AN ABSTRACT OF THE THESIS OF

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Title: The Oregon Nearshore Research Inventory Project: The Importance of Science and the Scientific Research Community in Marine Spatial Planning.

Abstract approved:

John A. Barth

The purpose of Oregon's Nearshore Research Inventory (NRI) project was to inventory and map the current and future use of Oregon's nearshore environment by the scientific research community for use in Oregon's marine spatial planning process. Spatial and qualitative data on the use of Oregon's ocean and coast by the scientific research community was collected using ethnographic research methods, including the geographic distribution of research, the people who are conducting scientific research, timeline for scientific research, and more. Through the NRI project, Oregon's Territorial Sea amendment process became the first marine spatial planning process in the world, other than through ocean zoning (e.g. Australia's Great Barrier Reef and China), to comprehensively recognize the scientific community as a stakeholder. This thesis contains the methods used to create the NRI database, interview the scientific community, and includes future recommendations for managers and the scientific community based on the results of the NRI.

As new uses, such as wave energy extraction, get proposed along coastlines and in the ocean, marine spatial planning (MSP) can be a tool to reduce conflict and find compatible uses of ocean and coastal space. Sound science needs to be used to understand social, ecological, and economic components to ocean and coastal resources

and make tradeoff decisions about ocean and coastal space use in the MSP process. The results of the NRI project demonstrate the need to recognize that the scientific research community as a stakeholder in the MSP process. Their use of ocean and coastal space helps provide the sound scientific information that is needed to make ecosystem-based management decisions. Interruptions in long-term scientific research and monitoring could limit the availability of scientific information for use in future management decisions.

There are also other values to comprehensively inventorying use of the ocean and coast by the scientific community. Spatial data about where people conduct scientific research provides information for potential collaboration amongst the scientific community and between scientists and non-scientists. It also identifies data gaps, which can then be filled to help have a more comprehensive understanding of ocean and coastal issues. The NRI can act as a template for other states to include the scientific community as a stakeholder in a MSP process, and as a template for a regional inventory of scientific research which can be useful for ecosystem based approaches to management. Overall, there should be value placed on sound scientific information for management decisions and the scientific community as a stakeholder in the marine spatial planning process, as demonstrated through the NRI.

The Oregon Nearshore Research Inventory Project: The Importance of Science and the Scientific Research Community in Marine Spatial Planning

by

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Dean of the Graduate School

I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Kate Sherman, Author

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The Oregon Nearshore Research Inventory Project: The Importance of Science and the Scientific Research Community in Marine Spatial Planning

Introduction

How to read this document

This document is intended for marine resource managers and the ocean and coastal scientific research community. This document contains a description of the importance and value of the work of the scientific research community to conduct research on ocean and coastal systems, processes, and organisms to inform management decisions. As marine resource managers look to make decisions that sustain future populations, science, and particular the scientific research community, should be thought about not only as a source of scientific information, but also as a stakeholder who uses the ocean.

Chapter 1 presents background information and literature on the marine spatial planning processes, wave energy, and the role of science in management decisions. Chapter 2 introduces the Nearshore Research Inventory project, and contains the purpose, methods, and results of the project. Chapter 3 is a journal article to be submitted to the journal *Ocean and Coastal Management*, and discusses the role of science in marine spatial planning decisions and the benefits of incorporating the scientific community as a stakeholder in the marine spatial planning process. Chapter 4 is a discussion about the results of the Nearshore Research Inventory project. Chapter 5 contains conclusions and recommendations that came out of this project.

Research Focus: Oregon's Nearshore Research Inventory

The foci of this document is the process of mapping the spatial footprint of where the scientific community uses ocean and coastal space off the coast of Oregon, incorporating it into the Oregon Territorial Sea amendment process, and the value that that science and scientists as stakeholders have for successful management decisions.

Complementary Materials as a Result of the Nearshore Research Inventory

Additional materials have been, and are currently being, developed as a part of the Nearshore Research Inventory, and they include:

- Microsoft Access database of ocean and coastal scientific research in Oregon;
- Online entry and reporting tool used as part of interview process for the Nearshore Research Inventory (available through the Department of Land Conservation and Development);
- ArcGIS shapefiles representing ocean and coastal scientific research in Oregon (http://www.oregonocean.info/data);
- Google Earth KML files representing each ocean and coastal scientific research project in Oregon that is included in the Inventory (will be available online);
- Website describing the Nearshore Research Inventory project (coming soon to www.oregonocean.info);
- Interactive web map showing ocean and coastal scientific research projects in Oregon (will be finished early July 2012);
- Report for DLCD about the Nearshore Research Inventory Project (http://oregonocean.info/index.php?option=com_docman&task=doc_details&gid=972&Itemid=19).

Acronyms

AUV	Autonomous Underwater Vehicle
CMOP	Center for Coastal Margin Observation and Prediction
CMSP	Coastal and Marine Spatial Planning
CRMC	Coastal Resource Management Council
CTD	Conductivity, Temperature, Depth
DLCD	Oregon Department of Land Conservation and Development
FERC	Federal Energy Regulatory Commission
HMSC	Hatfield Marine Science Center, Oregon State University
IRB	Institutional Review Board, Oregon State University
LCDC	Oregon Land Conservation and Development Commission
LME	Large Marine Ecosystems
MOA	Massachusetts Ocean Act
MOMP	Massachusetts Ocean Management Plan
MOU	Memorandum of Understanding
MSP	Marine Spatial Planning
NOAA	National Oceanic and Atmospheric Administration
NOC	National Ocean Council
NRI	Nearshore Research Inventory
ODFW	Oregon Department of Fish and Wildlife
OOI	Ocean Observatories Initiative, National Science Foundation
OPAC	Ocean Policy Advisory Council
OPT	Ocean Power Technologies
OPTF	Ocean Policy Task Force
OSU	Oregon State University
PI	Principal Investigator
PISCO	Partnership for Interdisciplinary Studies of Coastal Oceans
RPS	Renewable Portfolio Standard
SAMP	Special Area Management Plan
SCRIPPS	Scripps Institutions of Oceanography
TSP	Territorial Sea Plan
WCGA	West Coastal Governors Alliance

Chapter 1: Background On MSP, Wave Energy, and The Role of Science in Management Decisions

1.1 Introduction

This chapter is broken down into three sections about: (1) marine spatial planning, (2) wave energy, and (3) the role of science in ocean and coastal management decisions. Each section provides context and literature about current processes related to ocean and coastal management, and specifically the role of scientific information in informing the marine spatial planning process in Oregon, which is driven by proposals for wave energy development.

Oregon is currently in the process of amending the Territorial Sea Plan, the states' marine spatial plan that manages ocean uses in the area from 0-3 nautical miles off the coast of Oregon. This process is driven by the proposal for marine reserves as well as the interest in marine renewable energy off the Oregon coast. The State of Oregon and the Federal Energy Regulatory Commission (FERC) signed a Memorandum of Understanding (MOU), which stated that if Oregon developed a plan to find ideal places for wave energy devices, that FERC would make sure to follow guidelines from the plan, and the underlying constraints, when reviewing permit requests for marine renewable energy devices for the state (ODFW et al, 2007). As Oregon moves forward to find the ideal locations for wave energy devices, the state should use scientific recommendations to help inform decisions. Can the state find ideal locations where there will be minimal negative ecological, social, and economic consequences as a result of installation of wave energy devices? What are the tradeoffs between different uses of the ocean? What are the cumulative impacts of all of the uses of the ocean? All of these questions show the close connection between scientific information, wave energy, and marine spatial planning.

1.2 Marine Spatial Planning

1.2.1 Introduction

The ocean covers seventy-one percent of the earth's surface (NOAA, 2012). Oceans worldwide play an integral role in sustaining earth systems, such as climate and

Renewable Goods
~ Marine animals for food
~ Marine animals for recreation
~ Seaweed
~ Medicines
~ Other raw materials
(building materials, ornaments)
~ Energy (wind, wave, tidal, thermal)
~ Water

Non-Renewable Goods
~ Oil and gas
~ Sand and gravel
~ Marine minerals

Renewable Services
~ Habitat (nursery areas for fish)
~ Protected areas
~ Flood and storm protection
~ Erosion control
~ Nutrient cycling
~ Biological regulation
~ Waste processing
~ Marine transportation routes
~ Atmospheric and climate regulation
~ Carbon sequestration
~ Tourism, leisure, and recreation
~ Cultural heritage and identity
~ Aesthetics

Figure 1: Goods and Services Provided by the Ocean (Elher and Douvere, 2009).

weather, and by providing humans and other wildlife a source of food (NOAA, 2012). Many humans place values, both market and non-market, on the services that the coast and ocean provides to society (Elher and Douvere, 2009). Goods and services range from fish as food to eat to recreation such as surfing, scuba diving, or whale watching (Figure 1). Currently, human use of the coast and ocean is increasing, and will continue to grow with increasing populations of people living on the coast (Woods and Poole Economics Inc, 2010). With increasing population will come an increased demand for resources and services required to sustain populations. This increased use can lead to conflicts among different groups of people who are all competing for the same resources. It is a relatively new concept to think of ocean and coastal space as a limited resource, since the ocean covers such a large part of the planet. However, in order to ensure that these resources are available in the future, humans need to effectively manage the resources and services they provide. To do this, many countries and states are engaging in a process called marine spatial planning.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) defines marine spatial planning (MSP) 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 that are usually specified through a political process” (Elher and Douvere, 2009; OES, 2011). Over the next couple of years, approximately sixty MSPs will have been produced by twelve countries at the national (exclusive economic zone) and state levels (Ehler and Douvere, 2010). The countries that have existing and implemented plans include Belgium, The Netherlands, Norway, Germany, China and the United States (for the states of Massachusetts and Rhode Island). Other countries including Canada, Australia, Sweden, Poland, France, and the United Kingdom (England and Northern Ireland), as well as the state of Oregon in the United States, are in the process of developing their own marine spatial plans (Ehler and Douvere, 2010). In general, marine spatial planning is being recognized globally as tool to effectively manage ocean and coastal resources.

1.2.2 Marine Spatial Planning in the United States

The Deepwater Horizon-BP oil spill in the Gulf of Mexico in 2009 reminded the United States and the world of the ecological importance and economic value of the coasts and oceans. With this in mind, President Barack Obama and the Council on Environmental Quality formed the Ocean Policy Task Force (OPTF) (Beck et al, 2009). The president charged the task force with, “developing recommendations to enhance our ability to maintain healthy, resilient, and sustainable oceans, coasts, and Great Lake resources for benefit of present and future generations” (OPTF, 2010, p. 1). With recommendations from OPTF, President Obama responded by passing an executive order on July 19, 2010 calling for “the development of coastal and marine spatial plans that build upon and improves existing Federal, State, tribal, local, and region decision making and planning processes” (Obama, 2010, p. 6). The Executive Order also established a National Ocean Council (NOC) and a new framework for the first-ever national ocean policy to “implement comprehensive, integrated, ecosystem-based coastal and marine spatial planning and management in the United States” (OPFT, 2010, p. 32).

The national ocean policy framework identified the need to engage in coastal and marine spatial planning through a regional and ecosystem-based approach. In order to best reach this objective, the recommendations identified large-marine ecosystems (LME) in the United States, which were spatially established based on consistent ecological conditions and other factors (OPTF, 2010). The boundaries for the regional planning areas were based upon these LMEs and include the Northeast, Mid-Atlantic, South Atlantic, Gulf Coast, West Coast, Great Lakes, Alaska, Pacific Islands, and the Caribbean (Figure 2). These LME's became the nine regional planning bodies, and the NOC was tasked with facilitating MSP processes in each of the regions (OPTF, 2010).

The West Coast recognized the need for regional coastal and marine spatial planning before the national recommendations and the formation of the nine regional planning bodies. In September 2006, the three Governors of California, Oregon, and Washington announced the West Coast Governors Alliance on Ocean Health (WCGA). The goal of the WCGA is to protect and manage the ocean and coastal resources along

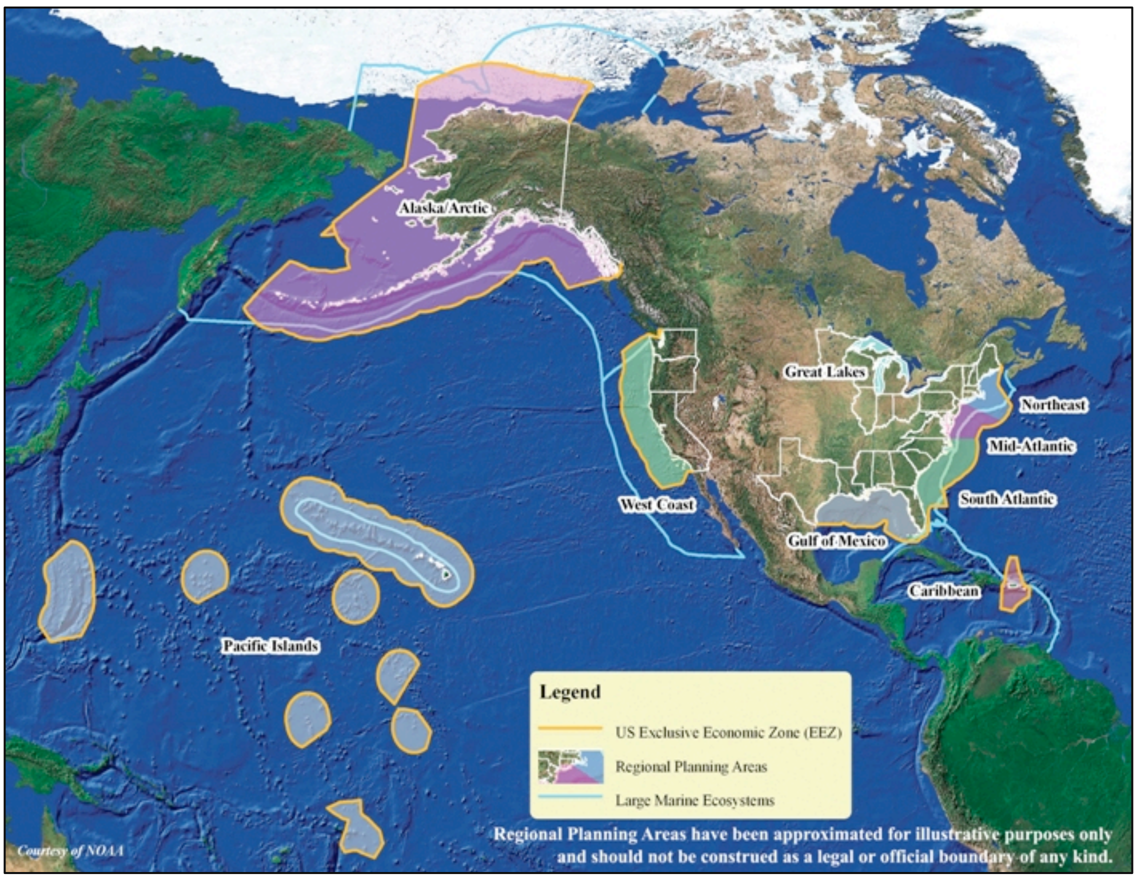

Figure 2: Nine Regional Planning Bodies Under the CMSP Framework of the National Ocean Policy (NOC, 2012)

the West Coast of the United States (Gregoire et al., 2008). One of the twenty-six objectives identified in the WCGA Action Plan calls for state and federal agencies to "Explore the feasibility for development and evaluate the potential environmental impacts of these technologies" (Carter et al., 2010, p. 3). The team charged with carrying out the Action Plan, called the Renewable Ocean Energy Action Coordination Team, convened workshops that highlighted marine spatial planning as a tool to evaluate areas along the West Coast for sustainable offshore alternative energy development and developed the West Coast Planning Assessment Framework (Gregoire et al., 2008).

Massachusetts and Rhode Island are the two states in the U.S. that already completed MSPs for the coast and ocean bordering their states. In Massachusetts, the Massachusetts Ocean Act (MOA) was enacted in 2008, which required the state to develop a comprehensive ocean management plan. The Massachusetts Ocean Management Plan (MOMP) was developed in three phases: information gathering, draft plan development, and formal public review of the draft plan and plan finalization

- Active Disposal Sites
- Anchorage Areas
- Automatic Identification System (AIS)
- Bathymetry
- Cable Areas
- Cables
- Colonial Nesting Waterbirds
- Commercial Fisheries Activity
- Eelgrass
- Ferry Routes
- Fin Whales
- Fisheries Resources
- Gas Pipelines
- Hard/Complex Bottom
- Humpback Whales
- Inactive Disposal Sites
- Intertidal Flats
- Land Use and Land Cover
- Leach's Storm Petrels
- Long-tailed Ducks
- Massachusetts Aeronautics Commission (MAC) Aviation Buffers
- MMTA Recreational Fishing and Boating Survey
- National Register of Historic Places
- North Atlantic Right Whales
- Pilot Boarding Areas
- Potential Tidal Resources
- Precautionary Areas
- Proposed New England Marine Renewable Energy Center (MREC) Test Area
- Proposed Tidal Energy Project Areas
- Public Open Spaces
- Recreational Fishing Areas
- Regional Planning Agencies
- Roseate Terms
- Rugosity
- Separation Zone
- Shipping Lanes
- Special Concern Terns
- Surficial Sediments
- Vessel Monitoring System (VMS)

Figure 3: Data Layers Used in Massachusetts Ocean Plan (MOP, 2012)

(MOMP, 2009). There are thirty-nine data layers used in the final plan (Figure 3). The MOMP was adopted at the end of 2009 and established different management areas, including prohibited areas (such as marine sanctuaries), renewable energy areas (in particular for wind energy), and multi-use areas (for aquaculture, cables and pipelines, extraction, wind energy, and wave and tidal energy) (MOMP, 2009). The management areas were established with standards for future development and management decisions. The MOMP became the first MSP for the state of Massachusetts.

In 1971, the Rhode Island General Assembly established the Coastal Resource Management Council (CRMC), and charged the council to "preserve, protect, develop, and where possible, restore the coastal resources of the state for this and succeeding generations through comprehensive and coordinated long-range planning and management designed to produce the maximum benefit for society from such coastal resources; and that the preservation and restoration of ecological systems shall be the primary guiding principal upon which environmental alteration of coastal resources shall be measured, judged and regulated" (RIGA, 2007, p. 1). This legislation established the CRMC as a state agency, and gave it the primary responsibility for planning and management of the state's coastal region resources (CMRC, 2012). From 2008-2010, driven by a proposal for an offshore wind-farm, CRMC engaged stakeholders and included scientific research in a public process to develop an Ocean Special Area Management Plan (SAMP). Data included in the SAMP included information on ecology, fishing, wildlife and habitats, recreation and tourism, cultural and historic resources, infrastructure, marine transportation, the physical environment, and legal aspects and policies. Figure 4 shows a full list of research projects and resulting data layers included for decision making in the SAMP, with the ultimate goal of developing use zones in Rhode Island's offshore waters.

CMSP in Massachusetts and Rhode Island has been established, and in other states will continue to move forward, using the framework of the NOP. The establishment of the regional planning bodies in addition to the WCGA identifies a positive political atmosphere for engaging in CMSP as a tool to help inform managers of how humans use the oceans and coasts on the west coast of the United States.

Ecology
- Spatial Distribution and Abundance and Flight Ecology of Marine and Coastal Birds off Coastal Rhode Island
- Assessing Spatial Distribution and Abundance of Waterbirds in Ocean SAMP Study Area
- Spatial Distribution and Abundance of Birds in Offshore Waters, Including Detailed Studies of Roseate Tern Use of Offshore Waters
- Ecosystems
- Spatial and Seasonal Distribution of Phytoplankton, Primary Production, and Flux of Organic Matter to Benthic Habitats in Rhode Island and Block Island Sounds

Fishing
- Commercial and Recreational Fisheries Usage Maps
- Refined Assessment of Fisheries Activity

Wildlife & Habitats
- Mapping and Characterizing Fish Habitat in Rhode Island's Transitional Seas
- Marine Mammal and Sea Turtle Analysis for the Rhode Island Ocean SAMP

Recreation & Tourism
- Marine Recreation Use and Impact Study

Cultural & Historic Resources
- Inventory of Significant Historic Properties, Archaeological Sites, Tribal Areas of Traditional Cultural and Religious Importance, and Recreational Areas
- Regional Subsurface Geology, Surficial Sediment, Benthic Habitat Distribution, and Cultural Resources

Infrastructure
- Rhode Island Wind Farm Structures/Foundations Study: Support Structures and Foundations for Offshore Wind Turbines

Marine Transportation
- Engineering Studies in Support of the Rhode Island Ocean SAMP

Physical Environment
- Engineering Studies in Support of the Rhode Island Ocean SAMP
- Characterizing Physical Oceanography of the Rhode Island Coastal Ocean
- Air Quality and Meteorology Studies in Support of the Rhode Island Ocean SAMP
- Sediment, Benthic Habitat Distribution, and Cultural Resources
- Regional Subsurface Geology, Surficial Sediment, Benthic Habitat Distribution, and Cultural Resources
- High Resolution Screening Analysis for Block Island Site
- High Resolution Modeling of Meteorological, Hydrodynamic, Wave, and Sediment Processes in the SAMP Study Area
- Buoy-Based Oceanographic and Meteorological Observations: Block Island and Deep Water Sites
- Mooring Deployments and Vessel-Based Surveys to Characterize Currents and Hydrography
- Rhode Island Wind Farm Siting Study: Acoustic Noise and Electromagnetic Effects
- Acoustic Noise and Electromagnetic Effects

Legal & Policy
- State Policy and the Rhode Island Ocean SAMP
- Legal Aspects of the Ocean SAMP

Figure 4: Data Layers Used in the Rhode Island Ocean SAMP (RI SAMP, 2010).

1.2.3 Oregon's Territorial Sea Plan

The Oregon Territorial Sea is the area of ocean off of the coast from the shoreline out into the ocean up to three nautical miles (Figure 5). In 1991, the Oregon legislature established the Ocean Policy Advisory Council (OPAC), which is made up of many different ocean stakeholders, local government representatives, and state agencies (LCC, 2011). OPAC was charged with providing the Governor and state agencies with policy advice on issues relating to the coast and ocean (LCC, 2011). This legislation also gave the Department of Land Conservation and Development (DLCD), which houses Oregon's federally approved coastal management program, responsibility for ocean planning and providing assistance to OPAC (LCC, 2011). One of OPAC's first duties was to create the Territorial Sea Plan (TSP) that would provide guidance to state agencies for activities within the Territorial Sea. The TSP is the marine spatial plan for the state of Oregon, since it is a framework for how to manage activities within a certain space of the ocean.

Figure 5: Geographic Scope of the Nearshore Research Inventory Project. This includes the shoreline of the Oregon coast out to the edge of the Continental Shelf (OCMP, 2012).

From 2005-2006, a number of wave energy companies submitted preliminary permit applications to FERC for the development of wave energy facilities off of the coast of Oregon. At the same time, a system of marine reserves was being proposed within the Territorial Sea. The combination of the marine reserve proposals and wave energy permit applications caused concern within coastal communities and the fishing industry. In 2008, Governor Kulongoski issued Executive Order No. 08-073, which directed state agencies to, "Protect Coastal Communities in Siting Marine Reserves and Wave Energy Projects" and DLCD to "seek recommendations from OPAC concerning appropriate amendments to Oregon's Territorial Sea Plan, reflecting comprehensive plan provisions on wave energy siting projects" (Kulongoski, 2008). With this directive, DLCD and OPAC became responsible for amending the TSP to include marine reserves and wave energy as a use of the coast and ocean in Oregon.

A new chapter of the TSP was created in November 2009, with guidance on how agencies should manage and regulate ocean renewable energy, and how data and information should be collected for potential siting of projects. The new chapter was adopted by the Oregon Land Conservation and Development Commission (LCDC), and is titled, “Part Five of the Territorial Sea Plan for the Development of Renewable Energy Facilities and Other Related Structures, Equipment, or Facilities” (OTSP, 2009). The plan is made up of recommendations made by OPAC and DLCD as part of the TSP amendment process.

DLCD and OPAC are currently in the second phase of the marine spatial planning process, which will follow and expand on the policy framework created in Part Five of the TSP. In this stage, there is a data collection and spatial analysis process, with meetings open to the public, to see where existing uses of the ocean occur, and to look to see where there are suitable places for marine renewable energy development that have the least conflict with other existing uses. This process relies on digital and spatial data to represent areas of use within the Territorial Sea. The areas identified by DLCD and OPAC to map and include in the marine spatial planning process are (DLCD, 2012):

(1) Fishing Areas;
(2) Marine Ecosystems;
(3) Recreation;
(4) Beneficial Uses;
    a. Navigation Channels;
    b. Dredge Material Disposal Sites;
    c. Telecommunication Cables;
    d. Pipelines and Outfalls;
    e. Research and Instrumentation;
(5) Jurisdictional Boundaries.

Each area of use (listed above) was categorized into the following four classifications and two overlays:

(1) Marine Renewable Energy Exclusion Area;
(2) Marine Conservation Area;
(3) Marine Resource Use Management Area;
(4) Marine Resource Development Area;
(5) Visual Impact Assessment Analysis Overlay;
(6) Marine Recreation Conservation Area Overlay.

As part of the MSP process, DLCD and the Territorial Sea Plan Working Group (a sub-committee of OPAC who is designated to work on the updates to the TSP) held a series of public working sessions in February and March of 2012, where any individual or stakeholder had the opportunity to comment on the maps of existing uses and potential renewable energy siting locations. Another meeting of the TSP Working group followed the public meetings. The working group is tasked with making recommendations to OPAC with regards to siting of the most suitable areas for potential renewable energy development within the Oregon Territorial Sea. OPAC will then make recommendations to LCDC, who will use these new recommendations to decide whether or not to adopt the new TSP plan, which would create an official marine spatial plan and framework for Oregon and allow for new uses of the coast and ocean, such as wave energy.

1.3 Wave Energy

1.3.1 Introduction

Today, dramatic increase in oil-prices, recognition that many of our energy sources are limited, and the desire for the development and deployment of renewable energy sources has spurred interest in ocean energy globally, including in the United States. Ocean energy is defined as renewable energy from the sea, which includes ocean wave energy, tidal and open-ocean current energy, tidal barrages, offshore wind energy, and ocean thermal and salinity gradient energy (Bedard et al, 2010). It is estimated that ocean energy could ultimately provide at least 10% of the electric supply in the United States (Thresher and Musial, 2010).

There are beneficial components to wave energy development, compared to other types of renewable energy sources such as wind energy, which make it attractive. One asset is the strength in our wave forecasting capabilities using satellites and indicator buoys, which can be critical for energy grid managers (Koch, 2008). In addition, wave energy devices have a lower profile and are likely to be less visible from the shoreline than wind turbines (Koch, 2008). Wave energy is also a local source of energy, since thirty-seven percent of the world's population lives within sixty miles of the coast, which creates a good match between source and demand for a resource (Cohen et al, 1997; Stefanovich, 2010).

There are also many barriers to wave energy development. With very few wave device arrays in existence, there are ecological, economic, regulatory, and social uncertainties associated with development. Wave energy devices are in the process of development, however, none have been deployed on a large scale (ECONorthwest, 2009). Baseline information can be collected, and test facilities can be used to estimate potential impacts. However, without a full-scale functioning wave array, it will be difficult to understand the full scale of ecological, social, and economic impacts, if any, of wave energy. There is also the issue of the potential cumulative impacts of wave energy when combined with other uses of the coast and ocean, such as fishing and shipping.

Relative to other renewable energy industries, such as wind and solar, the technology for wave energy is in a very young development phase (ECONorthwest, 2009; Stefanovich, 2010). It is estimated that there is significant economic potential, however, technological issues will need to be addressed before the industry can reach commercial stage (ECONorthwest, 2009). There are also uncertainties associated with connecting a wave energy source with the current electrical grid. Applicants for grid connection have constraints, including uncertainty about the generating equipment, and the process of financing and utility agreements (Pacific Energy Ventures, 2009). As a new industry, there is a need to develop regulatory policies and planning processes with regard to wave energy development (EPRI, 2004; Campbell, 2009). Many states are moving forward with this through the MSP process. It was very recently, in 2010, that federal level legislation for this process was passed, so many states are still working through the political and planning processes to include marine renewable energy development as uses of the ocean. There are also social uncertainties associated with wave energy development. Currently, there is a need for procedures for emergency situations (Advanced Research Corporation, 2009), such as a buoy or an array of devices breaking loose, or collision of boats with wildlife. There are a wide variety of other uses of the coast and ocean that wave energy device may conflict with, such as fishing and shipping (Conway et al, 2010; Gopnik et al, 2012). Like many other renewable energy industries, there are benefits to wave energy development, however, these benefits also come with potential costs and barriers to development.

