NANOOS
BUSINESS PLAN

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Executive Summary

NANOOS is the **N**orthwest **A**ssociation for **N**etworked **O**cean **O**bserving Systems. It is the Regional Association of the Integrated Ocean Observing System (IOOS) for the Pacific Northwest (PNW). Membership in the organization comes from a broad range of entities including academic institutions, state environmental agencies, tribal governments, professional trade organizations, and private enterprises. Despite the diversity, the member organizations hold a common goal – to implement an integrated observatory network, which provides the Northwest coastal states a regional resource supporting active use of our coastal oceans, a healthy environment, and a strong regional economy.

NANOOS was built and is operated as an organization that functions in a consensus and transparent manner, and relies upon active and ongoing participation from its members. These attributes are reflected at many levels – from the Memorandum of Agreement that member organizations sign, to the representative-based Governing Council, to the high level of volunteerism and active cooperation demonstrated by virtually all the members. Within this context NANOOS has already made significant accomplishments. These include:

- Development and operation of the NANOOS Pilot Project providing a single access point to PNW estuarine and shoreline observing assets;
- Successful competition for a larger Regional Coastal Ocean Observing System (RCOOS);
- Implementation of a multi-faceted outreach program, which leverages existing professional and educational institutions to promulgate ocean literacy and the role of observing systems in meeting societal needs.

NANOOS has developed a governance plan, its Memorandum of Agreement (MOA, http://www.nanoos.org/about_nanoos/documents.php) to guide implementation of NANOOS as the PNW Regional Association of IOOS as well as a Business Plan to guide enhancement of capabilities needed for the NANOOS RCOOS. NANOOS also has a Conceptual Design document, which has guided the initial development of the NANOOS RCOOS. These plans entail a multi-stage growth strategy, which plot a course towards a mature integrated PNW operational observing system.

- A particular focus for NANOOS in its current position is to transition from its foundation and planning stage into actualization of a functional integrated ocean monitoring infrastructure. To enable this transition will require funding at approximately $5M annually. Award funds to NANOOS in response to its submission to NOAA IOOS competitive award processes are currently short of this level. With this reality in mind, the Business Plan seeks to delineate the organization's goals, objectives, benefits and funding strategies in a broader context. We seek to establish a community of participants, a body of expertise, and an operational infrastructure that will provide true service to its constituents and the country as a whole.

1 Introduction

NANOOS was established to address the ocean observing and prediction needs of users in Washington, Oregon, and northern California. NANOOS was formed in 2003 under the aegis of the national Integrated Ocean Observatory Systems (IOOS) mandate to form regional bodies to execute directives under the auspices of this national charter. It now consists of a well-balanced alliance of major university entities, state, local, and tribal governments, trade organizations, non-profit organizations, and private industry.

The IOOS effort centers on addressing seven societal goals:

1. Improve predictions of climate change and weather and their effects on coastal communities and the nation;
2. Improve the safety and efficiency of maritime operations;
3. Mitigate the effects of natural hazards more effectively;
4. Improve national and homeland security;
5. Reduce public health risks;
6. Protect and restore healthy coastal ecosystems more effectively; and
7. Enable the sustained use of ocean and coastal resources.

This Business Plan outlines the objectives and planning efforts to achieve a viable Pacific Northwest (PNW) Regional Coastal Ocean Observing Systems (RCOOS) effort. It should be noted that, while this document forecasts the course and growth of the organization into the future, NANOOS already exists as a vital functional organization. NANOOS has a Governing Council, an Executive Director, a website, and enjoys active participation by about thirty separate organizations. Moreover through funds made available by NOAA, NANOOS successfully competed for a Pilot Project that integrated observations of PNW estuaries and shorelines and has recently successfully competed for a project to enhance NANOOS assets into a larger-scale and fully functional RCOOS. Most importantly, the organization has established a powerful, cooperative, and diverse group with a common purpose: to develop and maintain a permanent ocean monitoring infrastructure within the PNW that will ably serve the region and the nation now and in the future.

2 Goals, Organization, and Operations

2.1 Mission Statement

NANOOS operates as a collective organization to serve the PNW public and nation, in establishing and maintaining an integrated regional ocean observing infrastructure. The organization is dedicated to providing meaningful monitoring and modeling solutions for predicting and maintaining ocean health, public safety, while supporting a strong regional economy.

The mission of NANOOS is to coordinate and support the development, implementation, and operation of a regional coastal ocean observing system (RCOOS), as part of the U.S. Integrated Ocean Observing System (IOOS). NANOOS will provide timely, high quality oceanographic and marine related data and data products to a diversity of stakeholders and user groups. These products will encompass temporal and spatial qualities appropriate for the needs of multiple user sectors. The RCOOS that NANOOS proposes to initiate, capitalize, manage and improve over

time as well as to supplement the coastal backbone observing capabilities provided by various federal and State agencies in the Pacific Northwest (e.g., NOAA buoys and CMAN stations, future NOAA PORTS systems, USGS stream gauges, USACE wave stations, Washington State Department of Ecology, etc.).

2.2 Organization and Governance

NANOOS' current means of governance are encompassed by a Memorandum of Agreement (MOA) (http://www.nanoos.org/about_nanoos/documents.php). The MOA establishes a representative form of governance by its members and outlines the structure of the governing body.

NANOOS holds an open membership policy to constituted entities including academic institutions, state, tribal and local governments, other municipal and tribal organizations, trade organizations, non-profit organizations, and private companies with an interest in the PNW coastal ocean. Current membership consists of over 30 organizations (http://www.nanoos.org/about_nanoos/members.php) with a broad and balanced mix of affiliations. All member organizations are required to sign and abide by the MOA, which outlines the responsibilities and rights entitled to members and to the organization. The key tenants of the MOA revolve around maintaining an organization that is collective in process and transparent in its operation.

Figure 1 shows the organizational structure for NANOOS. Member organizations are entitled to representation on the Governing Council. The Governing Council meets periodically on a semi-annual basis and otherwise when important matters require a quorum in order for action. Presently, NANOOS has planned for four standing committees. They are:

- Data/Information Management and Communications (DMAC) Committee
- User Products Committee
- Science and Technology Committee
- Education and Outreach Committee

Each committee has an elected Chair who is responsible for managing the tasks for that committee set forth by the Governing Council of NANOOS.

The Governing Council has an elected President, Vice President, Treasurer, and Secretary. The President presides over the Governing Council and represents the organization in an official capacity.

