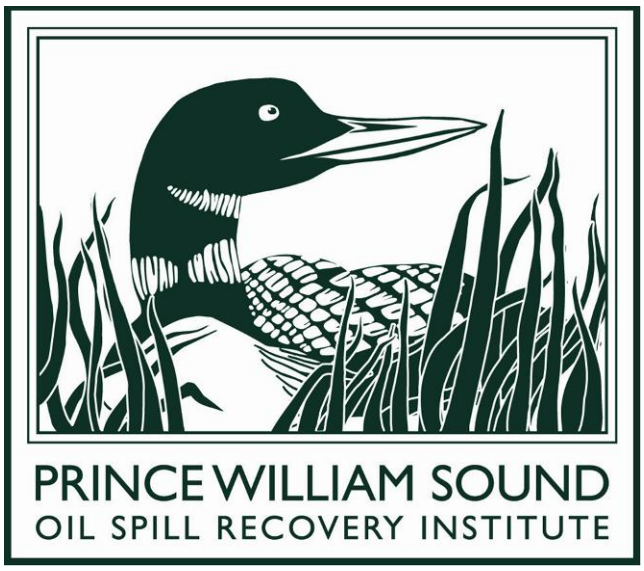

2016 Work Plan
Oil Spill Recovery Institute

October 2015

Contents

Prince William Sound Oil Spill Recovery Institute
2016 Work Plan

I. Purpose and organization of this document

This document describes the Oil Spill Recovery Institute (OSRI) 2016 Work Plan in the context of the overall Research Plan approved by the OSRI Board in October 2015 for fiscal years 2016 through 2020. The Research Plan should be referenced for detailed descriptions of the OSRI Program, the planning process and supporting documents. The annual reports and previous work plans should be referenced for more information regarding previously funded projects. The 2016 Work Plan provides descriptions of projects proposed for funding in the 2016 fiscal year beginning October 1, 2015 and a brief description of projects funded in previous years that have funding continuing into fiscal year 2016 (FY16). The OSRI Science Plan and previous OSRI Work Plans can be found on the internet at: www.pws-osri.org.

II. OSRI Strategic Goals and FY16 Work Plan New Projects

The Advisory Board of OSRI and the Executive Committee of the Board of Directors for the Prince William Sound Science Center (PWSSC) conducted a strategic planning session in 2014. The purpose of the planning session was to evaluate the past, the present, and plan for the future of OSRI. During that planning session the mission of OSRI was identified to be: **Support research, education, and demonstration projects that improve understanding and responding to oil spills in the Arctic and sub-Arctic marine environments**. Four goals were identified as part of the strategic plan: Understand, Respond, Inform, and Partner (see OSRI Science Plan). The fiscal year 2016 Work Plan has been placed in the context of these four goals.

A. Goal #1 Understand:

Attain an interdisciplinary understanding of Arctic and sub-Arctic marine environments as it pertains to: baseline conditions; the sources, fate, and effects of spilled oil; and the recovery of those environments following a spill.

This goal addresses the OSRI mandate to "determine, document, assess, and understand the long-range effects of Arctic or subarctic oil spills". The objectives listed in the science plan are to:

- Evaluate short and long-term effects.
- Identify chemical, biological, and physical impacts and consequences.
- Identify impacts of oil spill response options.
- Evaluate impacts from oil spills on the economy, lifestyle and well-being of people, and resiliency of communities and resource users.

- Achieve long-term coastal and ocean observing capabilities.

This work plan describes projects totaling $210K for projects related to Goal #1. OSRI has elected to support a portfolio of initiatives, including:

(1) Supporting the operation of SNOTEL meteorological stations in partnership with the Alaska Ocean Observing System (AOOS).

(2) Synthesis of marine mammal information.

(3) Continuing partnership with NPRB for biological research.