1.3.2 Global History of Wave Energy

Converting energy from the ocean, and in particular waves, into power is not a new concept. For over two hundred years, engineers around the world have been developing and obtaining patents for different ocean energy technologies (Clement et al, 2002). From the first British patent in 1855 up until 1973, nearly three hundred and forty patents for wave-powered devices were in existence (Clement et al, 2002). As oil prices rose in 1973, there was a renewed interest in wave energy, and a number of university researchers began looking at its' potential (Vosough, 2011). In the 1980's, as oil prices went down, wave-energy funding was reduced (Vosough, 2011). Today, interest in renewable energy sources has once again been renewed following public and political awareness about climate change and disaster events such as the Deepwater Horizon-BP oil spill in the Gulf of Mexico.

1.3.3 Wave Energy in Oregon

Introduction

In Oregon, interest in wave energy development began in 2004. Electric Power Research Institute (EPRI), a company that conducts research and development related to electricity generation and delivery (EPRI, 2012), released a report stating that Oregon has "an excellent offshore wave energy resource" (EPRI, 2004). The report showed that in Oregon, there are favorable characteristics needed for wave energy development, including the prevailing winds and swell conditions of the Pacific Coast, as well as the favorable bathymetric features. The report also identified seven potential sites for wave energy devices in the ocean off the coast of Oregon, along with wave energy resource characterization for each of the potential sites. Other research, in addition to this report, identified the existing coastal transmission capacity that would help transmit generated power from the coast to communities (EPRI, 2004; Brekken, 2007; Stefanovich, 2010). The positive reviews about Oregon's potential for wave energy spurred economic and politic interest. As of March 2012, FERC has issued two preliminary permits for wave energy devices off the coast of Oregon (FERC, 2012). A preliminary permit does not authorize construction, however, it gives the permit recipient priority in filing for a license when they have completed all of the studies that are required as part of the licensing process (FERC, 2012). No licenses have been issues in Oregon to date, however, Ocean Power Technologies will likely receive a permit to deploy grid connected buoys off the coast of Oregon (Busch, J., personal communication, May 18, 2012). Other companies are also interested in moving forward with the wave energy development process by testing buoys off the coast of Oregon at the Northwest National Marine Renewable Energy Center test berth site (Busch, J., personal communication, May 18, 2012).

Physical Landscape

The total available wave energy resource along the West Coast of the United States is estimated to be five hundred and ninety TWh/yr (EPRI, 2004). Out of all of the coastal regions in the United States including Alaska, Hawaii, the Gulf Coast, and all of the states along the Atlantic Coast, Oregon was identified as the second best location for ocean energy generation, and in particular wave energy (Gregoire et al., 2009).

According to the 2004 EPRI report, there are two main physical characteristics that make Oregon a good place for wave energy development. The first is the oceanographic features of the Pacific Ocean and specifically, the Oregon coast (EPRI, 2004). Wave energy is generated as wind blows over the ocean to create ripples that eventually turn into ocean swells (Bedard et al, 2010), which with the large span of the Pacific Ocean, can create large swells. Wave energy developers also look for locations that are considered sea state "hot" spots, where there are areas of wave focusing (EPRI, 2004). In addition, locations with deep water that are also relatively close to the shore are desirable (EPRI, 2004). The bathymetry and surficial geology are also important for minimizing potential problems with mooring a device and routing cables over the ocean bottom (EPRI, 2004). Oregon has all of these features, including an already existing underwater telecommunication cable network, demonstrating the required physical characteristics for wave energy development.

The second physical characteristic is that Oregon has an electrical grid infrastructure needed to support energy transmission to land from the coast (EPRI, 2004). The combination of these two physical characteristics in Oregon has stimulated industrial and political interest in marine renewable energy investments off the coast of Oregon.

Political Landscape

In 2006, Oregon Governor Theodore Kulongoski proposed a renewable portfolio standard (RPS) in Oregon, calling for twenty-five percent of the state's electricity to be generated from renewable energy as part of Oregon's Action Plan for Energy (Kulongoski, 2006). RPS's are policies that help ensure that a percentage of a state's energy sources are from renewables such as wind, solar, biomass, and wave energy (Huang et al, 2007). As a result of this policy, wave energy companies in Oregon have benefited, including $10 million provided to Oregon Wave Energy Trust (OWET) for the sustainable development of wave energy (Busch, J., personal communication, May, 18, 2012).

In 2008, Governor Kulongoski signed and released a MOU with FERC (ODFW et al, 2007). The purpose of the MOU was to, "coordinate the procedures and schedules for review of wave energy projects in the Territorial Sea of Oregon and to ensure that there is a coordinated review of proposed wave energy projects that is responsive to environmental, economic, and cultural concerns while providing timely, stable, and predictable means for developers of such projects to seek necessary approvals" (ODFW et al, 2007, p. 1). The MOU also stated that the state of Oregon would prepare a comprehensive plan for siting of wave energy facilities in Oregon, and in turn FERC will take the plan into consideration when issuing a preliminary permit, pilot project license, or any other project license for a wave energy facility (ODFW et al, 2007). This comprehensive plan would be part of an amended version of the TSP. The RPS, funding, and MOU give a positive political atmosphere for wave energy development off of the Oregon coast.

Regulatory Landscape

Applying for a wave energy facility license is a two-phased process. The first step is filing for a preliminary permit and the second step is filing for a license (Campbell, 2009). The preliminary permit allows for a developer to have priority over a specific geographic area for up to three years, in which they have time to conduct feasibility studies, assess potential environmental and social impacts, and test wave energy devices (Campbell, 2009). As part of the permit process, the applicant must "meet with Department of State Lands (DSL) staff, affected ocean users, and other government agencies having jurisdiction in the Territorial Sea to discuss possible use conflicts, impacts on habitat, and other issues related to the proposed project" (Pacific Energy Ventures, 2009, p. 8). The second step in the process, filing for a license, will depend on which of the filing types the developers choose. This step will be easier and take less time for projects that have been endorsed by stakeholders and related agencies before filing (Campbell, 2009).

Oregon recently amended the TSP to include wave energy as a use of the ocean. Therefore, there are now standards for permitting wave energy facilities, which give companies guidelines to follow so they can receive approval from DSL and a license from FERC.

Social Landscape

Research conducted on public perception of wave energy development in Oregon found that the overall attitude of the public towards wave energy is positive (Stefanovich, 2010). However, people are still uncertain about the benefits and costs of renewable energy because they do not have enough information about wave energy in order to make a decision about whether to support or be in opposition of development (Stefanovich, 2010).

An event that occurred in late October of 2007 raised awareness about potential issues with wave energy devices off of the coast. An experimental wave energy buoy placed off of the Oregon coast by Finavera Renewables Inc. had buoyancy issues as water leaked into the device causing it to sink to the ocean bottom. With no plans in place for emergency response to events like the sinking Finavera buoy, the buoy was left on the bottom of the ocean for months. The buoy has since been removed, however, events like this can leave the public and other stakeholders uncertain about the potential danger and damage that wave energy development can cause.

Other stakeholder groups also have opinions about wave energy development. In 2007, the FERC approved a preliminary permit for Ocean Power Technologies (OPT), a wave-energy development company, to study an area off the coast of Reedsport, Oregon as a potential site for an array of wave energy buoys. As part of the permitting and licensing process, OPT held a series of meetings with the public in and around Reedsport, Oregon to engage stakeholders. During these meetings, crab-fishermen expressed their concerns that the proposed wave energy facility would be located in the middle of important crabbing grounds. Potential conflict between wave-energy facilities and other human uses of the ocean are apparent, and these conflicts need to be addressed in order for development to move forward.

Another stakeholder group whose use of the ocean may conflict with wave energy devices is the recreational, or non-consumptive, community. A study conducted by Surfrider Foundation in 2011 identified twenty-nine recreational activities that the public participates in when visiting the Oregon Coast (LaFranchi et al, 2011). Another study by Eardley and Conway was conducted in 2010 to understand the non-consumptive recreation communities' views about alternative-energy development. The study targeted four types of recreation; waveriders, divers, boaters, and boat-based wildlife viewers. Out of all of the groups of non-consumptive users, waveriders expressed the most familiarity with wave energy, as well as the most concern. Other studies have also found similar concern amongst surfers about the potential negative impacts of wave energy on their ability to recreate (Hunter, 2009). However, in terms of recreation, there have also been positive impacts as a result of coastal development. Nine Oregon surf breaks were improved after the installation of jetties that altered sand movement (Corne, 2009). In addition, several of the same structures are now improved scuba-diving areas, due to improved access and habitat creation for wildlife (Eardley and Conway, 2010). In general, the actual impact of wave energy development on recreational communities will not be well understood until devices are actually in place, but there is still concern amongst the community.

Public views of wave energy should play a role in management decisions. Even though there is political and economic interest in wave energy development in Oregon, social acceptance will be an important factor in moving the development process forward in a timely fashion. The licensing process for wave energy will require stakeholder and public engagement and acceptance, so public and stakeholder perceptions about wave energy development need to be recognized.

Outlook for Wave Energy in Oregon

Overall, there are many uncertainties associated with the potential ecological, economic, and social impacts of wave energy development. Despite these uncertainties, the desirable physical characteristics outlined by EPRI, and the political climate of Oregon means that wave energy is more than likely on the horizon for the state.

1.4 The Role of Science in Ocean and Coastal Policy and Management Decisions

1.4.1 Introduction

State, regional, and national level ocean and coastal policies call for decisions to be made using best available science in marine spatial planning processes. Understanding ecological, social, and economic processes and issues surrounding a coastal and ocean resource is critical, and decisions should not be made without understanding and acknowledging all of these pieces (McLeod and Leslie, 2009).

MSP is a tool for ecosystem based management of ocean and coastal resources (McLeod et al, 2005). MSP processes around the world are moving forward, and will require scientific information to fill key information needs and gaps despite limited funding resources for scientific information (Halpern et al, 2012). This will require the scientific community to provide information and the management community to effectively incorporate science into decisions. Both communities will need to work together to effectively conduct MSP processes for successful ecosystem based management practices.

1.4.2 Science in State, Regional, and Federal Policies Related to Marine Spatial Planning

Goal 19 of Oregon's Statewide Planning Goals and Guidelines states that within the Ocean Stewardship Area, the State of Oregon will "encourage scientific research on marine ecosystems, ocean resources, and oceanographic conditions to acquire information needed to make ocean and coastal-management decisions" (DLCD, 1976, p. 1).

On a regional level, priority area six of the WCGA states, "Connecting science to management is a crucial foundational piece of any decision-making process, particularly for ocean and coastal policy" (Gregoire et al., 2008, p. 76). In this priority area, one of the main three actions is to "urge full federal support for the long-term maintenance of ocean observing systems and monitoring assets" (Gregoire et al., 2008, p. 87). Long-term data are also important for achieving other goals of the WCGA such as understanding water quality issues (eg. hypoxia, ocean acidification) and monitoring and adaptive management of ocean energy development. Therefore, continuing coastal and ocean research is a priority for regional ocean and coastal initiatives.

In 2009, the White House Council on Environmental Quality's Interagency OPTF made a unanimous recommendation for improved "Stewardship of the ocean, our coasts, and Great Lakes" (OPTF, 2009, p. 1). In order to complete this recommendation, OPTF calls for a "Comprehensive, adaptive, integrated, ecosystem-based, and transparent spatial planning process, based on sound science" (OPTF, 2009, p. 2). The scientific research conducted in Oregon will help inform decision-makers locally, regionally, and federally to make the most science-based policy and management decisions.

1.4.3 The Role of Science in Ocean and Coastal Management Decisions

It is apparent that many of the ocean and coastal policies today, at multiple governance levels, call for decisions to be made using the best available science. The issues underlying these policies, such as fisheries management and climate change, are inherently complex (McLeod et al, 2005). In an ecosystem-based management approach to managing coasts and oceans, decision makers are charged with emphasizing the protection of structure, functioning, and key processes to ensure a long-term delivery of important ecosystem services (McLeod et al, 2005). Managers look to incorporate many different aspects of a system including ecological, social, and economic factors in order to make decisions about how the ecological system should be used in the future. Managers have the responsibility of making tradeoffs amongst the different factors being incorporated into the decision, including science.

1.4.4 Types of Science in Management Decisions

Science can be defined as "information gathered in a rational, systematic, testable, and reproducible manner" (Lackey, 2007, p. 4). It is the role of scientific research community to conduct research and to interpret the resulting science (Lackey, 2007). Historically, natural science was conducted with the simple goal of understanding the structure, functioning, and processes of an ecosystem, and treated more as a discovery or baseline of knowledge about a subject. Today, a lot of science is driven by the need to grow a scientific body of knowledge so effective decisions can be made in order to resolve a political dispute (Sarewitz, 2004). Funding structures for scientific research can result in a purpose-driven research agenda that fails to look forward at unresolved issues and the larger ecosystem level questions humans face in the future (Southall and Nowacek, 2009).

Science can come out in two forms: policy neutral (apolitical) or normative (Lackey, 2004; Carver, 2010). Policy neutral science is "a way of learning about the world and it is characterized by transparency, reproducibility, and independence" (Lackey, 2004, p. 2). It is the science that is empirical, objective, and unbiased that is the baseline for sound science (Rice, 2011). Normative science is defined as "information that is developed, presented, or interpreted based on an assumed, usually unstated, preference for a particular policy or class of policy choices" (Lackey, 2004, p. 2). As the drive for science shifts from discovery to decision, funding, and need-based, there is greater potential for science to become laden with policy preferences of those conducting scientific research and the agencies that fund the research.

1.4.5 The Future of Science in Management Decisions

In marine resource management decisions today, science typically lies in the center of the debate (Sareitz, 2004). As the drive for science shifts because of the need to make policy decisions as well as the narrowed scope of funding agencies, there is a risk for science to become normative. Normative science can potentially distort how managers interpret the science, causing tradeoffs to become swayed in the direction of the policy preferences of those conducting scientific research. Science that informs decisions makers should come from individuals conducting sound science, and caution should be taken when scientific recommendations come from sources that may be laden with policy preferences. There is currently, and will continue to be, a need for scientific information that is free of policy preferences so that sound information can inform management decisions.

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Chapter 2: Oregon's Nearshore Research Inventory Project

2.1 Introduction

This chapter provides background information, methodology, and results for the Oregon Nearshore Research Inventory (NRI) project. This section is a subset of a report provided to the Department of Land Conservation and Development (DLCD) with the results of a year-long project and internship. Funding for the project came from the Coastal Zone Management Act of 1972, as amended, administered by the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration (NOAA), and the Ocean and Coastal Management Program, Department of Land Conservation and Development. The full report is available online at www.oregonocean.info.

The NRI is a research project designed to inventory and map the current and future use of Oregon's nearshore environment by the research community. A database of information related to the research was generated using in-person interviews designed to collect the details of project type, project location, physical parameters being studied, and contact information.

The objectives of the NRI project were to:

(1) Share information with the research community about the current marine spatial planning process in Oregon;
(2) Inventory the current research projects within the nearshore environment bordering Oregon;
(3) Identify when (over what time period), where (geographically off the Oregon coast), and what type of research is being conducted;
(4) Create a spatial footprint (map) using GIS tools such as Google Earth and ESRI's ArcMap to identify the locations where the research occurs off the coast of Oregon;
(5) Provide recommendations for maintaining and updating a database of research within the coastal and ocean environments of Oregon.

The results of the NRI project provide information about the research being conducted within coastal and ocean environments bordering Oregon, the primary focus being on the collection of geospatial information, which was used to create a spatial footprint of the extent of ocean and coastal use by the scientific research community. The data from the project was integrated within a geographic information system (GIS) into ESRI shapefiles representing different uses of the ocean associated with existing and planned research projects. The completed inventory was also used to generate Google Earth KML files, which were integrated into Oregon MarineMap, a GIS, to inform the Ocean Policy Advisory Council (OPAC) and the Territorial Sea amendment process in Oregon. In addition, the results of the project are available for the public online, and can act as template for other states to engage the research community in their marine spatial planning processes.

2.2 Methods

This project was completed through a series of interviews and interpersonal communications with the scientific research community. The project was conceived of and advised by a small group of interested researchers and community members, who also served in an ad-hoc way as liaisons for the project. The Department of Land Conservation and Development (DLCD) funded the project, and the work was done as part of an internship for DLCD. The work was completed over the course of one year with supervision and technical assistance provided by the Coastal Natural Resources Specialist and Coastal Atlas Administrator within DLCD.

The NRI was completed by identifying key persons within the scientific research community, designing interview guides and a database to capture the relevant information, conducting interviews, compiling the results, confirming the accuracy of the results through a verification step, compiling the results into a set of GIS files, and then analyzing and mapping the resulting database of information. The following sections of the document provide the details of each step in the process used to complete the project and the results of the project.

2.2.1 Identifying Project Participants

Key individuals, acting as key informants (Marshall, 1996), associated with scientific research institutions were targeted in the beginning of the project to gain background information on the nearshore research community in Oregon. Staff at DLCD provided a preliminary list of individuals who would act as key informants in addition to agencies associated with ocean and coastal scientific research. This list was developed based on DLCD's knowledge of research and existing partnerships as the Coastal Management Program in Oregon. The list included scientific researchers as well as principal investigators for research projects. To supplement the list provided by DLCD, targeted research was conducted online to find more contacts for scientific research projects.

Key informants were contacted through email, where they were requested to participate in an informal discussion. Ideally these discussions were conducted in-person, however, due to distance and scheduling, some were conducted over the phone. Using a snowball sampling technique (Robson, 1993), the key informants identified potential contacts for principal investigators of scientific research projects. In addition, the key informants reviewed and gave feedback on the interview questions to be used to guide interviews with the principal investigators (PI) whose research would be included in the NRI.

2.2.2 Oregon State University Institutional Review Board Approval

Prior to contacting people to participate in the project, information about the NRI project, including the project background and purpose, as well as supporting documents (including the interview guides), were submitted to the Institutional Review Board (IRB) at Oregon State University (OSU). The purpose of the IRB is to promote the rights and welfare of human research participants, facilitate ethical research, provide guidance to the research community, and assist the research community with complying with federal regulations surrounding human research. See Appendix 1 for the letter of approval from OSU's IRB office.

2.2.3 Geographic Scope of Research

The geographic area being researched for this project is the nearshore environment off the Oregon coast, which includes the shoreline up to the edge of the continental shelf. See Figure 5 as a reference for the geographic area being included in the NRI.

NOTE: Estuarine research was not included in the NRI due to time and budgetary restrictions. The focus of the inventory efforts is designed to inform activities primarily within Oregon's Territorial Sea.

2.2.4 Research Criteria

The purpose of identifying the research was to include it in the Territorial Sea amendment process in Oregon. Therefore, the following two criteria were identified as filters for including research in the Inventory:

(1) The research must be repeated in a geographic space;
(2) The research must be ongoing, and/or planned for the future.

The first criterion was used because many research projects will have a single-use of a geographic area, and no plans to conduct research in the area again. This type of research would not be relevant to the planning process because there would be little to no conflict over future use of that space because there is no tradition of use for that space and there is no expectation for continued use. The second criterion of planned future research helped ensure that research projects included in the NRI would be active in the future. Research projects that would not use future ocean space would not have potential for conflict with other uses of the ocean. This second criterion was determined by whether or not the research had future funding. Since most of the research off of the Oregon coast is funded by soft money (such as grants and other temporary funding), this criterion was met by research that already had future funding associated with it, or by who had grant applications currently submitted for funding for their research.

2.2.5 Background Research

Background research was conducted online to find the websites of known scientific research institutions and other entities conducting scientific research. There are many websites that spatially identify where research is being conducted. Since the critical piece of information being collected for the NRI was the geographic scope of the research, the websites that listed this type of information were particularly helpful at providing this information for the research projects. In addition to the spatial information, the websites provided background information on the research that provided context prior to the key informant, scoping, and formal interviews. In particular, the following websites provided good geographic context for ocean and coastal research:

- 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.
- 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.

2.2.6 Interview Guide Design

Two interview guides were designed to guide ethnographic, semi-structured interviews (Robson, 1993) that would collect information on the research being conducted within the nearshore environment off the coast of Oregon: a scoping interview guide and a formal interview guide.

The scoping interview guide was developed to guide a short, initial interview with the individuals conducting research to see if their research met the two criteria to be included in the NRI. The format was a predetermined set of questions used to guide the interview process (Robson, 1993), and included questions about the background and purpose of the research, the geographic scope of the research, as well as the timeline for research. These interviews were conducted primarily over the phone, however, in some cases they were conducted in person if the opportunity to meet in person was convenient for the participant. The length of the scoping interview was designed to be fifteen minutes long. The guide for the scoping interview is included as Appendix 2.

Questions for the formal interviews were developed based on protocol for conducting a data interview, which is included as Appendix 3 (Witt and Carlson, 2007). Questions for the formal interview guide were broken down into the following five categories:

(1) Project background and information;
(2) Geographic data information;
(3) Research timeline;
(4) Future planned research or data use;
(5) Contact information.

The focus of the formal interview was to collect data on the geographic footprint of the research. However, in order to understand the context behind why research is being conducted in a certain area, it was important to ask about the purpose of the research and other related information. Therefore, the results of the NRI project will provide baseline information about what kind of research is being conducted and why it is being conducted in the nearshore environment off the coast of Oregon. The formal interview guide was used to structure and guide the formal interviews with the researchers in order to collect consistent data for each research project. The formal interview guide is included as Appendix 4.

2.2.7 Database Design and Schema

The database was designed in Microsoft Access, using the questions in the formal interview guide as a template for the overall structure, and to develop tables, fields, and connections within the database (Figure 6). Three main types of data were entered into the database: organizations, project contacts, and data resulting from the interviews.

The organization portion of the database includes a list of the educational institutions, agencies, and other organizations that were contacted to participate in any part of the project. The organizational information includes the main title of the organization, as well as any sub-classes of the organization, such as a specific lab within a university, or a specific department within an agency. It also provides the contact information, address, email, and website for the organization.

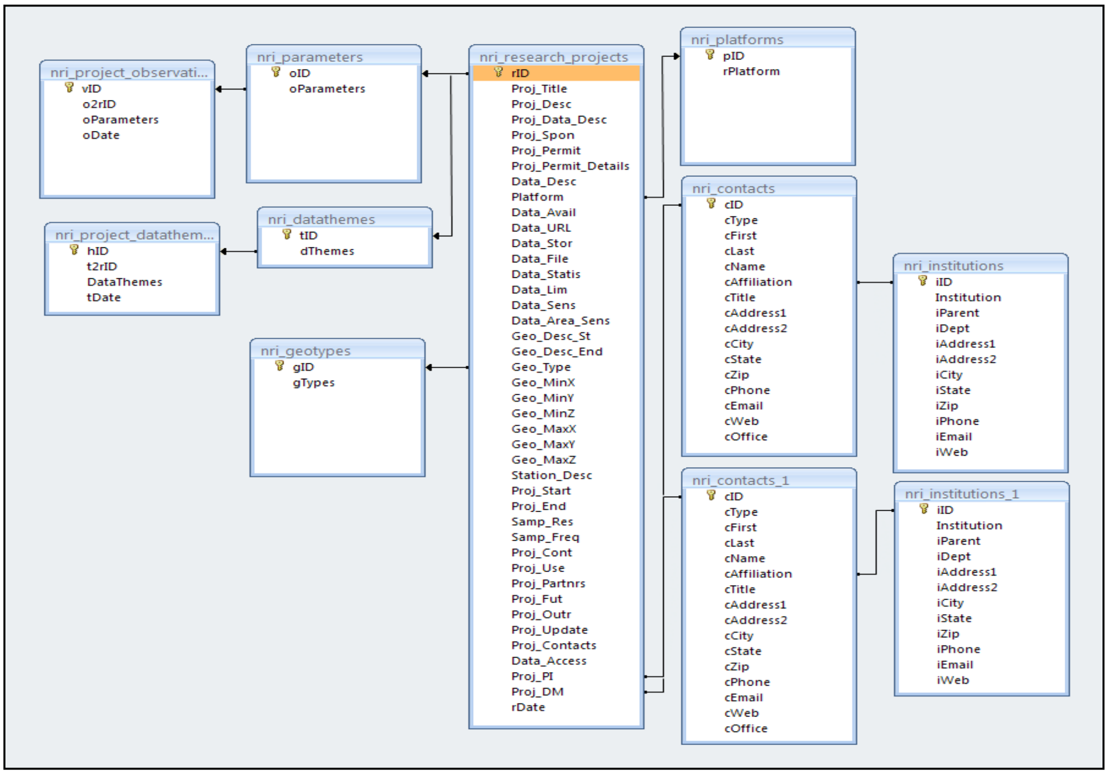

Figure 6: NRI Database Schema as Designed in Microsoft Access.

The project contacts portion of the database was sub-divided to include three types of individuals: related-project contact, PIs, and data managers. The related-project contacts were the key informants identified by DLCD. The PIs are the individuals who were interviewed and who are the scientist in charge of the scientific research projects. The data manager is the person associated with research that manages the data, and is the individual who the public can contact to request data for the particular research project. In some cases, the PI and data manager are the same person.

The data portion of the database was broken down into the same five categories that were used in the formal interview guide (project background and information, data information, research timeline, future planned research or data use, and contact information).

The database had four fields of data generated per record that were specified in the database for the purpose of research characterization; those were project data theme, geographic type, project platforms, and project parameters. The project data theme field categorized research into the following five categories:

(1) Biological;
(2) Chemical;
(3) Physical;
(4) Geological;
(5) Hydrographic.

Each project could have one or more categories of data associated with it. The data was categorized by the type of geographic space that the research occupied in the nearshore, which were categorized into the following three categories:

(1) Marine research points;
(2) Marine research lines;
(3) Marine research areas.

Each project could have one or more category of geographic space associated with it. The geographic type of research was subdivided into five more categories, and further subdivided into twelve types of research platforms (Figure 7).

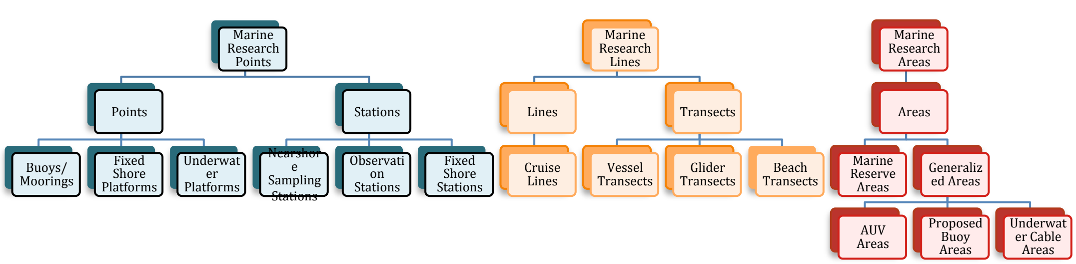

Figure 7: NRI Schema for Geographic Categorization.

The database also included a list of generalized study parameters, which are the data that are measured for each of the research projects included in the NRI (each project could have multiple parameters associated with it). The full list of parameters included in the database is listed in Appendix 5. Modification of the database was required at several points in the study for the addition of research parameters that were not included at the beginning of the NRI project. Care was taken to be consistent with the terminology for the parameters in the database in order to reduce redundancy. Since this list was pre-defined at the start of the study, there are parameters listed in the database that are not included in research projects within the NRI.

2.2.8 Interview Methods

Participants were recruited to participate in scoping interviews through email. After the scoping interview, if the research of the participant met the criteria to be included in the NRI, a formal interview was requested either on the phone, or through email.

Participant Recruitment

PI's identified during the key informant discussions and background research were emailed a request for their participation in the project, including a recruitment letter that gave purpose and background information on the project (Appendix 6). Upon response from the researcher to participate in the project, a preliminary interview was scheduled.

Scoping Interview

During the first portion of the key informant interview, context and purpose for the NRI project was explained to the participant. This included information about the marine spatial planning process in Oregon, and the potential for conflict between scientific community and potential wave energy devices. The participant was told that their participation in the project was completely voluntary. The purpose of the scoping interview was to establish if the research met the criteria to be included in the NRI (Bunting, 2007).

If the research met the criteria for inclusion in the NRI, relevant documentation about the research was requested (such as cruise plans, scientific journal articles, or project proposals) that would aid in providing information for the formal interview. Of particular importance, detailed geographic information about the location of the research was requested. The formal interview was requested, and in some cases scheduled, during the scoping interview. Other relevant project contacts, information, and scheduling for the formal interview was discussed through email in follow up to the scoping interview.

If the research was not suitable for inclusion in the NRI, the researcher was thanked for their participation in the scoping interview and they were not asked to participate further in the project.

NOTE: Many researchers indicated a desire to be included in a more comprehensive inventory of nearshore research, and felt that a project that included all research, not just research that met the criteria for this project, would be valuable for the purposes of a gap analysis. It was noted by many that an inventory of all research would be very time consuming and challenging.

Formal Interview

The formal interview began with an introduction and context to the NRI project, in a similar style as the scoping interview. The formal interview began by answering any of the participant's questions and discussing any concerns about the project. The participant then received an explanation about the process of the interview, and was also given the criteria for which research projects would be included in the NRI. If a researcher had more than one research project that met the criteria to be included in the NRI, each research project was identified and given a nickname in order to easily refer back to each projects during the interview process.

