



**PROPOSAL FOR FY2011-2012**  
**Developing Coastal and Marine Planning Visualization Tools**  
**for the U.S. Arctic and Alaska:**  
*Data Tools to Support Future Decision-Making on Arctic Fisheries*

**In response to Federal Funding Opportunity NOAA-NOS-CSC-2011-2002721**  
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**FY2011 Funding Competition, Focus Area 1**

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**BY**

**Tara Riemer Jones, Ph.D.**  
**Seward Association for the Advancement of Marine Science**  
**P.O. Box 1329**  
**Seward, AK 99664**

**Acting as Authorized Financial Representative**  
**ON BEHALF OF**

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**Alaska Ocean Observing System**  
**Ms. Molly McCammon**  
**Executive Director and Principal Investigator**  
**1007 W. Third Avenue, Suite 100**  
**Anchorage, AK 99501**

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## TABLE OF CONTENTS

PROJECT SUMMARY .....	i
PROJECT DESCRIPTION.....	1
I. GOALS & OBJECTIVES.....	1
II. BACKGROUND .....	2
III. PARTNERSHIPS & LEVERAGING .....	3
IV. AUDIENCE.....	4
V. APPROACH.....	4
A. Essential Elements of CMSP Process.....	4
B. Incorporation of CMSP Guiding Principles .....	4
C. Project Management.....	5
D. Role of Federal Partners .....	6
VI. PROJECT ACTIVITIES .....	6
A. Assess information needs for ocean and coastal data, data integration and data visualization tools.....	6
B. Identify synergies and overlap with current planning and data acquisition efforts to provide additional relevant data and increased opportunities for stakeholder engagement.....	7
C. Identify data and decision-making tools currently in use in Alaska for planning and decision-making; assess for their potential utility in Alaska additional data visualization and decision-support tools developed in other regions of the country and outside the U.S.....	7
D. Gather and Synthesize Data Layers and incorporate into AOOS Data System .....	8
E. Assess utility of AOOS Arctic portal as prototype data integration and visualization tool for planning and decision-making and identify additional needs for data integration and visualization tools to support planning and decision-making.....	11
VII. Benefits and Deliverables .....	11
A. Data and information product assessment and gap analysis.....	11
B. Summary of planning initiatives (short-term and ongoing) in Alaska and data products planned or produced.....	11
C. Decision methods and tools assessment .....	11
D. Additional data & information layers for manager & stakeholder user needs .....	11
E. Assessment of AOOS Arctic Portal and potential planning tool applications.....	12
VIII. MILESTONE SCHEDULE.....	12
IX. PROJECT BUDGET .....	13
A. Detailed budget information.....	13
B. Scalability .....	13
APPENDICES .....	14
A. Budget detail & forms	
B. Letters of Commitment	
C. Letters of Support	
D. Resumes	
E. References	
F. NEPA response	
G. AOOS Data Management 5-year plan	

## PROJECT SUMMARY

### **Project Title:**

Developing Coastal and Marine Planning Visualization Tools for the U.S. Arctic and Alaska:  
*Data Tools to Support Future Decision-Making on Arctic Fisheries*

### **Primary Contact:**

Alaska Ocean Observing System  
Ms. Molly McCammon  
Executive Director and Principal Investigator  
1007 W. Third Avenue, Suite 100, Anchorage, AK 99501  
[mccammon@aoos.org](mailto:mccammon@aoos.org) 907.644.6703

### **Recipient Organization:**

Tara Riemer Jones, Ph.D.  
Seward Association for the Advancement of Marine Science  
P.O. Box 1329 Seward, AK 99664  
Acting as Authorized Financial Representative *on behalf of* Alaska Ocean Observing System

### **Other Investigators:**

Rob Bochenek, Axiom Consulting & Design  
Randall Hagenstein, The Nature Conservancy  
Matthew Berman, University of Alaska Anchorage - Institute of Social and Economic Research  
Sarah Trainor, University of Alaska Fairbanks - Alaska Center for Climate Assessment & Policy

### **Project Summary**

Alaska's diverse oceans and expansive coast totals more than 44,000 miles and is longer than the rest of the U.S. coastline combined. These marine environments support a multitude of activities including commercial and recreational fishing, traditional subsistence hunting and gathering, oil and gas development, shipping, tourism, and an abundance of fish and wildlife, including endangered species. As the boundaries for these activities expand and change over time due to climate change, sea ice retreat, resource discoveries, and socioeconomic and political changes, Alaska residents and resource managers need access to the most current information and decision-support tools to help make sound decisions for the future.

In particular, in December 2009 the Secretary of Commerce approved a recommendation from the North Pacific Fishery Management Council to adopt a Fishery Management Plan for Fish Resources of the Arctic Management Area (Arctic FMP), which initially prohibits commercial fishing until sufficient information is available to enable a sustainable commercial fishery to proceed. To appropriately manage a future fishing industry, fishery managers will need to understand existing information and gaps in Arctic marine environmental conditions and human use and establish a framework for future decision-support.

In this proposal, entitled "Developing Coastal and Marine Planning Visualization Tools for the U.S. Arctic and Alaska: Data Tools to Support Future Decision-Making on Arctic Fisheries," the Alaska Ocean Observing System (AOOS) and its partners and collaborators request funding to design, develop and test interactive web-based data integration and visualization tools and products to be used for regional ocean planning to support future decisions on developing commercial fisheries in the Arctic. This proposal responds to Focus Area 1 of the Request for Proposals to implement numbers 1-5 of the Essential Elements in the Guiding Principles of Coastal and Marine Spatial Planning (CMSP). Although the State of Alaska has expressed concerns about implementation of CMSP, many of these principles are key to all successful planning efforts and are not controversial themselves. We propose to achieve this through the following steps:

1. Assess information needs in the northern Bering and Chukchi Seas for ocean and coastal data, data integration, and data visualization tools to aid planning and decision-making by federal and state managers and regional and local stakeholders in anticipation of future development of commercial fisheries in the Arctic.
2. Identify synergies with current planning and data acquisition efforts that could provide additional relevant data to help inform this needs assessment.
3. Identify data and decision-making tools currently in use in Alaska for planning and decision-making; and assess additional data visualization and decision-support tools developed in other regions of the country and outside the U.S. for their potential utility in Alaska.
4. Compile additional datasets describing the northern Bering and Chukchi Seas (e.g., physical, chemical and biological parameters, climate scenarios, habitat characterization, human activities, socio-economic and community profile information, etc.) for use in data visualization tools, and incorporate them into AOOS data system.
5. Assess the utility of the AOOS Arctic portal as prototype data integration and visualization tool for planning and decision-making, and identify additional needs to further advance data integration and visualization tools.

