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The Oregon Nearshore Research Inventory project: The importance of science and the scientific community as stakeholders in marine spatial planning

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ABSTRACT

The purpose of Oregon's Nearshore Research Inventory (NRI) project was to understand the geographic use of ocean space by the marine science community in order to include the information in Oregon's marine spatial planning (MSP) process. Spatial data and attributes about the geographic use of Oregon's ocean and coast by marine scientists were inventoried and mapped; including information about the geographic distribution of research, research timelines, and the people and institutions that conduct scientific research. The results of the NRI interviews show that the scientific community conducts research in twenty percent of the nearshore grid cells used in the Oregon's Territorial Sea amendment process. These results show that ocean space is used by the scientific community, and therefore, should be recognized as a use of ocean space in the MSP process.

As new uses, such as wave energy extraction, are proposed along coastlines and in the ocean, MSP can be used as a tool to reduce conflict and find compatible uses of ocean and coastal space. A major benefit of the scientific community's use of ocean and coastal space is that it results in data that can be used to inform ecosystem-based management decisions. Interruptions in long-term scientific research and monitoring as a result of ocean space use conflicts could limit the availability of information for use in future management decisions. While considering tradeoffs in the MSP process, decision makers need to recognize and account for the value of scientific space as a use of the ocean.

1. Introduction

Ecosystem-based management is an integrated approach that considers the entire ecosystem, including humans, by means of approaches that focus on protecting ecosystem structures, functions, and processes (Hughes et al., 2005; Leslie and McLeod, 2007; McLeod and Leslie, 2009). Marine spatial planning (MSP) is a management tool used to achieve EBM of marine resources (Douvere, 2008), and is defined as "a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives" (Ehler and Douvere, 2009, p. 18). Ideally, a MSP process will engage all ocean and coastal stakeholders (Halpern et al., 2011; Gopnik et al., 2012) to identify compatible use areas, thereby reducing conflict, while protecting and maintaining critical ecosystem services (McLeod et al., 2005; Foley et al., 2010; White et al., 2012).

During a MSP process, considering all social, ecological, and economic aspects of the ocean and coast is important when making these decisions (Pomeroy and Douvere, 2008; Halpern et al., 2011; White et al., 2012; Klain et al., 2014). A key facet of EBM is the science-based approach to making decisions, which aims to integrate multidisciplinary information from a variety of sectors (UNEP, 2011). This type of approach identifies scientific information as the building block for these management decisions (Stelzenmüller et al., 2013). Because of this, the marine and coastal scientific community, and in particular the data and interpretation they provide, plays a key role in MSP and other types of EBM activities.

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1.1. Challenges of integrating ocean and coastal science into management decisions

The National Ocean Policy (IOPFT, 2010) provides a framework for an ecosystem-based approach to managing marine resources. The role of scientists is to conduct research and interpret the resulting science (Lackey, 2013) and is perceived as apolitical (Carver, 2010). One of the roles of managers is to interpret and follow the guidelines of ecological policies while using scientific information to make tradeoffs between ecological, social, and economic considerations (Rosenberg and Sandifer, 2009). This can be challenging because the issues underlying management decisions are inherently complex (McLeod et al., 2005; Lester et al., 2013), and methods surrounding tradeoff decision-making and analysis are relatively new (Lester et al., 2013; Stelzenmüller et al., 2013).

The decision making process becomes even more challenging when managers need to make decisions when an action is new, such as marine renewable energy development (Lester et al., 2013); it is difficult to make a decision when there is a lack of understanding of the ecological consequences of the action (White et al., 2012). There is a tendency for policy issues to initiate funding for new research (Doremus, 2008), and with this comes a risk that science is engaged as a means to an end, rather as an end to itself (Krimsky, 2005). Scientific research, and specifically long-term monitoring of ocean and coastal ecological processes, provides valuable and relevant information to managers for use in trade-off analyses used to inform decisions. Without a comprehensive understanding of where, and over what time period, this research and monitoring is conducted, it is difficult to know what information is available, and where data gaps exist before managers need the information.

1.2. Scientists are ocean use stakeholders

The results of UNESCO's first international conference on marine spatial planning outline "research activities" as one of the 15 stakeholders groups (Ehler and Douvere, 2006). However, to date, the ocean and coastal monitoring community has been minimally recognized as an ocean use stakeholder in MSP processes around the world, and has not been formally recognized in MSP's in the United States. During the data gathering phase of Oregon's MSP process, a data gap in spatial information about where the ocean and coastal monitoring community uses ocean and coastal space was identified. This data gap prompted the Nearshore Research Inventory (NRI) in order to understand how and where research activities use ocean and coastal space in Oregon. The methods for this project can serve as a template for inventorying and mapping the use of the coast and ocean by marine scientists, from this point forward referred to as the coastal monitoring community.