During the formal interview, an audio-recorder was used to aid in capturing information. Prior to recording an interview, the participant signed a waiver of consent to be audio-recorded which included background information on the project, and stated that they understood that their participation in the project is completely voluntary. The waiver of consent can be viewed in Appendix 7. The main purpose of audio-recording an interview was to use the audio-file as an aid during the data entry process to reference details from the interview. The audio-recordings were not transcribed as part of this project.

During the formal interview, questions from the formal interview guide were asked, and notes outlining the participant's responses to each question were taken on a personal computer. If there was information that was already documented during the scoping interview, or from any files that were provided after the scoping interview, the information was stated as questions in order to confirm the accuracy of the previously collected information. If there was sensitivity of any information, the researcher could request for that information not to be included in their records. Sensitivity was also taken in consideration for files provided as background information for the research (such as a grant proposal). If a participant did not want to include the background files in the final product to be included in the NRI, they could opt not to include them. Otherwise, background documents and other information were included in the participant's file for any future research done on this subject.

Sensitivity of spatial information was taken into account by allowing participants to spatially generalize their research information using a buffer distance of their choosing. During preliminary discussion before the start of the project, some individuals expressed concern about identifying the specific geographic location of certain instruments in the water. Each participant was given the opportunity to place a buffered distance around the area where his or her research is located in addition to the option of not sharing the information at all.

The geospatial information collected for each research project was captured differently, depending on the resources and preferences of each of the participants. Most of the spatial information was determined from already existing resources, such as ESRI shapefiles, Microsoft Excel documents with spatial coordinates of the research, PDF documents, or websites with data available, all of which were provided by the researcher. Table 1 identifies how the spatial information was captured for each of the research projects included in the Inventory.

When the formal interview was complete, the researcher was thanked for their participation. They were informed that they would receive a follow up email that included their responses from the formal interview, as well as the geographic scope of their research in order to confirm the accuracy of the results from the interview. After each interview, the resulting data was entered into a database through an online data entry tool developed by DLCD and housed on the http://www.oregonocean.info webserver. The online data entry tool can only be accessed by individuals with permission and login information to access the website. After data entry, the data collected for each record of a project was made reviewable online using a specific website link, or URL, that was built for the purpose of facilitating participant review of the data associated with their projects.

The spatial information was not recorded in the online data entry tool. Each file of spatial information was transferred into a single table (Microsoft Excel document) to be used in the geospatial display of the information in Google Earth KML (keyhole markup language) files. The data was converted to KML from a Microsoft Excel file using an online data conversion provided by Earth Point (http://www.earthpoint.us/ExcelToKml.aspx). The template for entering the data into excel is listed in Appendix 8. Each KML file includes the name of the project, the PI, the parameters measured, and the spatial identifier (title/name of the research project) for the research area.

After data entry, each participant was sent a follow up email that included the following information:

(1) The spatial data (in KML format) for their research
(2) Results from the interview (which were entered into online data entry tool) in PDF format. In addition, the URL link to the results of their project on the oregonocean.info website was included.

The participant had the opportunity to update or comment on the information provided in the follow up email. At this point, they also had the opportunity to withdraw from participating in the project. Researchers who had multiple research projects to be included in the NRI received a PDF and KML file for each record created within the database.

Table 1: NRI Spatial Data Capture.

Project Title:	Spatial Data Capture (primary, secondary)
Acclimation and Adaptation to Ocean Acidification of Key Ecosystem Components in the California Current System	Online data
Affects of Hypoxia on Species Distribution off the Coast of Oregon	Journal article
Center for Coastal Margin Observation & Prediction Research	Online data, journal article
Center for Operational Oceanographic Products and Services	Online data
Coastal Data Information Program	Online data
Coastal Observation and Seabird Survey Team	Online data
Dynamics of Hypoxia	Interview: coordinates identified verbally
Effects of Biotic and Abiotic Environmental Conditions on Early Marine Life History of Salmon	Cruise plan
Effects of Hypoxia on Ichthyoplankton and Micronekton Communities off the Oregon Coast	Geographic information sent by the PI by email
Influence of Ocean Acidification on Estuaries	Interview: coordinates identified verbally
International Pacific Halibut Commission Annual Standardized Stock Assessment Survey	Geographic information sent by the PI by email
Long Term Zooplankton Sampling and Monitoring of the Newport Hydrographic Line	Cruise plan
Mapping Oregon Coastal Currents	Online data, Interview: coordinates identified verbally
Microbial Initiative in Low Oxygen areas off Concepcion and Oregon (MILOCO)	Interview: coordinates identified verbally, Online data
Monitoring Spatial and Temporal Patterns of Recruitment of Invertebrates to Rocky Shores along the West Coast	Online data
National Data Buoy Center	Online data
Northwest National Marine Renewable Energy Center	Geographic information sent by the PI by email
Ocean Observatories Initiative	PDF of scoping document, cables digitized by hand from PDF of scoping document to capture spatial information
Oregon Beach and Shoreline Mapping and Analysis Program	Geographic information sent by the PI by email
Oregon Beach Monitoring Program	Online data
Oregon Dead Zone - Hypoxia: Pre-Upwelling Conditions	Geographic information sent by the PI by email
Oregon Marine Reserves Research and Monitoring	Geographic information sent by the PI by email
Oregon Nearshore Bathymetry Surveys	Geographic information sent by the PI by email
Oregon, California, Washington, Line-Transect and Ecosystem (ORCAWALE) Survey	Online data
Pacific Ocean Coast Tracking (Kintama)	Geographic information sent by the data manager by email
Physical and Biotic Links between Estuaries and the Nearshore Pacific Ocean	Geographic information sent by the PI by email
Responses of Ecologically Important Species to Thermal Stress at Local and Regional Scales.	Online data
Restoration and Recovery of Native Olympia Oysters	Geographic information sent by the PI by email
Scaling Up from Community to Meta-Ecosystem Dynamics in the Rocky Intertidal - A comparative-Experimental Approach	Online data
Species Interactions Over Space and Time, and how these Interactions are Influences by Nearshore Ocean Conditions.	Online data
Telecommunication Cable Maintenance	Geographic information sent by the PI by email
Upwelling Dynamics from Days to Years Using Underwater Gliders	Interview: coordinates identified verbally
Wave Observations at the Mouth of the Yaquina (Newport, Oregon)	Geographic information sent by the PI by email
Zooplankton Sampling and Monitoring of Southern Oregon Lines	Cruise plan

2.2.9 Data Analysis Methods

The following data analysis methods were used to find results of where and when research is being conducted in the nearshore environment:

(1) Identification of categories of research efforts off the coast of Oregon;
(2) Density analysis of the intersection between research and the Oregon Marine Spatial planning grid;
(3) Analysis of timeline for each research project;
(4) Identification of quantitate data resulting from the interviews in order to better understand the research community and the future actions that need to be taken to work with them as a stakeholder group in marine spatial planning.

The data collected in the scoping and formal interviews were organized into common marine data types based on the Arc Marine Data Model (Appendix 9). The categories of research include marine research points, marine research lines, and marine research areas. These research categories were then further subdivided into types of research platforms, as seen previously in Figure 7. Some research projects had multiple platforms for data collection, and therefore had multiple categories of research.

ESRI shapefiles were created for each of the five subdivided categories: research points, research stations, research lines, research transects, and research areas (polygons). Each entry for each shapefile has all of the associated documentation about each research project. In addition, each shapefile has fully documented metadata that meet the Federal Geographic Data Committee (FGDC) and ESRI standards. A list of research projects and their spatial classification is presenting in Table 2.

A density analysis was conducted using the planning grid developed by DLCD (DLCD, 2010). The DLCD planning grid cell sizes are approximately one mile by one statute mile. Using the spatial join analysis in the overlay category of the Analysis Tools Toolbox in ESRI's ArcMap, tables from the DLCD planning grid layer were joined with the nearshore research feature layers including points, stations, lines, transects, and areas that represent features of research along the Oregon coast. After a join was completed, the new planning grid feature layer representing the joined attributes was used to join the next feature layer. Each research feature layer was represented in the planning grid attribute table by the number of research projects that intersected within each of the planning grid cells. This process continued until all of the research feature layers had counts for each of the planning grid cells. Density was calculated based on number of research project intersections per planning grid cell.

The researcher conducting the analysis determined ranges of the number of projects included in the categories of density. The density of research was broken down into five categories.

(1) Very high density of research: 12-16 projects;
(2) High density of research: 8-11 projects;
(3) Medium density of research: 4-7 projects;
(4) Low density of research: 2-3 projects;
(5) Very low density of research: 1 project.

The data was also analyzed based on timeline for the research. The ranges for the timeline of research were determined based on the data in the NRI and typical lengths of funding for scientific research projects. Each research project was divided into the following four timelines for research:

(1) Short-term research (conducted over 1-3 years)
(2) Medium-term research (conducted over 4-9 years);
(3) Long-term research (conducted over 10 years or more);
(4) Unknown.

In addition, the data was analyzed for frequency and seasonality. The ranges for the frequency and seasonality periods were determined based on the data in the NRI. Each research project was divided into the following seven periods:

(1) Triennial (research is conducted every three years);
(2) Biennial (research is conducted every other year);
(3) Annually: Winter (December-February);
(4) Annually: Spring (March-May);

(5) Annually: Summer (June, July, August);
(6) Annually: Fall (September-November);
(7) Annually: Year-Round.

2.3 Results

2.3.1 Projects

In total there were thirty-four scientific research projects included in the NRI. Table 3 lists all of the projects included in the NRI.

2.3.2 Project Contacts

The Nearshore Research Inventory has three types of contacts in the database and they include: key informant participants, scoping interview participants, and formal interview participants. All of the participants in the NRI are listed in Appendix 10.

There are individuals who participated in the scoping interviews whose research projects were not included in the NRI because the scientific research project did not meet the criteria to be included in the NRI, or did not follow up with information or participate in a formal interview. There were occasions when only a scoping interview was possible, and there was sufficient information for the project to be included in the NRI without the formal interview. Please note that the NRI database includes a more comprehensive list of individuals who were contacted to participate in this project than what is listed in the Appendix 10. These individuals either did not respond to the requests to participate, or their research did not fit the criteria to be included in the NRI. These individuals were identified during the key informant discussions as people who conduct research in the Oregon nearshore environment, and therefore, their contact information is included in the NRI even though their scientific research projects are not included.

2.3.3 Project Participants

Thirteen key informant discussions were conducted with individuals connected with to the research community and the participants. Thirty-one scoping interviews and fifteen formal interviews were conducted with scientific researchers in Oregon. All of

Table 2: NRI Scientific Research Projects by Spatial Data Classification

Marine Research Points	Points	**Buoys/Moorings**	Acclimation and Adaptation to Ocean Acidification of Key Ecosystem Components in the California Current System
			Center for Coastal Margin Observation and Prediction
			Coastal Data Information Program
			National Data Buoy Center
			Ocean Observatories Initiative
		Fixed Seafloor Platform	Ocean Observatories Initiative
			Pacific Ocean Coast Tracking (Kintama)
		Fixed Shore Platforms	Mapping Oregon Coastal Currents
			Wave Observations at the Mouth of the Yaquina (Newport, Oregon)
	Stations	**Sample Stations**	Center for Coastal Margin Observation & Prediction Research
			Dynamics of Hypoxia
			Effects of Biotic and Abiotic Environmental Conditions on Early Marine Life History of Salmon
			Effects of Hypoxia on Ichthyoplankton and Micronekton Communities off the Oregon Coast
			Influence of Ocean Acidification on Estuaries
			International Pacific Halibut Commission Annual Standardized Stock Assessment Survey
			Long Term Zooplankton Sampling and Monitoring of the Newport Hydrographic Line
			Microbial Initiative in Low Oxygen areas off Concepcion and Oregon (MILOCO)
			Oregon Dead Zone - Hypoxia: Pre-Upwelling Conditions
			Physical and Biotic Links between Estuaries and the Nearshore Pacific Ocean
			Restoration and Recovery of Native Olympia Oysters
			Zooplankton Sampling and Monitoring of Southern Oregon Lines
		Observation Stations	Coastal Observation and Seabird Survey Team
		Fixed Shore Stations	Acclimation and Adaptation to Ocean Acidification of Key Ecosystem Components in the California Current System
			Monitoring Spatial and Temporal Patterns of Recruitment of Invertebrates to Rocky Shores along the West Coast
			Oregon Beach and Shoreline Mapping and Analysis Program
			Oregon Beach Monitoring Program
			Scaling Up from Community to Meta-Ecosystem Dynamics in the Rocky Intertidal - A comparative-Experimental Approach
			Species Interactions Over Space and Time, and how these Interactions are Influences by Nearshore Ocean Conditions.

Table 2: NRI Scientific Research Projects by Spatial Data Classification (continued)

Marine Research Lines	Lines	Cruise Lines	Affects of Hypoxia on Species Distribution off the Coast of Oregon
			Center for Coastal Margin Observation & Prediction Research
			Dynamics of Hypoxia
			Effects of Biotic and Abiotic Environmental Conditions on Early Marine Life History of Salmon
			Influence of Ocean Acidification on Estuaries
			Long Term Zooplankton Sampling and Monitoring of the Newport Hydrographic Line
			Microbial Initiative in Low Oxygen areas off Concepcion and Oregon (MILOCO)
			Oregon Dead Zone - Hypoxia: Pre-Upwelling Condition
			Physical and Biotic Links between Estuaries and the Nearshore Pacific Ocean
			Restoration and Recovery of Native Olympia Oysters
			Zooplankton Sampling and Monitoring of Southern Oregon Lines
	Transects	Cruise/Ship Transects	Oregon, California, Washington, Line-Transect and Ecosystem (ORCAWALE) Survey
			Oregon Nearshore Bathymetry Surveys
		AUV/Glider Transects	Ocean Observatories Initiative (OOI)
			Upwelling Dynamics from Days to Years Using Underwater Gliders
Marine Research Areas	Polygons	Marine Reserve Area	Oregon Marine Reserves Research and Monitoring
		Generalized Research Areas	Center for Coastal Margin Observation and Prediction
			Northwest National Marine Renewable Energy Center
			Ocean Observatories Initiative
			Telecommunication Cable Maintenance

the participants are associated with federal and state governmental agencies, non-profit organizations, educational institutions, and other research institutions.

2.3.4 Research Institutions

Within Oregon there are a few research institutions that conduct a large portion of the research within the nearshore environment. The research institutions are collaborations of multiple educational institutions, industry, and federal and state agencies that work together to conduct research in Oregon. Researchers may primarily work for their host institution, however, many of the scientists whose research is included in the NRI are also associated with the major research institutions within Oregon. Within Oregon there are three major research institutions that have a suite of principal investigators who conduct many different research projects and they include the Center for Coastal Margin Observation and Prediction (CMOP), The Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO), and Hatfield Marine Science Center (HMSC).

Center for Coastal Margin Observation and Prediction (CMOP)

The Center for Coastal Margin Observation and Prediction (CMOP) conducts many different research projects in Oregon and Washington waters. The goal of CMOP is to understand variability to anticipate climate change, and does this through a collaborative process for integrated, high-resolution, and long-term observations and simulations (CMOP, 2012). Most of CMOP's research is conducted in the Columbia River, and some of their research is conducted in the nearshore environment off of the Oregon coast. The data collected is used for many different CMOP research programs geared towards exploring new ways to study and understand the coastal areas to address the increasing challenges faced by those environments due to human activities and changing climate (CMOP, 2012). Not all of CMOP's research platforms are included in the NRI, only those that exist within the nearshore environment. Within the NRI CMOP has four cruise lines, two buoys/moorings, and one AUV area. Because of this collaborative and experimental nature as well as limited time resources for this research project, CMOP as a whole is included in the NRI as one research project, as opposed to a series of smaller research projects. This does not limit the spatial extent to which their research is represented in the NRI.

The Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)

PISCO has been conducting research in Oregon since 1999. PISCO is led by scientists from Oregon State University, Stanford University's Hopkins Marine Station, University of California, Santa Cruz, and University of California, Santa Barbara.

Table 3: NRI Research Projects.

Project Name:
Acclimation and Adaptation to Ocean Acidification of Key Ecosystem Components in the California Current System
Affects of Hypoxia on Species Distribution off the Coast of Oregon
Center for Coastal Margin Observation & Prediction Research
Center for Operational Oceanographic Products and Services
Coastal Data Information Program
Coastal Observation and Seabird Survey Team
Dynamics of Hypoxia
Effects of Biotic and Abiotic Environmental Conditions on Early Marine Life History of Salmon
Effects of Hypoxia on Ichthyoplankton and Micronekton Communities off the Oregon Coast
Influence of Ocean Acidification on Estuaries
International Pacific Halibut Commission Annual Standardized Stock Assessment Survey
Long Term Zooplankton Sampling and Monitoring of the Newport Hydrographic Line
Mapping Oregon Coastal Currents
Microbial Initiative in Low Oxygen areas off Concepcion and Oregon (MILOCO)
Monitoring Spatial and Temporal Patterns of Recruitment of Invertebrates to Rocky Shores along the West Coast
National Data Buoy Center
Northwest National Marine Renewable Energy Center
Ocean Observatories Initiative
Oregon Beach and Shoreline Mapping and Analysis Program
Oregon Beach Monitoring Program
Oregon Dead Zone - Hypoxia: Pre-Upwelling Conditions
Oregon Marine Reserves Research and Monitoring
Oregon Nearshore Bathymetry Surveys
Oregon, California, Washington, Line-Transect and Ecosystem (ORCAWALE) Survey
Pacific Ocean Coast Tracking (Kintama)
Physical and Biotic Links between Estuaries and the Nearshore Pacific Ocean
Responses of Ecologically Important Species to Thermal Stress at Local and Regional Scales.
Restoration and Recovery of Native Olympia Oysters
Scaling Up from Community to Meta-Ecosystem Dynamics in the Rocky Intertidal - A Comparative-Experimental Approach
Species Interactions Over Space and Time, and how these Interactions are Influences by Nearshore Ocean Conditions.
Telecommunication Cable Maintenance
Upwelling Dynamics from Days to Years Using Underwater Gliders
Wave Observations at the Mouth of the Yaquina (Newport, Oregon)
Zooplankton Sampling and Monitoring of Southern Oregon Lines

PISCO has other sites where they have conducted research in the past, but for the purpose of planning, only research sites that have planned research associated with them are included in the NRI. PISCO is associated with five projects included in the NRI.

The goal of PISCO is to understand the dynamics of coastal and ocean ecosystems along the U.S. West Coast. This includes the states of Washington, Oregon, and California. There are twelve intertidal sites located along the whole coast of Oregon included in the NRI. In addition to these sites, PISCO has two moorings included in the NRI. While the research in Oregon is important, the research platforms in all three states provide context for scientists who study the larger California Current Large Marine Ecosystem.

Hatfield Marine Science Center (HMSC)

Hatfield Marine Science Center (HMSC) began as a marine laboratory for Oregon State University over forty-five years ago, and now currently hosts a large group of partners who conduct a wide variety of research in Oregon. HMSC is Oregon State University's campus for research, education, and outreach in marine and coastal sciences. It is also home to R/V ship operations for cruises used not only by the HMSC community, but as well by many other research institutions and programs (including both CMOP and PISCO).

Figure 8 identifies the different agencies and education institutions within HMSC. Highlighted in dark blue are the federal and state agencies and Oregon State University Colleges within HMSC that are associated with research projects that are included in the Nearshore Research Inventory. The ship operations hosted at HMSC are associated with research projects from agencies and programs outside of Hatfield Marine Science Center. Eight projects included in the Nearshore Research Inventory are associated with Hatfield Marine Science Center.

2.3.5 Educational Institutions

Throughout Oregon there are educational institutions and departments that conduct research along the coast. Many of these scientific researchers conduct research and teach classes at the universities within Oregon as well as at other universities throughout the country and the world. The educational institutions that conduct research in the nearshore environment and are included in the NRI are Oregon Health and Sciences University, Oregon State University, and University of Oregon. These universities also work as part of different research institutions throughout the state, and the scientists who work for the educational institutions are also affiliated with the research institutions.

2.3.6 State and Federal Agencies

Many state and federal agencies conduct research in the nearshore environment off the coast of Oregon. It is also the state agencies that manage the permits associated with conducting research. For example, the Oregon Department of Fish and Wildlife (ODFW) manages the take permits for collection of invertebrate species. Another example is special use permits issued by Department of State Lands (DSL) for underwater cables.

The following state and federal agencies participated in some form, either in a scoping discussion, in the interview process, or their research is included, in the NRI project:

- Oregon Department of Human Services (DHS);
- Oregon Department of Geology and Mineral Industries (DOGAMI);
- Oregon Department of Fish and Wildlife (ODFW);
- Oregon Department of Parks and Recreation (OPRD);
- Oregon Department of State Lands (DSL);
- The National Oceanic and Atmospheric Administration, National Data Buoy Center (NDBC);
- The National Oceanic and Atmospheric Administration, National Marine Fisheries Service - Northwest Fisheries Science Center (NWFSC);
- The National Oceanic and Atmospheric Administration, National Marine Fisheries Service - Southwest Fisheries Science Center (SWFSC).

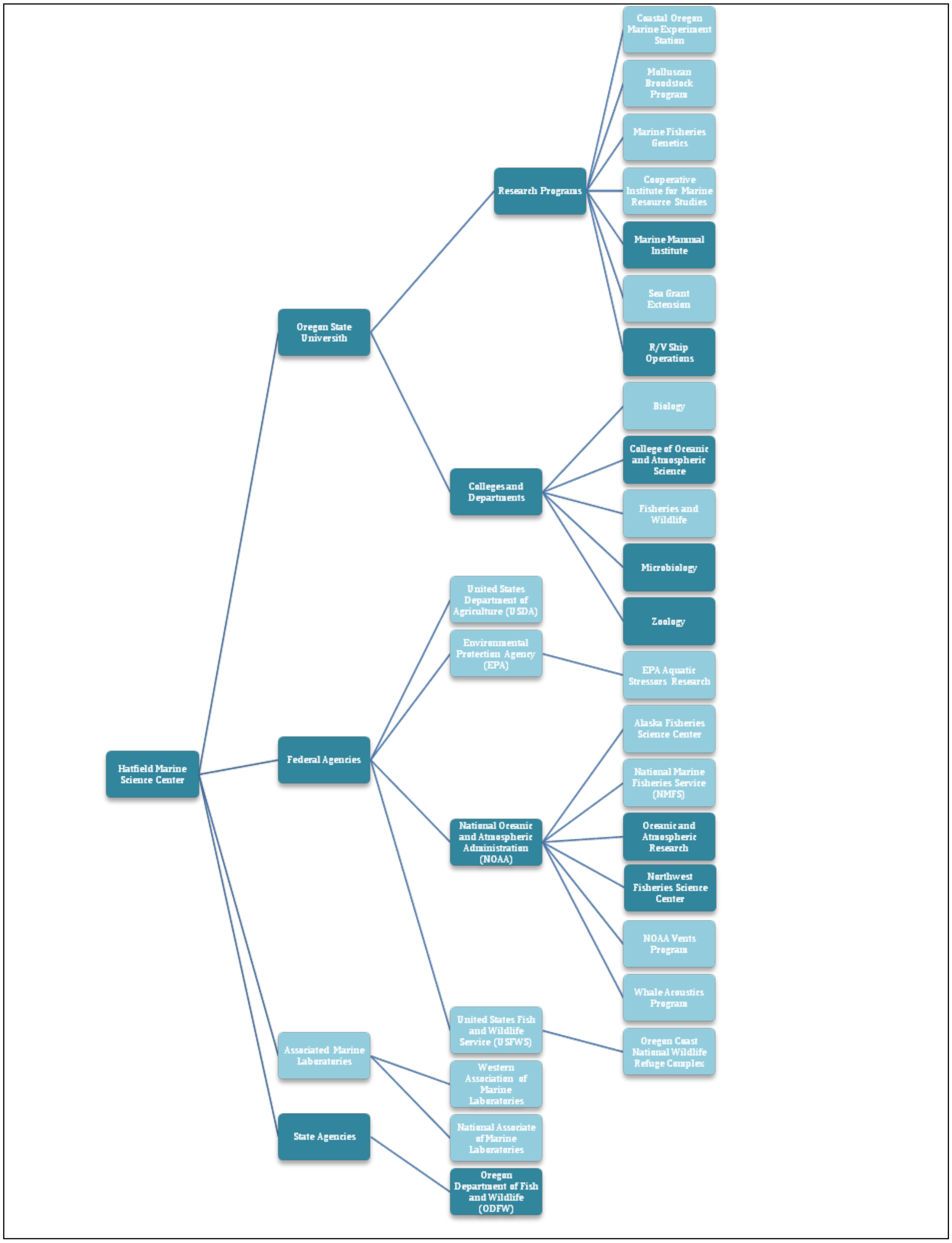

Figure 8: Hatfield Marine Science Center Agencies and Educational Institutions and Departments. The dark color represents the institutions and departments who participated in or have research projects included in the NRI.

2.3.7 Out of State Institutions

Scientists who are conducting research in the nearshore environment off the coast of Oregon are not necessarily based at an institution in Oregon. Both in state and out of state education and research institutions as well as federal agencies are conducting research in Oregon. For example, Scripps Institution of Oceanography (SCRIPPS), based in San Diego, California, manages a mooring in the nearshore environment of Oregon. The out of state participants in the NRI include the following:

- Coastal Observation and Seabird Survey Team (COASST) – *Seattle, Washington;*
- The International Pacific Halibut Commission (IPHC) – *Seattle, Washington;*
- The National Oceanic and Atmospheric Administration, National Marine Fisheries Service - Northwest Fisheries Science Center (NWFSC) – *Seattle, Washington;*
- The National Oceanic and Atmospheric Administration, National Data Buoy Center (NDBC) – *Stennis Space Center, Mississippi;*
- The National Oceanic and Atmospheric Administration, National Marine Fisheries Service - Southwest Fisheries Science Center (SWFSC) – *La Jolla, California;*
- Scripps Institution of Oceanography, University of California, San Diego – *San Diego, California;*

2.3.4 Categories of Research

In order to understand what type of research is being conducted in the nearshore environment in Oregon, research was categorized based on the type of geographic space that is occupied during data collection. There are three main categories of research included in the Inventory and they are:

(1) Marine research points;
(2) Marine research lines;
(3) Marine research areas.

Marine Research Points

Marine research points are specific locations along the coastline and in the nearshore environment where data is being collected for a research project. There are two main categories of marine research points and they are points and stations. Points are assets that are physically in the water or along the shoreline and are collecting data consistently. Stations are not permanent assets in the water or along the shoreline, but are locations where data is collected intermittently for the research project.

Points

There are two main types of points of research in Oregon and they are buoys/moorings and fixed shoreline platforms. All of the marine research points are associated with long-term monitoring projects, and are important assets for the research community since they are continually collecting data in the nearshore environment.

Buoys/Moorings

Throughout the Oregon nearshore environment, there are buoys measuring oceanographic and meteorological information. These buoys are considered permanent assets, since most of them are in the water year round (with the exception of removal for maintenance of the buoys). Many different institutions within Oregon, as well as institutions from other states, maintain the buoys. In total, there are thirty-one buoys/moorings included in the NRI (Figure 9).

The data collected from the buoys is used not only by the institutions that maintain them, but also by many other different researcher projects. For example, a NOAA National Data Buoy Center (NDBC) Buoy located outside of the Columbia River mouth is used not only by NOAA for the marine observations, but is also used by other scientists as part of their research.

Underwater Platforms

There are also platforms underwater that are not visible from the surface (unlike a buoy or mooring). These include underwater nodes for connecting cables, as well as underwater acoustic devices.   In total there are seventy-seven underwater platforms in the nearshore environment off the coast of Oregon.

Fixed Shoreline Platform

In addition to buoys in the nearshore, there are permanent assets along the shoreline. These mainly are radar antennas and stations (Figure 9). These shoreline platforms are used to observe Oregon coastal currents, and have been maintained in these locations for over ten years. These assets are strategically placed along the coastline of Oregon to have a continuous dataset measuring coastal currents of the whole coast of Oregon. Therefore, the physical location of these radar stations is along the shoreline but they are using radar to collect data in the nearshore environment.

Stations

The most abundant category of research is marine research stations along the shoreline and in the water of Oregon. Two-hundred and eighty one fixed shore stations, one hundred and sixty-two nearshore sampling stations, fifty-two observation stations, and twelve intertidal sampling stations were identified as having planned research and included in the NRI (Figures 10 and 11). Unlike buoys, moorings, and shoreline research platforms, research stations are not physical assets in the nearshore environment, and do not continually take measurements at that location. The stations are places in the nearshore environment that are sampled repeatedly, but not continuously.

Nearshore Sampling Stations

A nearshore sampling station is a location in the ocean within the nearshore environment where data is collected repeatedly. Common nearshore sampling stations include CTD (conductivity, temperature, and depth) casts, water samples, and phytoplankton and fish collection. All of the nearshore sampling stations are associated with oceanographic cruises because collection of a sample in the nearshore environment requires researchers to be on a research vessel. In addition, many of the nearshore sampling stations are associated with research cruise lines (described later in this report).

