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Combining geographic information systems and ethnography to better understand and plan ocean space use

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ABSTRACT

Agencies in the US with oversight for marine renewable energy development idealistically have sought space where this new use might proceed unhindered by other uses. Despite experiential evidence of spatial overlap among existing ocean uses, a lack of documentation made the identification of potential space-use conflicts, communication between existing and potential ocean users, and the design of mitigation exceedingly challenging.

We conducted a study along the US Atlantic and Pacific coasts to gather and document available spatial information on existing use through a compilation and organization of geographic information system (GIS) data. Stakeholder group meetings were used to vet the collected spatial data, and ethnographic interviews were conducted to gather knowledge and cultural perspectives. Results show extensive coverage and overlap of existing ocean space uses and provide a visualization of the social and cultural landscape of the ocean that managers can use to determine which stakeholders to engage.

Marine resource managers are encouraged to recognize that marine space use is dynamic and multi-dimensional and as such research thereof requires a balance between the efficiency of GIS and the stories captured and told by ethnographic research. There are important linkages within and across fisheries and other uses, communities and interests, and across the land–sea interface. Therefore, it is important to use techniques demonstrated in this research that (1) integrate ethnographic and geospatial data collection and analysis; (2) engage stakeholders throughout the process; and (3) recognize the unique qualities of each geographic location and user group to support sound decision-making.

Introduction

Nationally, the oceans provide a significant contribution – on the order of trillions of dollars each year – to the U.S. economy (Interagency Ocean Policy Task Force, 2010). The ocean is a highway for shipping, a store of biodiversity that could provide critical pharmaceuticals, a buffer to climate change, and a source of food, recreation, and cultural heritage (U.S. Commission on Ocean Policy, 2004). As the U.S. struggles with energy independence, harnessing the potential wind, wave, and tidal energy of the ocean with marine renewable energy (MRE) is increasingly important. Momentum in entrepreneurial interest, technological development, and ocean policy is building. However, responsible implementation is critical in order to preserve ocean ecosystems and maintain ecosystem services important to the public.

In order for the U.S. government to appropriately allocate lease blocks for MRE development, it must target sites with existing space uses that are compatible with the project, avoid or mitigate potential conflict, and optimize the necessary trade-offs between preserving existing space use and fulfilling U.S. energy needs. One tool that can be used to assess the ecologic, economic, and social needs already competing for space is marine spatial planning

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(MSP). MSP is a comprehensive ecosystem-based approach to decision-making concerning human interaction with marine resources (Ehler & Douvere, 2007). MSP benefits from spatial analysis in a geographic information system (GIS), which facilitates the combination of multiple datasets to examine the spatial configuration and interaction of various habitats and uses across scales (St. Martin & Hall-Arber, 2008). Central to MSP is stakeholder engagement to ensure all space uses are accounted for (accurately) and to increase legitimacy of decisions (Higgs, Berry, Kidner, & Langford, 2008; Pomeroy & Douvere, 2008). Ethnography is necessary both to create and explain spatial data that represent stakeholder values and characterize its use.

The U.S. Bureau of Ocean Energy Management (BOEM), the federal agency responsible for lease block allocation for offshore MRE development in federal waters, funded this research to begin to fill the knowledge gap in regional ocean space use and valuation. The three year effort (2009–2012) was implemented by a team comprised of social scientists and GIS analysts working from both the east and west coasts. The research considers where stakeholders are currently using ocean space and why, how many uses overlap, and the extent to which existing ocean space use might present potential for conflict with MRE development. This paper outlines the reasoning behind our approach, the specific methods used, and conclusions from our integration of GIS and ethnography to better understand ocean space use.

Background

State and federal agencies are working to implement ecosystem-based management (EBM), especially following direction from the recently adopted U.S. National Ocean Policy. EBM for the oceans is a framework for management that benefits from the use of MSP. It requires analysis of connections among components of the marine ecosystem and the social landscape that relies upon its ecosystem services (McLeod & Leslie, 2009). The guidelines for EBM provide an excellent model for siting MRE projects because the process entails understanding the connections within the marine ecosystem and with associated human systems, requires collaboration among participants in the process, and seeks achievement of multiple objectives.