NANOOS also has an Executive Director, which is currently a half-time paid position. The Executive Director prepares the annual budget, manages finances and ongoing operations, serves as regional and national liaison for NANOOS and acts as general manager for the organization. The Executive Director answers to the Governing Council.

The Executive Director, Governing Council's officers, and the Chairs of the standing committees form the Executive Committee for the organization. This committee is responsible for executing the mandates of the Governing Council.

A Users Advisory Group is envisioned for NANOOS as it builds its observing capabilities. This group will solicit and provide input for monitoring of the observing system to assure that data,

data products, and services are meeting requirements of the broader user community. Stakeholder and broader based user inputs are and will continue to be represented and engaged throughout NANOOS, in the Governing Council, on the standing committees, and via outreach, and will not be restricted to the Users Advisory Group.

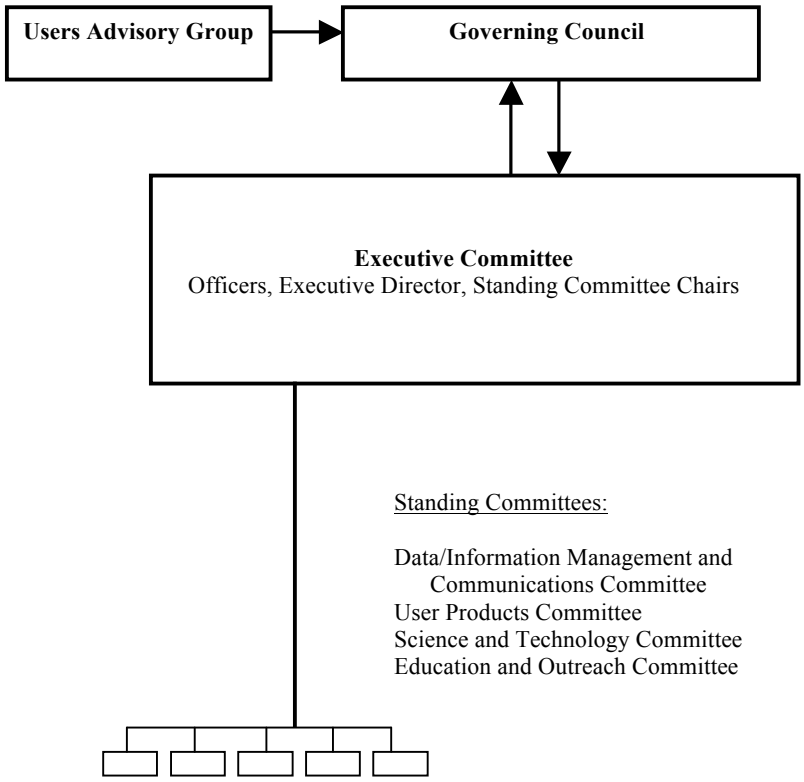

Figure 1 – Current Governance Structure of NANOOS

2.3 Finances and Administration

NANOOS currently operates as a grant based organization, under the administrative guidance and financial management of the Applied Physics Laboratory at the University of Washington (APL-UW) and all of its sub-contractors. Organization funding is currently derived from two (2) grants from the National Oceanographic and Atmospheric Administration (NOAA). Present funding for FY 2007 through 2009 is at the level of $400,000 per year for RA planning and $1,500,000 per year for RCOOS development. The RA planning grant is funded and has been renewed for 3 years, terminating in 2010 and the RCOOS grant is funded for 3 years, terminating in 2009. The RCOOS grant request for FY 2008 through 9 was $3,500,000, but this amount was not available. These grants are administered through APL-UW. The other organizations operating under a subcontract to APL-UW are Oregon State University (OSU), Oregon Health Sciences University (OHSU), The Boeing Company, Washington State Department of Ecology (WDOE), Oregon Department of Geology and Mineral Industries (DOGAMI), and the Oregon Department of State Lands (OR Lands).

The President and Executive Director manage most of the ongoing administrative tasks, which include general oversight of subcontracts and general management of NANOOS RCOOS related activities.

2.4 Assets

NANOOS does not own assets but rather forms a collective of partner organizations that hold their own substantial collective observing resources within the PNW. Certainly, in evaluating the present operational capabilities of the organization, these capabilities and resources enable the organization. Appendix 1 summarizes institutional resources that encompass the current observing capabilities of the NANOOS member organizations. This asset list will be updated and maintained on the NANOOS web portal (NANOOS asset list at http://www.nanoos.org/about_nanoos/documents.php) .

2.5 Operations

Currently NANOOS operations encompass three fundamental operational goals:

1. Develop regional technical capacity for a permanent coastal ocean observing system that includes estuaries and shorelines;
2. Establish education and outreach efforts for teaching, training, and recruiting the public;
3. Establish governance and infrastructure for IOOS accreditation as a Regional Association.

Day to day operations of NANOOS are managed by the Executive Director. Beyond basic administrative duties, operations focus upon coordinating efforts among organization members in fulfilling the above goals.

The goal of the RCOOS project is to develop, implement and integrate the various in-water and watershed-based systems that will constitute a fully robust and user-driven RCOOS. This includes all necessary RCOOS sub-systems (e.g., DMAC, products, outreach) to provide PNW, west coast, and national stakeholders with the high quality ocean data, predictive tools, and comprehensive knowledge they need to make responsive and responsible decisions appropriate to their individual and collective societal roles. Our goal is specifically focused on delivering easy to use data products and services that facilitate users who need to address high-priority issues, such as forecasting and prediction. Our collective knowledge of prioritized issues and user needs was and is continually gained through proactive NANOOS interactions with a wide range of PNW stakeholders.

The delineated goals provide a broad spectrum of duties for the Executive Director and President. These include but are not limited to:

- Coordination of RCOOS related design and implementation efforts among members.
- Leading and facilitating new proposal efforts for further funding.
- Managing staff as required
- Representing NANOOS at NRFA and other National level IOOS activities.

3 RCOOS Development

3.1 Developing Technical Capacity

Considering the extent and complexity of the PNW coastal region, as well as the number of societal/user needs impacted by coastal ocean/estuarine conditions, we note explicitly that the waters of the PNW remain fundamentally under-sampled in time and space to permit timely, scientifically-sound decisions to be made for the benefit of the numerous societal and cultural needs described. NANOOS, therefore, must prioritize where to build technical capability.