The nearshore sampling stations are determined and identified by their distance from shore, and by the depth of water at their location. Many scientists consistently collect samples from stations that are five, ten, fifteen, and twenty-five nautical miles off of the coast. Other scientists target specific depths, and therefore collect samples at, for example, depths of fifty and seventy meters. The stations are geographically specific, and the locations most consistently sampled are those off the coast of Newport, where CTD casts have been made for over 50 years. Other long-term sampling stations are off the coast of Coos Bay and Strawberry Hill. Most of the nearshore sampling stations are associated with known research cruise lines.

Fixed Shore Stations

A fixed shore station is a location along the shoreline where data is collected repeatedly. These stations are similar to nearshore sampling stations, except they are along the shoreline. Common fixed shore stations include invertebrate sampling sites and water quality monitoring sites (Figure 11).

Observation Stations

Observation stations are locations either along the shoreline or in the ocean, where data is collected through human observation and species counts, and not through sampling (Figure 11). The main types of observation stations included in the NRI are seabird surveys.

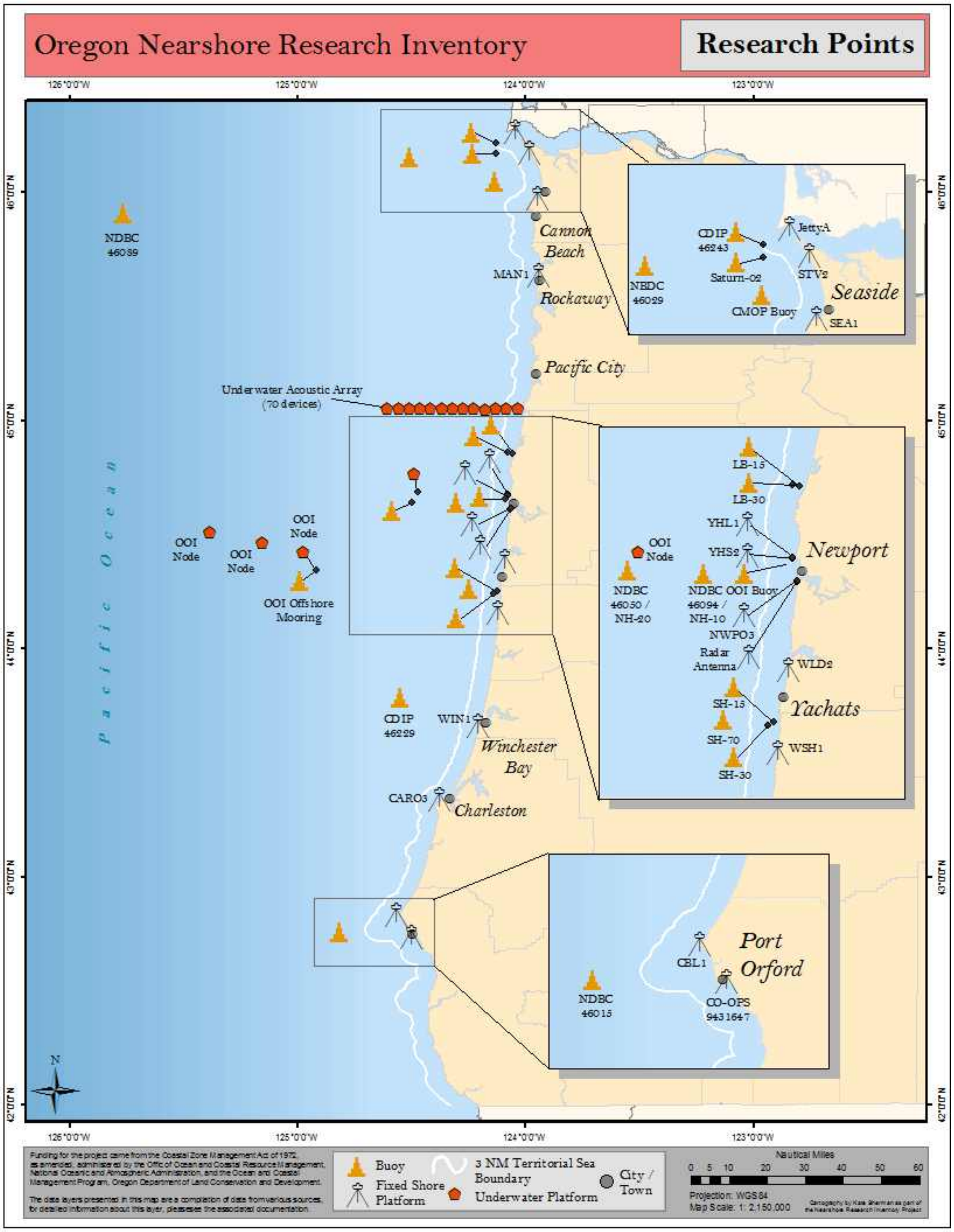

Figure 9: Map of Research Points included in the NRI. Research points are locations where there is a permanent asset in the water (e.g. buoy).

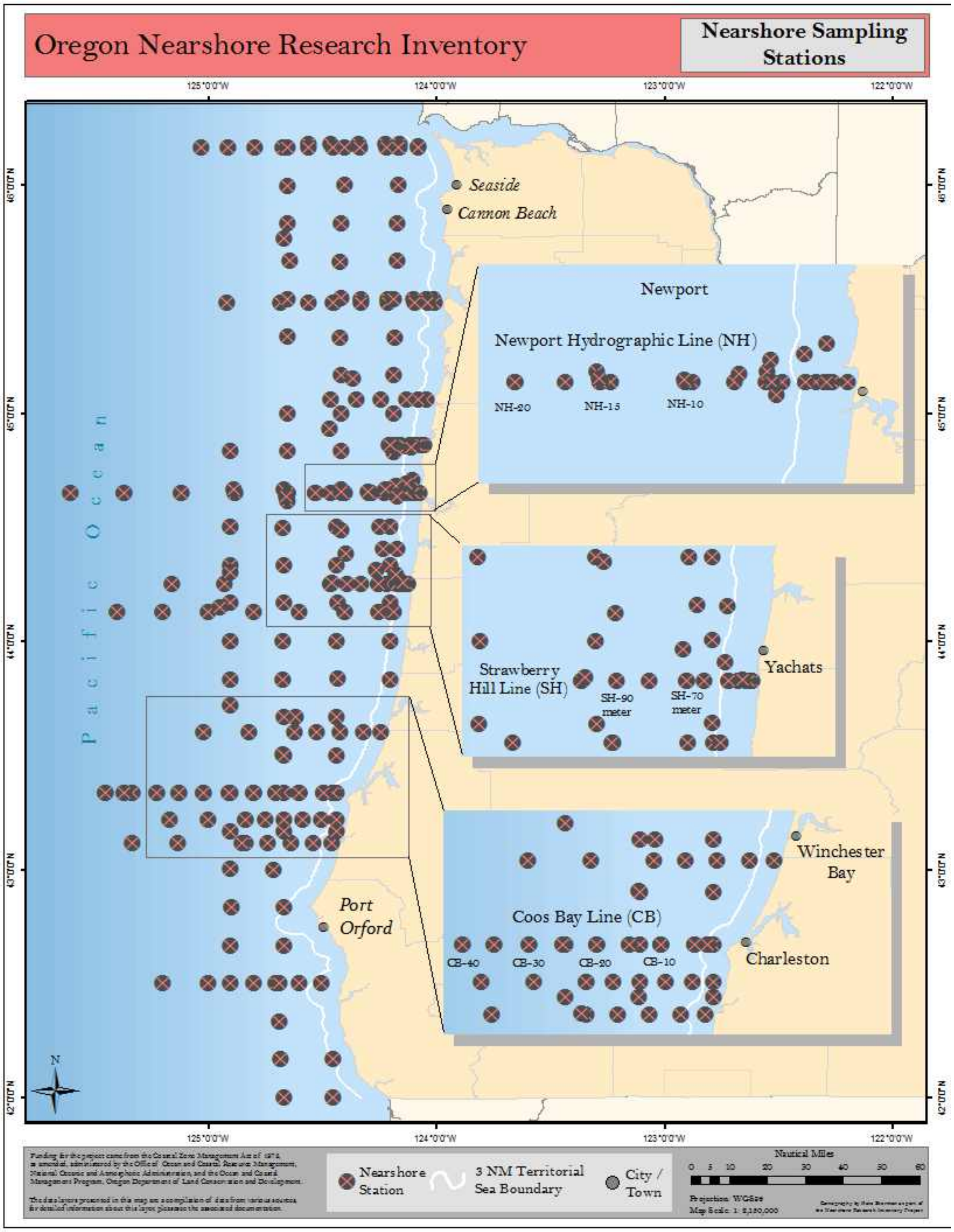

Figure 10: Map of Nearshore Sampling Stations Included in the NRI. Nearshore sampling stations are locations in the water that are used for scientific research repeatedly, but there is no permanent asset at that location (e.g. CTD cast).

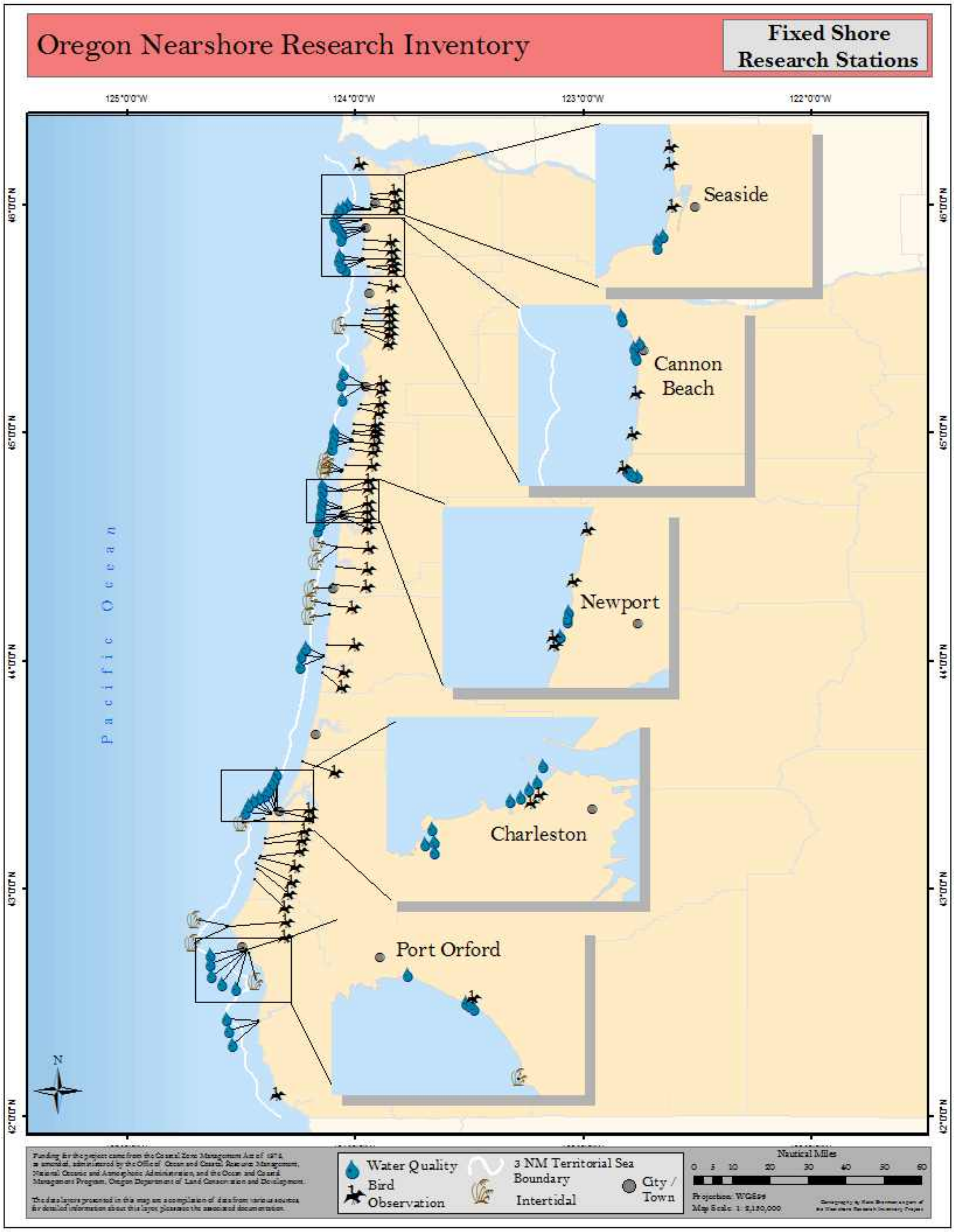

Figure 11: Map of Fixed Shore Stations Included in the NRI. Fixed shore stations are locations along the shoreline that are used for scientific research repeatedly, but there is no permanent asset at that location (e.g. water sampling station).

Marine Research Lines

Marine research lines are routes and tracks in the nearshore environment where research is conducted. The two types of marine research lines are lines and transects.

Lines

Research lines off of the coast of Oregon have been consistently sampled over time. These lines are geographically specific and samples are made intermittently along these lines. Research lines do not have continuous observations or samples taken along the lines, they are tracks for cruises to make samples. The following lines have the most research associated with them:

(1) Newport Hydrographic Line (referred to as the NH line) off the coast of Newport, Oregon;
(2) Strawberry Hill Line (referred as the SH line) off the coast of Strawberry Hill State Park south of Yachats, Oregon;
(3) Coos Bay Line (referred to as the CB line) off the coast of Coos Bay, Oregon.

In total there are fourteen lines along the Oregon coast that have regularly planned research associated with them (Figure 12). All of the research lines are associated with nearshore sampling stations.

Transects

Transects off the coast of Oregon are tracks where data for research is continuously collected along the track. There are forty-one transect lines off the coast of Oregon (Figure 13). The most continuously sampled transect is the track used by the underwater gliders, which are autonomous underwater vehicles that collect continuous oceanographic data. Currently, the gliders use the Newport Hydrographic Line to collect information. However, other glider lines are planned for other areas in Oregon as part of the Ocean Observatories Initiative, including a line parallel to the coast of Oregon at one hundred twenty-six degrees longitude in deep offshore waters. Other transects included in the NRI are cruises that make continuous observations of marine mammals and seabirds.

Marine Research Areas

The marine research areas included in the NRI are polygons off of the coast where research is conducted. In the case of the marine reserve areas, multiple types of scientific research platforms are in the same area for the same scientific research project. In other cases, the geographic area of research was buffered to make it larger than the actual area for security purposes, or because the exact extent of the research was not specifically identified. These were categorized as generalized areas of research. A map of the marine research areas can be seen in Figure 14.

Marine Reserve Areas

The marine reserve areas have multiple different research themes as well as platforms of research within the designated area with the purpose of monitoring the marine reserves. The marine reserve areas are monitored and compared to specifically designated comparison areas nearby to see if over time, closing off the specific area any extractive activity will have beneficial impacts within the ecosystem of that area. Therefore, many different types of research are conducted within the marine reserves to understand and monitor the whole ecosystem of that area.

Generalized Areas

There were two main purposes behind generalizing areas of research. The first reason to generalize an area was because the participant did not provide the exact geographic location. Therefore, the polygons were interpreted in order to capture the space continually used by a research project. These interpreted areas include the CMOP AUV (Autonomous Underwater Vehicle) area where underwater gliders and other AUV's conduct research as well as the Ocean Observatories Initiative (OOI) buoy, for which the exact location has not been specifically confirmed. The second purpose behind generalizing a research area was for security purposes, and to protect the exact location of a research asset from potentially being targeted for vandalism. The OOI and telecommunications cable areas were all generalized in order conceal the exact location of the cables.

2.3.5 Timeline for Nearshore Research

There is a long history of research along the Oregon coast. For example, the Newport Hydrographic Line has been sampled for over fifty years. This long-term data is what allows scientists to recognize trends, and notice any changes over time.

In the NRI, forty-one percent of research projects identified were found to have research conducted in the geographic space off the Oregon coast for more than ten years. Of those projects, eight are research stations, four are research points, four are research lines, and one is a research transect. This shows that a wide variety of research has been conducted for more than ten years off of the Oregon coast, and the data associated with that research is important for long-term monitoring efforts.

Another piece of information that was collected was the seasonality of the research to determine when throughout the year data is being collected. All of the research projects, eighty-eight percent were found to conduct research every year during the summer. This shows that the summer months are a particularly important time for research. Many of the research projects also collect research year-round, with forty one percent of projects conducting research throughout the year.

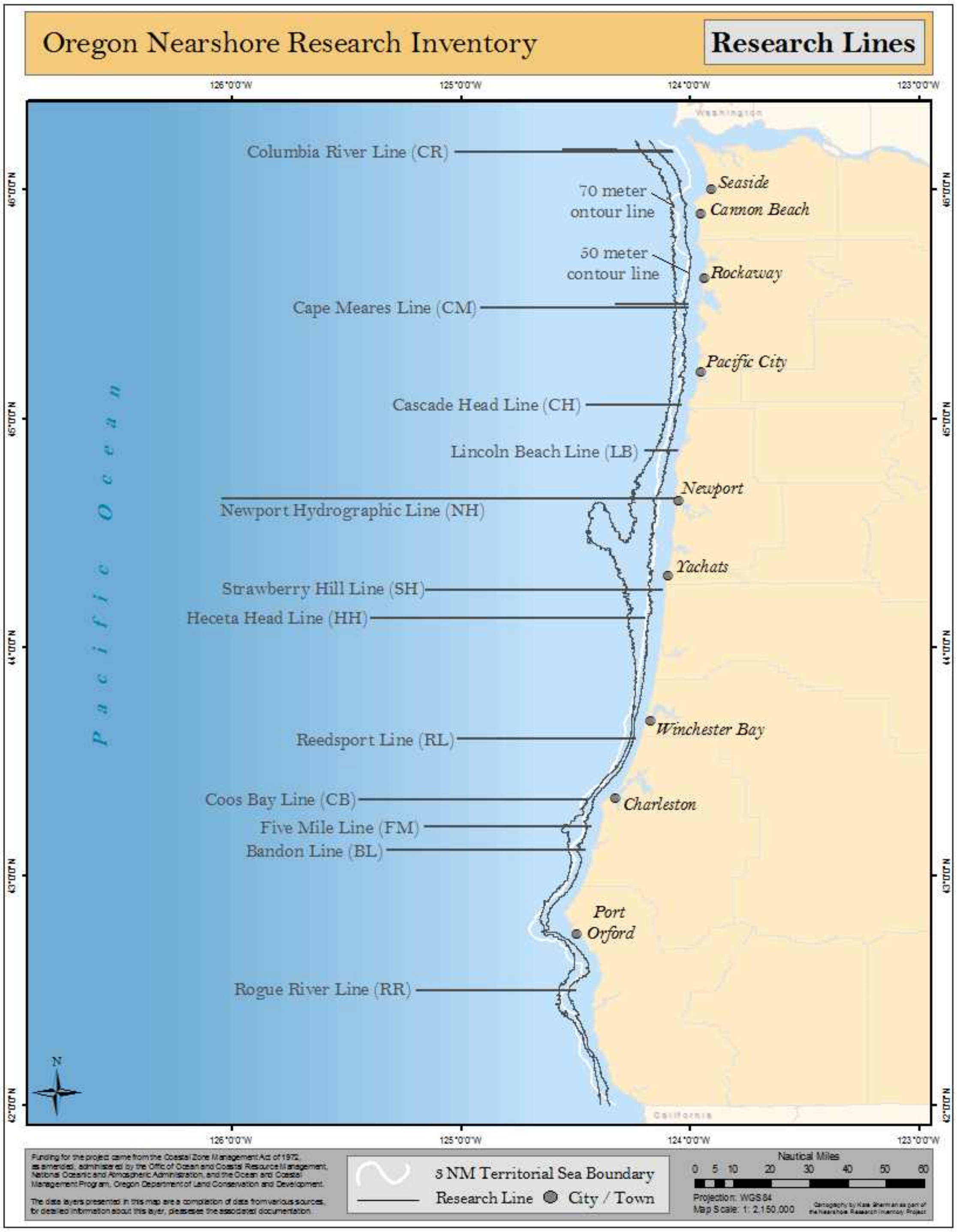

Figure 12: Map of Research Lines Included in the NRI. Research lines are lines across the ocean where scientific research is conducted repeatedly, however there are no continuous measurements along the line (e.g. scientific research vessel line).

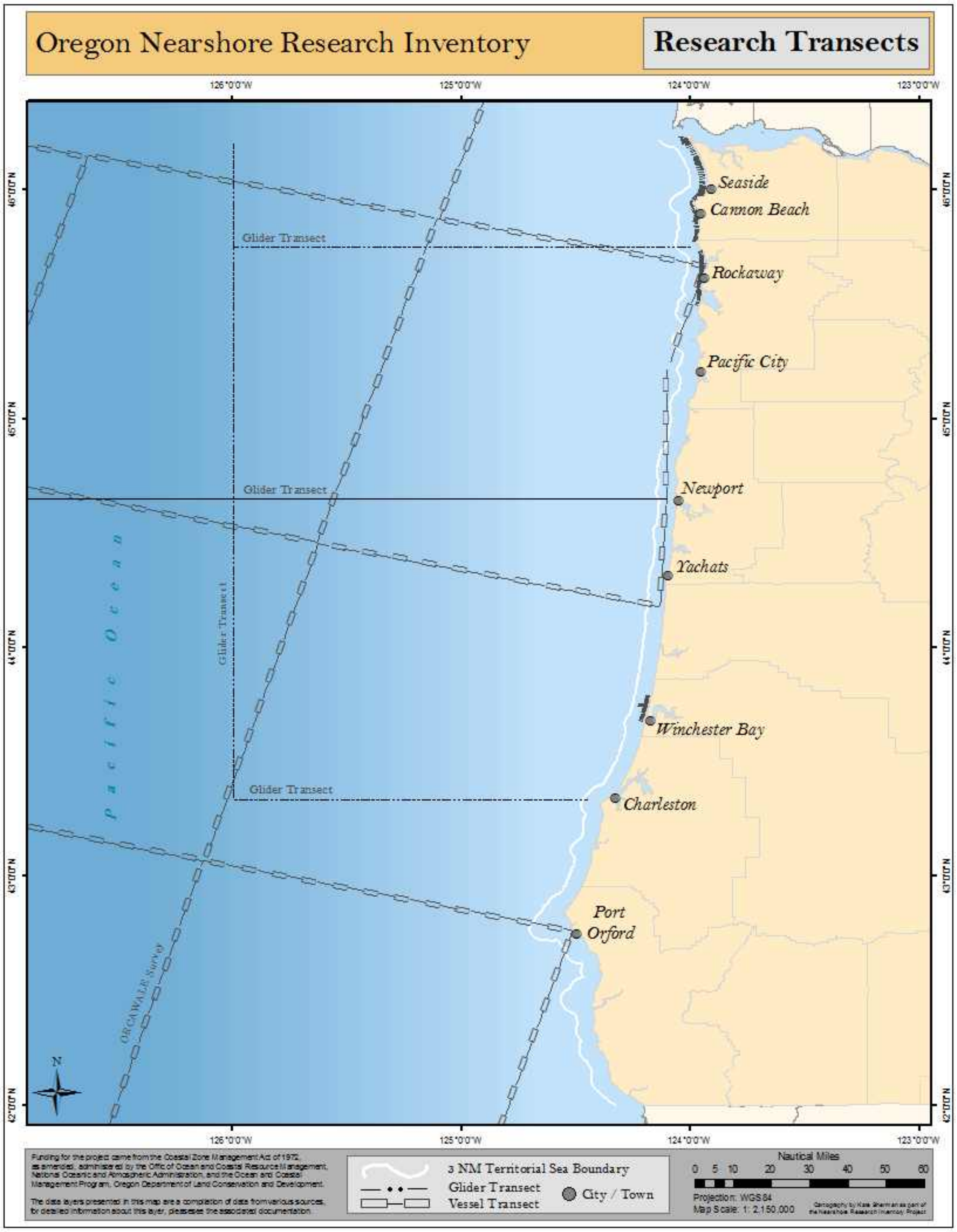

Figure 13: Map of Research Transects Included in the NRI. Research transects are locations in the ocean that are repeatedly used for scientific research, and measurements or observations are taken consistently along the transect line (e.g. underwater glider).

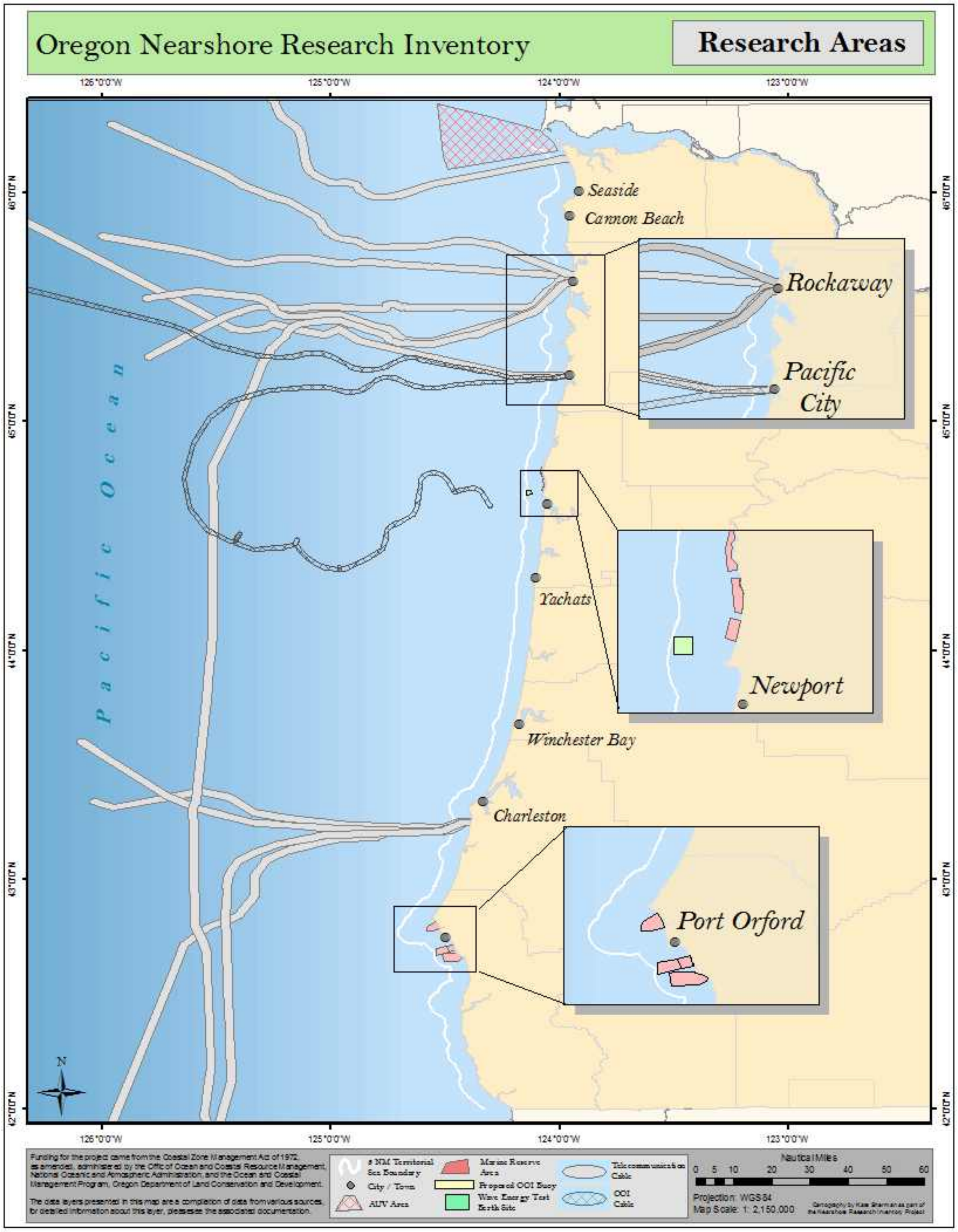

Figure 14: Map of the Research Areas Included in the NRI. Research areas are locations with multiple platforms for research in one space (e.g. marine reserves), or are generalized for security purposes or lack of data (e.g. underwater cables and CMOP AUV area).

2.3.6 Research Themes

Research projects included in the NRI were categorized into themes of the type of research. Most of the research projects included had either physical (thirty-three projects) or biological (twenty-seven projects) research themes (Figure 15). Many projects collected more than one type of data and therefore fell within multiple themes of research.