Due to funding restrictions, we are using a project advisory committee (PAC) as our primary means of stakeholder engagement. It will include local, state and federal agencies, and representatives of key stakeholder communities, such as Alaska Native communities and subsistence users, as well as commercial fishing interests. We will also leverage outreach opportunities available through other existing planning initiatives to expand our stakeholder engagement opportunities.

Our focus in this descoped proposal is exclusively on the portion of the Arctic that encompasses the northern Bering Sea, the Bering Strait Region, and the Chukchi Sea. We have chosen this region of the Arctic because of the need for additional data and data tools to assist with planning for any long-term future commercial fisheries. It also provides the ability to leverage data collection efforts currently underway for federal and state planning efforts associated with potential shipping and port development in the Bering Strait region. In addition, with diminishing sea ice, the Arctic is taking on new national security and international trade roles. The Alaskan Arctic comprises the entire U.S. Arctic, and is thus of national importance.

The partners in this project include: AOOS, which will serve as the project manager and contribute its extensive marine data resources and infrastructure with Axiom Consulting and Design as the technical lead for the project; the University of Alaska's Institute for Social and Economic Research which specializes in social and economic data; the Alaska Center for Climate Assessment and Policy for climate data; and The Nature Conservancy of Alaska for its experience with data visualization and decision-support tools. These partners will be assisted by a diverse team of collaborators who will serve in advisory capacities and as contributors of data and information. These include federal and state agencies, industry, academic institutions, regional boroughs, non-governmental organizations, and subsistence and commercial fishing interests.

The project deliverables include (1) an assessment of data and information products and tools needed for planning for future Arctic commercial fisheries, and identification of data layers that currently do not exist in Alaska; (2) identification of synergies with existing planning efforts for data and tools in this area; (3) documentation of existing data products and tools used in Alaska, and an assessment of new products and tools and their potential applicability to Alaska; (5) incorporation of existing data layers into the AOOS Arctic Ocean Portal; and (6) assessment of the AOOS Arctic Portal (enhanced with datasets identified and synthesized through this project) for use in planning and decision-support for Arctic commercial fisheries.

**Collaborators:** Alaska Native Tribal Health Consortium, Alaska Sea Grant Program, NOAA Regional Collaboration Team, North Pacific Fisheries Management Council, North Slope Borough, North Slope Science Initiative, Northwest Arctic Borough, State of Alaska Agency Representatives (ADF&G, ADNR, ADOT, and ADEC), University of Alaska representatives (Geospatial Information Network of Alaska, School of Fisheries & Ocean Sciences, Department of Political Science), US Arctic Research Consortium, US Coast Guard, US Fish & Wildlife Service, Western and Arctic Landscape Conservation Cooperatives, USGS Alaska Science Center and Regional Climate Science Center.

**Proposed Funding:**

**TOTAL:                   \$760,000**

## PROJECT DESCRIPTION

### I. GOALS & OBJECTIVES

The overall goal of this project is to develop data integration and visualization tools that could be used to help plan for future decision-making relating to potential commercial fisheries in the Arctic. The collection and synthesis of spatial data into a suite of visualization tools is a critical step for long-term collaborative planning in Alaska for a wide range of coastal uses.

We will leverage and build upon the statewide data system and architecture established by the Alaska Ocean Observing System (AOOS), but focus our data gathering and tool development efforts in this proposal on the northern Bering Sea, Bering Strait and Chukchi Sea sub-regions of the Arctic Large Marine Ecosystem (LME). We will assess the need for visualization and decision-support tools by using a project advisory committee (PAC) that includes a variety of stakeholders including federal, state and local management agencies, Alaska Native corporations and tribal organizations, industry, and conservation organizations, and research institutions. We will solicit their input and expertise to assess existing spatial datasets and data needs, what would be most useful to planning entities, and to test and evaluate the visualization tools as they are developed. In addition, we will leverage other planning efforts currently underway or being discussed, relating to potential fisheries, shipping, and port needs in the northern Bering Sea and Bering Strait region, including their stakeholder outreach and needs assessment.

At the conclusion of this project, Alaska will have a better understanding of the information needed for future decision-making in the Arctic, as well as expanded data and information tools that provide meaningful and transparent access to Arctic data. These data will be spatially explicit and relevant to coastal and marine management, and include indicators for economic/resource development potential, climate change, marine species, and socioeconomic characteristics. This process will also build a constituency that is more familiar with using spatial data and visualization tools. The project will thus provide a strong foundation for future integrated planning for local, state, federal and private sector activities in Alaska.

Our overall goal will be accomplished through the following five objectives:

1. Assess information needs in the northern Bering Sea and Chukchi Sea for ocean and coastal data, data integration, and data visualization tools to aid planning and decision-making by federal and state managers and regional and local stakeholders for future commercial fisheries.
2. Identify synergies with current planning and data acquisition efforts (e.g., Alaska Regional Ports Study, Arctic Deep Draft Port Charrette, North Slope Science Initiative, Landscape Conservation Cooperatives, Climate Service Centers, other shipping and port development activities, planning for fishing, oil and gas, etc.) that could provide additional relevant data to help inform this needs assessment.
3. Identify data and decision-making tools currently in use in Alaska for planning and decision-making; assess additional data visualization and decision-support tools developed in other regions of the country and outside the U.S. for their potential utility in Alaska.
4. Compile additional datasets describing the northern Bering and Chukchi Seas (e.g., physical, chemical and biological parameters, climate scenarios, habitat characterization, human use activities, socio-economic and community profile information, etc.) for use in data visualization tools, and incorporate them into AOOS data system. Identify gaps in information.
5. Assess the utility of the AOOS Arctic portal and other AOOS applications such as the Ocean Workspace as prototype data integration and visualization tools for planning and decision-making, and identify additional needs to further advance data integration and visualization tools.

