could be incorporated on a website with a simple interface to access and analyze updated legal information and produce overviews desired for any topic, as recommended in the U.S. Joint Ocean Commission report [6]. Using the results, policymakers, ocean managers, and other stakeholders could strategically enhance efforts to resolve problematic overlaps, thus reducing conflicts and redundancies. Thus, text analysis could provide fast, practical help in the move toward coordinated ocean governance achieved through EBM.

² The National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center's Digital Coast: Legislative Atlas program provides a natural opportunity for collaborative developments (<http://www.csc.noaa.gov/legislativeatlas/>). The Atlas provides geospatial boundaries of ocean and coastal laws, which could then be integrated with text analysis so a user can easily distinguish the functionality of laws based on the text.

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