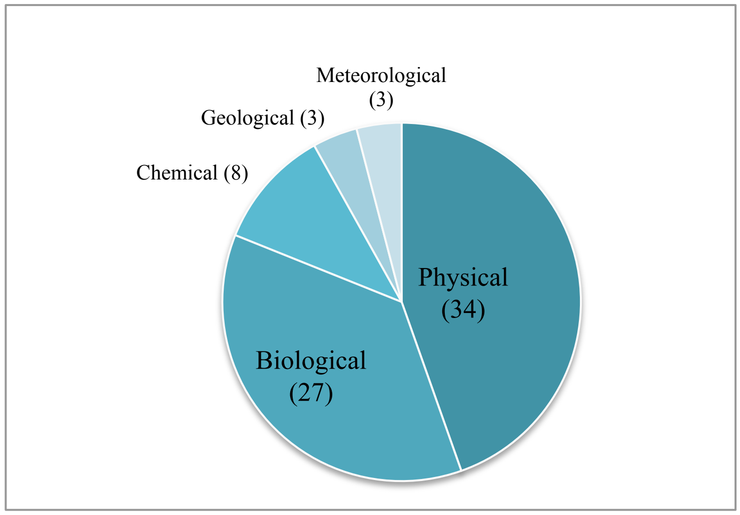

Figure 15: Scientific Research Themes in the NRI.

2.3.7 Ocean Space Used for Research

The results of the NRI show that research can be found throughout much of Oregon nearshore environment. Figure 16 shows a map of the density of research throughout the coast. Twenty percent of the DLCD planning grid cells intersected with nearshore research. The highest concentrations of research (10-14 projects) are shown in red, and the lowest concentrations of research (representing one project) are shown in light green. Even though the research is distributed throughout the coast and ocean, it is apparent that there are spatial dependencies for the location of research in the nearshore environment. It can be inferred from the spatial distribution of the research that there are two main reasons for the placement of research:

(1) The ecological significance of the area;
(2) Proximity to research institutions and ease of access for the researchers.

In general, the highest concentrations of nearshore research were found outside of estuaries, bordering coastal communities, and in close proximity to Oregon state parks.

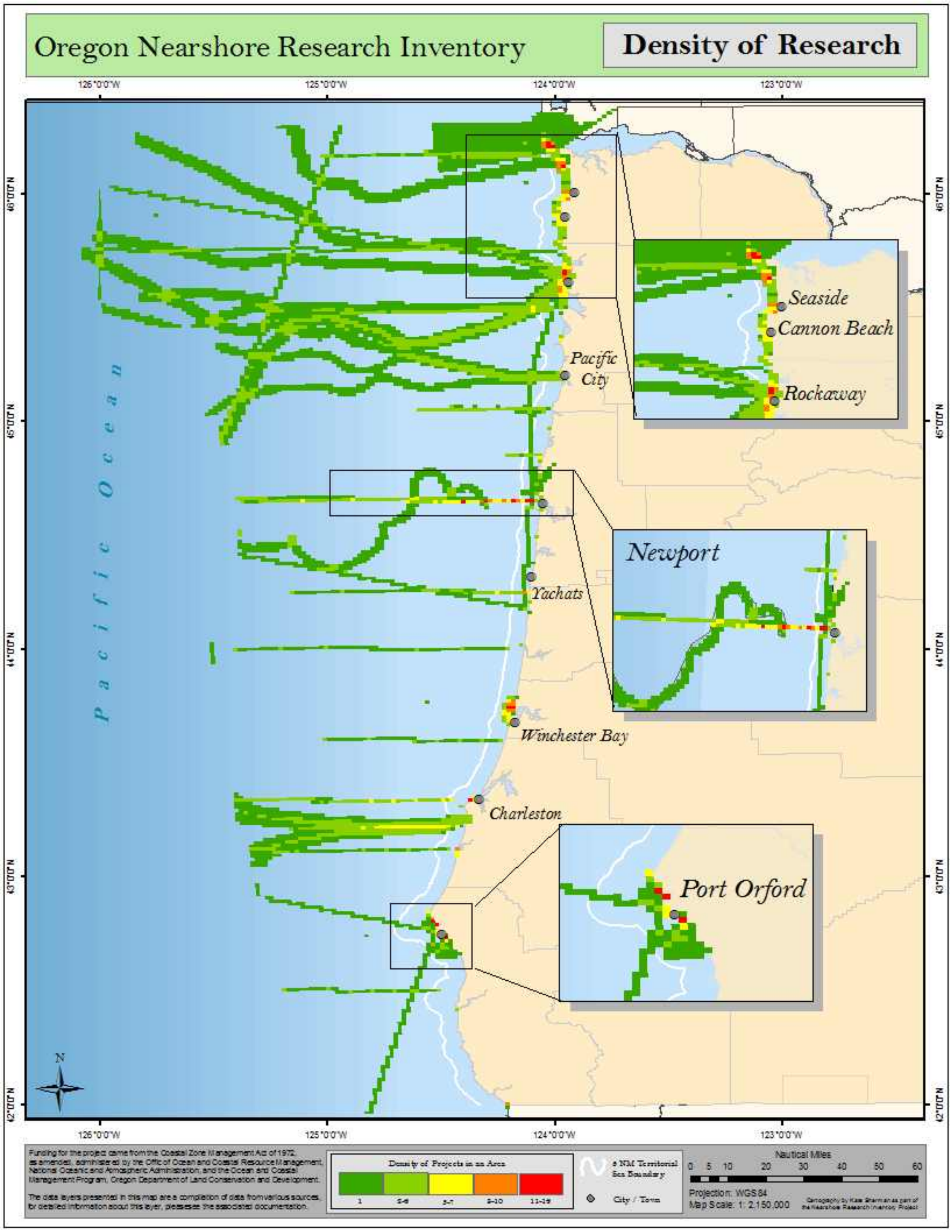

Figure 16: Map of the density of research projects in the nearshore environment of the Oregon coast.

Ecological Significance

Understanding ocean and coastal ecosystems will help us better protect and manage these locations. Oregon has state-wide management plans and policies that provide the framework for conservation and management of these ecologically important areas. Research plays a critical role in supplying information about these important areas and ecosystems. Therefore, much of the research included in the NRI is concentrated near ecologically significant areas such as estuaries and rocky shores.

<u>Estuaries</u>

In total there are twenty-two estuaries along the coast of Oregon. The results of the NRI show that thirty-three percent of estuaries have high concentrations of research nearby (Figure 17). The estuary with the highest concentration of research is Yaquina Bay Estuary.

Oregon estuaries with research projects in the surrounding nearshore:

Columbia River Estuary
Nehalem River Estuary
Tillamook Bay Estuary
Yaquina Bay Estuary
Umpqua River Estuary
Coos Bay Estuary
Coquille River Estuary

Figure 17: Oregon Estuaries with Scientific Research in he Surrounding Nearshore (listed from north to south).

Estuaries are ecologically important areas for many fish and invertebrate species along the coast, and therefore play a vital role in the ecological and economic health of coastal areas (Good, 1999). Estuaries are home to nurseries to many juvenile fish, and provide migration routes for important fish species such as salmon (Good, 1999).

In addition to being ecologically important areas, estuaries are transition ecosystems, areas where inland rivers and water connect with the ocean (Good, 1999). All of the characteristics of estuaries attract researchers to the nearshore environment outside of estuaries to better understand these important ecosystems.

Rocky Shores

Oregon headlands with research projects in the surrounding nearshore:

Tillamook Head
Cape Falcon
Cape Meares
Cape Foulweather
Yaquina Head
Cape Perpetua
Heceta Head
Cape Arago
Cape Blanco
Port Orford Head

Figure 18: Oregon Headlands with Scientific Research in the Surrounding Nearshore (listed from north to south).

Rocky shores, and specifically the intertidal zones and coastal headlands, are ecologically important areas where scientific research is concentrated (Figure 18). Within Oregon, there are over 1,400 rocks and islands sprinkled along the nearshore environment of the coastline (Oregon Coastal Atlas, 2012). Many of these rocks and islands are within the Oregon Islands National Wildlife Refuge. In addition there are tidepools, coastal headlands, and submerged reefs that make up the rocky shores of the Oregon coast. The rocky shores are vital habitats for marine mammals, seabirds, fish, and invertebrates (Oregon Coastal Atlas, 2012). The NRI project identified the intertidal areas, or tidepools, as areas that have high concentrations of research. One research institution in particular, PISCO, collects physical and biological information in the rocky-intertidal zones throughout the Oregon coast. PISCO currently has twelve sites along the Oregon coast where they have projects studying these intertidal zones, and in particular, the invertebrate populations in these areas.

Ease of Access

Much of the research conducted within the nearshore environment requires scientists to access the ocean by boat or other vessel, or have shoreline access to areas they want to study. The weather in Oregon is widely variable, and therefore the ease of access to areas where scientists want to conduct research is important. Proximity to a research vessel or scientific research institution can make conducting research in the nearshore environment easier for scientists. With Oregon's dynamic coastline, access to the ocean by vessel is most common through the mouth of an estuary. In general, much of the research is concentrated near areas that are easily accessed by the scientific community.

Coastal Communities

The NRI shows that scientific research is concentrated near coastal communities. The city of Newport has the highest concentration of research projects, followed by Port Orford and Charleston. Other communities with concentrations of research in the nearshore environment include Seaside, Cannon Beach, Yachats, Winchester Bay, and Bandon (Figure 19). There is also scientific research conducted near other coastal communities, however, it is not as highly concentrated. The coastal communities in Oregon, and in particular the ports within these communities, provide important infrastructure for access to the ocean. Therefore, it is easy for researchers conduct much of their research close to communities that have access to the nearshore environment. Ports and ease of beach and boat access to the open ocean will help provide easy access for people to conduct research on the shoreline and ocean.

Oregon coastal communities with research projects in the surrounding nearshore:

Newport
Port Orford
Charleston
Seaside
Charleston
Winchester Bay
Yachats
Cannon Beach

Figure 19: Oregon Coastal Communities with High or Very High Densities of Scientific Research in the Surrounding Nearshore (from highest concentration to lowest).

Oregon State Parks with research projects in the surrounding nearshore:

Fort Stevens State Park
Fogarty Creek State Recreation Area
Agate Beach State Park
Sunset Bay State Park
Humbug Mountain State Park

Figure 20: Oregon State Parks with High or Very High Densities of Scientific Research in the Surrounding Nearshore (from north to south).

Oregon State Parks

Many Oregon State Parks have high concentrations of research along the shoreline as well as in the nearshore environment bordering the park. Along the coastal region of Oregon, there are eighty-six areas designated as state parks. Fort Stevens State Park, Fogarty Creek State Recreation Area, Agate Beach State Park, Sunset Bay State Park, and Humbug Mountain State Park have high densities of research nearby (Figure 20). There are other state parks that have research concentrations nearby, however, they are not as highly concentrated. The mission of Oregon state parks is to provide access to and protect outstanding natural, scenic, cultural, and historic sites. The natural and scenic values of the parks to the state make state parks good places to conduct research. Also, many state parks along the coast provide boat and beach access, making it easier to conduct coastal and ocean research.

2.3.8 Classification of Research Included in the NRI

In total, permanent research assets in the Oregon nearshore include thirty-nine buoys and land stations, twelve underwater cables, and five glider lines. Other stations consistently used for research purposes include two-hundred and eight-one shore sampling stations, two-hundred and fifty-three nearshore bathymetric surveys, one-hundred and sixty-two nearshore sampling stations, and twelve intertidal sampling stations. Research was also identified along forty-one transect lines, fourteen cruise sampling lines, six areas for marine reserve related research, one area of research using AUV's, one area of research for wave energy development, and one proposed area for a permanent buoy for OOI.

2.3.9 Permits for Research Identified in the NRI

Much of the scientific research conducted today in Oregon requires the scientific community to use space that is managed by many different agencies, some of which require permits to conduct research over the land or area that they manage. The following permits were required for research that is included in the NRI:

State of Oregon Permits:

- Oregon Scientific Take Permit (Oregon Department of Fish and Wildlife and the National Marine Fisheries Service);
- Scientific Research Permit (Oregon Parks and Recreation Department);
- Ocean Shores Alteration Permit (Oregon Parks and Recreation Department);
- Special Use Permit (Department of State Lands);
- Temporary Use Permit (Department of State Lands).

Federal Permits:

- Endangered Species Act Recovery and Interstate Commerce Permit (U.S. Fish and Wildlife Service);
- Marine Mammal Protection Act Permit (National Oceanographic and Atmospheric Administration – National Marine Fisheries Service);
- Clean Water Act Section 404 Permit (Environmental Protection Agency);
- Rivers and Harbors Act of 1899 Section 10 Permit (Army Corps of Engineers).

Other forms and requests for research were identified such as a federal ships request form (from NOAA), a letter of recognition from the National Marine Fisheries Service (NMFS), and a Federal Communications Commission (FCC) license.

Fifty percent of projects included in the NRI required permits and twenty-three percent do not require permits. Twenty-six percent of projects has no response to whether or not a permit was required.

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Chapter 3: Journal Article

The Oregon Nearshore Research Inventory Project: The Importance of Science and the Scientific Community as Stakeholders in Marine Spatial Planning

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3.1 Abstract

The purpose of Oregon's Nearshore Research Inventory (NRI) project was to inventory and map the current and future use of Oregon's nearshore environment by the scientific research community for use in Oregon's marine spatial planning process. Spatial and qualitative data on the use of Oregon's ocean and coast by the scientific research community was collected, including the geographic distribution of research, the people who are conducting scientific research, timeline for scientific research, and more. Through the NRI project, Oregon's Territorial Sea amendment process became the first marine spatial planning process in the United States to comprehensively recognize the scientific community as a stakeholder.

As new uses, such as wave energy extraction, get proposed along coastlines and in the ocean, marine spatial planning (MSP) can be a tool to reduce conflict and find compatible uses of ocean and coastal space. Sound science needs to be used to understand social, ecological, and economic components of ocean and coastal resources and make tradeoff decisions about ocean and coastal space use in the MSP process. The results of the NRI project demonstrate the need to recognize that the scientific research community as a stakeholder in the MSP process. Their use of ocean and coastal space helps provide the sound scientific information that is needed to make ecosystem-based management decisions. Interruptions in long-term scientific research and monitoring could limit the availability of scientific information for use in future management decisions.

3.2 Introduction

Scientists, managers, and other stakeholders working on ocean and coastal resource management issues understand that there are challenges with connecting science and policy for effective natural resource management decisions (Pietri et al, 2011). They also know that when it is done correctly, science can advance informed decision-making (Pietri et al, 2011).

Ecosystem-based management is an integrated approach that considers the entire ecosystem, including humans (Leslie and McLeod, 2007). There is evidence that ecological interactions in ocean and coastal systems are vital to the resilience and health of natural resources, and ecosystem-based management approaches focus on protecting these ecosystem structures, functions, and processes (Leslie and McLeod, 2007). Marine spatial planning (MSP) is a management tool used to achieve ecosystem-based management of marine resources (Douvere, 2008; White et al, 2012), and includes human interactions with ocean and coastal systems in management decisions. MSP 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” (Elher and Douvere, 2009, p. 18). Ideally, the MSP process will engage all stakeholders of the ocean and coast to identify compatible use areas and reduce conflict amongst ecosystem uses.

In the MSP process there will be tradeoffs among sectors of ocean use (White et al, 2012). It is important to use sound science, “a way of learning about the world [that] is characterized by transparency, reproducibility, and independence,” (Lackey, 2004, p. 2) as a basis for making decisions about tradeoffs. This makes the work conducted by the ocean and coastal scientific research community valuable in the MSP process, since its successful integration into decisions about tradeoffs can lead to a more sustainable ecological, economic, and social future.

3.2.1 Scientists as Stakeholders

The source of sound scientific information used in management decisions is the scientific research community. Monitoring ocean and coastal ecological and social processes provides valuable information that can be used in management decisions. To collect this information, this community uses ocean space; including buoys for monitoring efforts, research cruises, and collecting samples and making observations of marine organisms. If the MSP process engages all stakeholders, it must include the scientific research community.

To date, the scientific research community has minimally been recognized as a stakeholder in marine spatial planning processes around the world, other than in marine zones (e.g. Australia Great Barrier Reef and China), which poses a risk to current and future sound scientific research and monitoring. If the MSP process includes the scientific research community as a stakeholder, then their use of the ocean becomes a part of the conversation about tradeoffs. If they are not included as stakeholders in tradeoff decisions, it could lead to the interruption of scientific research and monitoring, which is the very scientific information needed to inform ecosystem-based decisions. Therefore, in order to obtain sound scientific research for future management decisions, there needs to be encouragement for and protection of current and future research and long-term monitoring programs for coasts and oceans. If MSP processes include the scientific research community as a stakeholder, then their use of the ocean becomes a part of the conversation about tradeoffs, which will be important for securing current long-term monitoring sites that provide sound scientific information for management decisions.

3.2.2 The Role of Ocean and Coastal Science in Management Decisions

The recognition of the scientific research community as a stakeholder becomes even more important as future scientific efforts become driven by the needs of managers. Science can be defined as “information gathered in a rational, systematic, testable, and reproducible manner” (Lackey, 2007). Historically, natural science was conducted with the simple goal of understanding the structure, functioning, and processes of an ecosystem, and treated more as a discovery, or baseline of knowledge, about a subject. Recently, some scientific research has become more decision-driven with the need to grow a specific scientific body of knowledge so effective decisions can be made (Sarewitz, 2004). Current funding structures for scientific research can result in a purpose-driven scientific research agenda that fails to look forward at the larger ecosystem level questions and challenges that humans face in the future (Southall and Nowacek, 2009), and looks narrowly at the short term need for information.

Science can come out in two forms: policy neutral (also known as sound science) or normative (Lackey, 2004: Carver, 2010). Normative science is defined as “information that is developed, presented, or interpreted based on an assumed, usually unstated, preference for a particular policy or class of policy choices” (Lackey, 2004). As the drive for science shifts from discovery to decision-based, there is greater potential for science to become laden with the policy preferences of those conducting and funding normative science. However, science that informs managers should come from scientists in a policy neutral form and should not be laden with policy preferences (Lackey, 2004). Many of the challenges associated with incorporating science into management decisions are due to the differences between scientists and managers. Scientists look to conduct research and monitoring over long periods of time, whereas managers have relatively short timescales to make decisions (Plasman, 2007). Managers have certain spatial features to the decisions they make (territorial sea boundaries), whereas scientists, in particular in the marine environment, work on scales that do not always match management boundaries. Scientists need to provide information that is sound and based on experimentation and observation (Paslman, 2007), whereas managers follow policies and need to balance many different considerations in tradeoff decisions in what tends to be a political process. Scientists look at particular attributes of information about a system, whereas managers need to understand multiple attributes, or potential cumulative impacts, in order to make a decision.

Differences become even more apparent when managers need to make decisions when an action has never been performed before, and the potential ecological impacts are not well understood. This uncertainty can lead managers to engage the scientific community in new research. Even though the resulting information is relevant, it may reflect information only over a short period of time, and there is also the potential for policy preferences to exist underlying the science, since the purpose behind the research is to understand a proposed and desired action in order to make a management decision. There is also risk for decision driven scientific research to become influenced by the funding sources or organizational missions that are driving the objectives of the research. The source of sound, policy neutral science comes from scientific monitoring and long-term research of ocean and coastal ecological and social systems. Understanding how ocean and coastal resources change over time, and any triggers for change, is critical for informing and making management decisions.

3.2.3 There are Catalysts for MSP that make science important

Many ecological policies today provide a framework for an ecosystem-based approach to managing marine resources, with the ultimate goal of maintaining a healthy, productive, and resilient condition of the coasts and oceans so they can sustain human uses and provide services that humans depend upon (McLeod et al 2005; Katsanevakis, 2011). The role of scientific researchers is to conduct research and interpret the resulting science (Lackey, 2007), with the ultimate goal of having a better understanding of ecological and social structures, functions, and processes (McLeod et al, 2005). It is the role of managers to interpret and follow the guidelines of ecological policies, while using sound science to make tradeoffs between ecological, social, and economic considerations. This can be very challenging for managers because the issues underlying ecological policies and management decisions are inherently complex (McLeod et al, 2005) and tend to be political.

Moving forward, there needs to be a more comprehensive understanding of what ocean and coastal scientific research and information are available, on all time and spatial scales, for all stakeholder groups, in order to inform management decisions. Making this information available to ocean and coastal managers will allow them to understand where the gaps of scientific information are. The scientific community and ocean and coastal managers can work together to fill the information gaps so management decisions, particularly during a marine spatial planning process, can be made comprehensively.

3.3 Oregon’s Territorial Sea Amendment Process: A Case Study of Integrating the Scientific Research Community as a Stakeholder in the Marine Spatial Planning Process

Oregon is currently in the process of amending it’s Territorial Sea Plan (a marine spatial plan), which is the state’s policy for managing activities from 0-3 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 this new ocean use. As part of this process, DLCD engaged different stakeholders in order to map current and future uses of the Territorial Sea for inclusion in the TSP amendment process.

Staff at DLCD identified a data gap of information about where the scientific research community used ocean and coastal space in the Oregon Territorial Sea. With academic institutions such as Oregon State University, University of Oregon, Oregon Health and Sciences University, and many other research institutions along the coast, staff at DLCD realized that the scientific community could have a large footprint of use and could be a knowledge gap in the depiction of existing uses of the Territorial Sea. The agency initiated the Nearshore Research Inventory (NRI) project, and hired a graduate student intern at the College of Oceanic and Atmospheric Science (COAS) at Oregon State University (OSU) to document the geographic use of the ocean and coastal scientific community to see if the data gap was real.

3.3.1 Objectives

The purpose of the NRI project was to inventory and map the current and future use of Oregon's nearshore environment by the scientific research community for use in Oregon's marine spatial planning process. The nearshore environment, for the sake of this project, is the area from the shoreline up to the edge of the continental shelf, with an emphasis on the Territorial Sea, from 0-3 nautical miles off of the shoreline.
The objectives of the project were to:

- Include the scientific research community in the current marine spatial planning process in Oregon;
- Inventory the current research projects within the nearshore environment bordering Oregon;
- Identify when (over what time period), where (geographically off the Oregon coast), and what type of research is and will be conducted;
- Create a map using tools such as Google Earth and ESRI's ArcMap to identify the locations where research occurs off the coast of Oregon.

Overall, the goal of the NRI project was to provide a baseline of information about the research being conducted within the ocean and coastal environments bordering Oregon for understanding their stake in the marine spatial planning process.

3.4 Methods

3.4.1 Interviews

Individuals acting as key informants (Marshall, 1996) associated with scientific research institutions were targeted in the beginning of the project to gain background information on the nearshore research community in Oregon. Key informants were contacted through email, and asked to participate in an informal discussion. Using a snowball sampling technique (Robson, 1993), the key informants identified potential contacts for principal investigators of scientific research projects. A list of individuals and agencies associated with research was developed, and this list included research institutions as well as known principal investigators (PI) for research projects. This list of potential contacts grew through targeted internet searches.

Two criteria were used as filters for including research in the NRI in order to keep the project relevant for the marine spatial planning process: (1) the research must be repeated in a geographic space, and (2) the research must be ongoing and planned for the future. The first criteria was used because research that was not spatially dependent 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.

Participants from the scientific research community were recruited through email requests. Data was collected using ethnographic, semi-structured interviews (Robson 2007), and two interview guides were used for the interviews. A scoping interview guide was designed to determine whether the research fit the criteria for being included in the NRI. The formal interview guide was used to collect the following information to be included in the NRI: (1) project background and information; (2) geographic data information, (3) research timeline; (4) future planned research or data use; and (5) contact information.

Through interviews, data was collected on the geographic footprint of the scientific research community. The interview also served as 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 make decisions about tradeoffs between uses of the marine environment.

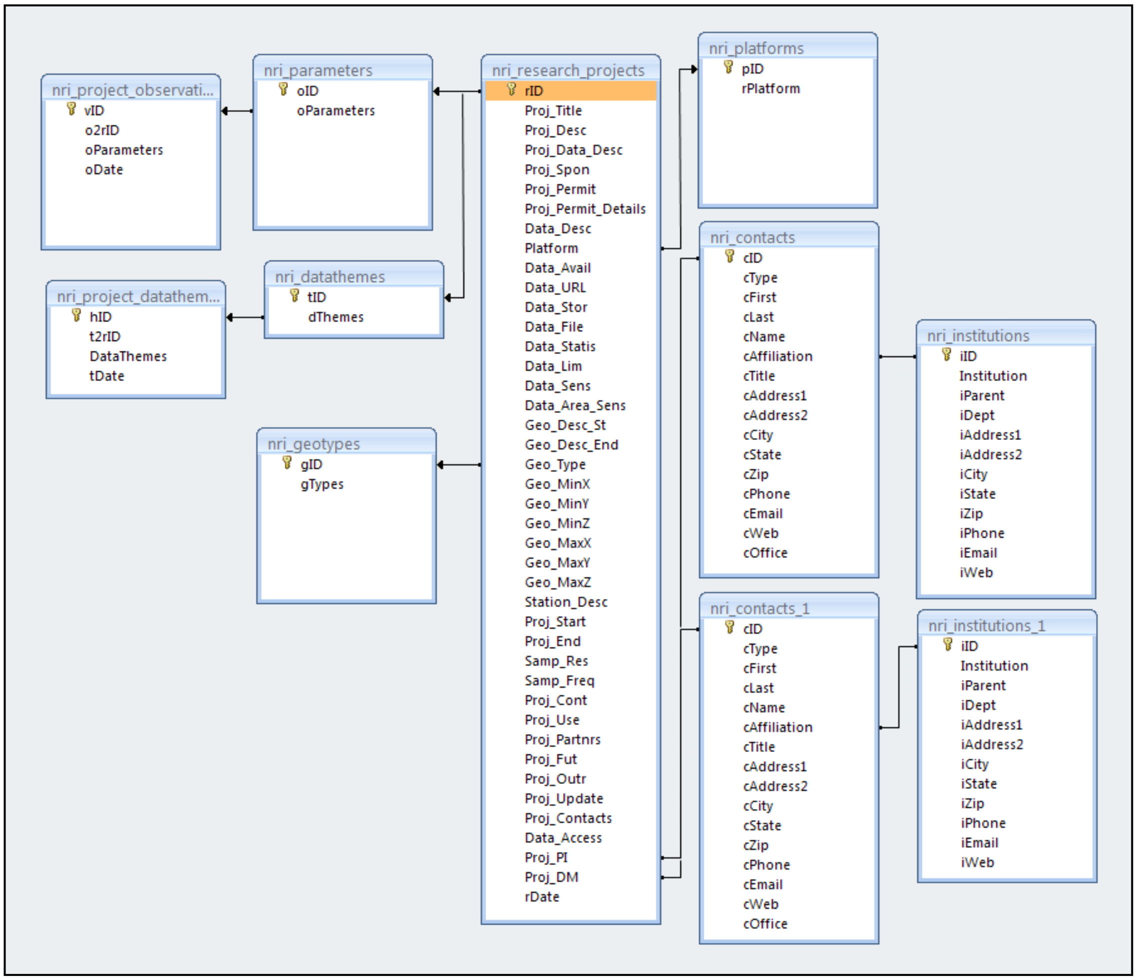

Figure 21: NRI Database Schema as Designed in Microsoft Access. Database connections are made between research projects, research institutions, and project contacts (the principal investigator and data manager for a scientific research project). Qualitative data included in the database includes: scientific research project name, description, permits, parameters measured, type of research platform, geographic location of research platform, research timeline, frequency of scientific research, and contact information for the principal investigator, data manager, and associated research institutions.

3.4.2 Data Analysis

Contextual data were organized into a Microsoft Access database, which was designed specifically for this project. Data was entered into the database using an online data entry page developed by DLCD. Spatial data was collected using a variety of methods, depending on the format in which the research had this information. Formats included Microsoft Excel files, ESRI shapefiles, maps, online data, journal articles, cruise plans, and verbal identification by participants during interviews. The spatial data was then organized into Google Earth KML files for consistency. Spatial data was also used to create ESRI shapefiles, and information as a result of the interviews was included in the attribute tables of the shapefiles. A KML file of the spatial results along with an Adobe PDF file with the data from the interview were sent to participants for validation of accuracy of the information documented during the interviews and included in the NRI. Corrections were made as requested after participants reviewed the files in order to include the most accurate information.

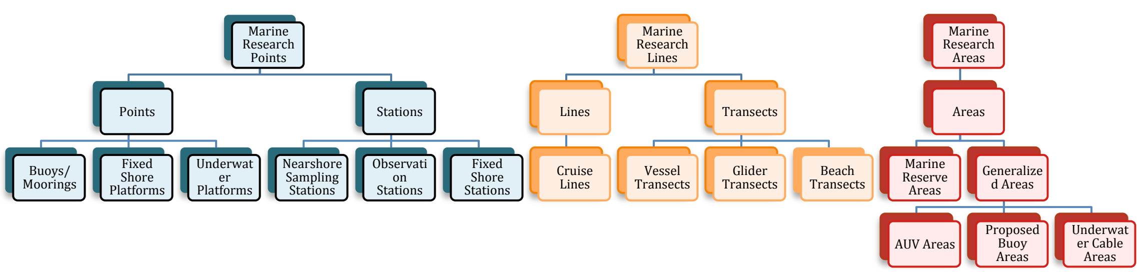

Figure 22: NRI Schema for Geographic Categorization. Scientific research projects were categorized into three main categories: marine research points, marine research lines, and marine research areas. The projects were the further divided into sub-categories including points, stations, lines, transects, and areas. The sub-categories were used to create thematic maps for visual representation of the scientific research projects that are conducted off of the coast of Oregon.