## II. BACKGROUND

Alaska's Arctic region comprises the entire U.S. Arctic. Subsistence is vital to traditional culture for Alaska's Native population, where fishing, gathering, and hunting of marine mammals and other wildlife help sustain daily life. In the same region, offshore industrial activities are expanding. Oil and gas production has been a critical part of the Alaska economy for 40 years, but as production in North Slope oil fields has peaked, both federal and state governments are looking intently at offshore opportunities to maintain the state's economy and national oil supplies. While only two nearshore Arctic offshore wells are currently producing oil and gas (Endicott and Northstar), 670 active offshore leases to energy companies totaling 3.7 million acres hold potential for exploration and development.

Other activities are emerging as the ice-free season is lengthening. While a moratorium by the North Pacific Fishery Management Council has put a hold on Arctic commercial fishing in federal waters awaiting further research, it is conceivable that commercial ships and military vessels could soon be plying Arctic seas and would be factors in managing an Arctic fishery in the future. The Arctic Marine Shipping Assessment, produced by the Arctic Council (AMSA 2009), forecasts an increase in shipping activities by orders of magnitude in Arctic waters as sea ice continues to diminish. The report also highlights the associated risks and relative lack of infrastructure for emergency response in the Arctic.

With human uses of Alaska's coasts and oceans projected to increase dramatically in the next 50 years (AMSA 2009), coastal resource managers must foresee and plan for the cultural, economic, and political conflicts that will arise. These conflicts will be further complicated by predicted climate-change impacts, which may shift the boundaries of current activities, creating more overlap, complexity, and conflict. Ocean acidification, of special concern in northern latitudes, could also impact future marine uses and management. These challenges underscore the need for a solid understanding of existing human activities and environmental processes, and for coordinated planning and management. To be successful, decision makers on the federal, state, local, and tribal levels will need access to integrated, up-to-date spatial information.

At present, spatial data for Alaska does not exist in a format where multiple types of human uses, and biological, oceanographic, and management data can be viewed together in a single location. The Alaska Ocean Observing System has made the development of a central access portal for oceanographic data a high priority. It is currently developing prototype visualization products, but is challenged by data being located in isolated and physically dispersed agencies. Furthermore, technical barriers, complex data formats, a lack of standardization, and missing metadata have made acquiring, much less using, available scientific information a cumbersome and daunting task. As a consequence, existing data are underused and often not incorporated into planning and decision-making processes. We will address this problem directly by searching for and bringing together spatial datasets in a suite of integrated visualization products and tools.

### *Status of Ocean Planning in Alaska*

We will build on a long history in regional partnerships, collaborations, and planning initiatives in Alaska. The history began in the 1960s and 1970s with the Alaska Land Use Council, the development of regional area plans by the State of Alaska, the establishment of the Governor's Office of Governmental Coordination, the Alaska Coastal Management Program, the Alaska Boards of Fisheries and Game, and the North Pacific Fishery Management Council.

More recently, a number of new initiatives have begun to incorporate planning for ocean observing. These include:

- The Alaska Ocean Observing System, one of 11 regional observing systems established as part of the national Integrated Ocean Observing System;
- The North Slope Science Initiative funded by the U.S. Department of Interior to coordinate North Slope oil and gas research and monitoring;
- The Alaska Climate Change Executive Roundtable, a forum primarily for exchanging information about climate change activities, and now overseeing a new Department of Interior regional climate science center and the new Landscape Conservation Cooperatives;
- The Alaska Marine Ecosystem Forum, established under the leadership of the North Pacific Fishery Management Council to provide a forum to share information about management issues in the marine environment;
- Cooperative management organizations between the federal government and Alaska Natives to facilitate management of whales, walrus and belugas;
- The North Pacific Research Board whose mission is to fund marine ecosystem and fisheries related research in Alaska waters; and
- Most recently, the Northern Waters Task Force established by the Alaska Legislature to investigate the need for infrastructure and new partnerships in response to increased activities in Arctic waters.

The State of Alaska has recently expressed concerns over a new ocean policy being enacted at the federal level. This includes the new Presidential Executive Order establishing a *National Policy for the Stewardship of the Ocean, Coasts, and Great Lakes*, and the President’s call for establishing new regional ocean partnerships and developing mandatory coastal and marine spatial plans. The key questions for the State are whether a new ocean governance or partnership structure and their required plans are necessary; and how such a structure and plans would add value to existing institutions. We leave that deliberative process and judgment to the State, and, for that reason, are focusing this proposal on the data collection, integration and visualizations tools for Focal Area 1 in the Request for Proposals. Development of data integration tools to help in decision-making is strongly supported by the State of Alaska.

### **III. PARTNERSHIPS & LEVERAGING**

The success of this project depends upon strong partnerships and the engagement of informed stakeholders. Project partners include five funded organizations and their principal investigators; a team of collaborators serving on the Project Advisory Committee; and other federal, state, local, tribal, non-governmental organization, university, and industry partners providing access to and reviewing data and tools. All of the project’s partners are extensively connected to the various planning and coordination entities already existing in Alaska, and provide a wealth of knowledge about Alaska’s marine environment and resources.

This project will benefit from significant leveraging opportunities from existing projects and collaborators. AOOS is contributing its existing data infrastructure, comprised of several dedicated computer systems including a 128-processor core High Performance Compute Cluster. AOOS is also involved in other projects to develop user tools for data access, visualization and analysis of Alaskan coastal and ocean data, especially for the Exxon Valdez Oil Spill Trustee Council, the Cook Inlet Regional Citizens Advisory Council, and the Oil Spill Recovery Institute.