(4) Oil degradation agent effectiveness

a. SNOTEL stations (OSRI cost: $10K)

One objective of the research plan is to achieve long-term coastal and ocean observing capabilities. AOOS and OSRI have had a long standing partnership in developing, testing, and maintaining the Prince William Sound Ocean Observing System. There are two primary goals of the Prince William Sound Observing System. The first is to combine long-term monitoring with short-term hypothesis-driven process studies to understand mechanisms underlying the regional ecosystem dynamics. Understanding the circulation and the patterns of water exchange will provide a solid scientific foundation for addressing fisheries and ecosystem management needs related to long-term oceanic and climatic variability. The second goal is to provide information to the major user groups in Prince William Sound (PWS) including the coastal communities, oil and gas transportation industry (tanker traffic and oil spill response), air taxis, commercial fishermen, recreational and commercial boaters, and Coast Guard search and rescue operations.

Understanding the circulation of Prince William Sound requires accurate measurements of wind fields and precipitation. Snowmelt runoff and rainfall creates a freshwater layer that sets up aspects of the surface circulation. By understanding the basic meteorological conditions, including precipitation, we hope to improve our ability to model the hydrology of Prince William Sound, improve our understanding of the forces driving seasonal changes in circulation, and provide oil spill response organizations with necessary data.

Snowpack Telemetry (SNOTEL) meteorological stations, set up in partnership with the Natural Resources Conservation Service (NRCS) and the Alaska Ocean Observing System (AOOS), measure precipitation from snow and rain throughout the year and are needed to establish the freshwater budget. Since the summer of 2005, six SNOTEL stations have been deployed at sea level in PWS, and two stations at alpine elevations. Each station in PWS measures temperature, wind speed and direction, precipitation, and solar

radiation. With several years of data now available, we are able to test, more quantitatively, our understanding of freshwater input into PWS. The weather measurements are also important for oil spill trajectory modeling.

The annual operating cost for the weather stations is about $4K per station per year. The operating costs include regular maintenance, calibration of sensors, access to the sites, and telemetry related expenses. Funding for operation of these sites has been transitioned to AOOS. The OSRI FY16 budget includes $10K for upgrades and repairs to the eight existing systems.

b. Synthesis of information regarding marine mammals (OSRI cost: $25K)

The Defenders of Wildlife have funding to begin the development of Northwest Arctic Response Mapping Portal Tool that focuses on marine mammals. The project includes an Arctic marine mammal synthesis, examines how to engage communities, and provide recommendation and actions to improve wildlife response in the Arctic. The project is developing a mapping portal to act as a visual aid. By contributing to the effort OSRI would address the synthesis portion of the ecological research track described in the five-year research plan. The desire is to synthesize existing information and it is required that the synthesized data be able to be displayed in Environmental Response Management Application (ERMA) and by AOOS. OSRI will contribute up to $25K for the synthesis and mapping of existing information in the Northwest Arctic. This work is to be completed in partnership with other funding as obtained by the Defenders of Wildlife.

c. Funding partnership with the North Pacific Research Board (NPRB)

(OSRI cost: $100K)

The NPRB and OSRI have science plans that encourage research partnerships and the two organizations have been partnering to fund research of joint interest since 2006. Section 4.2.3 of NPRB's science plan directly responds to a strong recommendation of the National Research Council to seek partnerships with other entities to support joint research and funding of projects of mutual interest. Similarly, Section III.A.1 of OSRI's research plan identifies a potential partnership with NPRB to support ecological research projects in Arctic and sub-Arctic climates. NPRB and OSRI have science and implementation plans that provide the foundation for defining research priorities of mutual interest in any given year.

This year OSRI will review proposals from many potential topic areas in the NPRB request for proposals that overlap with OSRI's research plan. The OSRI research plan notes that the nearshore environment is the most likely area to be impacted by an oil spill, therefore knowledge of the environment and ecology of this zone is of greatest use to OSRI. There is also increasing pressure from shipping and oil development in the Arctic that makes that area of particular interest.