A major motivation behind the Nearshore Research Inventory was concern that future proposed ocean uses, such as marine renewable energy development, would pose a risk to current and future research and monitoring activities. This community provides data and information that can be used by managers during decision-making processes. However, to gather this information, the ocean and coastal monitoring community uses ocean space – through buoys, research cruises, and biological and chemical sampling stations, and should be considered an ocean use stakeholder. Therefore, it is important to have a more comprehensive understanding of how and where the coastal monitoring community uses ocean and coastal space in order for the MSP process to truly engage all stakeholders.

1.3. Oregon's Territorial Sea Amendment process: a case study of integrating the ocean and coastal monitoring community as an ocean use stakeholder in the MSP process

In 2013, Oregon approved amendments to its Territorial Sea Plan (TSP: a marine spatial plan), which is the state's policy for managing activities from 0 to 3 nautical miles from the shoreline, in order to include marine renewable energy as a potential use of the ocean and coastal environment. In order to amend the plan, Oregon Department of Land Conservation and Development (DLCD), which houses the state's federally approved coastal management program, was charged with conducting a public process to spatially identify current ocean uses and resources and plan for future marine renewable energy development activities. As part of this process, DLCD engaged different stakeholders to map current and future uses of the Territorial Sea for inclusion in the TSP amendment process. Stakeholders identified in the process include the commercial and recreational fishing community, recreational use community (e.g. surfers, kayakers, and scuba-divers), and other beneficial uses (navigation channels, dredge disposal sites, telecommunication cables, pipelines and outfalls). After identifying a data gap regarding the space used by the coastal monitoring community in the Territorial Sea, DLCD initiated the Nearshore Research Inventory (NRI) project. This project, which defines the nearshore environment as the area from the shoreline up to the edge of the continental shelf, with an emphasis on the Territorial Sea, aimed to document the geographic and temporal use of ocean and coastal environments by the coastal monitoring community for use in Oregon's TSP amendment process.

The objectives of the project were to:

- Inventory current research projects within the Oregon nearshore environment;
- Identify when (over what time period), where (geographically off the Oregon coast), and what type of research is being and will be conducted;
- Create maps using tools such as Google Earth and Environmental Systems Research Institute's (ESRI®) ArcMap that identifies research locations off the coast of Oregon.
- Include the coastal monitoring community's ocean space use (e.g. scientists from federal and state agencies, non-profit organizations, educational institutions, research institutions, and privately owned companies) as a stakeholder in Oregon's MSP process;
- Provide a template for inventorying and mapping the spatial use of the coast and ocean by marine scientists for user in other MSP processes.

2.0. Methods

2.1. Data gathering

A list of individuals identified as key informants (Berg and Lune, 2012) was developed by the Coastal Permit Specialist for the Oregon Department of Land Conservation and Development. These individuals were identified based on their professional involvement with the Oregon marine research community in the beginning of the project to gain background information on the ocean and coastal monitoring community in Oregon. Key informants were contacted by email, and asked to participate in an informal discussion over the phone. Using a snowball sampling technique (Robson, 2002), the key informants identified potential contacts for principal investigators (PI) of specific research projects. Using this information, a list of individuals and agencies associated with ocean and coastal research in Oregon was developed. This list included research institutions as well as PIs and their associated research projects. In addition, this list of potential contacts was expanded through targeted Internet searches, using names of research institutions identified during key informant discussions as the basis for the search.

Two criteria were used as filters for research to be included in the NRI in order to keep the project relevant for the MSP process: (1) the research must be repeated in a particular geographic space, and (2) the research must be current and planned for the future. The first criterion was used because research that was not geographically fixed would not have high potential to conflict with other uses of the ocean, and therefore, would not be relevant to include in the marine spatial planning process. Second, if a scientific research project was not planned for the future, then it would not be relevant for future management decisions in a planning process.

Data were collected using ethnographic, semi-structured interviews (Robson, 2002) in two phases and facilitated using two interview guides to ensure consistency in the interviews. Interviews were conducted in-person, at an agreed upon location convenient to both the subject and the interviewer, beginning in fall of 2010 and ending in spring of 2011. As information was gathered through interviews of human subjects, an institutional review board assessment was completed prior any direct contact with the researchers. Interviews were conducted in two stages; the first consisted of a scoping interview, designed to determine whether the research fit the criteria for being included in the NRI. The second stage included the formal interviews used to collect the following information to be included for each project record in the NRI: (1) project background and information; (2) geographic location information, (3) research timeline; (4) planned research or data use; and (5) contact information.