Data assimilation and integration are occurring at other agency and multi-agency levels in Alaska as well, providing opportunities to easily import data important to the project. These include initiatives by the U.S. Bureau of Ocean Energy Management and the North Pacific Research Board to synthesize recently acquired Arctic research and monitoring data. Another example is the U.S. Fish & Wildlife Service-led Landscape Conservation Cooperatives (LCCs) whose mission includes “improve the quality and availability of natural resource data in spatially linked digital databases.” Similarly, the Alaska Data



Integration Working Group, initiated by the federal-state Climate Change Executive Roundtable, has been working since 2008 to produce guidelines and procedures to promote and implement data sharing among resource management agencies in Alaska. The North Slope Science Initiative was specifically established by Congress to coordinate research and monitoring activities related to North Slope oil and gas activities. In addition, the U.S. Coast Guard is currently conducting its Port Access Route Study for the Bering Strait region, the North Pacific Fishery Management Council and its Rural Community Outreach Committee are assessing future commercial fisheries in the northern Bering Sea, and the State Dept of Transportation and the US Army Corps of Engineers are assessing future deep water port development in the Arctic. Without taking advantage of these opportunities, it would be impossible to achieve the goals and objectives outlined in this proposal for the budgeted amount requested. Project partners will continue to seek out and initiate further leveraging opportunities during the course of the project.

#### **IV. AUDIENCE**

The data products and tools developed through this project will be aimed at four major audiences:

- 1) Resource managers and planners who make decisions at state, federal, local and tribal levels;
- 2) Regional planning and management partnerships and organizations;
- 3) Stakeholders who provide input into those decisions and make socio-economic decisions themselves; and
- 4) Local and national audiences with an interest in specific aspects of the Alaska marine environment, and who want to easily access data.

These entities include but are not limited to: resource managers in the Alaska Departments of Fish and Game, Environmental Conservation, and Natural Resources; federal agencies such as National Oceanic and Atmospheric Administration (NOAA), Bureau of Ocean Energy Management (BOEM), U.S. Fish and Wildlife Service (USFWS), U.S. Coast Guard, National Park Service, and U.S. Geological Survey; local governments such as cities, boroughs, ports and harbors; Alaska Native organizations, tribes, profit and non-profit corporations, and co-management organizations; commercial fishing and aquaculture, sport fishing, subsistence users, shipping and marine service industries, University of Alaska and other research institutions, educators, conservation groups, oil and gas industry, and renewable power developers.

#### **V. APPROACH**

##### **A. Essential Elements of CMSP Process**

Because the State of Alaska is still assessing whether and how a new regional ocean partnership and planning body might work in Alaska, waters and if the entire federal CMSP Process is needed in Alaska, this proposal focuses only on numbers 1-5 of the Essential Elements of the CMSP process as they represent interests held in common both by Federal agencies and the State. We propose to: identify regional objectives and needs for ocean and coastal data and information products; identify existing efforts; engage stakeholders, including local, state and federal decision-makers as well as the public throughout the process; consult with scientists and technical experts, including those with local and traditional knowledge; and develop a data framework and visualization tools that could be used in current and future planning initiatives, with a specific focus on future Arctic commercial fisheries.

##### **B. Incorporation of CMSP Guiding Principles**

The activities outlined in this proposal address the principles outlined in the Ocean Policy Task Force CMSP Framework. While no ocean management plans will be created at this time, the data visualization and decision support tools will be developed to be consistent with the framework. In particular, the project activities and deliverables will incorporate multiple existing and emerging uses, engage broad-based stakeholder support and participation, further ecosystem-based management and address cumulative impacts, and integrate the most current and scientifically sound information in the natural and

social sciences, including local and traditional knowledge. By providing this foundation, the project will advance collaborative planning and management initiatives in Alaska.

### **C. Project Management**

The overall project team consists of the project leader and core funded investigators, a group of advisors composing the Project Advisory Committee (PAC), and an array of collaborators providing support and in-kind resources. We plan to rely extensively on input and resources from many of the organizations and institutions already working on these issues.

#### ***Funded Investigators***

1. The Alaska Ocean Observing System (AOOS) will serve as project lead. AOOS is one of 11 regional coastal ocean observing systems from across the country that meet national and regional needs for local ocean observations, data management, and modeling. Its board is made up of state and federal agencies and Alaska research institutions. AOOS provides a centralized clearinghouse for data and information products on Alaska's coast and ocean for use by a variety of stakeholders, including resource managers. AOOS Executive Director Molly McCammon will function as the overall project lead and AOOS Program Manager Darcy Dugan will serve as the project's logistics and communications coordinator and ensure the timely development and submission of reports and deliverables. AOOS will make available its existing data system and architecture ([www.aos.org](http://www.aos.org)), as well as oceanographic data from the AOOS data warehouse.

2. Axiom Consulting & Design, as AOOS's data management services contractor, will be the technical lead on the project. Axiom is a technology and informatics firm located in Anchorage dedicated to providing data management and informatics support for the scientific and management sector. Axiom has a full-spectrum client base that spans from local nonprofit organizations to state and federal agencies. It specializes in the development of data management systems, data portal user interfaces and data storage frameworks that communicate information with other data systems via interoperability protocols. Axiom Director Rob Bochenek will provide expertise in programming and database development to create the data integration and visualization tools. Axiom will also assist in the technical aspects of stakeholder engagement.

3. The Institute for Social and Economic Research (ISER) is part of the College of Business and Public Policy at the University of Alaska Anchorage. In this project, ISER will be responsible for collecting and geo-coding existing data on human uses and associated socio-economic indicators for the project region and identifying data that might be developed to fill gaps. Led by Dr. Matthew Berman, ISER will aim to provide spatial and temporal datasets representing marine and coastal use areas and infrastructure for subsistence activities, cultural and recreational activities, commercial fishing, sport fishing, shipping, energy, tourism, science and research, conservation, and security, safety and emergency response. ISER will also provide social indicator data for coastal communities dependent on marine ecosystem services.

4. Alaska Center for Climate Assessment and Policy (ACCAP) and Scenarios Network for Alaska and Arctic Planning (SNAP). ACCAP is a NOAA-funded Regional Integrated and Science Assessment (RISA) Program focused on making the best available climate change science accessible and available to decision-makers through a variety of formats, including the creation and assessment of decision-support tools (<http://ine.uaf.edu/accap>). SNAP provides downscaled climate models and scenario planning tools for Alaska and the Arctic ([www.snap.uaf.edu](http://www.snap.uaf.edu)). Based at the University of Alaska, Fairbanks, ACCAP and SNAP each have experience working directly with Alaskan stakeholders to provide timely and relevant climate information for planning and decision-making. In this project, Dr. Sarah Trainor and Dr. John Walsh will work closely with project partners as consulting climate scientists and experts to provide access to the best available climate science for Alaska.