OSRI may contribute up to a total of $100K for one or more projects relevant to its research plan.

d. Degradation additive effectiveness (OSRI cost: $75K)

Several products have been proposed as additives to spilled oil to speed up the natural degradation of oil by microbes. Few have been tested in conditions expected in the Arctic or sub-Arctic. Some have not been tested by independent parties. We desire to test the efficacy of these agents prior to a spill so we can understand their potential for spill remediation and their potential effects on the environment. There is a need to understand, if the agents are enhancing degradation or dispersing the oil, what the natural response time is to the additive, and what end and intermediate products are produced. Linking the efficacy to toxicity is also desirable for understanding the impact of using these products. Testing is to be done at temperatures and salinities representative of Alaskan waters, with microbial assemblages from those waters, using bioremediation agents listed on EPA's NCP product schedule. Of particular interest are enzyme additives. Depending on the number of degradation agents to be tested, we expect the tests to last one to three years and cost $50K-$150K per year depending on the scope and complexity of the testing. OSRI will provide up to $75K in this fiscal year for such projects.

B. Goal #2 Respond:

Enhance oil spill response and mitigation capabilities in Arctic and sub-Arctic marine environments.

This goal addresses the OSRI mandate to "identify and develop the best available techniques, equipment, and materials for dealing with oil spills in the Arctic and subarctic marine environment." The objectives listed in the Research Plan are to:

- Identify and evaluate new prevention and response technologies.
- Evaluate relative benefits and consequences of specific response and mitigation techniques.
- Fill knowledge gaps on behavior of spilled oil.

The components to achieve these objectives are described below.

1. Technology research and development

This work plan describes projects totaling $250K for projects related to Goal #2, oil spill response, OSRI is looking to fund projects in partnership with other organizations or that complement ongoing research programs.

a. Partnership proposals. (OSRI cost - $150K)

A number of agencies, organizations, and industry members fund research designed to improve spill response. The missions of the various groups can be diverse, but overlap

with OSRI's mandate to identify and develop the best available techniques, equipment and materials for dealing with oil spills in the Arctic and sub-Arctic marine environment. Such organizations include, but are not limited to, the International Oil and Gas Producers Arctic Technology joint industry program (http://www.arcticresponsetechnology.org/), Bureau of Ocean Energy Management (BOEM, www.boem.gov), Bureau of Safety and Environmental Enforcement (BSEE, www.bsee.gov), Coastal Response Research Center (www.crrc.unh.edu), Alaska Clean Seas (ACS, www.alaskacleanseas.org), Prince William Sound Regional Citizens Advisory Council (PWSRCAC, www.pwsrcac.org), United State Coast Guard (USCG, http://www.uscg.mil/hq/cg9/rdc/), Emergency Preparedness Prevention and Response, North Slope Borough (www.north-slope.org), American Petroleum Institute (www.api.org), and the oil industry. The oil industry currently has several joint industry programs (JIP) focused on arctic spill response issues, including detection and tracking, improved mechanical recovery, in-situ burning, and fate of dispersed oil.

With the Arctic Technologies JIP active we expect that there will be opportunities to contribute to their efforts as gaps are identified from the existing laboratory and field work. Additional work with oil in ice may be available at the Cold Regions Research and Engineering Laboratory in partnership with Alaska Clean Seas. BSEE and USCG continue to fund research related to improving spill response in the Arctic and it may be possible to develop partnerships with them.

By pursuing potential partnerships OSRI can leverage its limited funds to engage in larger projects, expanding the total budget for innovation. It should be noted that it is inherently expensive to work in Arctic and sub-Arctic regions, which increases the cost of proposals. OSRI will look to contribute to a JIP aligned with our research goals. If a partnership in a JIP or elsewhere is unavailable for the OSRI developed research topics OSRI will develop and release an RFP as the sole funding source. The research topics will be guided by these OSRI science plan response subjects:

1) Oil Spill Detection and Tracking
2) Spill Response in Ice
3) Best Practices
4) Spill Response Information Tools

Potential areas of research include, but aren't limited to:

1) ShoreZone mapping of coastal regions for input into spill response information tools.
2) Demonstrating airborne remote sensing technologies for broken ice conditions.
3) Demonstrating Autonomous Underwater Vehicle (AUV) applications under ice. (Partnership with BSEE, USCG, or Alaska Clean Seas)
4) Continued work on detection of oil in ice. (Partnership with JIP)

5) Testing new spill recovery equipment in Arctic and sub-Arctic waters. (Partnership with JIP)
6) Testing the stickiness of physically and chemically dispersed oil on arctic organisms.
7) Improving communication capabilities during spills
8) Developing best practices and tactic guides for spill response.