Through these interviews, data were collected on the geographic extent (footprint) of Oregon's coastal monitoring community. Interviews also served as a way to gather more context and background about the purpose behind the scientific research. These data are relevant to the MSP process because managers will need context and background on stakeholder uses in order to understand and make decisions about tradeoffs between uses of the marine environment.

2.2. Data analysis

Research project data were organized into a Microsoft® Access database, designed and built specifically for this project. Data was entered into the database using an online data entry page developed by DLCD. Geospatial data were collected using a variety of methods, depending on the format in which the scientists stored the data. Formats included Microsoft® Excel files, ESRI® shapefiles, paper maps, online data, journal articles, cruise plans, and verbal identification by participants during interviews. Spatial data were then organized into Google® Earth KML (Keyhole Markup Language) files for consistency with other data in the MSP process. In addition, the spatial and interview data were used to create ESRI® shapefiles and associated attribute tables, respectively. A KML file of the spatial results along with an Adobe® PDF (Portable Document Format) file with the data from the interview were sent to the corresponding interview participants for verification.

The geospatial data were divided into three main categories based on the type of activity used to collect the research data: (1) marine research points, (2) marine research lines, and (3) marine research areas. The data were further broken down into subcategories in order to more accurately represent the research project activities (Fig. 1). It was important to distinguish between categories of research projects because the spatial designations (and resulting data types) will have different implications during a MSP process. For example, permanently moored buoys are more likely to conflict with other uses of the ocean than sampling stations, which are places in the ocean where samples are collected repeatedly but have no permanent structure in the water. Another example is the difference between research lines and transects. Research lines are lines in the ocean where research is conducted along the line, but only at certain locations. Research transects are lines where research is conducted continually along a path. The spatial data type (points, lines, and areas) was the main attribute used to represent the extent of the coastal monitoring community footprint when mapped cumulatively.

Other attributes of the research were used to help analyze the cumulative project database, including time. Each research project was categorized into short-term (0–3 years), medium-term (4–9 years), and long-term (10 years or more) projects. Data were analyzed for how frequently measurements were made during a research project, and over what time periods during the year the research was conducted (e.g. seasons: spring, summer, fall, winter, year-round, or a combination of seasons). This information helped to provide a perspective on the geographic and temporal extent of use for any research project included in the NRI.

3.0. Results

A total of thirteen key informant discussions, thirty-one scoping interviews, and fifteen formal interviews were conducted to gather data. Participants were associated with federal and state agencies, non-profit organizations, educational institutions, research institutions, or privately owned companies. As a result of the fifteen formal interviews, thirty-four unique research projects were identified and included in the NRI.

Ocean and coastal research projects are found along much of the Oregon coast, and distributed throughout the nearshore environment. The geographic extent of all records in the NRI were intersected with the state marine spatial planning grid, approximately one square mile blocks covering the nearshore environment (DLCD, 2010). As a result, approximately twenty percent of the DLCD planning grid cells spatially intersected with the NRI (Fig. 2). A frequency analysis of the NRI data shows that the highest densities of research are found near coastal communities, outside of river mouths, and in ecologically important areas such as rocky reef environments.

The completed NRI was used to produce maps of the research points, research lines, and research areas, thereby highlighting the different types of research activity. Research projects along the Oregon coast include physical and semi-permanent research assets such as buoys, repeated sample stations along research lines, and research areas (Fig. 3). One example of space use is the Newport Hydrographic Line (NH-Line), along which the scientific community has been conducting research on ocean physics, biology and chemistry for over fifty years (Huyer et al., 2007). Scientific research platforms monitoring the NH-line currently include buoys, ships, and underwater gliders. The on-going monitoring of this line is improving our long-term, fundamental understanding of oceanographic processes (Pierce et al., 2012).