5. The Nature Conservancy Alaska (TNC) has been working with marine spatial data for over two decades and has a breadth of expertise in the development of marine spatial software and tools in other regions. TNC maintains a reputation among community, state and federal interests for its skill and even-handedness in bringing diverse voices to a shared table. For this project, TNC Alaska Director Randall Hagenstein will be responsible for documenting current Alaska decision-making tools and assessing the utility for Alaska of new data visualization and decision-support tools.

### ***Project Advisory Committee***

A Project Advisory Committee (PAC), drawing from the organizations below, will provide overall guidance to the project investigators. Additional partners may include local governments, legislative-led initiatives (the Northern Waters Task Force), industry representatives, regional tribal service non-profit organizations, marine mammal co-management organizations, and Alaska Native profit and non-profit corporations. The PAC will meet in person at least two times during the project, and as needed by video and audio conference, and will serve as the primary means for stakeholder engagement for the project.

- Alaska Native Tribal Health Consortium
- Alaska Sea Grant Program (NOAA)
- NOAA Regional Collaboration Team
- North Pacific Fishery Management Council
- North Slope Borough
- North Slope Science Initiative
- Northwest Arctic Borough
- State of Alaska Agency Representatives (ADF&G, ADNRR, ADEC)
- University of Alaska representatives (Geospatial Information Network of Alaska, School of Fisheries & Ocean Sciences, Department of Political Science)
- US Arctic Research Consortium
- Federal agency Representatives (Coast Guard, Army Corps)
- US Fish & Wildlife Service Western and Arctic Landscape Conservation Cooperatives
- USGS Alaska Science Center and Regional Climate Science Center

### **D. Role of Federal Partners**

Many of the federal agencies in Alaska serve on the AOOS Board and the regional planning partnerships described in Section III. As members of these organizations, they are committed to contributing the data they collect and participating in achieving the overall goals and objectives of this proposal.

## **VI. PROJECT ACTIVITIES**

### **A. Assess information needs for ocean and coastal data, data integration and data visualization tools**

*Task 1. Establish a Project Advisory Committee (PAC) to help identify regional objectives and needs for data acquisition and tools. The Project Advisory Committee (which include numerous federal and state agencies) will provide strategic guidance about the linkages between this project and other, existing and future planning efforts. The PAC will also assist the project team in analyzing data needs, prioritizing initial activities, identifying stakeholders for outreach, commenting on workshop agendas and methodologies, and providing feedback on product and tool development. See proposed committee membership in Section V.C.*

*Task 2. Support Project Advisory Committee (PAC) meetings.* The PAC will meet as needed throughout the project, but at least quarterly. Since many of the participants are based in Anchorage, meetings will be held in Anchorage with non-Anchorage participants connecting via audio and video teleconferences. At least two all-hands in-person meetings will be held: at the beginning of the project and in the fall of 2013 in conjunction with the data tools workshop. The AOOS project leader will provide frequent project status reports to the PAC.

*Task 3. Develop project communication and outreach materials.* The AOOS project staff will develop a project website as well as a set of standard communication tools about the project. These will include website updates, written handouts and brochures that can be widely distributed, displays and PowerPoint presentations to be used by PAC members as well as various stakeholder forums throughout Alaska (e.g., at the Alaska Marine Science Symposium and the Alaska Forum on the Environment). AOOS has strong relationships with its member organizations such as the Alaska SeaLife Center, the Alaska Sea Grant Program, and COSEE Alaska. These entities all have project websites and outreach mechanisms to further communicate the goals and objectives of this project and solicit additional stakeholder input.

**B. Identify synergies and overlap with current planning and data acquisition efforts to provide additional relevant data and increased opportunities for stakeholder engagement.**

These efforts include the U.S. Coast Guard's current Bering Strait Port Access Route Study, the Alaska Department of Transportation and US Army Corps of Engineers (USACOE) deep-draft Arctic port study, and the North Pacific Fishery Management Council's Northern Bering Sea Research Study Area planning activities. In addition, a number of ongoing programs have data planning and outreach activities as described in sections II and III above.

*Task 1. Identify current and future planning initiatives* that may have data and spatial efforts underway that could inform or complement this project. These initiatives will be assessed for synergies, overlaps, and common objectives addressing issues such as climate change impacts, the loss of sea ice and increased coastal erosion and changes in habitat, existing and anticipated commercial and recreational fishing and hunting and subsistence uses, changes in marine shipping and vessel traffic, existing and proposed offshore oil and gas activities, and trends in ocean acidification. In addition, many of these initiatives have outreach and communication efforts that will provide opportunities for the project team to solicit additional stakeholder input into the data needs for this region.

*Task 2. Incorporate data from these projects into the AOOS data system.* Relevant data acquired through the above efforts, especially those that have a spatial component, will be incorporated by the Axiom data analysts as funding allows into the AOOS data system and/or other relevant data systems useful to Alaska decision-makers.

*Task 3. Use NOAA/Alaska Sea Grant workshop in Bering Strait region to gather additional regional agency and stakeholder input into the needs assessment and development of Arctic Portal tools.* NOAA's Regional Collaboration Team and the Alaska Sea Grant Program already have plans and funding for a workshop in Nome in the summer or fall of 2012 to provide a regional forum on potential Bering Strait shipping and navigation. Participants will include tribal representatives from the region's Alaska Native villages, as well as local and regional managers and governments. We will leverage this workshop to discuss information needs for potential commercial fisheries in the Arctic, and local and regional needs for data, data integration, and visualization tools to assist in local and regional decision-making.

**C. Identify data and decision-making tools currently in use in Alaska for planning and decision-making; assess for their potential utility in Alaska additional data visualization and decision-support tools developed in other regions of the country and outside the U.S.**

*Task 1. Conduct scoping interviews with project advisory committee members and other local and regional decision-makers.* The TNC PI will conduct interviews to help identify management issues, existing data and the need for additional data. The PI will also document the data and decision tools currently used by decision-makers. These include state and federal managers and permittees, as well as stakeholders who need to make decisions about future activities. Many, but not all, will be members of the PAC. Questions to be asked include: How are decisions currently made? Are the tools currently used adequate? Do we need unique tools for Alaska's regions and issues? Can the tools already in existence and used outside Alaska be applied or adapted to Alaska? What tools are most useful to stakeholders? During these interviews, respondents will be queried on other issues such as existing data sets, information flow for decision-making, and the most pressing management issues facing them.