MSP is a space-oriented tool to implement EBM with the goal of efficiently identifying stakeholders and compatible ocean space uses, thereby enabling managers to reduce conflict among users while siting renewable energy projects (Ehler, 2008). MSP can designate areas for one or multiple uses in order to balance the demands on ecosystem services and improve resilience. For the purpose of siting offshore renewable energy, MSP could help ensure responsible allocation of lease blocks for development.

To improve conflict management during MSP it is particularly important to first improve understanding of the human dimension of the marine environment (Bonzon, Fujita, & Black, 2005; Conway et al., 2010; St. Martin & Hall-Arber, 2008). The increasing utility of GIS for multicriteria analyses is an exciting and potentially comprehensive tool to achieve MSP, but only with all the appropriate data (McGrath, 2004; St. Martin & Hall-Arber, 2008). Much of the significant data, however, is lacking. Specifically, managers need GIS data that represent human reliance on resources at sea, to allow its inclusion with the abundance of spatial data on physical and biological features (St. Martin & Hall-Arber, 2008). As a bonus, the process of creating GIS layers to represent the human dimension is highly compatible with another key aspect of MSP – stakeholder research, analysis, and engagement.

There are many benefits to the process of identifying and understanding key stakeholders and subsequently empowering them to engage in MSP (Conway et al., 2010; Pomeroy & Douvere, 2008). Users of ocean space benefit from having their interests accurately represented because early involvement helps to alert planners of major issues, discover compatible (as well as incompatible) uses, and mitigate conflict (Gilliland & Laffoley, 2008; Portman, 2009). Early and sustained involvement of stakeholders greatly enhances the legitimacy of MSP decisions and therefore the likelihood of cooperation of the affected parties (Higgs et al., 2008; Pomeroy & Douvere, 2008). Stakeholders such as fishermen, shippers, and scientists all have critical interests in ocean space use and possess local and traditional knowledge about use patterns that must be integrated into MSP (Kliskey, Alessa, & Barr, 2009; Pomeroy & Douvere, 2008). If no attempt is made to gather and utilize this information, the potential for conflict increases. Stakeholder engagement provides key insights as to the complexity and extent of human use in a given area and the potential compatibility (or lack thereof) of their space use with concurrent uses by other stakeholders (Pomeroy & Douvere, 2008). This process encourages community involvement in MSP while creating much needed GIS and qualitative data for use in EBM.

St. Martin and Hall-Arber (2008) show that logbook data can be a very useful starting point to approximate broad-scale behavior. Their maps of fishing communities in the Gulf of Maine used Vessel Trip Records (VTR), which were analyzed with density maps and contours to highlight spatial clusters of trip destinations and gear-type-based communities (St. Martin & Hall-Arber, 2008). These maps were vetted by local fishermen and found to be useful representations of human dependence on the ocean (St. Martin & Hall-Arber, 2008). The combination of existing data (e.g., VTR data, even with its limitations) and knowledge and participatory mapping as a groundtruthing mechanism is an invaluable tool for documenting the social landscape (NOAA Coastal Services Center, 2009).

EBM as a guiding framework, and MSP as a tool to enhance its implementation, are promising approaches to marine decision-making not only to ensure stewardship of ocean ecosystem services but to incorporate new uses such as MRE while recognizing and mitigating potential conflict, thereby bolstering the U.S. energy portfolio.

Methodology

Study area

The study area includes state waters and the outer continental shelf (OCS) of the U.S. mainland Pacific and Atlantic coasts. Specifically this extends from baseline, the mean lower low water line along the coast, to the greater of 200 nm from the baseline or the edge of the continental margin. BOEM chose not to include the OCS of the Gulf of Mexico, Alaska, Hawaii, or U.S. territories due to limited funding. The project team included ten researchers on the east coast team based mainly out of Cambridge, MA and ten researchers on the west coast team based mainly out of Corvallis, OR working together for about three years on various aspects of this project. Each team further divided the work to focus on sub-regions of the two coasts and specific tasks (e.g., data mining and organization, meeting coordination, literature review) but the larger group met regularly via conference call to ensure alignment of methods.

Data gathering

Federal, state, and nongovernmental GIS data clearinghouses were searched, and ocean related data located along the US Atlantic and Pacific coasts were downloaded. Examples of GIS data downloaded include shapefiles of cables, dredged material dumping areas, and military training areas from sources including the NOAA