The Nearshore Research Inventory includes (Fig. 3):

- 281 shoreline sampling stations
- 253 nearshore bathymetric surveys
- 162 nearshore sampling stations
- 77 underwater platforms
- 51 shoreline observation stations
- 41 research transect lines
- 31 buoys, moorings, and land stations

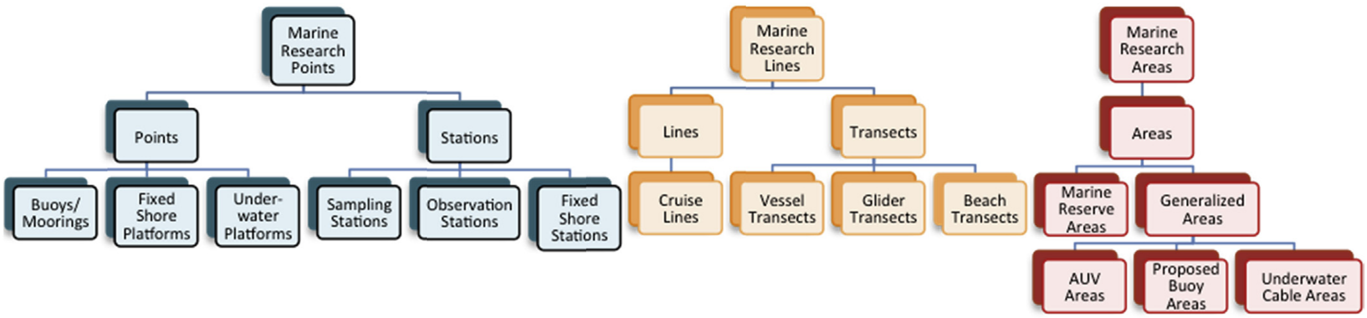

Fig. 1. The schema for geographic categorization of research project activities included in the Nearshore Research Inventory.

- 14 cruise sampling lines
- 12 underwater cables
- 12 intertidal sampling stations
- 6 areas of marine reserve related research
- 5 underwater glider lines
- 1 area of AUV research
- 1 area of wave energy development research
- 1 proposed area for a buoy

Most of the research projects inventoried were measuring either physical oceanographic processes (100% of projects) or biological processes (79% of projects). Fifty percent of the projects collected data for over ten years, 88% conducted research during the summer months, and 41% conducted research year-round. Spatially, research projects are distributed near ecologically significant areas, such as rocky reefs, headlands, and estuaries. Research projects were found in proximity to known research institutions, coastal communities, and locations where there is easy access to the coast and ocean.

The completed NRI was integrated into Oregon MarineMap (http://oregon.marinemap.org/), an online geospatial visualization tool, to inform the Oregon's Ocean Policy Advisory Council (OPAC) and its Territorial Sea Plan amendment process. In addition, the results of the project are available to the public at http://www.oregonocean.info and can serve as a template for other states engaging in a MSP process.

4.0. Discussion

Through the NRI project, Oregon's Territorial Sea amendment process became the first MSP process in the United States to comprehensively recognize the scientific community as a stakeholder. The Oregon NRI project documented that research projects are conducted throughout the year, over widespread geographical domains, and by many different groups and organizations. The scope of ocean space that is used by the coastal monitoring community, in addition to the variety of activities and timelines, made it apparent that inclusion of the coastal monitoring community as an ocean space stakeholder is needed as part of MSP processes.

The NRI project identified individuals and institutions that conduct ocean and coastal research in Oregon. It also spatially identified scientific research, in addition to other attributes associated with research, such as context and background, purpose, and timeline. Much of the scientific research that was identified has been conducted for more than a decade. The NRI provides background information helpful to managers as they weigh different options during tradeoff analyses for uses of space of the ocean and coast.

4.1. The NRI as a planning tool to ensure continued long-term monitoring

Without scientific research and understanding, management decisions have the potential to negatively impact ecological functions and processes (Katsanevakis et al., 2011). Coastal communities depend on the services provided by theses functions and processes (McLeod et al., 2005; Barbier et al., 2011; Klain et al., 2014), and negative ecological impacts from poor management decisions can lead to negative impacts on social and economic systems (Klain et al., 2014). As populations grow, policy makers and managers will look for solutions, such as wave energy, to meet society's energy demands. As MSP is used as a tool to make ecosystem-based management decisions about new uses of the ocean and coast, the coastal monitoring community must be considered an ocean and coastal use stakeholder in the MSP process. If research space is not considered a valuable use of the ocean and coast during tradeoff decisions, new uses of the ocean, such as wave energy, have the potential to conflict with ocean and coastal research locations. The potential impact as a result of leaving the scientific space, and more specifically space used for long-term monitoring, out of tradeoff decisions could lead to the elimination of space used for scientific research, which in turn, would lead to a reduction of information and knowledge about the area. The inclusion of the coastal monitoring community as an ocean use stakeholder in the MSP process can prevent this situation. While considering tradeoffs in the MSP process, managers need to, at minimum, recognize and account for the use of space by the coastal monitoring community.