The interactions NANOOS has undertaken over the last several years have enabled us to identify a prioritized set of needs and user requirements. We leverage our analyses of user needs and system designs developed with our stakeholders (e.g., Workshop 3 at http://www.nanoos.org/about_nanoos/documents.php) to guide our implementation of an end-to-end RCOOS for NANOOS, addressing operational observation assets, modeling and products, data management and communication (DMAC), and education and outreach, all to produce user-defined data and information.

3.2 Initial NANOOS RCOOS Objectives

NANOOS will specifically focus on high-priority PNW applications of: a) maritime operations; b) ecosystem impacts including hypoxia and harmful algal blooms; c) fisheries; and, d) mitigation of coastal hazards to guide our efforts as these issues represent those having the greatest impact on PNW citizenry and ecosystems and, we believe, are amenable to being substantively improved with the development of a PNW RCOOS.

To meet our stated goal for the RCOOS, we proposed to accomplish the following objectives (all based on available appropriated federal funding and thus uncertain):

1. ***Maintain existing surface current mapping capability and expand with new prioritized HF radar sites in the PNW.*** This tool is a fundamental foundation block for building an observing system for the coastal ocean and serves a multitude of disparate users.
2. ***Maintain and expand observation capabilities in PNW estuaries.*** The desired objective is a federated real-time observation network across Oregon and Washington estuaries to address their sustainable management and utilization, with assets strategically prioritized based on societal needs.
3. ***Strategically expand coverage and range of observations in the PNW shelf, in coordination with emerging national programs.*** Target the use of fixed (buoys) and mobile (glider) assets to provide advanced information on hypoxia/anoxia and HABs, which are major regional concerns affecting ecosystem and human health, fisheries, and coastal economies.
4. ***Maintain and expand core elements of existing beach and shoreline observing programs in Oregon and Washington.*** This can improve coastal hazard mitigation by providing better decision support tools for coastal managers, planners, engineers, and coastal hazard mitigation decision makers.
5. ***Create a federated system of numerical daily forecasts of PNW circulation.*** This will span from the head of tide of estuaries to the outer edges of the exclusive economic zone (EEZ). The NANOOS vision requires availability of a range of modeling tools in support of user needs including marine operators, first responders, and environmental managers.

6. ***Commence development of state of the art cross-shore profile change models and probabilistic shoreline change models.*** Such models can be used by coastal managers to assist with predicting future coastline positions.
7. ***Bolster ongoing Data Management and Communications (DMAC) activities to support routine operational distribution of data and information.*** The NANOOS DMAC design mandates a collaborative, dynamic distributed system of systems that provides a wide range of products, tools, and services to regional user communities while allowing unfettered access to the IOOS national backbone and national information infrastructure.
8. ***Build from and strengthen ongoing NANOOS education and outreach efforts.*** Conducted in coordination with other regional efforts, this will foster ocean literacy and facilitate use of NANOOS products in the PNW by stakeholders, decision makers, and the general public.

4 Training and Education

The NANOOS coordinated RCOOS will provide a new level of insight into the oceans around us through 24-7 monitoring previously unavailable to such a wide audience. While its products are capable of making society more ocean literate, appropriate outreach and education are critical to realizing this improvement. A significant amount of groundwork in engendering basic understanding, such as spreading the seven essential principles of ocean literacy, needs to occur to make the utility of NANOOS assets apparent to the average citizen. Without the basic building blocks in place, the wealth of complex data and specialized products may overwhelm both casual and expert users. The spread of ocean literacy principles using NANOOS products thus forms an overarching goal of the organization.

The ocean observing assets, which NANOOS seeks to bring together and put on-line, will create a subsequent increase in the need to educate people as to the systems' potential uses, and how to take advantage of the products available from them. This is a function of both teaching and training; the former addressing the larger scale problems and the latter for specific details of the data output and communication infrastructure available through NANOOS. Training and engaging new users is one mechanism to keep the organization's vitality high, as those new users will bring new ideas (and demands) that the system(s) should respond to. In many respects, education is one of the primary interfaces of all of NANOOS to its users

Specific representative (but not totally inclusive) programs already in place or under development include:

- ***Ocean Inquiry Project*** (http://www.oceaninquiry.org) – This organization has been providing on-the-water marine science education coupled with research data collection for over six years. It serves community colleges and high schools in the Puget Sound region and has reached over 1200 students. The data it collects is currently part of NOPP funded program (Puget Sound Marine Environment Modeling) and will become part of the NANOOS-accessible in-situ data for Puget Sound.
- ***Scientists and Fishermen Exchange*** (http://www.fishresearchwest.org/) – NANOOS will contribute to this existing educational resource by providing training of members (both fisherman and scientists) to use NANOOS data and products, and therefore to bring them into the NANOOS users group. SAFE is several years old and gets funding from a variety of sources (Sea Grant, NOAA, Pacific States Marine Fisheries Commission, etc)

but will benefit in stability by the addition of NANOOS as an agent of funding training and outreach.

- ***Boater Information System*** (http://bis_portal.apl.washington.edu/) – This effort, currently in development, combines already available information on winds, tides, and currents into a unique display engine specifically for recreational boaters. It is already on the NANOOS website but will require more work in engaging users and developing interface improvements in order make this a viable resource for the large number of boating public in the region.

5 The Concept of NANOOS Accreditation

We note here the concept of "accreditation" though its specific meaning at both the national and regional level remains unclear. At this point of time, to our understanding, being accredited (by some as yet unidentified federal entity) consists of establishing a system of governance, exercising an auditable financial management program, and publishing an executable business plan to enable being "certified" by the federal government as being the responsive entity (in the case of NANOOS) for establishing and maintaining an RCOOS for the Pacific Northwest. To this end, a functional financial operations system and system of governance are now in place and the NANOOS industry partners have delivered this business plan for the organization. We expect, but do not know, that this foundation document will be a required part of any future final "accreditation" decision.

6 Funding and Growth Plan

Achieving NANOOS operational goals will require substantial investment in continued integration of existing assets and in developing new observational capabilities. In order to implement this broader vision the organization has developed a long-term design framework, an estimate of the costs involved, and an opportunistic strategic plan for obtaining funding. The organization understands that successful implementation of its vision will always be subject to available funding, federal science agendas, and other constraints and requirements. For this reason, we propose a multiple stage growth plan that encompasses broader scope with available funding. Needless to say the lines between the stages are not hard, and depending upon the nature of funding, focus may shift with time. That said, the broadly defined agenda and this business plan, which prioritizes the functions and activities of NANOOS, should allow NANOOS to seize and appropriately respond to funding opportunities as they arise. Moreover, in understanding current efforts in context of the comprehensive growth plan, the organization can conduct gap analyses of needs in an ongoing basis. This will promise focused progress and effective use of funding that is obtained along the way. Growth stages are outlined below.