A total of $150K is expected to be available to fund one or more proposals under this topic area.

b. Update of the Field Guide for Oil Spill Response in Arctic Waters. (OSRI cost - $100K)

With the U.S. becoming the chair of the Arctic Council there is an increasing desire in the U.S. to address issues related to oil spills in the Arctic through their Emergency Prevention Preparedness and Response (EPPR) committee. The U.S. delegation to the EPPR has identified updating the *Field Guide for Oil Spill Response in Arctic Waters* as a priority. The document was originally prepared in 1998. Since that time there have been advances in our understanding of many aspects of spill response in ice-covered waters and changes in tactics used for spill response. We expect that the update process will be similar to the original creation of the document in that a contractor will be responsible for creation of the revised document under the guidance of working group with members from the Arctic Council nations. We anticipate that the effort will take one to two years and OSRI will commit $100K in FY16 towards this effort.

C. Goal #3 Inform:

Share information and educate the public on the issues of oil spill prevention, response, and impacts.

The objectives of this goal are to:

- Publish scientific and technical results in open literature
- Brief the response community on OSRI products.
- Facilitate the exchange of information and ideas through workshops and other forums.
- Educate future researchers and responders through K-12 programs, undergraduate internships, and graduate fellowships.
- Convey information to the general public through various media.
- Be a source of expertise.

The approach to reach these objectives OSRI proposes spending $190K to fund a suite of projects related to education and outreach along with supporting workshops and conferences that provide a means to disseminate OSRI research.

1. Education

Development of future researchers, engineers, and others involved in oil spill response requires an education component that exposes students to the issues important to ecology and technology. OSRI has been a strong supporter of education programs targeting students from kindergarten to graduate school. OSRI intends to continue building upon existing regional education and outreach programs.

a. Graduate Research Fellowships (OSRI Cost: $75K for up to three students)

Support of graduate students provides a means of focusing people at the start of their careers on oil spill related issues. OSRI funds are provided to support graduate projects that will better understand the social and economic effects of oil spills on coastal communities, provide information needed by managers and decision-makers for oil spill response and recovery, improve the technologies available to spill responders, and improve public awareness and understanding of marine and estuarine ecosystems.

Masters students may be supported for two years and doctoral students for up to four years. Applications for extensions beyond that time frame will be considered during the last year of existing funding. Students will be expected to present results to the OSRI Board at some point in their fellowship. Up to three Graduate Research Fellowship projects will be supported in FY16. We anticipate two fellowships will support continuing students and OSRI will release an RFP for the selection of the third student. Up to $25K of support per year will be available to each fellowship. A twenty five percent match by the proposing institution is required.

Continuing fellowship: Combining Long-term Data and Ecological Modeling to Assess Sensitivity of Coastal River Otters to Climate Change

Barocas, University of Wyoming.

Catastrophic oil spills such as the Deepwater Horizon, *Exxon Valdez*, or the *Esso Bernicia* are rare, but their ecological impacts can last for decades. The acute and lingering chronic effects of such oil spills have been well studied, demonstrating that long-term monitoring of ecosystems affected by such ecological catastrophes is necessary for future management recommendations.

In the over-two-decades since the *Exxon Valdez* Oil Spill (*EVOS*), Alaska coastal ecosystems have shown strong signs of recovery. One of the first species to recover from *EVOS* was the North American river otter (*Lontra canadensis*). The long-term, multi-agency, studies of river otters following *EVOS* highlighted their susceptibility to environmental catastrophes, their sensitivity to climate-induced changes in fish communities, and their key role in linking aquatic and terrestrial ecosystems at the land-margin. These attributes led to the identification of river otters as a sentinel species.

A recently developed spatially explicit individual-based model predicts a shift in social behavior and population declines of river otters in response to reductions in forage fish abundance. Thus, long-term monitoring of river otter sociality, diet composition, and

abundance in various locations along the Alaska coast provides insight into ecosystem recovery from *EVOS* and its responses to the threat of climate change.