4.2. The value of long-term research

Long-term scientific data are valuable when managers and policy makers are looking to make decisions about issues that occur over long time scales (Hobbie et al., 2003). The NRI identified multiple research projects that conducted research for over ten years in the same ocean space, and one in particular, the Newport Hydrographic Line, that has been in existence for over fifty years. Identifying areas with long-term research projects, such as those included in the NRI, is a way to identify ocean space that provides valuable scientific information. Understanding where this valuable scientific information is collected during spatial tradeoff analyses will reduce the risk of potentially eliminating long-term monitoring locations.

4.3. NRI as a way to identify data gaps and potential collaborations

To meet ecosystem-based management objectives, it is recommended that managers look for interdisciplinary scientific information to meet the complex challenges associated with decision-

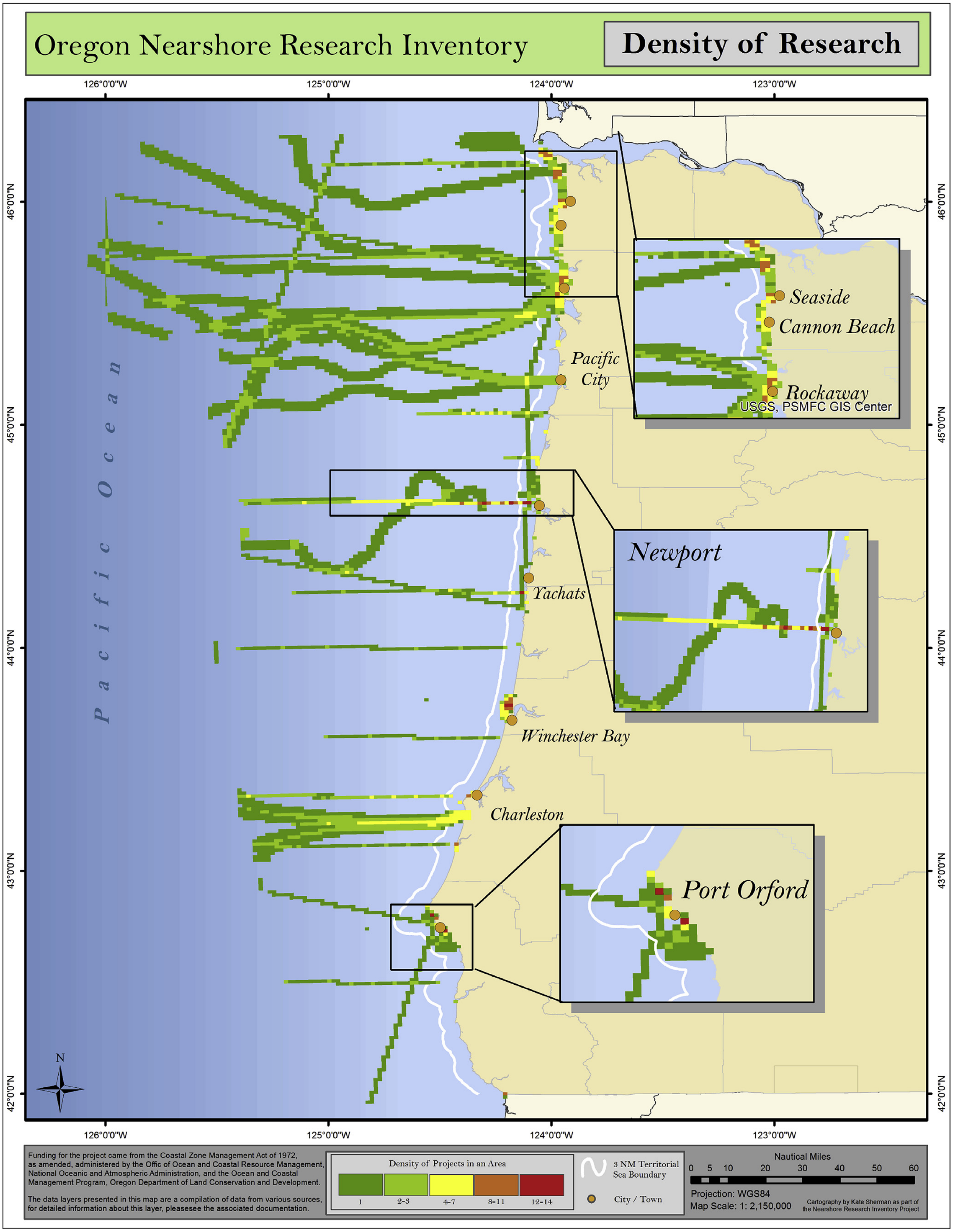

Fig. 2. Density of Oregon's nearshore, marine research projects.