Stage 1 – Organizational development, planning, and maintenance (~$0.5 M annually – adequately funded as of March 2008)

Stage 1 captures the essence of NANOOS' level of operations since 2003. This stage largely involves foundation building, planning, demonstration, and assessment. While this stage is vital in effecting the overall growth plan it is not enough to develop and maintain a regional observatory infrastructure

Stage 2 – Implementation of regional coastal ocean observing system (~$5M annually – partially but inadequately funded as of March 2008)

Stage 2 is where NANOOS is currently transitioning. Stage 2 efforts involve developing and maintaining true operational observing capabilities for the region and evolving the organization into a service oriented entity, providing education and data products to the public. This stage is the primary focus as a "next step" for the organization and is further elaborated upon in the following section.

Stage 3 – Expanded capabilities and scope of operations ($5M- $15 M annually- not presently funded)

Stage 3 focus will involve substantial enhancing of the observing infrastructure. This will include deploying more buoys, implementing high bandwidth nodes for advanced monitoring of biogeochemical parameters, wide spread use of autonomous mobile platforms, automated moored profilers, and other autonomous and unattended platforms, development and installation of regional forecasting models and expansion of the DMAC resources to accommodate much larger data requirements. In addition to the capability growth, the organization will support and facilitate "research-to-application" transitions of promising new methods and technologies to provide regional products for users. Based on funding levels, this work will be accomplished on a priority basis, as revisited in the annual planning meetings and revisions of the business plan as the program progresses to higher levels of funding.

Stage 4 – Mature RCOOS ($10 M – $20 M annually – not presently funded)

Costs for operation and maintenance of a fully functional and mature RCOOS will naturally scale with the number and composition of deployed assets. That said an operational system will entail both substantial ongoing efforts both in basic maintenance, and focused problem solving in addressing regional needs. Moreover, institutional training and education of qualified personnel to use and effectively maintain the system will also be needed. In addition to core monitoring efforts, a mature system will also entail pilot installations for ongoing qualification and adaptation of new technologies. Dedicated facilities and resources for administration, equipment repair and calibration, and asset deployment will also be beneficial to the long-term viability of the program. Finally, a mature system will also imply broader integration to other operational and regional ocean observing systems, such as the National Science Foundation-funded Regional Scale Node (RSN) system in the Pacific Northwest coastal ocean.

7 NANOOS Vision for Stage 2

NANOOS is currently transitioning into Stage 2 of its development. Elaboration of design, education, finances, and administration for this stage is given here.

7.1 Stage 2 Design

As noted above, we are at the beginning stages of this level of maturity. The Executive Director, President and Governing Council members have worked together to develop a conceptual design for a viable PNW RCOOS that will further integrate and dramatically expand PNW observing

capabilities. The NANOOS RCOOS Conceptual Design for Stage 2 is found at http://www.nanoos.org/about_nanoos/documents.php.

There are several components in contemplating future regional coastal ocean observing infrastructure design and implementation. They include ongoing assessment of and responding to PNW user needs and regional priorities, leveraging of existing resources, delineating the requirements for extending scope and resolution, for common-use data products for the observing systems, and the integration and access of data and fitting of requirements to meet existing allowable budgets. In establishing the conceptual design for a RCOOS, we took all these factors in to consideration and have proposed a conceptual design framework that specifically addresses PNW priorities.

Accordingly, the conceptual design addresses the following components:

- Integrate disparate fixed and mobile assets (including existing and emerging (i.e., the NSF RSN and Coastal Margin Observation and Prediction Science and Technology Center);
- Build new, modular and expandable assets (i.e., buoys designed to incorporate novel sensors as those technologies mature) to ensure the sustained and operational maintenance of a wide array of PNW ocean observations throughout the NANOOS domain that link to other RCOOS efforts;
- Enhance the robustness and data delivery of existing HF Radar arrays along the Oregon coast and expand this critical capability north along the length of the Washington coast and into the Strait of Juan de Fuca;
- Integrate and maintain cross-scale modeling systems for estuarine and coastal circulation, inclusive of near real-time forecasts and long-term simulations, by leveraging existing and emerging assets across the region;
- Sustain and expand a bi-State PNW Shoreline Initiative, initiated by the Washington Department of Ecology and expanded through the NANOOS Pilot Project, consisting of shoreline-monitoring components and large-scale shoreline management observations and sediment dynamics models;
- Begin the transition of new ocean technologies from research to operational service;
- Enhance and expand our regional DMAC capabilities, initiated through NANOOS, and leveraged by powerful industry and academic PNW expertise in information technology. This will include
  - Ensuring information flow across the NANOOS domain, and into the national system, consistent with federal plans, formats, and standards.
  - Focusing on distinctive approaches to address three grand DMAC challenges:
    1. Enable the effective extraction of information from massive data sources;
    2. Enable effective decision making by end-users on a routine, unassisted basis;
    3. Implement effective assessments of performance and customer satisfaction metrics, to guide functional adaptations based on cost/benefit metrics.

7.2 Stage 2 Education

The NANOOS Education team, consisting of the Education/Outreach Coordinator, the Chair of the Education/Outreach standing committee, and the Executive Director, are responsible for the Stage 2 education plan. As outlined in our NANOOS Conceptual Design, the education efforts contemplated in this stage involve development of new programs, and sustain and enhance the programs already active or now in development the NANOOS partnership. Ensuring long-term stability for such programs is critical to building and maintaining ocean literacy, and will create active users of products brought about by NANOOS data providers. New efforts will include:

- Upon behalf of Washington and Oregon shellfish growers, a joint project of NANOOS and the National Estuarine Research Reserves of South Slough (OR), Padilla Bay (WA) and Kachemak Bay (AK), is underway to determine optimal observations of temperature and dissolved oxygen for shellfish bed management. While the start-up phases of this project are funded, ongoing users will need education and training in its benefits and details.
- We will target educators specifically so that they in turn may use NANOOS products in the classrooms. We will first seek out educators using data products from current monitoring efforts through such organizations as the Northwest Aquatic and Marine Educators. This will serve both to identify what gaps that need filling, and to recruit a core group. This in turn will allow us to build a community of educators who will be leaders in using NANOOS products in their classrooms.
- We intend to train target user groups specifically on new NANOOS tools in at least four target areas. These tools will have the best chance for success if (1) they are explained and demonstrated to the user communities in their own environment, and (2) the user communities provide feedback to the developers, so that the information is ultimately delivered in a form that is most useful to the communities. To accomplish this, we will, given sufficient funds, establish two training groups, one for Oregon, and one for Washington, each of which will travel to meet in person with one user community per month. Appropriately, a member of the NANOOS User Products Committee will participate in each of these meetings during the first year. Following each visit, the Education/Outreach Coordinator will report feedback to the E&O and User Products Committees. The two state coordinators will share experiences and materials freely and regularly.