The data was categorized by the type of geographic space that the research occupied in the nearshore into three main categories: (1) marine research points, (2) marine research lines, and (3) marine research areas. The data were further broken down into sub-categories in order to accurately represent the scientific research projects (Figure 22). It was important to distinguish between spatial categories of research projects because the spatial designation will have different types of implications for the MSP process. For example, buoys, which are permanently moored in the water, 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. The spatial designation was the main attribute used to represent the data in the maps included in the marine planning process.

Data were analyzed based on the timeline of research. Each research project was categorized into short-term, medium-term, and long-term to show how long a research project is or will be conducted. Data were analyzed for frequency and seasonality including how often throughout the year, and over what time period.

3.5 Results

Overall, forty-six people participated in the key informant, scoping, and formal interviews. All participants were associated with federal and state agencies, non-profit organizations, educational institutions, research institutions, and privately owned companies. As a result, thirty-four research projects were identified and included in the NRI. Maps created as part of a result of the NRI were separated into marine research points (Figure 23), marine research lines (Figure 24), and marine research areas (Figure 24).

Ocean and coastal research projects are found along much of the Oregon coast, and distributed throughout the nearshore environment. Twenty percent of Oregon's ocean and coastline has research conducted within it (Figure 25). The highest densities of research are found near coastal communities, outside of estuary mouths, and in ecologically important areas (e.g. Rocky reefs).

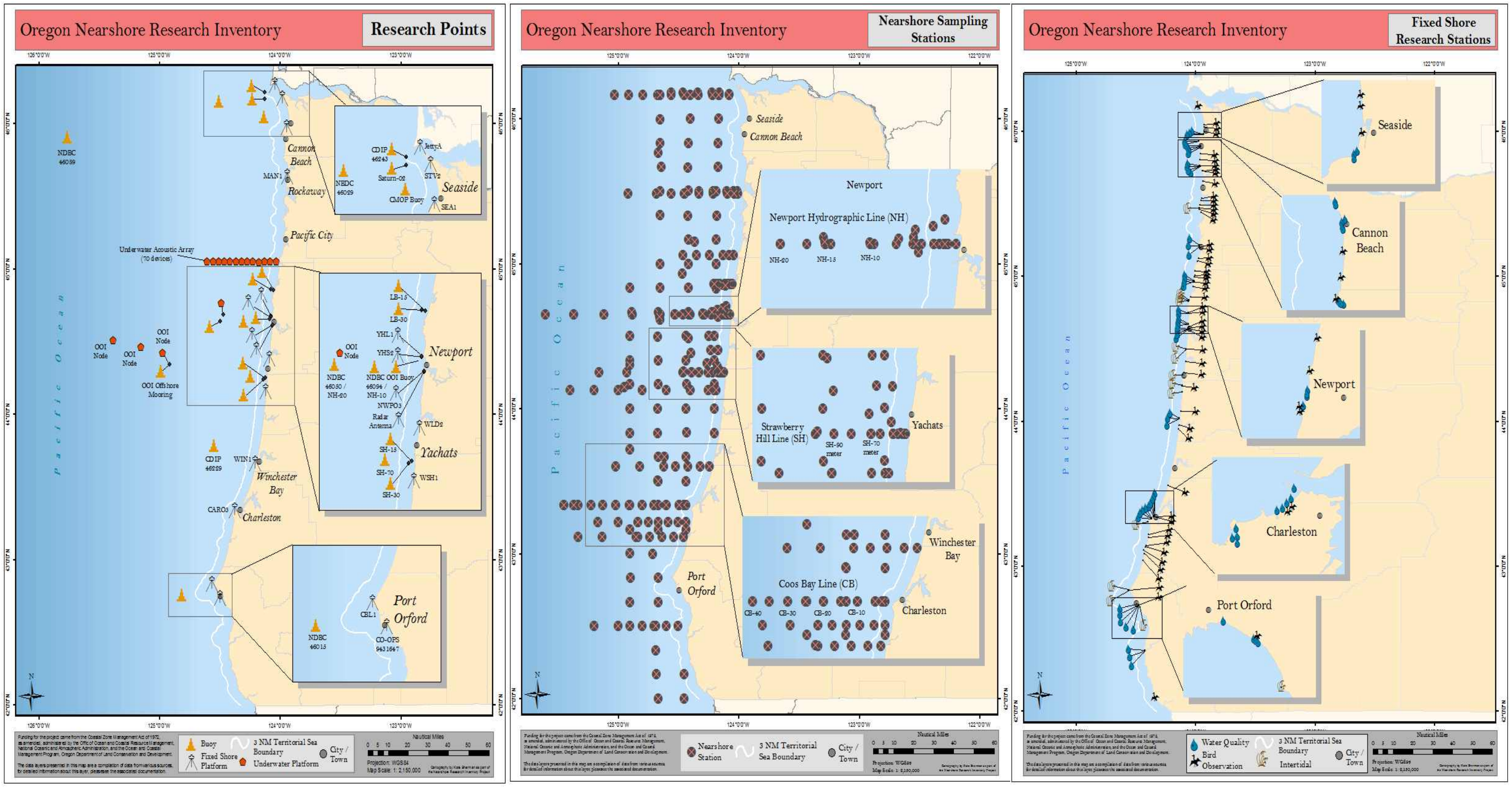

Figure 23: NRI Research Points Maps. Maps are divided into research points, nearshore sampling stations, and fixed shoreline research stations. Marine points represent permanent assets in the ocean, for example a buoy. Nearshore sampling stations represent locations in the ocean where research is conducted repeatedly, however, there is no permanent asset in the water at that location, for example a CTD cast station. Fixed shore sampling stations include locations along the shoreline where research is conducted repeatedly, however, there is no permanent asset on the shoreline at that location, for example a water quality monitoring station.

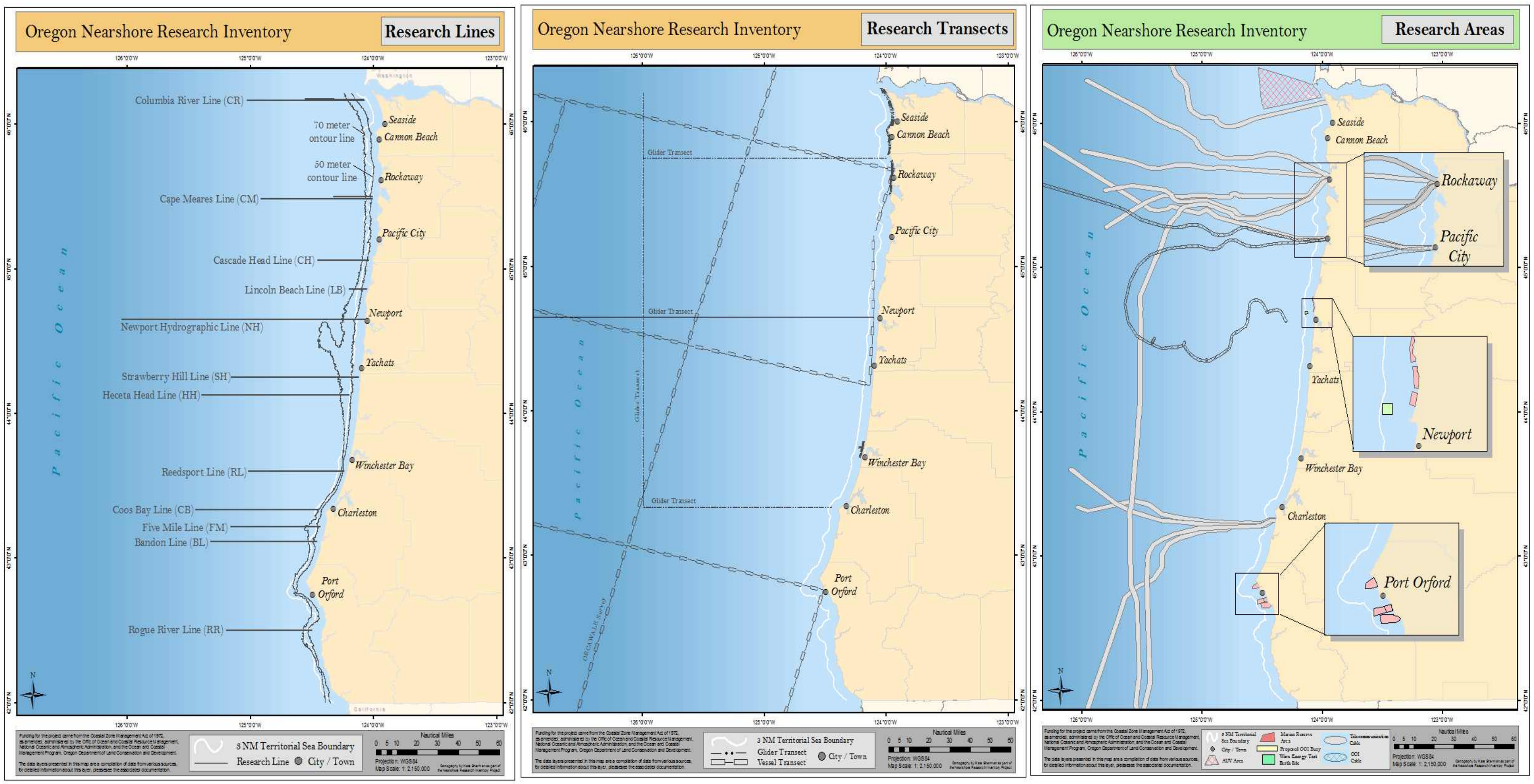

Figure 24: NRI Research Lines and Areas Maps. Maps are divided into research points, nearshore sampling stations, and fixed shoreline research stations. Marine points represent permanent assets in the ocean, for example a buoy. Nearshore sampling stations represent locations in the ocean where research is conducted repeatedly, however, there is no permanent asset in the water at that location, for example a CTD cast station. Fixed shore sampling stations include locations along the shoreline where research is conducted repeatedly, however, there is no permanent asset on the shoreline at that location, for example a water quality monitoring station.

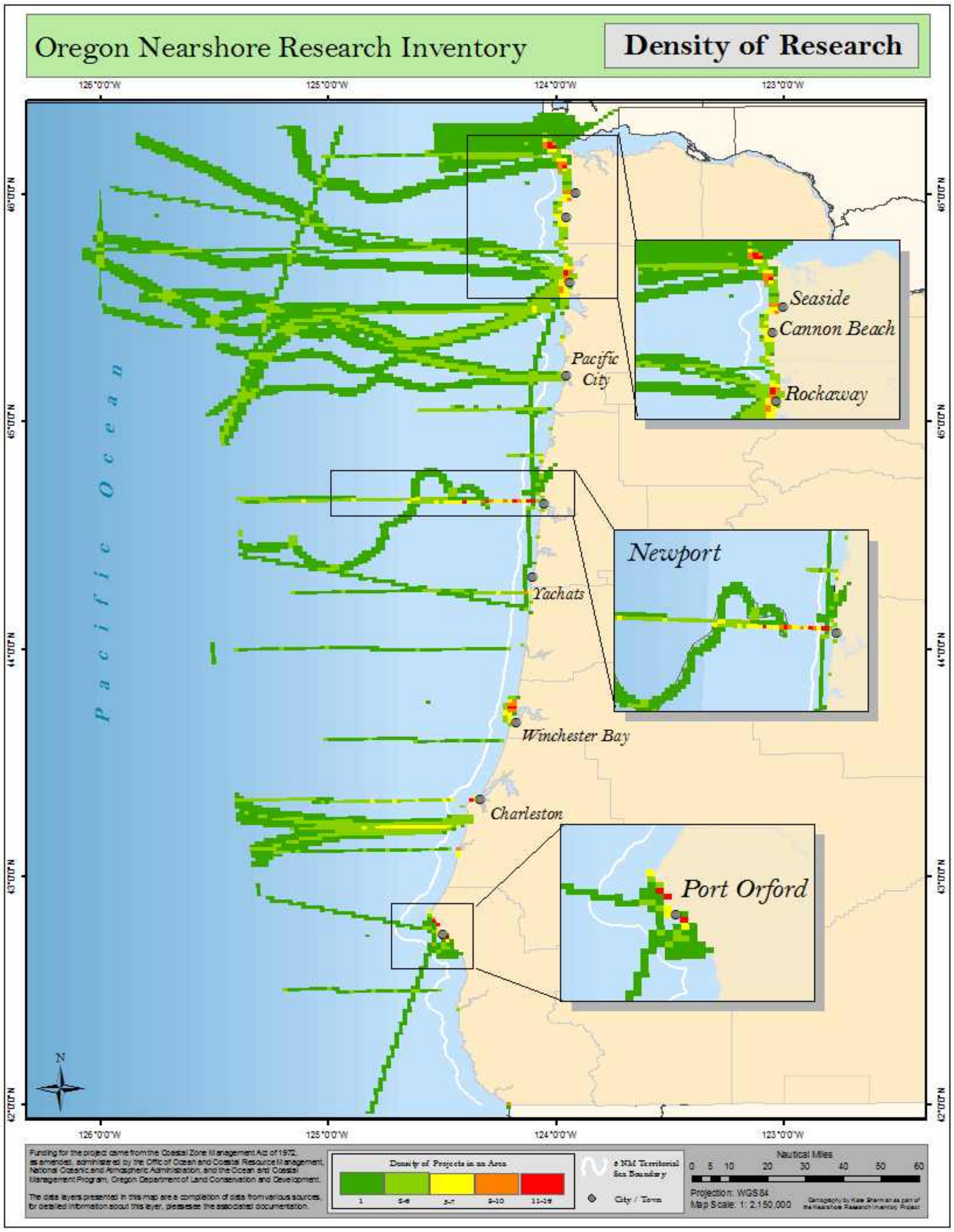

Figure 25: NRI Density Map. A map of the density of scientific research projects in the ocean and shoreline along the coast of Oregon. This includes research conducted along the shoreline up to the continental shelf break. Density was determined by the number of scientific research projects within one Department of Land Conservation and Development planning grid cell, which are 1 nautical mile by 1 nautical mile in area. The dark green represents locations that have at least one scientific research project conducted within the planning grid cell. Red represents locations where at least ten scientific research projects are conducted within the planning grid cells.

Scientific research projects off of the coast and in the ocean near Oregon are being conducted in many forms. These include permanent research assets such as buoys in the water, and consistent sampling of locations along the shoreline and coast. One example of scientific research space use is the Newport Hydrographic Line (NH-line), where the scientific community has been conducting research on physical, biological, and chemical of the area for over fifty years (Huyer et al, 2007). Scientific research platforms on the NH-line include research platforms such as buoys, ship-based and glider sampling, yielding long-term, fundamental understanding of oceanographic processes (Pierce et al, 2012). The NRI includes:

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

Most of the research projects measured had either physical (one-hundred percent of projects) or biological (seventy-nine percent of projects) research parameters. Fifty percent of the projects have collected data for over ten years, eighty-eight percent conducted scientific research during the summer months, and forty-one percent conducted research year-round. Spatially, research projects are distributed near ecologically significant areas, such as state parks and estuaries. Research projects were found in proximity to known research institutions, coastal communities, and locations where there is easy access to the ocean.

The completed NRI was integrated into Oregon MarineMap, an online tool for visualizing geospatial information, to inform the Oregon Policy Advisory Council (OPAC) and the Territorial Sea amendment process in Oregon. In addition, the results of the project are available for the public (www.oregonocean.info) and can serve as a template for other states engaging in a MSP process.

3.6 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 scientific research projects are conducted in many places throughout the ocean by many different groups and organizations and throughout different times of the year. The large scope of ocean space that is used by the scientific research community, in addition to the variety of activities and timelines, make it apparent that more comprehensive engagement of the scientific research community as a stakeholder of the ocean and coast is needed in the MSP process.

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. All of this information will be helpful for managers to know what types of scientific information is already available. Much of the scientific research that was identified has been conducted over a long period of time (over ten years), and this type of data is valuable in management decisions. The NRI provides background information helpful in informing managers as they weigh different tradeoffs for uses of space of the marine environment off the coast of Oregon.

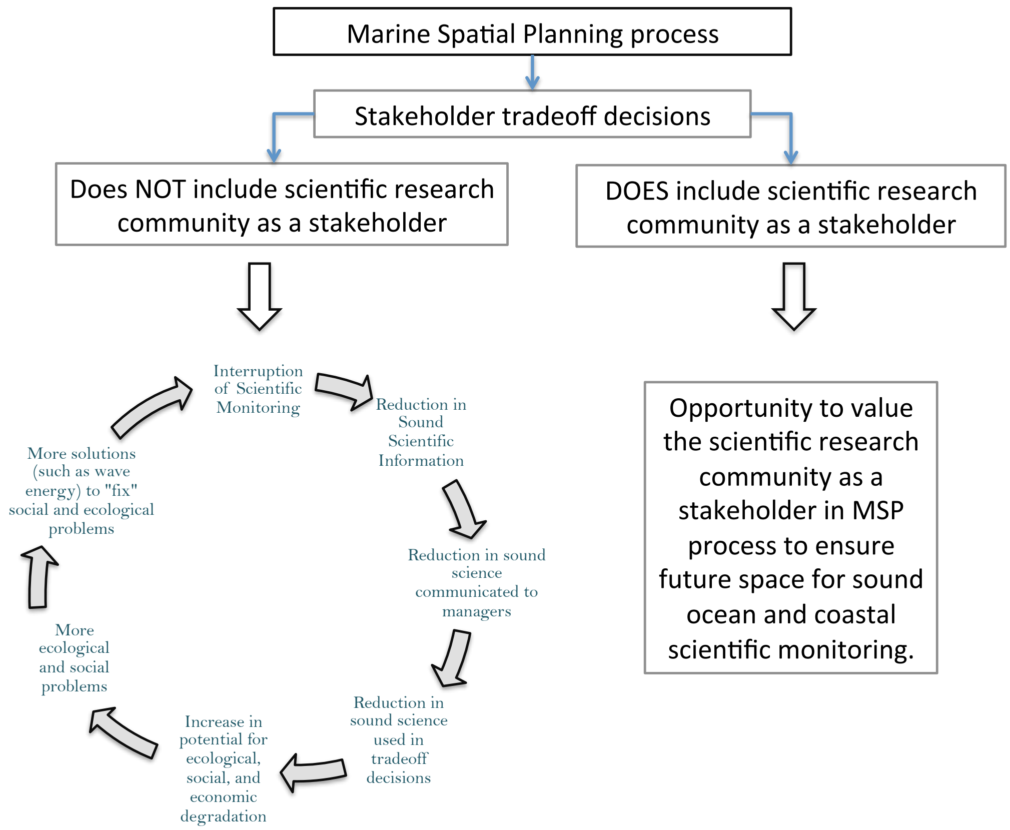

Figure 26: Feedback loop potential if the scientific community is not included as a stakeholder in the marine spatial planning process.

3.6.1 The NRI as a Way to Ensure Future Research Through Planning

Without sound scientific research, actions may be taken that have negative impacts on important functions and processes of the environment. Coastal communities depend on the services provided by theses functions and processes (McLeod et al, 2005), and negative ecological impacts from poor management decisions can lead to negative impacts on social and economic systems. As populations grow, policy makers and managers will look for solutions, such as wave energy, to meet societal demands. As MSP is used as a tool to make ecosystem based management decisions about ocean and coastal placement of technological solutions, the scientific community must be considered a stakeholder in the MSP process. If science is not considered a valuable use of the ocean and coast, further development, such as wave energy, could conflict with locations of scientific research, and lead to reduction in scientific information and knowledge. This cycle can continue in a feedback loop (Figure 4). To prevent this feedback loop it will require the scientific community to be engaged in the MSP process as a stakeholder. While considering tradeoffs in the MSP process, managers need to recognize and account for the value of sound scientific information to ensure future ecological, social, and economic sustainability and well-being of coastal areas and communities.

3.6.2 Valuing Long-Term Research

Long-term scientific data is valuable when managers and policy makers are looking to make decisions about issues that occur over a long time scale, such as climate change. It will be important for scientific researchers to monitor and evaluate the changes that are occurring within the marine environment. The NRI identified the projects that have been conducting research for over ten years in a space. Data from long-term research will provide more context for change than research conducted over a short time period.

Much of the long-term information identified was part of monitoring projects with the purpose of looking at changes over time. Relevant and sound information is extremely valuable in management decisions since the main purpose of scientific research is to understand the function or system that is being studied.

3.6.3 NRI as a Way to Identify Data Gaps and Potential Collaborations

Mapping the scientific research community's spatial use of the marine environment identifies spatial, temporal, and thematic gaps in data that could be useful in management decisions. Managers look for interdisciplinary scientific information to meet the complex challenges associated with decision-making processes. Understanding what is not available helps them understand what gaps need to be filled in order to make relevant and science-based decisions.

Ocean space that could be shared by scientific researchers indicates potential for collaboration. 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 gaps of research over time can be filled. This can help reduce costs for science, since the typical cost for use of a scientific research vessel can be prohibitively expensive. Collaboration can lead to a comprehensive, and more interdisciplinary understanding of ocean space by the scientific community, which can help inform managers for more ecosystem based management decisions.

3.6.4 The NRI as a Way to Enhance Data Networks

Comprehensively including the scientific research community in the MSP process is a way to identify the data networks that have relevant scientific information for management decisions. Data networks and institutions that have readily available information are a good way 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 make their data available online. This data ranges from water quality monitoring and beach health, to ocean surface currents.

The organizations who 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

Traditionally, research is conducted, written-up, reviewed, and then published in scientific journals. This process takes time and, unfortunately, can reduce the relevancy of the research for use in management and policy decisions. Enhancing data sharing and data networks provides relevant information to managers who need to understand and use scientific information.

3.7 Conclusions

Scientific information is the basis for many management decisions in an ecosystem-based management framework. Long-term, sound scientific information is valuable in marine spatial planning, and ultimately ecosystem based management. The information collected as part of the NRI project provides information about the scientific community and the availability of scientific information for management decisions. Recognizing that the scientific research community is an ocean and coastal stakeholder, and including them in the MSP conversation, will allow future tradeoff decisions to benefit from the best available scientific information.

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Chapter 4: Discussion

4.1 Introduction

As managers move forward with marine spatial planning (MSP) as a tool for ecosystem-based management of ocean and coastal resources, it will be important to include all stakeholders in the planning process. Decisions about tradeoffs and how space will be used and managed in the future will rely on the scientific information about all uses of the ocean and coast and their ecological, social, and economic values. This makes it important to recognize the value of sound science in ocean management decisions. The scientific research community is the source of this information, and in order for them to conduct research and have an understanding of ocean and coastal systems, they will use space in the ocean. This makes the ocean and coastal scientific research community a stakeholder of the marine environment, which needs to be recognized by managers for inclusion in MSP processes.

This chapter discusses the results of the Nearshore Research Inventory (NRI) project, as explained in detail in Chapter Two of this document. Benefits and future recommendations for society, managers, and the scientific community as a result of the NRI project are discussed. Limitations of the NRI project are also discussed.

4.2 Benefits of the Nearshore Research Inventory

4.2.1 Including the Scientific Research Community in the MSP Process

The NRI project initiated conversation with the scientific research community within Oregon about the MSP process, and the potential conflict between marine renewable energy development and their research. Other MSP in the United States, such as the Massachusetts Ocean Management Plan and the Rhode Island Special Area Management Plan, do not recognize the scientific research community as human users of the ocean. Therefore, there is no precedence of the scientific research community acting as a stakeholder in the planning process. The interview process for the NRI project was the first time that the scientific research community was comprehensively interviewed as a stakeholder for inclusion in the marine spatial planning process.

During the interviews for the NRI, most of the participants did not realize that a wave energy device could potentially overlap spatially and conflict with their research use of ocean space. If the scientists themselves are not aware of the potential conflict, they are at risk to lose the space to other stakeholders who are more actively engaged in the planning process.

NOTE: There was no direct question in the interview about whether or not the participant realized that the wave energy device could potentially overlap spatially with their research. This information was interpreted from discussions during the interviews after the purpose of the NRI project was stated.

Wave energy companies are required, as part of the permitting and licensing process, to engage with ocean stakeholders for the areas where they are proposing a wave energy facility. This requirement can be beneficial to the wave energy companies, because they are playing an active role in advocating for their use of the ocean.

Other uses of the ocean such as fishing and recreation do not have stakeholder engagement requirements associated with their use of the ocean. This is because many ocean uses do not need to apply for permits or licenses, many of which require stakeholder engagement, or do not ask for exclusive use of a specific ocean space. The stakeholder engagement requirement can be burdensome, yet beneficial for those who are required to initiate discussion amongst stakeholders. Unlike the wave energy companies, it is up to these other existing users to engage in and advocate their role as a user of the ocean. For example, only certain permits for scientific research require that the community have a public engagement process. Therefore, the rest of the scientific research community has to advocate for their role as a user of the ocean on their own accord. Through the NRI project in Oregon, the scientific research community has actively identified themselves as a stakeholder in the MSP process.

The Oregon NRI allowed the scientific research community to spatially identify themselves and their uses of the ocean and become a stakeholder in the MSP process. It takes time to engage in the planning process. The PIs of scientific research projects are busy securing the financial future for their research, conducting their research, and in some cases teaching classes at a university, and this makes engaging in the planning process challenging. The NRI visually and qualitatively represents ocean space use by the scientific research community, which makes the NRI valuable in the marine spatial planning process.

4.2.2 Identifying the Scientific Research Community

Before the NRI was completed, knowledge about who is part of the scientific research community that uses ocean space was segmented. Many people could identify portions of information about who is a part of the scientific research community, but there was no one place for this information, and it was not in a comprehensive database form.

The NRI project comprehensively identified who within the scientific research community uses ocean space, the specific locations, and frequency of use. This information will be important for future management decisions, since understanding who uses certain spaces of the ocean will allow managers to engage stakeholders in planning discussions to encourage compatible uses of the ocean, and reduce conflict amongst uses.

In addition, the NRI acts as a database of the scientific research community using ocean space. The contacts include individuals who are at institutions within and outside of the state of Oregon. The database includes all the contacts identified during the key informant interviews and background research process (even if their research did not meet the criteria to be included in the Inventory) as well as interview participants. This list of contacts can continue to grow with updates to the NRI.

4.2.3 Identifying Potential Partnerships

The NRI can provide scientific researchers a way to identify potential partners with whom to work with on future projects. The NRI includes themes of research as well as the parameters being measured for each research project. When this is connected with the geographic space of where the research is being conducted, it can identify areas research overlap and research gaps, both thematically and spatially. These research gaps can identify new avenues for research, as well as a opportunities for people to collaborate. For example, the two major themes of research identified in the Inventory were biological and physical research. Chemical research, which only had eight research projects categorized within the Inventory, is a theme that people may be interested in having more research done in certain locations. By adding a chemical component to a research project, it may be a way for scientific researcher to get more funding or collaborate with other scientists who specialize in chemical oceanography. If one scientific researcher is conducting research on a cruise, that person can potentially collaborate with another researcher who also collects data from that same space. This can reduce the cost of cruises amongst the scientific community, as well as help there be more comprehensive and well-rounded datasets for specific geographic area. Collaborative research will also benefit future management decisions, since a more comprehensive understanding of the processes of a given space of the ocean will help inform managers so they can weigh tradeoffs when making decisions.

One example of a community of scientists who collaborate is the community studying hypoxia within Oregon. Each spring, the hypoxia research community gathers to discuss their plans for the summer research season. In the fall, they meet again to discuss the results of the season. These meetings are organized by the research institution PISCO, one of the research institutions identified in the NRI as conducting a large portion of research within Oregon's ocean and coastal environment. 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 an ocean space and equipment, such as ship time and scientific instruments.

Overall, there is potential for more collaboration amongst the scientific community in Oregon. The three research institutions identified in this report as hubs of research (CMOP, PISCO, and HMSC), could be hosts for collaborative meetings. In addition to the research institutions, Oregon Sea Grant (seagrant.oregonstate.edu) and COMPASS (www.compassonline.org) are two entities that work with the scientific research community in Oregon to integrate science into management decisions. More collaboration amongst the scientific community for future research can be achieved by working across research institutions and other entities.

4.2.4 Public and Other Stakeholder Awareness of Scientific Research

The information collected in the NRI, including both the spatial component of research and the description and other metadata collecting during the interview process, will be available to the public online at www.oregonocean.info. This information will help raise awareness about all of the research that is being conducted in the nearshore environment off of the coast of Oregon. It can also benefit the scientific community by helping with public outreach of their work.

This NRI data is also helpful for maintenance and protection of scientific devices. Many of the devices are expensive, and therefore, very valuable for the scientific community since there are often limited funds to conduct research. If the public is not aware that an instrument is in the water, there are potential risks that damage can be done. For example, if a fishermen is not aware that there is an acoustic devices on the bottom of the ocean floor, they may accidentally snag it with their fishing net. If a fishermen is aware of where there are scientific devices, they can be cautious with their fishing equipment, which is not only beneficial for the scientific community, but it also helps prevent the fishermen from ruining or damaging their fishing equipment.