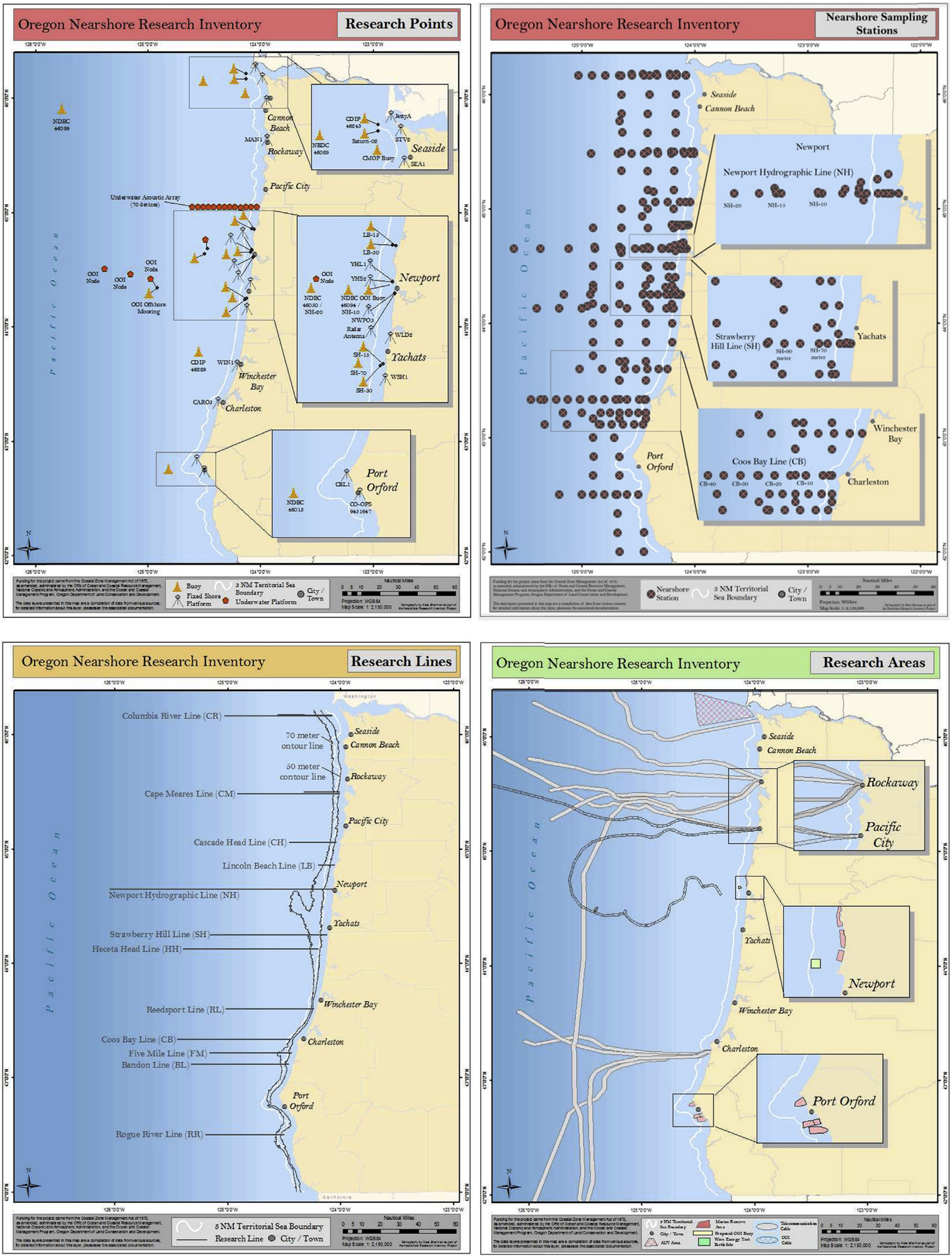

Fig. 3. Maps of research points, sampling stations, lines, and areas of data from the Nearshore Research Inventory.

making processes (Leslie and McLeod, 2007). Comprehensively inventorying the coastal monitoring community's use of the ocean and coast has other benefits; it identifies temporal and thematic data gaps that could be useful for management decisions. Understanding what is not available helps identify gaps that need to be filled in order to make relevant and comprehensive science-based decisions.