7.3 Stage 2 Finances and Administration

The currently envisioned embodiment for NANOOS based RCOOS will entail approximately $2M - $ 4M annually. We will maintain funding flexibility and will continually assess our progress. Notionally, funding allocations might be expected to be divided as shown below:

- Observations and project management: $1.1M
- Modeling and Data Products: $300K
- Education/Outreach: $200K
- DMAC: $400K

Currently the planned financing method for funding planned growth is through obtaining competitive grant funds resulting from Broad Agency Announcements, and other similar avenues.

The present grant will be administered per NANOOS' current operations – APL-UW will operate as the primary finance and administration center for the grant. Other participating organizations budgeted within given grants will operate on a sub-contract basis to the principal organization. Equipment purchased as part of any funded development effort will remain property of the purchasing organization.

The NANOOS Executive Director will serve as Principal coordinator for the project and manage reporting requirements and other administrative tasks charged to the project. It is assumed that any major grant proposal submitted by NANOSS will include provisions for basic managerial support (Executive Director, President, web manager) at least at current levels, unless these costs have been explicitly covered through other contracts or grants.

8 Marketing and Outreach

While developing technical capacity for the PNW ocean observing infrastructure is a primary mandate for the NANOOS organization, we must also recruit, use, and develop an educated constituency from the community for the NANOOS concept and practice to remain viable.

A first glance, NANOOS, operating as a regional federation of existing and disparate organizations, does not seem subject to conventional marketing methodologies and planning. However, upon our deeper analysis, the importance, relevance, and ultimate fate of the organization are absolutely dependent upon establishing a sense of value and place. This value concept is important to national government agencies charged with oceans' research and resource protection, to individuals and organizations within the region, potentially impacted by ocean monitoring, and to the NANOOS member organizations themselves. Within this context, several important questions both define the mission and message necessary to build a viable and useful organization.

- Does NANOOS effectively connect the national IOOS mission with local needs?
- Does NANOOS facilitate integration of existing monitoring resources with new deployments to provide a regional observing solution that meets regional and national requirements?
- Do models and products generated and promulgated through NANOOS related efforts provide useful, accurate, and accessible information to the public?
- Does the organization provide its members with a useful resource and basis for alliance in furthering organizational interests?

To the degree that NANOOS can successfully address these questions it will make itself valuable and integral to the development, implementation, and use of permanent ICOOS infrastructure in the Pacific Northwest. With this in mind, the organization needs to achieve understanding and balance with the various factors that are brought to bear by the constituent segments it serves.

NRFA, NOAA, and the Federal Government – While long-term leadership of the Nation's IOOS is not yet completely defined, it is reasonable to assume that NOAA will play a major role. While the model for Regional Coastal Ocean Observing Systems as envisioned by the IOOS

community offers a viable approach for integrating disparate observing resources around the country, long-term viability of the approach will depend heavily upon the ability of the regional entities to cost effectively integrate and manage their resources. The NANOOS organization must remain keenly aware that no matter how strong the Federal mandate for supporting a strong ocean observing infrastructure, funding for this effort will always prove limited, and that responsible agencies will ultimately demand cost-effective development and management. The organization must also be responsive to the Government's changing requirements of the regional associations' role in observing systems management as the IOOS implementation effort matures.

PNW public – The Pacific Northwest's economy and quality of life are deeply tied its natural resources in general and its coastal zone in particular. The Seattle and Tacoma ports combine to form the second largest container port facility in the Western Hemisphere. The state of Washington supports the US' second largest commercial seafood industry outside of Alaska. Commercial and sport fishing also form an important part of the Oregon economy. A vital tourism industry in both states relies upon the natural beauty and health of coastal environs. In short, life in the PNW is deeply connected to its coasts and people of the region all sense a certain "ownership." While consensus may exist for the continued health and diverse use of the regions coastal waters, people are far from agreement as to what the conditions are and even less so, upon what we must do. Moreover, many of those who directly depend upon our coastal resources are skeptical of, or worse, see themselves as victimized by those charged to effectively manage those resources. Therein lies a major challenge and opportunity for the NANOOS organization. In the end, effective and relevant monitoring, modeling, and timely information dissemination will prove vital for understanding and management of our waters. That said, without an ongoing sustained effort to both educate and listen to the public, good science and technology will not be sufficient to succeed in these causes. More practically stated, ongoing public support of the IOOS effort will ultimately require a perception of value. This can only occur through maintaining a strongly interactive and responsive outreach effort with the public. As an organization that draws upon diverse sectors of PNW economy, cultures, government, and education NANOOS finds itself in a natural position to take on this task.

NANOOS organization – The NANOOS organization's brings a highly diverse group of organizations together – their common ties being region and connection with our coastal oceans. While some of these individuals and organizations will take a very active role in operational components of the organization's existence and draw directly upon funds obtained by the organization, others will have more indirect but no less important connections. While we recognize that the science and technology infrastructure goals for the association could be achieved by a smaller subset of the involved major academic and research institutions, it is clear that achieving the broader scope and vision of NANOOS will rely upon a wide and diverse subscription to the effort. To date, the leadership and member organizations have proven scrupulous in honoring the intent and letter of the MOU that binds them. In fact, there is a growing since of pride and spirit within the governing counsel as evidenced by their consensus approach to seeking competitive funds to accomplish the NANOOS growth plan. In effect, the continued commitment of the member organizations and honoring of the objectives set forth provides a solid foundation for success.

9 Marketing Plan

Our message: Better decisions result from a better understanding informed by a capable ocean observing system.