The scientific advances in understanding river otter ecology were complemented by intensive demographic and genetic surveys, conducted in various sites of coastal Alaska. The magnitude and diversity of the research efforts over the past two decades yielded a wealth of data that is currently deposited in various formats maintained by various agencies. In order to establish valid monitoring program for river otters, a systematic inventory of the diverse types of data, and a subsequent synthetic analysis will be required.

This project aims to compile the data collected from the various river otter studies, methodically sort them, and store them in a permanent database managed by the Alaska Department of Fish and Game. Using the compiled data, several hypotheses concerning spatio-temporal changes in sociality and abundance of river otters in relation to the historical effects of *EVOS* and projected climate change will be examined. Models will be developed based on historic and recently collected data with new analytical methods (e.g., dynamic linear modeling and network theory) and then validated by investigating current river otter sociality and abundance. These models will then be applied Regional Climate Models to project river otter abundance, sociality, diet, and nutrient transfers from sea to land.

This year is the third year of OSRI support for this Ph.D. project.

Continuing fellowship: Tools to Model Present and Projected Freshwater Fluxes in High-Latitude Regions and Application to Cook Inlet, Alaska
Mosier, Oregon State University.

Salinity gradients between freshwater discharged into the Gulf of Alaska and relatively well-mixed coastal ocean water drive nearshore ocean currents in the region. Knowledge of the nearshore circulation in the Gulf of Alaska is important to the Oil Spill Recovery Institute (OSRI) since it determines the flowpath of oil, were a spill to occur. Circulation patterns also significantly affect the distribution and vitality of important biological systems, including salmon populations. Additionally, oil spill preparedness and ecosystem understanding are intertwined since the wellbeing of Alaska depends on both oil production and the maintenance of high quality ecosystems.

Significant work has been undertaken to understand freshwater inputs into the Gulf of Alaska. These projects have ranged in spatial extent from modeling for a particular inlet to modeling discharge into the entire Gulf of Alaska and have provided valuable insights; however, many of the methods have been either scale-dependent or not easily portable to other high-latitude regions of interest. This work proposes to develop novel, spatially-distributed hydrologic modeling tools appropriate to high-latitude regions which are

characterized in part by their data scarcity, significant contributions to annual runoff from seasonal snowpack, and importance of glacier mass balance.

These tools will be coupled to downscaled climate data inputs for both the historic time period and projected future scenarios (based on general circulation model future climate representations), to assess not only current freshwater fluxes but also a plausible range of future freshwater flux scenarios.

These tools will be demonstrated by applying them to Cook Inlet, Alaska. The tools will be designed to be robust across temporal and spatial domains, and will be validated in ways that assess this. The production of the tools themselves are a significant output of this work, but additionally this work will produce a historical model of freshwater fluxes into Cook Inlet, Alaska and an ensemble of plausible future freshwater flux scenarios.

This year is the third year of OSRI support for this Ph.D. project.

b. K-12 Programs: (OSRI Cost: $55K)

OSRI will continue to support the Prince William Sound Science Center's Headwaters to Ocean program in order to introduce younger students to the concepts important to understanding oil spill response and the recovery of the environment. Programs include components such as oceanographic monitoring, environmental education, and an introduction to oceanographic technologies. Beyond classroom delivery in PWS, OSRI is requesting that portions of the Discovery Room program be delivered to at least two other geographic areas in the north, west, or Aleutian Island regions of the state, or at a gathering that brings together people from those areas. OSRI desires a proposal that continues to support the existing education efforts and includes travel for delivery of materials to other communities.

This funding is for a single year to continue the Headwaters to Ocean environmental and technical education at the K-12 level. OSRI will provide $55K in FY16. The total cost of this program is between $130K and $150K and is supported by a wide array of other funding sources including grants and contributions.

c. Internship: (OSRI Cost: $15K to support one internship)

Undergraduate internships provide a mechanism to support students who will become the future workforce, but who are not necessarily continuing their education in graduate school. This program aims to support an internship for students interested in working with oil spill preparedness and response organizations in the Arctic and sub-Arctic regions. Individuals supported through OSRI's internship program will be required to submit a report describing their internship. They will also be encouraged to attend an OSRI Advisory Board Meeting to describe their experience.