One example of a data gap is the lack of ocean chemistry data collected in Oregon. The NRI identified that 23% of the projects measured chemical variables (such as dissolved oxygen and pH) where as physical (temperature and depth) and biological (presence of organisms) variables were measured for 100% and 79% of research projects, respectively. Today, as evidence of ocean acidification emerges (Feely et al., 2009), and scientific information on this topic is needed, there is an opportunity to add a chemical component to research projects that are traditionally oriented around physical and biological research. Doing so would allow more long-term scientific information on chemical components of Oregon's ocean and coast to be available in the future.

Identifying ocean space that is shared by different coastal monitoring researchers can identify areas that can be used collaboratively. For example, if two different researchers have cruises that conduct scientific research in the same area, but at different times of the year, they can collaborate to collect information in a complementary manner so that research gaps can be addressed. This can help reduce costs, since the typical cost for use of a scientific research vessel can be prohibitively expensive. Such scientific collaboration can lead to a more comprehensive and interdisciplinary understanding of the marine environment.

4.4. The NRI as a way to enhance data networks

Comprehensively inventorying coastal monitoring community's use of the ocean and coast for use in an MSP process provides additional value; it is a way to identify data networks that have existing, relevant scientific information for management decisions. Data networks from institutions that have readily available scientific information are a good way for the scientific community to share information with managers. Much of the data inventoried during the NRI project was accessed through online data networks. These networks engage a suite of scientists and by in large allow free, online access to their data. These data range from water quality monitoring and beach health, to ocean surface currents. Some organizations that are successfully engaging in online data sharing in Oregon are as follows:

- Center for Coastal Margin Observation & Prediction: (CMOP): www.stccmop.org.
- Coastal Observing Research and Development Center: http://cordc.ucsd.edu/projects/mapping/maps.
- Coastal Observation and Seabird Survey Team (COASST): http://depts.washington.edu/coasst.
- Northwest Association of Networked Ocean Observing Systems (NANOOS): www.nanoos.org.
- The National Oceanic and Atmospheric Administration, National Data Buoy Center (NBDC): http://www.ndbc.noaa.gov/
- Oregon Beach Monitoring Program (OBMP): http://public.health.oregon.gov/HealthyEnvironments/Recreation/BeachWaterQuality/Pages/beaches.aspx.
- Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO): www.piscoweb.org

Two organizations, the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) and the Northwest Association of Networked Ocean Observing Systems (NANOOS), both located in the Pacific Northwest, have been particularly successful in data sharing, networking, and collaboration.

Each spring, PISCO hosts a meeting with the hypoxia research community to discuss plans for the summer research season, including what research they are conducting, what variables they are measuring and where they will be conducting research. In the fall, they meet again to discuss the results of the research season. By openly sharing summer research plans, researchers can collaborate with each other, as well as reduce the conflict and competition with other researchers for use of ocean space and equipment, such as ship time and scientific instruments. By discussing the variables that they plan to measure, potential data gaps and possible collaborations are identified. In addition, this data is available online for managers and other interested parties to access. PISCO's example of collaboration, networking, and data sharing will help make more comprehensive information available to managers.

NANOOS is the Regional Association of the National Integrated Ocean Observing System (IOOS) in the Pacific Northwest, primarily Washington and Oregon. NANOOS provides real-time data from ocean observing platforms and other data collecting instruments to provide relevant information to a wide variety of ocean and coastal stakeholders including fishermen, search and rescue personnel, and coastal managers (Mayorga et al., 2010; Risien et al., 2009). An example of data and information provided by NANOOS are interactive tsunami evacuation maps, which can allow for individuals, schools, towns and organizations to plan their evacuation route in case of a tsunami evacuation emergency (Martin et al., 2011). NANOOS's example of data sharing can help local governments and the general public to make decisions about disaster mitigation plans.

Traditionally, research is conducted, written-up, reviewed, and then published in scientific journals. This process takes time and, unfortunately, may not always be released in a timely fashion for use in management and policy decisions. Enhancing data sharing and identifying data networks, through the NRI, provides relevant information to managers and stakeholders who need to use scientific information to make decisions.

4.5. The NRI as a way to reduce conflict

As with many other ocean space users, the coastal monitoring community has conflicts with other users of the ocean and coast. In a study on ocean use conflict completed for the Bureau of Ocean Energy Management, conflicts (and some potential solutions) between fishermen and scientists were identified. For example, conflicts arise when fishermen snag gear on research equipment, or fishermen accidentally remove equipment from the water (Industrial Economics, Inc., 2012).