The key component of the marketing plan involves outreach to the public. Closely coupled but distinct from education related responsibilities of the organization, outreach efforts will entail informing the public about the organization, the resources we bring, and the potential benefits of this information. It will also provide forums to engage the public and draw upon their input. Outreach efforts will be ongoing as we develop new capabilities. Representative efforts we intend to pursue include:

- We will develop and distribute materials introducing NANOOS to members of the public that provide a means for explication of the Association's purpose, features, products, and avenues of engagement.
- We will publish specialty brochures, targeted specifically at primary initial focus areas of the growth plan – and modify these publications in response to user input
- We will work with regional science centers and aquaria to develop topical displays describing the organization and the efforts we are undertaking. These displays could potentially be interactive allowing visitors to access buoys and other monitoring assets in the system and see how monitoring and modeling couple to provide dynamic understanding of the ocean.
- We will rely upon direct one-on one promulgation by our members to broaden the membership and user base of the organization.
- We will seek to provide timely press releases and other publication information concerning NANOOS efforts and how they play in to regional resource and societal issues related to OR and WA coasts.

This effort is one that will require effort from several different types of professionals, including those in publication design and market outreach. Initial focal points for general public outreach could be the region's many science centers and aquaria

Next level outreach efforts coupled with education will seek to involve the public at greater levels. NANOOS will facilitate and guide collaborative problem solving in which diverse interests are engaged in solution building processes for problems that will entail using observing resources.

10 Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis

In looking forward to the implementation of the NANOOS growth plan, it is instructive to realistically analyze the plan's viability. At one level, the near term success of the plan will be completely dependent upon our ability to obtain funding. Opportunities to obtain this funding will likely be few and far between, so the better we understand our strengths and weaknesses the more likely our success. Towards this opportunity, we provide a summary SWOT analysis of our contemplated growth.

10.1 Strengths

- The NANOOS organization is already viable, functioning, and operating in accordance with its charter and the governing MOU.
- Many members within the organization have a successful track record in working together.
- The organization already has funding which has manifested progress within all of its operational mandates.
- NANOOS leadership has demonstrated effectiveness and achieved a remarkable level of consensus among members in moving forward.
- Members of the organization constitute a body of high-level expertise.

10.2 Weaknesses

- The organization is dependent upon limited available funding and may need to resort to a patchwork implementation.
- The uncertainty of IOOS at the national level hinders NANOOS' ability for long-term planning.

10.3 Opportunities

- Future BAAs could complement the successful awarding of the RCOOS grant to NANOOS.
- Ongoing programs at members' organizations provide a wide avenue for leveraged and synergistic efforts.

10.4 Threats

- The volunteer oriented, consensus based organizational structure now enjoyed by the organization will require some sense of progress in order to stay together. Prolonged delays in implementing the growth plan will damage this structure.
- Potential divisiveness among members is always a threat in this type of organization. Particular attention to maintaining an inclusive and transparent operation must be paid, in the case that the growth plan is successfully funded. This can be in part achieved by setting up a priority of objectives to be slated as funding becomes available.

11 Summary

NANOOS currently exists as a functioning organization that enjoys broad active subscription from a diversity of member organizations. Efforts over the past several years successfully laid a strong foundation for putting in place a regional integrated operational ocean observing system, and the organization is now actively seeking funding for this transition. Placed in a more general scope this transition is one of several stages that will ultimately lead to mature organization and monitoring infrastructure, serving the needs of the Pacific Northwest public and the nation at large.

Appendix 1 – Current Monitoring Resources

NANOOS Asset List

1 National Oceanic and Atmospheric Administration

1.1 The CoastWatch West Coast Regional Node

http://coastwatch.pfel.noaa.gov

Daily – Monthly composites of satellite observations

- Sea Surface Temperature (GOES & POES)
- Ocean Color (MODIS and SeaWiFS)
- Ocean Winds (QuikSCAT)

1.2 The National Data Buoy Center

http://seaboard.ndbc.noaa.gov/maps/Northwest.shtml

6 Minute – Hourly buoy observations

- Meteorological Observations (Air Temp., Pressure, Wind Speed and Direction)
- Ocean Observations (Water Temp., Wave Height, Period and Direction)

1.3 The Center for Operational Oceanographic Products and Services

http://tidesandcurrents.noaa.gov

http://opendap.co-ops.nos.noaa.gov/content

6 Minute near-shore station observations

- Meteorological Observations (Air Temp., Pressure, Wind Speed and Direction)
- Ocean Observations (Water Temp., Water Level)

1.4 NOAAWatch

http://www.noaawatch.gov

Information related to ongoing environmental events

- NOAAWatch themes include Air Quality, Droughts, Earthquakes, Excessive Heat, Fire, Flooding, Harmful Algal Blooms (HABs), Oil Spills, Rip Currents, Severe Weather, Space Weather, Tsunamis, and Volcanoes

1.5 National Weather Service

http://www.weather.gov

Environmental observations and forecasts

- Coastal and Marine Forecasts
- Weather Warnings

- Surface Pressure Maps
- Coastal and Marine Observations (Wind, Visibility, Sky Conditions, Temperature, Dew Point, Relative Humidity, Atmospheric Pressure, Pressure tendency)
- GOES Satellite Observations (Visible, Infrared, Water Vapor: http://www.goes.noaa.gov)
- Pacific Tsunami Warning Center (http://www.prh.noaa.gov/pr/ptwc)

1.6 Environmental Modeling Center

http://polar.ncep.noaa.gov/waves/index2.shtml

Four times daily wind and wave forecast information

Wave Watch III: http://polar.ncep.noaa.gov/waves/wavewatch/wavewatch.html

- Wind Speed and Direction
- Significant Wave Height, Wind Sea Wave Height, Primary Swell Wave Height, Secondary Swell Wave Height, Peak Wave Period, Wind Sea Period, Primary Swell Period, Secondary Swell Period
- Note: The Fleet Numerical Meteorology and Oceanography Center and NCEP (National Centers Environmental Prediction) are also running WWIII.

1.7 NCEP Central Operations

http://www.nco.ncep.noaa.gov

Four times daily meteorological forecast model output graphics for 12 models covering 6 regions

- North American Mesoscale (NAM)
- Global Forecast System (GFS)
- Nested Grid Model (NGM)
- Short Range Ensemble Forecast (SREF)
- Rapid Update Cycle (RUC)
- High Resolution Window (HRW) Weather Research and Forecast (WRF)
- Global Ensemble Forecast System (GEFS)
- Real Time Mesoscale Analysis (RTMA)

1.8 Coastal Services Center

http://www.csc.noaa.gov/csp/pacific_nw/coastal_waves.html

SWAN Model

Through the Coastal Storms Program, the National Weather Service (NWS) has adapted a high-resolution wave model, the SWAN model (Simulating WAves Nearshore) for the Columbia River and the nearby coastal waters of Washington, Oregon, and Northern California. This model provides guidance to NWS forecasters in the preparation of marine forecasts, bar condition reports, and sea-state warnings.