The participants from the scientific research community said that the information about the NRI should be made publicly available. During the interview process, participants were asked the question, “How should the information from the Nearshore Research Inventory project be made available?” Fifty percent of NRI participants said that this information should be available online. Ten percent of participants also recommended that this information should be made available through presentations to the public and other stakeholders.

4.3 Scientific Research - A Public Asset

Scientific research about the marine environment can also be viewed as a public asset since it provides information about social, ecological, and economic services provided by ocean and coastal ecosystems. There are a wide variety of services that are provided to humans that come from the ocean. The services range from provisioning services, such as fish for food, to social services such as surfing and scuba diving for recreation (McLeod et al, 2005). Since humans depend on these services, there is a connection between society and the environment (McLeod et al, 2005). Many of these services are inherently part of our economy because people pay for these types of services. The scientific research community provides valuable information by studying the functions and processes within the ocean so humans, and in particular managers, can understand and make decisions so the services are available in the future. Without scientific information, decisions could be made that potentially negatively impact ocean ecosystems, which in turn, may reduce or limit the services that are provided to humans by the ocean.

There are many ways that the public benefits from ocean and coastal scientific research. One example is the work done to monitor shoreline change and erosion. This information will be important for planners to understand the potential impacts of climate change and sea level rise on coastal communities. In Oregon, two of the projects included in the NRI, the "Oregon Beach and Shoreline Mapping and Analysis Program" and the "Oregon Nearshore Bathymetric Surveys" work with the purpose of monitoring shoreline change. In particular, these projects look to see if there are any hotspots of coastal change, such as erosion, along the Oregon coast. This type of scientific research will help managers when making planning decisions about infrastructures and homes along the coastline.

Another example is the work done by biologists to understand fish populations. Humans are consumers of fish, and therefore, adequate fish populations are important for continued consumption and enjoyment of fish, as well as for ecological and cultural purposes. The scientific community provides managers with information about fish populations so decisions can be made about whether or not a fish population is at risk of exploitation and extinction (and therefore in need of protection), or if there are plenty available for fishermen to catch. One project included in the NRI is research done on "The effects of biotic and abiotic environmental conditions on early marine life history of salmon." This project aims to understand how oceanic conditions relate to juvenile salmon recruitment and survival. This work helps managers understand and predict how much salmon will be available in the upcoming years and decide how many shares fishermen can receive to catch salmon.

Other scientific research helps keep people healthy, and gives them confidence in visiting the beach and participating in marine activities. The Oregon Beach Monitoring Program, run by the Oregon Public Health Division, monitors beach water quality at beaches along the Oregon coast. Through this program, the public is alerted if there are high levels of bacteria in the water that make it not safe to swim or recreate at the beach.

There are also many projects included in the NRI that look at hypoxia (low oxygen) in Oregon marine environments. When a hypoxic event occurs, it can kill marine life, in particular marine invertebrates such as Dungeness crab, which can have a negative impact on crab fishermen as well as members of the public who like to eat crab. Having an understanding of hypoxic events can allow fishermen to avoid areas where crabs may have died from lack of oxygen.

All of the scientific research projects included in the NRI should be considered assets for the public. Without this type of work, a lot of the functions and processes occurring in the coastal and ocean environment would not be well understood. The NRI project is beneficial for the public so MSP decisions can be made knowing where scientific research occurs.

4.4 Time in Management Decisions

When making management decisions about tradeoffs between different uses of the ocean, it is important to consider time restrictions for ocean use. The NRI project shows that much of the ocean and coastal research conducted in Oregon occurs within the summer months. This is due to the challenging weather and ocean conditions throughout the rest of the year, which make it difficult to access and be out on the water. Many other stakeholders are also restricted to this time frame. It is important to consider that the timing of scientific research in Oregon is driven by the weather and ocean conditions. Other states, such as California (and particularly in Southern California), do not have this type of time restriction. Therefore, as managers move forward with MSP, engagement activities with the scientific research community in Oregon should not occur in the summer months when they are out conducting scientific research.

Frequency of use of space by the scientific research community should be a considering in the MSP process. The NRI project shows that the frequency of research varies for each scientific research project. Some projects have continuous sampling, whereas other projects only sample every three years. When considering potential conflict between the scientific research community and marine renewable energy, there is more likely to be high conflict for research that is conducted more frequently.

4.5 Limitations of the Nearshore Research Inventory

The NRI Project interviews were conducted throughout the summer and fall of 2010, so the short timeline to conduct the project placed limitations on how much information is included in the NRI. Updates to the NRI were made in the spring of 2012 to include scientific research projects that were not included in the original NRI, or where space use by a particular scientific research project changed. The NRI is representative of the projects that were ongoing or planned during the original timeframe and what was updated in 2012. Other projects that may not be included in the NRI either were not identified during this timeframe or are new scientific research initiatives in Oregon.

The PI's were hard to contact during the interview process during the NRI project; many follow up emails were sent and phone calls made to individuals requesting their participation in the project, and with all of the reminders it was often challenging to get in touch with potential participants.

The timelines for research were either estimated based on responses in the interview, or were researched after the interview if the participant was not able to answer the timeline question. Therefore, the timelines for research are estimates based on what the participants discussed during the interviews, or what literature was available online about the research projects.

Given the researcher for the NRI project's affiliation with Oregon State University, the data and research projects associated with the school may be better represented than other education and research institutions. The proximity to OSU participants, as well as having the researchers as professors in class, made it easier to contact and arrange meetings with the OSU scientific research community than other participants outside of OSU.

Interviews were not conducted for all of the research projects included in the NRI. Interviews were conducted for eight-five percent of the scientific research projects included in the NRI. Ideally, each research project would have a scoping and formal interview with the PI as well as an email confirmation of the accuracy of the data collected during the interview process. Many PIs only participated in a portion of this process. If a scientific research project met the criteria to be included in the NRI and geographic information for the project was publicly available, it was included even if the PI was not accessible to participate in the interview process.

During the interview process, the formal interview guide was used to guide the discussion and collect information about the research projects. Not all of the participants responded to every question during interview. The database is based on responses obtained during the interviews, and therefore some projects have more detailed data than others.

The main purpose of creating the NRI was to provide a spatial footprint of the scientific research community for the MSP process in Oregon. There were research projects within Oregon's nearshore that were not included in the NRI because they did not meet the criteria to be included. The NRI is not a full representation of all of the research being conducted in the nearshore environment of Oregon, but is a subset of research projects.

Chapter 5: Conclusions And Recommendations

5.1 Introduction

This chapter includes concluding thoughts about the Nearshore Research Inventory (NRI) project as well as recommendations for future action. There are two main sets of recommendations; the first is for managers and current and future decisions makers involved in marine spatial planning (MSP) processes and the second set is for the scientific community. It is their work and livelihood that is at risk if they aren't considered a stakeholder in the marine spatial planning process. Additionally, the MSP process could potentially suffer if scientific information is not used to inform management decisions.

The resulting maps and data from the NRI project are currently being used in the Territorial Sea amendment process of finding suitable locations for marine renewable energy off the coast of Oregon. Use by the scientific research community is represented in the marine spatial planning (MSP) process in Oregon.

The NRI project was one outlet to make the scientific research community aware of the MSP process in Oregon. The final report, written for the Department of Land Conservation and Development (DLCD), will be shared with this community. This will inform them of the results of this project as well as introduce them to the recommendations that resulted from the project.

5.2 Recommendations for Managers/Marine Spatial Planners

5.2.1 Engaging the Scientific Research Community

The scientific research community's involvement in the MSP process will help ensure that research is represented as a human use of the ocean. A first step to continue to involve the research community in the MSP process is for DLCD, who manages the state of Oregon's MSP process, to email the contacts in the NRI to see if they would like to stay up to date and receive further notifications about the planning process. This will give the participants the opportunity to receive DLCD's updates, which include public meeting dates and locations where there is opportunity to comment on the MSP process and decisions.

5.2.2 Maintaining the Nearshore Research Inventory

The NRI is comprehensive, however, due to time restraints for collecting information to include in the NRI, it may not be complete. There will be new research projects proposed and it is possible that some ongoing projects may not have been included in the NRI. Even though some long-term scientific research projects will continue into the future, much of the research being conducted off the coast of Oregon will change; therefore, it is important to continue to engage the research community in order to have the most up to date and relevant information.

During the interview process, the participating scientists were asked the question, "How would you suggest we update this information to keep it up to date?" The main responses to this included continuing interviews with researchers as well and continuing to survey them for updates. The following is a list of responses about how to maintain the NRI:

- Through interviews (44% of responses)
- Survey (13% if responses)
- Web-based form (6% of responses)
- Look up permits (6% of responses)

Maintaining the NRI will require someone to either interview or survey the researchers on a consistent basis to maintain an up-to-date database of research. One participant said, "DLCD should manage this information, the researchers already have it, DLCD just needs to file it in one place." Another participant said, "the information should be kept current by maintaining contact with researchers and talking to them about the research they are conducting." These responses show that the researchers do have this information, and that they simply need to be asked for it in order to get updates.

The results of the NRI project can serve as baseline of information to be used in the future to update the NRI to be as accurate as possible. Since a majority of the research is conducted in the summer, this season should be avoided for interviewing or surveying researchers on their research plans. In early spring most scientific researchers know what research they will be conducting over the summer, therefore, a survey of PI's or their graduate students, or a phone call, to find out about research being conducted is one way to maintain the NRI and keep it up to date. Another way to maintain the NRI is to check the websites of the known research institutions that are identified in the NRI, in particular the websites of the institutions that make data available online.

5.2.2 Creating Research Inventories in Other States

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 is also the first time within the United States that the research community's use of the coast and ocean has been mapped for inclusion as a stakeholder in a state level MSP process. Therefore, when other states engage in MSP activities, they can use this project as a template to conduct their own inventories of scientific research.

After gathering information to include in the NRI, it became clear that many of the questions on the interview guide did not have responses and some of the responses, such as the spatial component of the research, were more valuable to the MSP process than other responses. For future inventories, it is recommended that the following information be emphasized in the data collection process since it is the most important for inclusion in the MSP process and for other uses of the NRI:

- Background information on the research;
- Geographic space of the research;
- Timeline for research;
- Themes for research;
- Parameters being measured during the research;
- How to keep the database of research up to date.

To begin applying this project to other states and regions, it is important to conduct background research to get a perspective of who is included in the research community. The following resources are a good way to begin a new inventory:

- Identifying research institutions;

- Identifying educational institutions;
- Identifying state and federal agencies;
- Identifying the regional ocean observing system for a list of ocean observing assets through the Integrated Ocean Observing System (IOOS).

These local institutions and agencies will provide a lot of background information on who is conducting scientific research as well as the type of research being conducted.

Another way to find out information about ocean and coastal scientific research is through permit applications. Many scientists have 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. This outlet of information can also be used as resource for the individual trying to maintain the NRI. Each state has different agencies that manage the permit process, so it is important to understand who is managing the permits in order to successfully find out who is applying for the permits.

Not all of the research being conducted within a state is by people who work and live within the state. Federal agencies and other institutions looking at larger scale phenomena study ocean and coastal areas in more than one state. Therefore, it is beneficial to conduct a more comprehensive NRI of the research being conducted along the shoreline and in the ocean off of a state in order to get the most accurate spatial footprint of scientific research use.

When scheduling time to interview or survey researchers, it is best to contact during the season when the researchers are not busy conducting scientific research. This may vary from state to state, therefore, timeline for scientific information is important information to research before initiating the interview process.

It is important for other states to include the contextual information on a research project in order to best inform managers and decision makers in the marine spatial planning process. The value of the data in the NRI is more than just the spatial footprint of scientific research.

As indicated by participants in the NRI project, a more comprehensive database of ocean and coastal research would be beneficial, not just what is included based on the criteria for the NRI project. Other states should look to limit the criteria for including research in their inventories, and if time and resources permit, look to inventory more of the research within their states than would be included by using the criteria for this project.

5.2.3 Future Research

A West Coast Research Inventory

The current NRI includes research projects for the state of Oregon. The state of Oregon is physically 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. The NRI should be expanded regionally to California and Washington in order to have the best understanding of what research is being conducted on the west coast. Many of the research and educational institutions conduct research throughout the whole coastline, therefore a west coast inventory would better represent an ecosystem framework for science and management, as recommended for successful ecosystem based management practices.

This report provides a template for creating an inventory of scientific research in other states, which makes it easy for other states to repeat the process. In California, the California Coastal Commission could partner with an educational institution (similar to how DLCD worked with Oregon State University) to obtain a graduate student to conduct the inventory. In Washington, the Department of Ecology and the Washington State Coastal Zone Management Program could inventory the research in Washington in conjunction with a graduate student there. With all three states using a similar template for inventorying the research, it would be easy to integrate all three of the inventories to create a West Coast Nearshore Research Inventory for regional MSP. This information would be helpful for identifying research and potential collaboration to be used to help inform different working groups that were formed within the West Coast Governors Alliance (WCGA). In particular, a West Coast research inventory would contribute to a Regional Data Framework, a goal of the WCGA, for linking various data managers, users, and systems throughout the West Coast. A West Coast research inventory would not only benefit state-wide marine spatial planning efforts and collaborations, but would benefit region-wide planning processes.

Estuarine and Offshore Research Inventories

The data in the NRI includes scientific research conducted along the shoreline up to the continental shelf break. This did not include research that is conducted in the estuaries or research that is conducted offshore, or past the continental shelf break. An inventory that included both estuarine and offshore research would be more comprehensive and representative of ocean and coastal ecosystems since in the marine world, functions and processes do not stop because a line on a map stops.

Economic Analysis

Now that the research has been inventoried and mapped, more research can be done on the socio-economic benefits that the nearshore research brings to the state of Oregon. Questions related to the economic value of the research was not part of the interview process because the results would have only been a snapshot of the total economic gain from research than what it is in reality. For example, another potential research project is to use the NRI to identify and contact researchers to look at the number of jobs as well as the income associated with conducting research off the Oregon coast. Caution should be taken when conducting this type of research, since in order to get the best snapshot of this information, all of the ocean and coastal research in Oregon should be included, not just the research that has a spatial footprint on the coast and included in the NRI.

Additionally, the value of ocean and coastal research goes beyond economic value to the values based on the benefit that scientific research gives to society as a whole. Therefore, conducting an economic analysis of the value of scientific research for our economy may not represent the non-market values that scientific research provides to society as a whole.

5.2.5 Other Uses of the Nearshore Research Inventory

If any research assets are lost in the ocean, the NRI can provide information to public, specifically fishermen, who might find the lost research equipment while they are out fishing. The fishermen can use the NRI to identify the PI who is in charge of research equipment in a specific area. In addition, the background information on the research project helps identify if the research asset in the water is supposed to be there. One example is a fishing boat finding a buoy in the ocean. Often it is challenging to know whether or not the buoy supposed to be in that area or if it broke free from its mooring. The NRI database can provide information about the location where the buoy is supposed to be, and therefore help identify whether or not the buoy is supposed to in that certain space or not.

5.3 Recommendations for the Scientific Community

5.2.1 Engaging in the Marine Spatial Planning Process

Despite the scientific community being inherently busy, it is still important for them to engage as a stakeholder in the MSP process. One recommendation for a way to help engage this community is to have a graduate student, or another worker, become the planning process liaison to the PI of a scientific research project. This person can keep the PI informed on the progress of the planning process, and alert them of any relevant information. This would not only benefit the PI, but it would also benefit the person acting as liaison. It will benefit the liaison by teaching them about the current management plans and policies relevant to their work. This type of engagement will not only benefit the planning processes of today, but can act as a way of training the future PI's, so the next generation of scientists will be even more engaged in relevant political and management processes than scientists have historically. In a time when a lot of research activities are driven by management needs, it will be important for upcoming scientists to learn to conduct research while at the same time learning to conduct scientific research and communicate sound science to managers.

5.2.2 Engaging in Public Meetings and Public Comment

As a requirement for ocean and coastal development, companies need to follow regulations laid out in the National Environmental Policy Act (NEPA) of 1969 by writing an Environmental Impact Statement (EIS). The main purpose of NEPA is for potential developers to consider the potential environmental consequences of their decisions before proceeding with any actions. The EIS is a document that includes a description of the proposed action, purposes and need for an action, alternatives, affected environment, environmental consequences, and required mitigations and recommendations for best management practices (NMFS 2012). NEPA requires there to be opportunities for public involvement in the process in two different stages, which includes reviewing the draft and the final EIS for the project.

It is during the public comment period that the scientific research community has the opportunity to comment on a proposed wave energy project. If there is a proposed wave energy project that interrupts a location that is associated with long-term research, it will be beneficial for the scientific research community to comment on the potential impact during the public comment period. This will allow decisions makers to understand the potential risks associated with placing a wave energy device in that specific geographic area. There is no guarantee that the comment will be enough to cause the wave energy company to change potential development space, however, it is important that the decision makers understand that potential impact of the proposed action on the scientific community. Information on public meetings surrounding wave energy devices in Oregon is made available on the website http://oregonocean.info.

5.2.3 Research Permits

Oregon's coast and ocean is managed by many different agencies at both the state and federal level. Appendix 11 lists which agencies have jurisdiction over what areas of the coast and ocean in Oregon. As identified in the NRI, many of these agencies require permits in order to conduct scientific research over the areas that they manage. Most of the permits are related to interactions with wildlife, physical alteration of a piece of land (submerged or not submerged), or water quality. Of the nine permits and three other types of paperwork identified in the NRI as being required to conduct scientific research, only two of the permits allow a member of the scientific community to rent or lease part of the ocean, or more specifically, the land that is underneath the water. The two permits are:

1. *Temporary Use Permit*. Issued by the Department of State Lands (DSL), this permit allows short-term use of a specific area of publicly-owned submerged and

or submersible land for specific use under specific terms and conditions. The lease is, in most cases, for up to one year. Fees for this permit will be between $250 to $500. Applications are available on the DSL website (http://www.oregon.gov/DSL/LW/temporaryuse.shtml).

2. *Special Use Permit*. Issued by the Department of State Lands (DSL), this permit allows special authorization for a short term lease of land for uses that are not otherwise governed by other DSL administrative rules. This includes many uses including scientific experiments and demonstration projects and renewable energy projects. The lease can last anywhere from one to thirty years. Fees for this permit are up to $500/year in addition to a $750 of non-refundable application processing fee. Applications are available on the DSL website (http://egov.oregon.gov/DSL/LW/specialuse.shtml).

These permits provide an opportunity for the scientific community to lease the submerged lands under which they conduct scientific research. There are small fees associated with these permits, however, they are minimal compared to most costs of scientific research. These permits could be used to ensure that a specific space of the Oregon Territorial Sea is available for scientific research. This could be most important for locations that have long -term research associated with the area, such as along the Newport Hydrographic Line. In general, these permits are a potential avenue of opportunity to ensure the protection of long-term monitoring locations.

It is unclear whether or not scientific research that doesn't require structure (such as a CTD cast or a research cruise line) could apply for a permit. In addition, these permits are limited to the Territorial Sea boundaries, which are up to three nautical miles off of the coast of Oregon. Therefore, any research conducted outside of the Territorial Sea boundary would not be able to apply for this permit, since it no longer falls under jurisdiction of DSL.

5.3 Final Thoughts

It is not solely the responsibility of managers or the scientific community alone for there to be successful incorporation of the scientific community as stakeholders in the MSP process. Success will come from both sides recognizing the value of each other, communicating, and working together.

As populations grow, the use of ocean and coastal space will become more competitive. Ideally, decisions will be made taking ecological, social, and economic processes into consideration in a balanced, sustainable way. All ocean uses are at risk for being trumped by other uses. I urge everyone not to forget the value of sound science, and in particular long-term monitoring projects in marine spatial planning processes, which help us understand how the earth was in the past, and will continue to help us understand earth processes in the future.

APPENDIX

Institutional Review Board ● Office of Research Integrity
B308 Kerr Administration Building, Corvallis, Oregon 97331-2140
Tel 541-737-8008 | **Fax** 541-737-3093 | IRB@oregonstate.edu
http://oregonstate.edu/research/ori/humansubjects.htm

NOTIFICATION OF EXEMPTION

September 7, 2010

Principal Investigator:	Michael Harte	Department:	Marine Resource Management
Study Team Members:	Andy Lanier		
Student Researcher:	Kate Sherman		
Study Number:	4730		
Study Title:	Oregon Nearshore Research Index Project		
Funding Source:	Oregon Dept. of Land Conservation and Development (DLCD): student is a student professional funded to complete this project for DLCD.		
Submission Type:	Initial Application received 08/06/10		
Review Category:	Exempt	Category Number:	2

The above referenced study was reviewed by the OSU Institutional Review Board (IRB) and has determined that it is exempt from full board review. You may proceed with the research described in the protocol.

Expiration Date: 08/31/15

*The exemption is valid for **5 years** from the date of the initial determination.*

Annual renewals will not be required. If the research extends beyond the expiration date, the Investigator must request a new exemption. Investigators should submit a final report to the IRB if the project is completed prior to the 5 year term.

Documents included in this review:

☒ Protocol	☒ Recruiting tools	☐ External IRB approvals
☒ Consent forms	☒ Test instruments	☐ Translated documents
☐ Assent forms	☐ Attachment A: Radiation	☐ Attachment B: Human materials
☐ Grant/contract	☐ Letters of support	☐ Other:

☐ Project revisions:

Principal Investigator responsibilities:

- Amendments to this study must be submitted to the IRB for review prior to initiating the change. Amendments may include, but are not limited to, changes in funding, personnel, target enrollment, study population, study instruments, consent documents, recruitment material, sites of research, etc.
- All study team members should be kept informed of the status of the research.
- Reports of unanticipated problems involving risks to participants or others must be submitted to the IRB within three calendar days.
- The Principal Investigator is required to securely store all study related documents on the OSU campus for a minimum of three years post study termination.

If you have any questions, please contact the IRB Office at IRB@oregonstate.edu or by phone at (541) 737-8008.

College of Oceanic Atmospheric Sciences
104 COAS Administration Building, Oregon State University, Corvallis, 97331
Tel 541-737-3504 | **Fax** 541-737-2064 |
http://www.coas.oregonstate.edu

Project Background and Process:

I have contacted you because I would like to learn about the research you are conducting off the coast of Oregon. The purpose of the project is to inventory and map the current and future use of Oregon's nearshore ocean environment by the research community. If the research you are involved with fits a predetermined set of criteria, then I'd like to set up a formal interview with you at a later time to be included in this project.

The purpose of the formal interview will be to discuss in some detail information about your research with questions about the following topics:

- Project Background (purpose of the research, desired results).
- Data Information (type of data, research technologies being used, geographic footprint/area of research).
- Research Timeline (dates, frequency).
- Future research (uses of the data, potential partnerships, potential education and outreach).

Questions

What is the name of your project/study?

Is your research being conducted in the nearshore environment (we are using this term broadly to cover research that occurs on the continental shelf all the way up to the ocean front intertidal communities)?

i. If yes, describe the geographic area, in general.
   a. Is the platform for the research a point, line, area, 3-d area?

ii. If no, outside the nearshore environment, then the project will not meet the criteria to be included in the Nearshore Research Index.

Please give a brief description of the research being conducted.

Is the research a single sample (only one time), or will it be conducted repeatedly over time?

i. If its a single sample (for example a research vessel collecting data at a location once), then it will not be included in the Nearshore Research Index.
ii. If its repeated over time in the same geographic area, then yes it can be included.

5. Is information about your research currently publicly available?
   i. If yes, please give a location (website).

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6. If meet eligibility requirements, get the following information about the researchers:
    - Who is the project investigator (PI)?
        i. First name, last name
        ii. What institute is the PI associated with?
        iii. Address, city, state, zip code.
        iv. Phone number
        v. Email
        vi. Website

    - What institute or individual has control over the data?
        vii. If individual, first name, last name
        viii. Name of associated institute
        ix. Address, city, state, zip code.
        x. Phone number
        xi. Email
        xii. Website

7. If they meet eligibility requirements, discuss the more formal interview:

I'd like to set up a date and time for the formal interview. This discussion will last approximately one hour. During this discussion, I plan to tape record our conversation to ensure an accurate representation of your research, but the audio recording is option. After completion of our discussion, I will send you the results to verify and update as needed. If there are any concerns about security of the information you share, I will work with you to best represent your research and ensure its security.

Questions?

PURDUE UNIVERSITY **Libraries** *Access. Knowledge. Success.*

INTRODUCTION

Librarians at Purdue University are beginning to identify the scientific datasets that are being generated by our faculty and researchers as information assets to be collected, preserved, and made accessible as a function of the library's collection development. These librarians are subject-area specialists, and many have advanced degrees in their respective disciplines in addition to a degree in library science. They have all been trained in collection management; however, much of this training was related to traditional formats such as monographs and serials and not datasets. In our experience, one of the most effective tactics for eliciting datasets for the collection is a simple librarian-researcher interview. In this poster, we share a set of ten questions that a librarian can use as a starting point for such a "data interview". It is not a comprehensive strategy but instead a practical tool to draw out information that needs to be considered in order to evaluate the suitability of a dataset for the collection and the requirements for the infrastructure and services that will be needed for data curation.

#1 What is the story of the data?

Begin the interview with an open-ended question that allows the researcher to talk freely about his or her research, scientific workflow, and community of practice. This lends some insight into the value of the dataset and how it may fit into your collection and be used, and it provides the ***context*** for understanding how and why the dataset was created and how it was processed and analyzed.

#2 What form and format are the data in?

What computing environments (e.g., software) are required to use the data? If the data are in proprietary structures, you may consider reformatting them into agnostic formats or ones that can be more easily ***re-versioned***. Is there any existing ***metadata***, either external to the data or description that could be extracted from it? Ideally the data could be described to be discoverable by researchers from another discipline.

#3 What is the expected lifespan of the dataset?

In many cases, there are distinctions in the utility of a dataset as it begins in a raw state and then is analyzed and processed into new forms and versions as a result of different steps in the research workflow. Different entities may have custody of the data and use it for different purposes at different times, affecting its ***provenance***. Funding agencies may require that data be archived for a prescribed period of time or you may forecast its future value and the amount of time it should be retained. The data may be described and archived for effective ***preservation*** to ensure its accessibility and integrity over time.

#4 How could the data be used, reused, and repurposed?

This is a primary ***selection*** criterion that also impacts how the data are ***accessed*** and what ***policies*** may be needed to govern its use. As data are archived and shared, new and unintended uses for the data may increase its value. For example, a research dataset may be repurposed as a learning object.

#5 How large is the dataset, and what is its rate of growth?

It is important to quantify the size of the data for storage and network provisioning if you intend to ***ingest*** it into your repository. What is its physical (bits) and logical (records) ***scale***? Is the dataset static or dynamic? Ask for a sample of the data to examine.

#6 Who are the potential audiences for the data?

Information regarding potential users of the data and the users' needs is paramount. Along with potential uses for the data, this is another primary ***selection*** criterion. In some cases, the data may need to be embargoed or restricted to a limited group of users who are granted ***permission*** to access it.

#7 Who owns the data?

Establishing and maintaining the ***intellectual property*** represented by the data should be discussed at the earliest opportunity, and any conflicts should be resolved up-front. Many organizations have a submission policy that asks the contributor to verify that they own the data and have the right to submit it.

#8 Does the dataset include any sensitive information?

All data should be reviewed for information that violates ***confidentiality***, such as identification information on human subjects. Data curation activities should be informed by institutional review board requirements.

#9 What publications or discoveries have resulted from the data?

The researchers may have a bias regarding the importance of their data. The purpose of this question is to establish an objective metric for determining the value of the data for the collection. Different metrics may be more appropriate in determining the ***selection*** criteria for different kinds of data and data collections.

#10 How should the data be made accessible?

There is value in making data accessible using a conventional web-based user interface, but machine-to-machine interfaces should also be evaluated. These ***methods of access*** will be informed by the answers to the previous questions, and this question can be asked in an open-ended manner to fill in any gaps remaining at the conclusion of the interview.

SUMMARY

Although building robust collections of datasets present several complexities and challenges to resolve, the process of looking at scientific datasets as information assets and exploring what is needed to develop and manage data collections is similar to the traditional collection development practices that have been successfully employed by librarians for decades. We offer these ten "data interview" questions as a springboard for librarians to explore data curation in greater depth and specialization.

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Purdue University Libraries
Distributed Data Curation Center
http://d2c2.lib.purdue.edu

D2C2 Distributed Data Curation Center

"Conducting a Data Interview"

Michael Witt & Jake Carlson, Purdue University Libraries, West Lafayette, Indiana, USA

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Appendix 3: Nearshore Research Index Project Interview Guide

1. Project Background and Information

Questions about the the project background, purpose of the research being conducted, desired results, and funding.