The NRI can be used to reduce conflict between the space used by the scientific community and fishermen. The Oregon Fishermen's Cable Committee (OFCC) is an organization whose mission is an example of how identifying equipment can benefit fishermen and the equipment owner. The OFCC collaborated with fiber optic cable companies off of the Oregon coast to identify cable locations in order to reduce the number of snags of fishing gear on the cables. This type of collaboration, by identifying location of sensitive equipment and sharing it with a community of people who use the space, is a great example of the type of benefit the NRI can have with the fishing community. If information about the location of scientific equipment is made available through the results of the NRI, or fishing seasons and efforts are considered before placing new scientific equipment, space use conflicts between these two communities can be reduced.

5.0. Conclusions

The NRI project was a comprehensive way to gather information about the scientific research projects being conducted in Oregon along the coast and ocean. This was the first time within the United States that the coastal monitoring community's use of the coast and ocean has been comprehensively mapped for inclusion as a stakeholder in a state level MSP process. In Oregon's revised Territorial Sea Plan, it requires that all proposed projects within the Territorial Sea, such as wave energy arrays, must provide a resource inventory and effects evaluation before the project will be approved (OTSP, 2013). Scientific research is listed as one of eleven cultural, economic, or social uses of the ocean that needs to be inventories. For other states engaging in MSP activities, the Oregon NRI can be used as a template to conduct research inventories in order for other marine spatial plans to include scientific research space as an ocean use.

Currently along the west coast, The West Coast Ocean Data Portal (WCODP), a project of the West Coast Governors Alliance on Ocean Health, aims to connect people and ocean and coastal data. The WCODP has information that is part of the larger California Current Ecosystem and politically part of the West Coast Regional Planning Body of the National Ocean Policy, and the West Coast Governors Alliance on Ocean Health (Gregoire et al., 2008). Currently, the Nearshore Research Inventory is included in the data portal. Future work can be done to inventory the scientific research in California and Washington, since that information is currently not included in the portal. This regional expansion would allow managers to have better information as part of this larger ecosystem framework, as recommended for successful EBM practices (McLeod et al., 2005).

While every effort was made to make the NRI project as comprehensive as possible, it is ultimately a snapshot in time. There will be new research projects proposed and some ongoing projects may not have been included in the NRI. It is important to continue to engage the coastal monitoring community in order to have the most up to date and relevant information regarding marine science and associated research activities.

One shortcoming of the present analysis is that it did not account for some remote-sensing instruments, which occupy a small physical footprint but measure over a much greater area. One example is the array of HF surface current mapping systems installed along the Oregon coast (categorized in the NRI as land-based stations). The physical location of the instruments is included in the NRI; however, the full footprint that they measure is not included. In the future, these systems should be included by their measurement area, not just their physical location, in order for their data to be properly assessed in MSP.

Maintaining the NRI will require a person to interview or survey the researchers periodically to maintain an up-to-date database of research. Since a majority of the research is conducted in the summer, this season should be avoided for interviewing or surveying researchers about their research plans. Another way to maintain the NRI is to check the websites of the known research institutions that are identified in the NRI. Information about ocean and coastal scientific research can also be obtained through permit applications, because some scientists are required to apply for permits to conduct their research. The permit application, if accessible, can provide some of the information that would be included in the NRI. There needs to be an individual in charge of examining all of the scientific research information outlets in order to maintain relevant data in the NRI.

Twenty percent of grid cells used in the Territorial Sea Amendment process had scientific research conducted within them. In addition to already identified space use conflicts between scientific instruments and fishing, there will be other conflicts when all ocean and coastal space uses are taken into consideration during the marine spatial planning process. The NRI demonstrates that the use of ocean space by the marine science community is important, and inventorying it is the first step in including this community's ocean space use in tradeoff decisions. The final decision about whether scientific research space takes precedence over the use of the coast and ocean over other uses will vary by each decision making process. It will be up to each process to place a value on coastal monitoring community space use. At minimum, the NRI project shows that scientific space needs to be inventoried and considered in the tradeoff decision-making process.

Scientific information is the basis for many management decisions in an ecosystem-based management framework. Long-term, scientific information, identified in the Oregon NRI is valuable for MSP and, ultimately, ecosystem-based management of the ocean and coast. Recognizing that the coastal monitoring community is an ocean and coastal stakeholder is the first step to in ensuring that scientific information is available in the future.

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