2 Oregon Health and Sciences University

http://www.stccmop.org/datamart

2.1 CORIE observation network

http://www.stccmop.org/corie

1 minute observations for the Columbia River Estuary and Plume

- 18 fixed stations and 2 buoys (http://www.stccmop.org/corie/observation_network)
- Water temperature, salinity, and water levels, oxygen
- Current profiles and acoustic backscatter
- Exact variables available depend on period of interest.

2.2 SATURN vertical profiling stations

http://www.stccmop.org/datamart/saturn01

- Salinity, temperature, turbidity, fluorescence, oxygen
- ~4Hz; 13MB/day

2.3 CMOP Cruise

http://www.stccmop.org/datamart/cruises

Variables collected depend on cruise/mission

- CTD Casts (http://www.stccmop.org/datamart/access/casts)
  - salinity, temperature, oxygen, PAR, pH, fluorescence/chlorophyll, turbidity
- Flow-through System (http://www.stccmop.org/datamart/access/flowthrough)
  - salinity, temperature, PAR
- Acoustic Doppler Profilers (http://www.stccmop.org/datamart/access/adcp)
- Meteorology (http://www.stccmop.org/datamart/access/met)
  - Wind speed, direction, precipitation, pressure, PAR
- Microbiology Water Samples (http://www.stccmop.org/datamart/cruises/sample_inventory)
  - Total DNA, mRNA, population profiles, gene expression data
- Chemical Water Samples
  - nitrates, carbon dioxide

2.4 Modeling at CMOP

- Models:
  - ELCIRC: Eulerian Lagrangian Circulation model
  - SELFE Semi-Implicit Eulerian Lagrangian Finite Element model
- Variables: salinity, temperature, 3D circulation, elevation
- Space:
  - REF Grid covers Alaska to the Baja peninsula, with high resolution around the Columbia River Estuary
  - DB16 grid focused on Estuarine dynamics; does not include ocean waters

- Time:
  - Hindcasts cover 10+ years of history, including some pre-development models from the 1800s
  - Forecasts available about 24 hours in advance. Some experiments for longer-term forecasts underway.
- Scale:
  - Hindcasts occupy 40+TB
  - Forecasts are purged after 10 days to make room
- Unstructured grids: NetCDF is not sufficient
- Modes:
  - Forecasts: ~15 forecasts optimized for various bays and inlets in the Northwest and around the world.
  - Hindcasts: 3+ "databases" covering 10+ years. Used for climatology studies, "what if"scenarios, and inter-model comparisons.

2.5 Other NANOOS Data Served via OHSU Cyberinfrastructure

http://www.ccalmr.ogi.edu/nanoos

- Washington Department of Ecology
  - 4 sites with temperature, salinity, conductivity, dissolved oxygen at ~15 minute intervals. Example: http://www.ccalmr.ogi.edu/nanoos/network/puget/bud01
- Oceanic Remote Chemical Analyzer (ORCA) Buoys (http://orca.ocean.washington.edu)
  - 4 vertically profiling stations with temperature, salinity, PAR, Oxygen, NO3, chlorophyll, (E.g.: http://www.ccalmr.ogi.edu/nanoos/orca/?platform=Twanoh)
- South Slough National Estuarine Research Reserve (SSNERR)
  - 5 sites, no real time data currently
- Monterey Bay Aquarium Research Institute LOBO sensors
  - 5 sites, NITRATE ,SALINITY ,TEMPERATURE ,OXYGEN,CDOM, CHLOROPHYLL ,TURBIDITY
- NOAA-COOPS stations
  - Elevation – Just redirecting requests currently

3 University of Washington

3.1 Oceanic Remote Chemical Analyzer (ORCA) Buoys

http://orca.ocean.washington.edu

Hourly buoy observations for the Hood Canal and Puget Sound

- Currents, Salinity, Temperature, Turbidity, Nitrate, Ammonium, Met. Observations, Irradiance, Dissolved O2

3.2 Environmental & Marine Science Seahurst Observatory

http://iop.apl.washington.edu/seahurst/index.php

Cabled observatory monitoring the Puget Sound

- 5 minute conductivity, water temperature and pressure observations
- Analog underwater camera with integral LED lighting. Full-rate video is captured and archived when motion is detected

3.3 Pacific Northwest MM5 Weather Forecasts

http://www.atmos.washington.edu/mm5rt/info.html

Meteorological forecast (72 hrs) model output

- Atmospheric Pressure, Temperature, Winds, Relative Humidity, Solar Radiation, Precipitation
- Fields are made available at 3 hour intervals

4 Oregon State University

4.1 CODAR

http://bragg.coas.oregonstate.edu

Daily Mapping Oregon Coastal Ocean Currents

- Surface Currents

4.2 NH10 Mooring

http://agate.coas.oregonstate.edu/data/nh10.html

10-Min Buoy Observations

- Meteorological Observations (Air Temp., Relative Humidity Pressure, Wind Speed and Direction)
- Ocean Observations (Surface and Sub-Surface (~70 m) Water Temp. and Salinity, Current Profiles)

4.3 Slocum Gliders

NRT Ocean Observations

- Physical Observations (Conductivity, Temperature, Depth, DO)
- Optical Observations (Fluorometer, PAR, Spectrophotometer, Backscatter, Transmissometer)

4.4 Remote Sensing Ocean Optics (ORSOO) Group

http://sugar.coas.oregonstate.edu/MODIS

Satellite Observations

- Ocean Color (1km MODIS)

4.5 Oregon Coastal Ocean Simulator Group

http://www-hce.coas.oregonstate.edu/~orcoss/SSCforecast.html

Daily ROMS Ocean forecast model output for the Oregon coastal ocean

- Temperature, Salinity, Currents

4.6 Coastal Imaging Lab

http://cil-www.oce.orst.edu

Argus Beach Monitoring Station

- Photographs of Agate Beach, OR updated hourly (http://cil-www.oce.orst.edu/agate.html)

5 South Slough NERR

5.1 SSNERR Observation Network

http://cdmo.baruch.sc.edu

15 minute buoy observations for the South Slough Reserve, OR

- Water Quality Data (Water Temperature, Specific Conductivity, Percent Saturation, Dissolved Oxygen, Depth, pH, Turbidity)
- Meteorological Data (Air Temperature, Relative Humidity, Barometric Pressure, Wind Speed and Direction, Solar Radiation, Precipitation)
- Nutrient Data (Orthophosphate, Ammonium, Nitrite, Nitrate, Chlorophyll a)