- Please describe the background and purpose of your research.
- What information (data) are you hoping to obtain from the research?
    - i. What quantitative information?
    - ii. What qualitative information?
- Who is connected to the project?
    - i. Funding?
    - ii. Affiliation?
    - iii. Partnerships?
- What permits are required for you to perform your research?

2. Data Information

Questions about the data including, research technologies, data observations, and metadata.

- What type of data are you collecting?
    - i. What technologies are being used to collect the data?
    - ii. What category does the data exist in (biological, chemical, physical, etc).
    - iii. List of the different types of data being collected.
- What geographic area does the data set cover? (this can be used if the information is sensitive and they do not want to give exact points or locations)
    - i. Please describe the geographic area researched by your project.
        1. Does it start in a town, or out in the sea? Where does it end? Is it always in one place?
    - ii. Is there a station associated with your research? A station can include buoys, boats, transects, etc.
        1. If yes, what are its GPS coordinates?
        2. If yes, Is there a station ID or description. For example, Hatfield Marine Science Center in Newport, Oregon.
    - iii. What is the geographic type measured by your data?
        1. Point, Line, 3d area, area
    - iv. West, East, North, and South boundaries (use grid map to select the boundaries).
    - v. What is the elevation, if any, of your research?
        1. If on shore, what is the elevation.
        2. If on seafloor, what is the depth?
        3. Sea level?
- In what format do you store the data?
    - i. If it is in a proprietary structure, can it be exported (for example, to excel).

ii. Spreadsheet, tabular digital data, multimedia presentation, etc.

- Is the data publicly available? If yes, what is the website or location where the data is accessible. If no, do you have plans to make it public available?
- Are there any limitations to the data? If so, what are they?
- Is there any metadata or a description associated with the data?

3. Research timeline

Questions about the timeline of research as well as timing for data measurements.

- On what dates is the research being conducted?
  - i. Is this a short term project? Is this a continuous project?
- What are the time frames of research being conducted?
  - i. Example, is it one measurement every hour? Or is it conducted over a period of twenty minutes every day? Sample resolution is what this is called?
- Will future data be collected?
  - i. If yes, when?
- Will the data change over time?

4. Future Planned Research or data use

Questions about the potential uses of the data. Questions about sharing the data with potential partners and for communication purposes.

- What are the potential uses of the data?
  - i. What other uses is it used for?
  - ii. What other uses can it be used for?
- Are there other people who can benefit from this data? Do you have specific target audiences you tailor products for?
- Are there any potential partnerships you could have to share this data? (For example this crab pot, sensor data collection).
  - i. Who are the people/agencies/organizations you could partner with?
- Is this data helpful for educational purposes?
  - i. For schools?
  - ii. For communities?
  - iii. For general public?
- How would you suggest we update this information to keep it up to date.
  - i. Online survey?
  - ii. Phone call?
  - iii. Email

5. Contact Information

General contact information for study participant as well as contacts for research accessibility. This is confirmation of the information given in the preliminary phone conversation.

- Who is the project investigator (PI)?
    i. First name, last name
    ii. What institute is the PI associated with?
    iii. Address, city, state, zip code.
    iv. Phone number
    v. Email
    vi. Website
- What institute or individual has control over the data?
    i. If individual, first name, last name
    ii. Name of associated institute
    iii. Address, city, state, zip code.
    iv. Phone number
    v. Email
    vi. Website

Parameters in the Nearshore Research Inventory Database

acoustic telemetry
acidity
algae abundance
algae presence
algae species
alkalinity
ammonium
ammonium nitrate
average wave period
barometer pressure
bathymetry
biomass
bird species
bottom pressure
boundary layers
chlorinity
chlorophyll-a
chromophoric dissolved organic matter
ciliate
conductivity
cross shore beach
current - direction
current - speed
density
depth
dew point
dewpoint temperature
directional waves
dissolved CO_2 (seawater)
dissolved hydrogen
dissolved organic matter
dissolved Oxygen
dominant wave period
entangled birds
fish abundance
fish class
fish presence
fish size
fish species
fluorescence
gravity field
gray whale location
gust speed
habitat classification
hydrogen peroxide (h2o2)
imaging of biology
imaging of fluid flow at vents
invertebrate density
invertebrate presence
invertebrate recruitment
invertebrate species
irradiance
kelp growth rate
krill abundance
larval samples
light radiation
long-wave radiation
manganese (Mn^{2+})
marine mammal presence
max fluorescence
mean wave direction
mean wind direction
met. Observations
microbe-temperature-fluid sampling
minimum fluorescence
motionally induced electric fields
mussel genomics
mussel growth
mussel physiology
nitrate
nutrients
ocean surface winds
oiled birds
oxygen saturation
partial pressure of CO_2 (air)
pc02
percent cover
pH
phosphate
photosynthetically active radiation
phycoerythrin
phycoerythrin fluorescence
pinniped abundance
pinniped behavior
pinniped brand number
pinniped brand quality
precipitation
predator abundance
pressure - atmospheric
pressure - water
pressure tendency
quantum yield
radiation
relative humidity
salinity
salmon (adult) abundance
salmon egg abundance
salmon larvae abundance
sand accretion
sand erosion
scattering coefficient
sea level pressure
sea surface temperature
seabird presence
seafloor to sea surface acoustic travel time
sediment concentration
sediment transport
seismicity
short-wave radiation
significant wave height
solar Radiation
stream flow
surf grass growth rate
surface Current
surface height
surface winds
suspended sediments
swell direction
swell height
swell period
temperature - air
temperature - water
turbidity
turbulence
vent wall environmental conditions
voltage
water column height
water transparency
wave height
wave steepness
wind chill
wind direction
wind gust
wind speed
wind velocity
wind wave direction
wind wave height
wind wave period
zooplankton abundance

Oregon
Theodore R. Kulongoski, Governor

Department of Land Conservation and Development
Ocean and Coastal Services Division
635 Capitol Street NE, Suite 150
Salem, Oregon 97301-2540
Phone: (503) 373-0050
Fax: (503) 378-6033
www.oregon.gov/LCD/OCMP

Dear (Researcher),

My name is Kate Sherman, and I am currently working on a project funded by the Department of Land Conservation and Development (DLCD) in support of the ongoing state process to amend the Oregon Territorial Sea Plan for the incorporation of marine renewable energy. The purpose of the project is for DLCD to inventory and map the current and future use of Oregon's nearshore ocean environment by the research community. The project will also be used as part of my masters project requirements with the College of Oceanic Atmospheric Sciences at Oregon State University.

I am contacting you because I would like to set up an initial scoping conversation to learn about your research (this will last approximately fifteen minutes). If research you are involved with fits a predetermined set of criteria, then I'd like to set up a formal interview with you at a later time. The more detailed discussion will last approximately one hour.

Your participation in this project will help ensure that:

- Research is recognized as a significant human use of the ocean that should be represented in future ocean planning and management processes.
- The identification of where research is being conducted and what areas need more research.
- There are outreach and education tools to help to inform the public about the ongoing investigations into Oregon's ocean environment.

One minimal risk of the project is the identification of the location of research technologies in the ocean to the public, which, if identified, could be damaged or stolen. In order to minimalize this risk, we will allow you to generalize the geographic area of research.

Your participation in this research project is voluntary, and we thank you in advance for your participation. The information resulting from this project will be crucial in representing Oregon nearshore research and researchers.

To schedule a phone call for the initial scoping conversation, or if you have any questions regarding this project, I may be contacted at (503) 269-2040 or katherine.j.sherman@state.or.us. If you have questions about your rights or welfare as a participant, please contact the Oregon State University Institutional Review Board (IRB) Office, at (541) 737-8008 or by email at IRB@oregonstate.edu.

Best Regards,

Kate Sherman
Student Professional/Technical Worker
Oregon Coastal Management Program

Personnel associated with this project:

Principal Investigator:
Michael Harte
Principle Investigator
Professor & Director,
Marine Resource Management Program College of Oceanic and Atmospheric Sciences
Sea Grant Extension Specialist
Oregon Sea Grant
104 COAS Administration Building
Oregon State University, Corvallis, 97331
Tel: + 1 541 737 1339
Fax: + 1 541 737 2064
mharte@coas.oregonstate.edu

Co-Investigator:
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Coastal Resources Specialist
Oregon Coastal Management Program
Oregon Dept. of Land Conservation and Development
635 Capitol Street NE, Suite 150
Salem, OR 97301-2540
Office: (503) 373-0050 ext. 246
Andy.Lanier@state.or.us
www.oregon.gov/LCD

Student Researcher:
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Student Professional/Technical Worker
Oregon Coastal Management Program
Marine Resource Management Masters Student
College of Oceanic Atmospheric Science, Oregon State University
(503) 269-2040
katherine.j.sherman@state.or

College of Oceanic Atmospheric Sciences
104 COAS Administration Building, Oregon State University, Corvallis, 97331
Tel 541-737-3504 | **Fax** 541-737-2064 |
http://www.coas.oregonstate.edu

Project Title:	Nearshore Research Inventory Project
Principal Investigator:	Michael Harte
Student Researcher:	Kate Sherman
Co-Investigator(s):	Andy Lanier
Sponsor:	Department of Land Conservation and Development

1. WHAT IS THE PURPOSE OF THIS FORM?

This informed consent document contains information you will need to help you decide whether to participate in this study or not. Please read the form carefully and ask the study team member(s) questions about anything that is not clear. You will receive a copy of this form for your records.

2. WHY IS THIS STUDY BEING DONE?

The purpose of the project is for the Department of Land Conservation and Development (DLCD) to inventory and map the current and future use of Oregon's nearshore ocean environment by the research community. The project will also be used as part of Kate Sherman's (Student Researcher) master's project requirements with the College of Oceanic Atmospheric Sciences at Oregon State University. Up to 100 researchers will be invited to take part in this study.

3. WHY AM I BEING INVITED TO TAKE PART IN THIS STUDY?

You are being invited to take part in this study because you currently conduct, or plan to conduct research in Oregon's nearshore environment.

4. WHAT WILL HAPPEN IF I TAKE PART IN THIS RESEARCH STUDY?

If you take part in this study, I will interview you to determine the geographic footprint of your research off of the Oregon coast. The interview will last approximately one hour.
The interview will include questions on the following topics:

- Project Background (purpose of the research, desired results).
- Data Information (type of data, research technologies being used, geographic footprint/area of research).
- Research Timeline (dates, frequency).
- Future research (uses of the data, potential partnerships, potential education and outreach).

I plan to audio record the interview to ensure accuracy of the information included in the study. The audio recording is optional. The audio recording will be used document details from the interview that may have not been recorded by the student researcher during the interview. The audio recording will serve mainly as an aid in the data collection process. As necessary, the student researcher will transcribe parts of the interview to provide perspective on the data when reaching project conclusions.

______I agree to be audio recorded.
Initials

______I do <u>not</u> agree to be {audio recorded, video recorded, and/or photographed}.
Initials

During the interview I will record your responses to the survey questions using an online form. The data from your responses will be stored in a secure database housed at the Department of Land Conservation and Development.

After the interview, I will send you the information that was documented during the interview to confirm accuracy of all of the information. At this time, you may update, correct, and/or remove any of the information that was documented during the interview.

Storage and Future use of data:

The data will be stored in the database at the Department of Land Conservation and Development for a minimum of five years post study termination. In addition, since the data from the study will be published online for incorporation into the Territorial Sea Plan, this information will be permanently available to the public. The data will also be stored by the Principal Investigator, Michael Harte, on the secure Oregon State University server for at least three years after the termination of the study.

The information that identifies you and/or your research will only be provided to other ocean resource users who may potentially disturb your geographic area of research. This information includes the geographic location of where you conduct your research

We may contact you in the future for another similar study. You may ask us to stop contacting you at any time.

We will send you a copy of the results once the study is complete.

5. WHAT ARE THE RISKS OF THIS STUDY?

The research being conducted is minimally invasive and poses very few risks. One minimal risk of the project is the identification of the location of your research technologies in the ocean to the public. We understand that many of these technologies are expensive, and if identified, could potentially be stolen or damaged. In order to reduce this risk, we will allow you to generalize the geographic area of research using the mapbook layout of the coast of Oregon. This will make it very difficult for a person to find the exact location of your research platform.

6. WHAT ARE THE BENEFITS OF THIS STUDY?

We do not know if you will benefit from being in this study. However, the results from this research may protect the geographic area of your research from being developed for alternative energy use. Your participation in this project may help ensure that:

- Research is recognized as a significant human use of the ocean that should be represented in future ocean planning and management processes.
- A gap analysis exists that identifies where research is being conducted and what areas need more research.
- There are outreach and education tools to help to inform the public about the ongoing investigations into Oregon's ocean environment.

7. WILL I BE PAID FOR BEING IN THIS STUDY?

You will not be paid for being in this research study.

8. WILL IT COST ME ANYTHING TO BE IN THIS STUDY?

There is no cost for participation in the interviews other than time involved with participating in the interview. There may be travel costs associated with the interview (i.e. if you need to travel to a meeting location that is comfortable for both myself and you). However, I will do my best to conduct the interview in a location that is most accessible for you.

9. WHO IS PAYING FOR THIS STUDY?

College of Oceanic Atmospheric Sciences
104 COAS Administration Building, Oregon State University, Corvallis, 97331
Tel 541-737-3504 | **Fax** 541-737-2064 |
http://www.coas.oregonstate.edu

The Department of Land Conservation and Development is funding this study.

9. WHO WILL SEE THE INFORMATION I GIVE?

The information you provide during this research study will be kept confidential to the extent permitted by law. Research records will be stored securely and only researchers will have access to the records. Federal regulatory agencies and the Oregon State University Institutional Review Board (a committee that reviews and approves research studies) may inspect and copy records pertaining to this research. Some of these records could contain information that personally identifies you.

The information that identifies you as a participant and/or your research will be provided to other ocean resource users who may potentially disturb your geographic area of research. This information includes the geographic location of where you conduct your research.

The Department of Land Conservation, as the funder of this project, will see the information resulting from this study. The data will be housed within the Department of Land Conservation and Development. To ensure confidentiality, the database will exist behind the state of Oregon's IT firewall, and will be password protected so that only the PI, co-investigator, and student researcher will have access to the raw survey data. The data will also be stored by the Principal Investigator on the secure Oregon State University server for at least three years after the termination of the study.

9. WHAT OTHER CHOICES DO I HAVE IF I DO NOT TAKE PART IN THIS STUDY?

Participation in this study is voluntary. If you decide to participate, you are free to withdraw at any time without penalty. You will not be treated differently if you decide to stop taking part in the study. If you choose to withdraw from this project before it ends, the researchers will not keep information collected about you and this information will not be included in study reports. You are free to skip any question during the interview that you do not want to answer.

10. WHO DO I CONTACT IF I HAVE QUESTIONS?

If you have any questions about this research project, please contact:

Michael Harte, Principal Investigator, mharte@coas.oregonstate.edu, or (541) 737-1339.
Kate Sherman, Student Researcher, katherine.j.sherman@state.or.us , or (503) 269-2040
Andy Lanier, Co-Investigator, andy.lanier@state.or.us, or (503) 373-0050

If you have questions about your rights or welfare as a participant, please contact the Oregon State University Institutional Review Board (IRB) Office, at (541) 737-8008 or by email at IRB@oregonstate.edu

12. WHAT DOES MY SIGNATURE ON THIS CONSENT FORM MEAN?

Your signature indicates that this study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.

Participant's Name (printed): ____

______________________________________ ____________________________
(Signature of Participant) (Date)

______________________________________ ____________________________
(Signature of Person Obtaining Consent) (Date)

Latitude	Longitude	Name	Description	Icon	LineStringColor	Icon Heading

Common Marine Data Types

Marine Points

Instantaneous Points

Feature Points
ID
X,Y
Z
Examples: marker buoy, transponder, other fixed, geography

Instant (Subtype)
ID
X,Y
Z or ΔZ
$m_1 \ldots m_2$
t
Examples: CTD, XBT, SVP casts at ΔZ, fish density, tide gauge, etc., at surface or a single Z

Location Series (Subtype)
ID
ΔX,Y
ΔZ
$m_1 \ldots m_2$
$t_1 \ldots t_2$
Examples: telemetry, bird/mammal sighting, ship mounted ADCP

Survey (Subtype)
Examples: aerial coastal survey, lidar, SCUBA/free swim obs.

Sounding (Subtype)
Examples: single beam bathy

Time Series Point

Time Series
ID
X,Y
Z or ΔZ
$m_1 \ldots m_2$
$t_1 \ldots t_{infinity}$
Examples: current meter, moored ADCP at ΔZ, obs. buoy, hydrophone, OBS at single Z

Marine Lines

Profile Line
ID
X,Y
M_1, M_2
$Z_1, Z_2 \ldots$
Examples: for abstracting data from, building profile from, measuring change along... seismic reflection, bathy profile, cross section, sed. transport line

***Time Duration Line* Track**
ID
$X_1, Y_1, X_2, Y_2 \ldots$
M_1, M_2
$Z_1, Z_2 \ldots$
$m_1, m_2 \ldots$
$t_1, t_2 \ldots$
Examples: transit ship track, ROV or sub track, algal bloom trawl, ADCP tracks, ARGO drifter

Feature Line
ID
$X_1, Y_1, X_2, Y_2 \ldots$
M_1, M_2
Examples: cable, pipeline, sea wall, ocean front, EEZ or legal boundaries NOT enclosing an area

Shoreline
shoreline type, VDatum

Marine Areas

Feature Area
ID
$X_1, Y_1, X_2, Y_2 \ldots X_1, Y_1$
Z
m
Examples: Marine boundaries (e.g., sanctuary, MPA), habitats, patches, lava flows, clipping, masking

Time Duration Area
ID
$X_1, Y_1, X_2, Y_2 \ldots X_1, Y_1$
Z
m
$t_1 \ldots t_n$
Examples: No-take zones, oil spills, harmful algal bloom

Marine Rasters/Grids/Meshes

Regularly Interpolated Surfaces
$row_1, col_1 \ldots row_n, col_n$
$Z_{r,c1} \ldots Z_{r,c,n}$
multipoint
Examples: multibeam bathy, sidescan, lidar, SST, climatology, scientific mesh, "re-analyzed" products (images such as GeoTIFF, BIL, etc.)

Irregularly Interpolated Surfaces
$row_1, col_1 \ldots row_n, col_n$
$Z_{r,c1} \ldots Z_{r,c,n}$
multipoint
Examples: TINs, bathymetry, sidescan, lidar, scientific mesh for finite element model, etc.

Mesh Volume
ID
$X_1, Y_1, Z_1, X_2, Y_2, Z_2$
$\ldots X_1, Y_1, Z_1$
m or $m_1 \ldots m_n$
t or $t_1 \ldots t_n$
ncols,nrows,nlayers in scientific mesh, multipatch
Examples: model of plume, front, warm core, trawl abundance

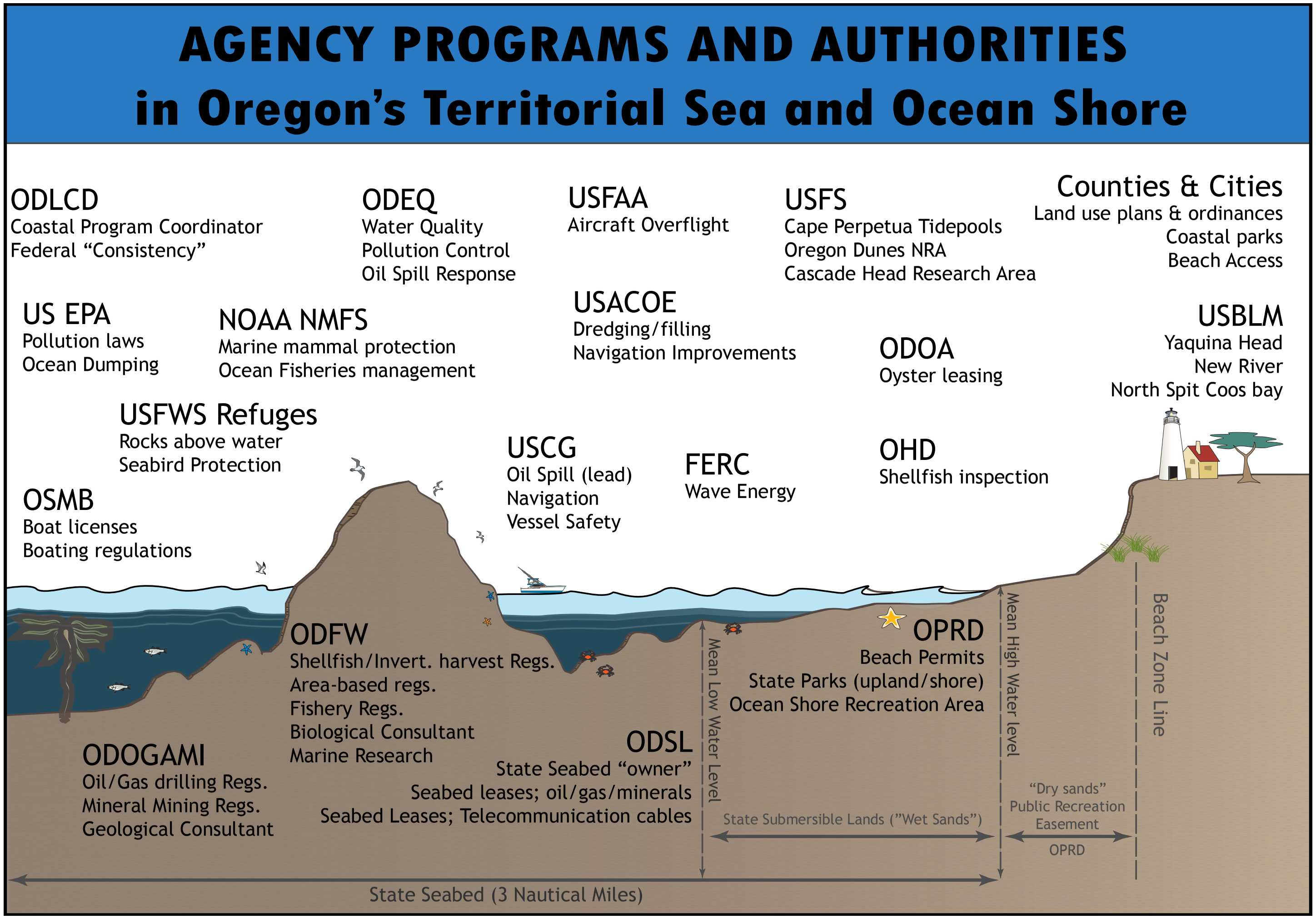
Derived or Placeholder

Animations, Movies, Video
$X_1, Y_1, Z_1, X_2, Y_2, Z_2$
$\ldots X_1, Y_1, Z_1$
$t_1 \ldots t_n$
Examples: U/W video footage, outputs from atm. or circulation models that are animated & georegistered so other data may be overlain

ACRONYMS—definitions

ADCP—acoustic doppler current profiler
ARGO—array for real-time geostrophic oceanography
BIL—band interleaved by line (for remotely sensed images or grids)
CTD—conductivity, temperature, depth
EEZ—exclusive economic zone
GeoTIFF—georeferenced tagged image file format
LIDAR—light detection and ranging
MPA—marine protected area
OBS—ocean bottom seismometer
ROV—remotely-operated vehicle
SCUBA—self-contained underwater breathing apparatus
SST—sea surface temperature
SVP—sound velocity profile
TIN—triangulated irregular network
U/W—underwater (also often refers to "underway")
VDatum—vertical datum
XBT—expendable bathythermograph

Name	**Affiliation** (at the time of interview)
Aimee Keller	National Oceanic and Atmospheric Administration (NOAA) - *Northwest Fisheries Science Center*
Alix Laferriere	Oregon Department of Fish and Wildlife (ODFW)
Anette Von Jouanne	Oregon State University (OSU) - *School of Electrical Engineering and Computer Sciences*
Arlene Merems	Oregon Department of Fish and Wildlife (ODFW)
Bill Peterson	National Oceanic and Atmospheric Administration (NOAA)
Bob Collier	Oregon State University (OSU) - *College of Oceanic and Atmospheric Science (COAS)*
Bruce Mate	Oregon State University (OSU) - *Marine Mammal Institute*
Bruce Menge	Oregon State University (OSU) - *Department of Zoology*
Claude Dykstra	International Pacific Halibut Commission (IPHC)
Craig Risien	Oregon State University (OSU) – *College of Oceanic and Atmospheric Science*
Curt Whitmire	National Oceanic and Atmospheric Administration (NOAA) - *Northwest Fisheries Science Center (NWFSC)*
Dave Fox	Oregon Department of Fish and Wildlife (ODFW)
Emilio Mayorga	Northwest Association of Networked Ocean Observing Systems (NANOOS)
Gil Sylvia	Coastal Oregon Marine Experiment Station (COMES)
Jack Barth	Oregon State University (OSU) - *College of Oceanic and Atmospheric Science (COAS)*
Jan Hodder	University of Oregon (UO) - *Oregon Institute of Marine Biology*
Jeff Kroft	Oregon Department of State Lands (DSL)
Jessica Miller	Oregon State University (OSU) - *Department of Fisheries and Wildlife*
John Stevenson	Ecotrust
Jonathan Allen	Oregon Department of Geology and Mineral Industries (DOGAMI)
Kaety Hildenbrand	Oregon Sea Grant Extension
Kim Raum-Suryan	Oregon State University (OSU) - *Marine Mammal Institute*
Kipp Shearman	Oregon State University (OSU) - *College of Oceanic and Atmospheric Science (COAS)*
Kristen Milligan	Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)
Laurel Hillman	Oregon Department of Parks and Recreation
Leesa Cobb	Port Orford Ocean Resources Team (POORT)
Lisa Balance	National Oceanic and Atmospheric Administration (NOAA) - *Southwest Fisheries Science Center (SWFSC)*
Lorenzo Ciannelli	Oregon State University (OSU) - *College of Oceanic and Atmospheric Science (COAS)*
Lydie Herfort	Center for Coastal Margin Observation and Prediction (CMOP)
Meleah Ashford	Northwest National Marine Renewable Energy Center (NNMREC)
Merrick Haller	Oregon State University (OSU) - *School of Electrical Engineering and Computer Sciences*
Michael Wilkin	Center for Coastal Margin Observation and Prediction (CMOP)
Mike Greybill	South Slough National Estuarine Research Reserve (SSNERR)
Mike Kosro	Oregon State University (OSU) - *College of Oceanic and Atmospheric Science (COAS)*
Paul Winchell	Kintama
Peter Ruggiero	Oregon State University (OSU) - *Department of Geosciences*
Roberto Venegas	Oregon State University (OSU) - *College of Oceanic and Atmospheric Science (COAS)*
Sarah Mikulak	Northwest Association of Networked Ocean Observing Systems (NANOOS)
Scott Heppell	Oregon State University (OSU) - *Department of Fisheries and Wildlife*
Scott McMullen	Oregon Fishermen's Cable Committee (OFCC)
Selena Heppell	Oregon State University (OSU) - *Department of Fisheries and Wildlife*
Steve Giovannoni	Oregon State University (OSU) - *Department of Microbiology*
Steve Rumrill	South Slough National Estuarine Research Reserve (SSNERR)
Suzanna Stoike	Port Orford Ocean Resources Team (POORT)
Tony D'Andrea	Oregon Department of Fish and Wildlife (ODFW)
Tuba Ozkan-Haller	Oregon State University (OSU) - *College of Oceanic and Atmospheric Science*


AGENCY PROGRAMS AND AUTHORITIES
in Oregon's Territorial Sea and Ocean Shore
ODLCD
Coastal Program Coordinator
Federal "Consistency"
ODEQ
Water Quality
Pollution Control
Oil Spill Response
USFAA
Aircraft Overflight
USFS
Cape Perpetua Tidepools
Oregon Dunes NRA
Cascade Head Research Area
Counties & Cities
Land use plans & ordinances
Coastal parks
Beach Access
US EPA
Pollution laws
Ocean Dumping
NOAA NMFS
Marine mammal protection
Ocean Fisheries management
USACOE
Dredging/filling
Navigation Improvements
ODOA
Oyster leasing
USBLM
Yaquina Head
New River
North Spit Coos bay
USFWS Refuges
Rocks above water
Seabird Protection
USCG
Oil Spill (lead)
Navigation
Vessel Safety
FERC
Wave Energy
OHD
Shellfish inspection
OSMB
Boat licenses
Boating regulations
ODFW
Shellfish/Invert. harvest Regs.
Area-based regs.
Fishery Regs.
Biological Consultant
Marine Research
OPRD
Beach Permits
State Parks (upland/shore)
Ocean Shore Recreation Area
ODSL
State Seabed "owner"
Seabed leases; oil/gas/minerals
Seabed Leases; Telecommunication cables
ODOGAMI
Oil/Gas drilling Regs.
Mineral Mining Regs.
Geological Consultant
Mean Low Water Level
Mean High Water level
Beach Zone Line
State Submersible Lands ("Wet Sands")
"Dry sands"
Public Recreation
Easement
OPRD
State Seabed (3 Nautical Miles)