*Task 2. Assess new data visualization and decision support tools in development or in use both in and out of Alaska, and use committee members to determine their potential utility in Alaska.* Potential products and software to review include the U.S. Government's new marine data portal under development by data.gov, NOAA's Digital Coast and the Marine Cadastre, MarineMap, cumulative impacts tools developed by University of California at Santa Barbara, University of Queensland Spatial Ecology Lab Tools Marxan/Marzone, and a host of other spatial analysis and visualization tools provided by research laboratories and software companies. In Alaska, products to review include Arctic ERMA, the Cook Inlet Response Tool, and the AOOS Arctic Portal. Many of the newly developed spatial visualization and decision support tools have already been assessed by other entities (see the 2010-2011 assessment by the Center for Ocean Solutions of U.S. decision support tools and the UNESCO CMSP initiative - <http://www.unesco-ioc-marinesp.be/>, etc.). However, they have not been assessed for their applicability to Alaska issues and decision-making processes, including planning, permitting and economic decision-making. This assessment will include recommendations of which tools have the most applicability to Alaska issues and users.

#### **D. Gather and Synthesize Data Layers and incorporate into AOOS Data System**

Based upon the scoping interviews with PAC members, the regional workshop in Nome and the assessment of other planning initiatives, the project team will have a solid understanding of existing data sets and preliminary data gaps. The team will use this information to obtain, synthesize, and geo-code the prioritized data layers. This component is the heart of this project. Since Alaska is relatively data-poor, there is a critical need to identify and synthesize existing data and make it more useful for decision makers.

*Task 1. Develop socio-economic, human use and community profile information and format for use in tools and data system.* ISER will compile and geo-code existing data on human use and associated socio-economic indicators and identify data gaps for coastal communities in the study region. ISER will use existing data to develop baseline community socio-economic profiles that are geo-coded and can be displayed spatially. This work builds on the Arctic Council's Arctic Social Indicators project which identified a set of indicators that are important to people who live in the Arctic and for which data are routinely collected.

*Task 2. Develop climate scenarios and projections for the Bering/Chukchi Seas for sea ice and ocean conditions for use in tools and data system.* ACCAP and SNAP will work closely with project partners as consulting climate scientists and experts to provide access to the best available climate science. Using previously developed methodology (Walsh, Chapman et al. 2008) SNAP will identify the climate models that perform best in northern latitudes for sea ice extent and sea level pressure (geostrophic winds). Using existing archived model output, they will produce future scenario projections (up to the year 2100) for sea ice extent and distribution, storminess trends (wind vectors) and sea surface temperature (SST) for the Bering and Chukchi Seas. Axiom will be responsible for interpolating data to the actual geospatial grid of the final visualization tool.

*Task 3. Collect, synthesize and geo-code additional data layers identified by activities under VI.A and B above as critical for use in tools and data system.* Funding is provided for subawards to entities to be determined by the PAC and project team based on the priority needs identified by the PAC. These could include additional data needs such as habitat characterization, subsistence use, fish and marine mammal surveys, etc. We do not intend to collect new data, but rather, integrate and visualize existing data.

*Task 4. Compile other existing physical, chemical and biological datasets, as well as those datasets gathered in Tasks 1-3 above into the data system.* AOOS and Axiom will focus on gathering existing data pertaining to physical, biological and chemical resources and parameters for the Bering and Chukchi Seas. Federal and state resource agencies and academic researchers will provide the majority of this data. Examples of existing data sets include: existing federal, state and industry surveys of fish, marine mammals and seabirds; AK Dept. of Natural Resources data initiatives for geolocating permits and land ownership; Audubon Alaska's Arctic Atlas; ShoreZone imagery and mapping; the Ecosystems Considerations Chapter of the Stock Assessment and Fishery Evaluation reports for Alaska fisheries; and ocean acidification data from the Alaska Ocean Acidification Center, partially funded by AOOS. AOOS will incorporate these data into its overall data system, and also identify data layers comprised of oceanographic model output in order to display three dimensional water column information.

In many cases, the datasets will need to be processed into modern or more usable formats consistent with federal and national Integrated Ocean Observing System (IOOS) standards, in addition to being documented by metadata. National Spatial Data Infrastructure standards and best practices will be employed when preparing and exposing the data. This will involve the creation of FGDC-compliant metadata when metadata do not exist to document source characteristics such as sampling methods, use constraints, contact information and other qualities. Dataset structures will be enhanced so they can be available and understood by other scientists and the public.

*Task 5. Incorporate the new data sets into the AOOS Arctic Portal and Ocean Workspace.* The overarching technical strategy for this effort leverages the AOOS investment in an end-to-end data management architecture that allows data and information to be channeled and distilled into user-friendly products. The AOOS data management team has already achieved considerable progress towards this effort for a subset of datasets for Alaska. Currently, a large number of biological and physical data layers, models and sensor feeds are managed and available via the AOOS data system and visualization tools. See Appendix G for a technical description of the system and approach.

Using other funding, AOOS is developing a statewide Ocean Portal, with a regionally tailored Arctic Portal to be released in spring 2012. These portals will build upon a set of existing data visualization applications already created by AOOS data management, including the Arctic assets data portal, oceanographic/climate model explorer, real time sensor portal and North Pacific seabird portal. These applications are available for public access at <http://data.aos.org>. See Figure 1.