6 WET Labs

6.1 LOBO (Land/Ocean Biogeochemical Observatory) System

http://yaquina.satlantic.com

Hourly Buoy Observations for the Yaquina Bay Estuary, OR

- Water Temperature, Salinity, Nitrate, Turbidity, Dissolved O2, Dissolved Organics, O2 Saturation, Chlorophyll

7 Coastal Data Information Center (CDIP)

http://cdip.ucsd.edu/?nav=recent&sub=observed&units=metric&tz=UTC&pub=public&map_stati=1

30 minute buoy observations

- Meteorological Observations (Air Temp., Pressure, Wind Speed and Direction)
- Ocean Observations (Water Temp., Wave Height, Period and Direction)

8 Olympic Coast National Marine Sanctuary

OCNMS Buoy Array in nearshore

9 US Army Corps of Engineers

9.1 Adult Fish Counts

https://www.nwp.usace.army.mil/op/fishdata/home.asp

Daily adult fish counts at the following locations, Bonneville Dam, the Dalles, John Day, McNary, Ice Harbor, Lower Monumental, Little Goose, and Lower Granite.

10 Oregon Department of Fish and Wildlife

10.1 Oregon Fish Counts

http://www.dfw.state.or.us/fish/fish_counts

Monthly fish counts at the following locations, Willamette Falls, Gold Ray Dam, Winchester, and the Columbia River.

11 Washington Department of Fish and Wildlife

- Periodically updated demoic acid levels in razor clams along the outer Washington coast (http://www.wdfw.wa.gov/fish/shelfish/razorclm/levels/levels.htm)

12 Washington Department of Ecology

Puget Sound and Willapa Bay
http://www.ecy.wa.gov/programs/eap/mar_wat/moorings.html

15 minute buoy observations

- Willapa Bay moorings (near-surface, mid-channel water temperature, salinity, density and chlorophyll data)
- Puget Sound moorings (near-shore, near-bottom water temperature, salinity, density, and dissolved oxygen data)

13 Washington State Department of Health

- Periodically updated health status report, in terms of marine biotoxins, for Washington State beaches (http://ww4.doh.wa.gov/scripts/esrimap.dll?name=bioview&Cmd=Map&Listing)

14 Oregon Department of Agriculture Food Safety Division

- Periodically updated Shellfish safety closure report for the Oregon coast (http://www.oregon.gov/ODA/FSD/shellfish_status.shtml)

15 Other Potential Periodic Data Providers

15.1 NOAA Coastal Services Center:

- Topographic LIDAR Data (http://maps.csc.noaa.gov/TCM/)

- Coastal Storms Program: Oregon Coastal Inundation Visualization Tool (http://www.csc.noaa.gov/cspPNW/mapping.html). This tool contains the following information: coastal inundation data, dune toe line, beach profile points, aerial photographs, and the mean high water line.

15.2 NOAA National Geophysical Data Center (NGDC):

- NGDC Tsunami Database (http://www.ngdc.noaa.gov/seg/hazard/tsu.shtml)
- NRT Dart II observations are available from NDBC (http://www.ndbc.noaa.gov/dart.shtml)

15.3 NOAA Center for Tsunami Research

- Tsunami Modeling and Research (http://nctr.pmel.noaa.gov/model.html)

15.4 US Geological Survey:

- USGS Tsunami Program (http://walrus.wr.usgs.gov/tsunami/index.html), which includes information on significant tsunamis, and tsunami modeling

15.5 University of Southern California Tsunami Research Center:

- Tsunami modeling and significant tsunami event archive (http://www.usc.edu/dept/tsunamis/2005/index.php)

15.6 Oregon Department of Geology and Mineral Industries

DOGAMI has generated several tsunami inundation maps for the Oregon coast, including one complete coastwide inundation map and several more detailed site specific maps for Newport, Seaside, Gold Beach, Coos Bay, Alsea Bay. It is presently working on the next generation of mapping standards for Cannon Beach based on a reevaluation of Cascadia source ruptures.

DOGAMI periodically releases the results of its geologic studies in a variety of ways including CD-ROM disks, computer files, and publications such as maps, books, open-file reports, special papers and brochures. (http://www.oregongeology.com/sub/pub%26data/pub%26data.htm)

15.7 US Army Corps of Engineers (USACE):

Historical aerial photos: USACE Portland has complete 1939 (earliest flight) coverage of the OR coast (non-rectified).

15.8 Oregon Geospatial Data Clearinghouse

Aerial photos for 1994, 2000, & 2005 that are orthorectified and digital elevation model file all of which are available online (http://www.oregon.gov/DAS/EISPD/GEO/sdlibrary.shtml)

15.9 California Coastal Records Project

An aerial photographic survey of the California Coastline (http://www.californiacoastline.org/)

15.10 Oregon Beach and Shoreline Mapping and Analysis Program:

Provides beach profile information (http://www.oregongeology.com/sub/nanoos1/index.htm)

15.11 Washington Department of Ecology Beach Monitoring Program:

The beach monitoring program collects the following data sets: cross-shore beach profiles, three dimensional topographic surface maps, sediment samples, and nearshore bathymetry. (http://www.ecy.wa.gov/programs/sea/swces/research/change/monitoring/maps/bp_mapindex.htm). The Southwest Washington Coastal Erosion Study website also contains beach profile information (http://www.ecy.wa.gov/programs/sea/swces/products/data.htm).

15.12 NOAA Northwest Fisheries Science Center (NWFSC)

Hake and Groundfish Survey Data (http://www.nwfsc.noaa.gov/ and http://pacoos.coas.oregonstate.edu/)

15.13 The Pacific States Marine Fisheries Commission

http://www.psmfc.org/

StreamNet provides data and data services in support of the Pac NW Fish and Wildlife Program and other efforts to manage and restore the region's aquatic resources (http://query.streamnet.org/Request.cfm?cmd=BuildCriteria&NewQuery=BuildCriteria; http://map.streamnet.org/criticalhabitat/viewer.htm)

16 Coastal Atlases

Oregon (http://www.coastalatlas.net/)

Washington (https://fortress.wa.gov/ecy/coastalatlas/viewer.htm)

Humboldt Bay (http://www.humboldtbay.org/gis/interactivemap.html)