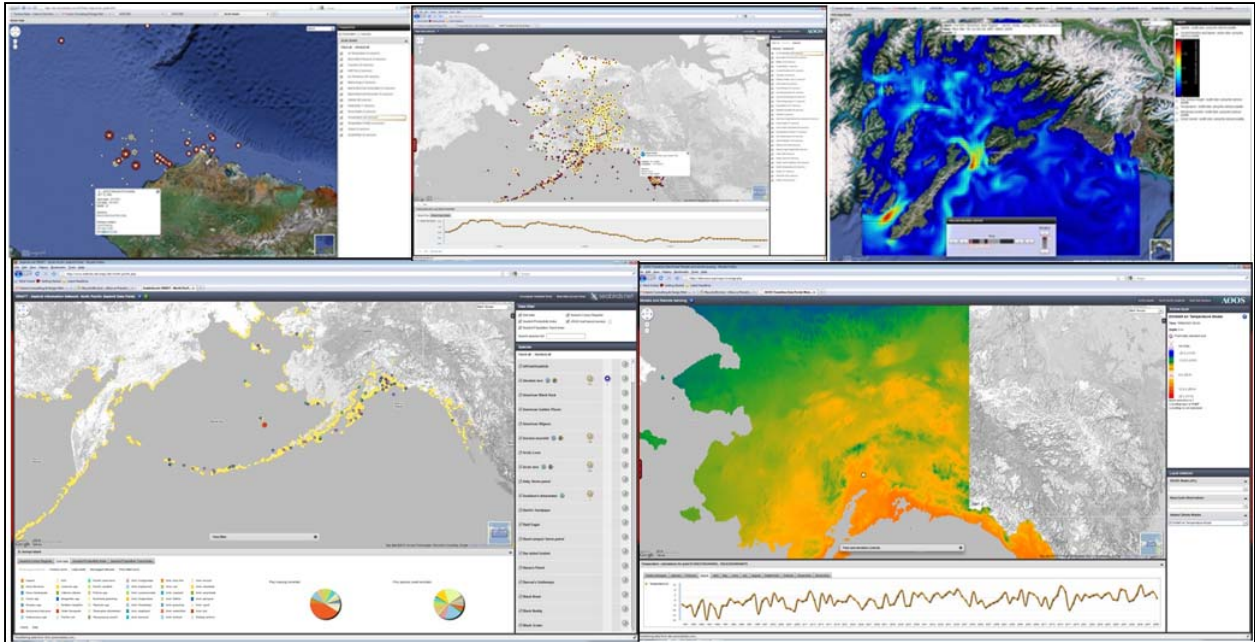


Figure 1. Screenshots of existing AOOS data visualization and access systems are available at <http://data.aos.org>. At top from left to right are screenshots of the Arctic assets portal, real time sensor portal, and the model explorer displaying a ROMS circulation model of Prince William Sound. On the bottom are screenshots of the North Pacific Seabird Portal and another model explorer view portraying an analysis tool for a climate modeling dataset.

Due to limited funding, this project will not be able to support development of additional tools beyond enhancing what is currently planned by AOOS. To the extent funding from this project and other projects might be available, we will attempt to provide some additional core functionality. These include:

- Capacity to provide stakeholders, user groups and management agencies with accessible, relevant information for decision-making.
- Intuitive interfaces for stakeholders to review and explore data and to submit feedback and comments.
- Capacity to store, use and provide access to more complex types of information than is currently provided by existing prototypes. These data sources include various oceanographic observations throughout the water column, other modeling and remote sensing datasets and a variety of socioeconomic data.
- Capacity to enable users themselves to perform useful spatial analysis routines and data analysis.

*Task 6. Establish data sharing agreements with regional data holding organizations.* Most federal and state agencies and research entities in Alaska that hold potential data are AOOS board members and have already agreed to share their data. For those regional organizations that are not members of AOOS and for prioritized data held by private industry, data sharing agreements will be established to steward data deemed important for this effort. This process will establish protocols for periodic data transfer and ensure that the most current and accurate information is available for use in existing and potential data visualization and integration tools. NOAA and Shell Oil, Statoil and ConocoPhillips signed an umbrella Memorandum of Agreement in August committing to share industry-collected data from the Chukchi Sea. AOOS is currently in discussions with the same three companies for establishing mechanisms to make available industry-collected data through the AOOS portal.

**E. Assess utility of AOOS Arctic portal as prototype data integration and visualization tool for planning and decision-making and identify additional needs for data integration and visualization tools to support planning and decision-making.**

*Task 1. Use project advisory committee as a beta test group to assess Arctic portal for tool functionality.* Before the Arctic Portal is released in June 2012, a beta version of this application will be made available to PAC members to garner feedback on its utility and functionality. Recommended changes will be incorporated when possible prior to the public release of the Arctic Portal.

*Task 2. Host workshop for Project Advisory Committee and other representative decision-makers and stakeholders.* This hands-on workshop in Anchorage will be used to: share the results of the assessments made in A-C above; share case studies of use of data integration and visualization tools by others; hear from experts in the field of decision tool development; further assess needs for additional tool functionality; and garner feedback on prototype tools. The workshop will provide PAC members and other agency managers and stakeholders with the opportunity to view and test the Arctic Portal and its various applications developed to date. Feedback from this session will inform the project team and allow the team to revamp and improve the tools prior to the end of the project. Additional functionality for data visualization tools will be identified based on this input.

**VII. Benefits and Deliverables**

The following products will be produced as tangible deliverables from the efforts of this project. All final products will be made available on the project page on the AOOS website.

**A. Data and information product assessment and gap analysis**

The project team will produce a report summarizing the additional data, data integration and data visualization and decision-support tools identified by stakeholders necessary for planning and decision-making for future Arctic fisheries. This report will be made available to state and federal managers and other stakeholders and decision-makers. It will include specific data layers that currently do not exist in Alaska, so that regional research and data stewardship agencies can use this information to drive their future data collection and research activities. Once it is known what information management agencies and stakeholders need to better assess the ecological impacts of human development activities, future research and data collection activities can be designed to meet those specific needs.

**B. Summary of planning initiatives (short-term and ongoing) in Alaska and data products planned or produced**

The project team will produce a summary of those planning initiatives currently ongoing or planned and the data and data products to be developed by these initiatives. This summary will assist other planning efforts in setting priorities for new data collection.

**C. Decision methods and tools assessment**

The project team will produce a report describing the existing data and decision support tools and methods used by state and federal managers and relevant stakeholders. This report will also include an assessment of existing tools and their applicability to Alaska. This product will provide a reference for future discussions about planning tools. The report will be made available to federal and state managers and other stakeholders and decision-makers.

**D. Additional data & information layers for manager & stakeholder user needs**

The individual data layers will be made available through the AOOS Arctic data portal for manager and stakeholder use as well as for use in other data applications and tools.



**E. Assessment of AOOS Arctic Portal and potential planning tool applications**

Due to funding limitations, we will not be able to produce completely new data visualization tools that will assist in planning and assessment of ocean and coastal uses. However, we will be able to expand upon the currently planned AOOS Arctic Portal with new data and a variety of enhanced applications that will be web-based, using open source technologies and driven by the needs of management agencies and stakeholder groups.

The benefits of this process and these products include providing a better understanding of the information needs and decision support tools for current and future uses of Alaska’s coasts and marine ecosystems to Alaskans, and especially for consideration of future commercial fishery development in the Arctic. These will all aid in smooth development of future planning initiatives for uses of Alaska’s marine waters.

**VIII. MILESTONE SCHEDULE**

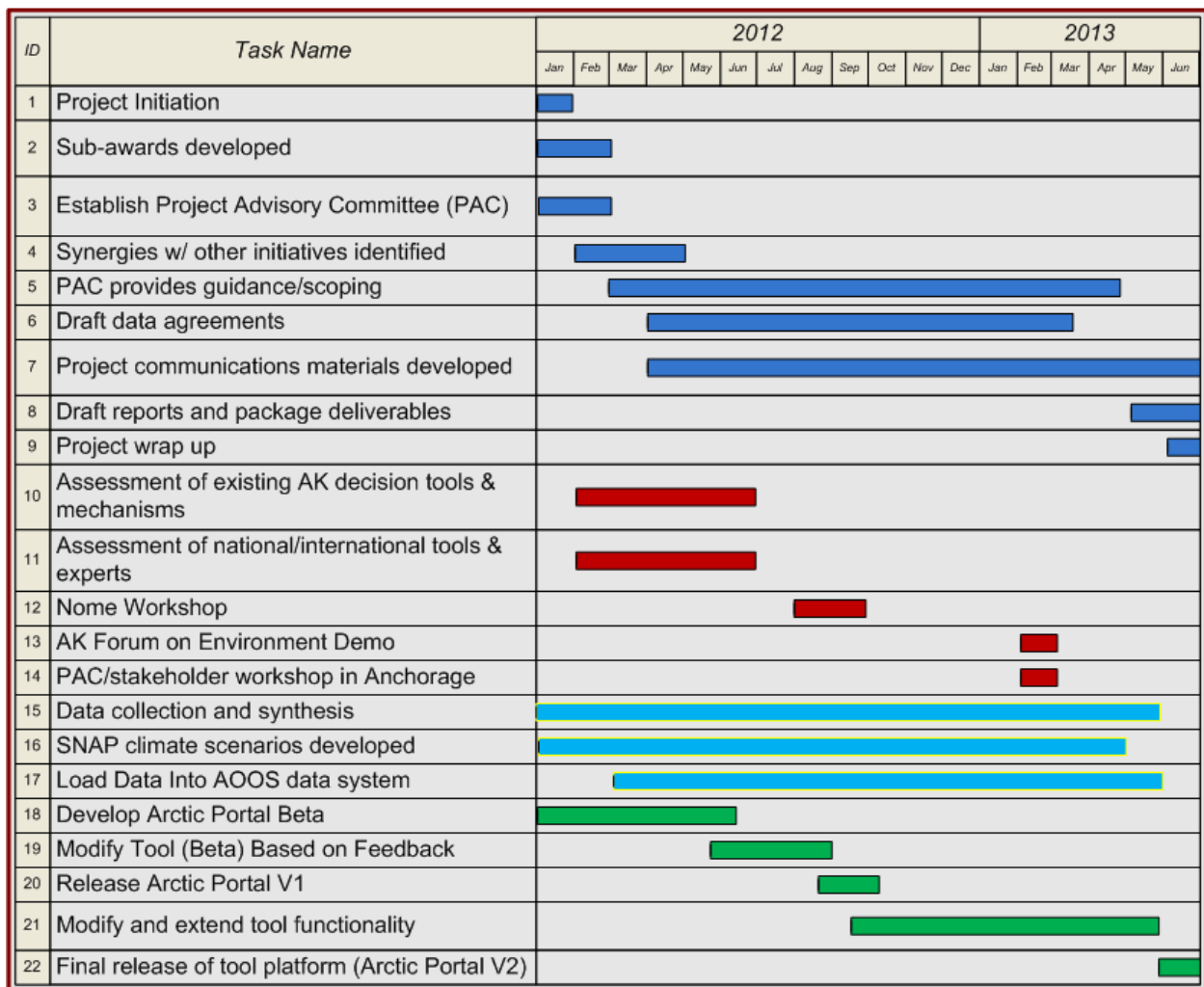


Fig. 2 The above Gantt chart details task start/end dates and milestones for the project. Tasks are grouped into four categories. Administrative, project oversight and communication activities (AOOS Lead) are represented as dark blue bars. Decision-tool assessment activities & workshops (TNC and AOOS leads) are represented as red bars. Data acquisition, documentation and processing (Axiom, ISER and SNAP) and loading of data into the AOOS data management system (Axiom) are portrayed as aqua blue bars. Finally, tasks relating to tool development (Axiom lead) are represented as green bars.

## IX. PROJECT BUDGET

	YEAR 1	YEAR 2	18-month TOTAL
	Budget	Budget	Budget
AOOS Program Management Totals:	54,806	41,047	<b>95,853</b>
AOOS Programmatic Component Totals:	109,500	77,643	<b>187,143</b>
The Nature Conservancy	40,067	12,008	<b>52,075</b>
University of Alaska Anchorage - ISER	56,921	43,008	<b>99,929</b>
Axiom Consulting & Design	125,282	74,718	<b>200,000</b>
University of Alaska Fairbanks - ACCAP	87,666	37,334	<b>125,000</b>
<b>Totals</b>	<b>474,242</b>	<b>285,758</b>	<b>760,000</b>

### **A. Detailed budget information**

Included in Appendix A are an overall project budget and budget narrative, and the detailed budgets for each of the subawards. No equipment in this proposal is available for lease. All items require a direct purchase.

### **B. Scalability**

Since the original project is funded at less than the requested amount, we will focus all our efforts on the northern Bering Sea, Bering Strait, and Chukchi Sea sub-region of the Arctic, with a scaled back stakeholder engagement process.

## APPENDICES