OSRI will seek proposals to support an internship with OSRI providing up to $15K.

d. Ocean Science and Technology: (OSRI Cost: $20K)

It can be difficult to educate people on the capabilities, limitations, and risk-based tradeoffs of various oil spill response options using existing written and oral materials. For many, concepts are likely to be more apparent when depicted by other means. It is our desire to seek hands-on, graphical, or other visual media to show the limitations, capabilities, and risk-based considerations for various oil spill response options. The material should enable people to understand tradeoffs of response decisions, such as: in situ burning vs. dispersants vs. mechanical recovery capabilities, in situ burning vs. respiratory consequences of downwind communities; mechanical recovery options vs. responder safety during inclement weather conditions; ecological implications of response techniques, etc. The end product should be transportable to communities throughout Alaska and useful with adult and school-aged children.

OSRI will seek a one-year proposal up to $20K to develop educational activities with appropriate lesson plans or activity guides, and materials lists that allow the demonstration of recovery technologies and options. The proposal must include a description of how the activities would be made available for use throughout Alaska.

2. Outreach

Outreach to the public, researchers, and spill responders is important in ensuring OSRI's activities provide benefits and are peer-reviewed. Several means have been used to publicize OSRI's activities including sponsoring workshops and conferences, outreach activities of the Research Program Manager, and supporting public outreach through lecture series, radio programs, and development of printed materials. This year the funding for the latter activities has been included in the Research Program Manager's budget.

a. Workshops and Conferences (OSRI cost: $25K)

These funds are for workshops or special projects at the discretion of the OSRI Advisory Board. Funding is set aside for regularly scheduled conferences where OSRI funded research is presented and for supporting workshops that help OSRI achieve its mission. Workshops being considered for FY14 support include:

(1) **Alaska Marine Science Symposium**. (OSRI cost: $5K) Each January, researchers from throughout Alaska are invited to participate in a 3-4 day conference. It is an excellent opportunity for presentation of new results and networking. OSRI will contribute $5K to support this workshop, which will be held in late January in Anchorage.

(2) **Alaska Forum on the Environment.** (OSRI cost: $5K) OSRI will continue its support of the Alaska Forum on the Environment, which is typically during February in Anchorage. The conference covers many issues relevant to understanding the potential impact of oil spills in Arctic and sub-Arctic marine environments. OSRI will allocate $5K to the Alaska Forum on the Environment. A limited number of registration waivers will

be available for the staff, Board, and Scientific and Technical Committee to attend the workshop.

(3) **Alaska Oil Spill Technology Symposium** (OSRI cost $8K) The Alaska Oil Spill Technology Symposium began in 2014 as a desire to highlight oil spill research activities taking place in Alaska and connect agency and spill response personnel with those research activities. The overwhelming positive reception to the first symposium has led to a desire to hold it as an annual event. The symposium is organized by the Alaska Department of Environmental Conservation and the University of Alaska. OSRI will continue to support the symposium through covering logistical costs.

(4) **Workshops of opportunity.** (OSRI cost: $7K) Many important workshops occur that could provide improved products with a little additional support. The support provided here is intended to help cover the cost of running the workshop, the addition of teleconference capabilities, providing a facilitator or report editor, or other needs. We foresee several opportunities to support such workshops this fiscal year. Potential workshops include the community response workshop and an opportunity to partner on a workshop for identifying new techniques to clean small spills. OSRI will allocate a total of $7K to support workshops that align with the OSRI mission.

D. Other Programs

1. Program coordination (OSRI cost: $158K). The position of OSRI Research Program Manager is a programmatic expense. The total costs include salary, benefits, travel and commodities. The Research Program Manager's responsibilities include:

- Preparation of the annual work plan in consultation with the Board-appointed Work Plan Committee and in accordance with the Five-Year Science Plan adopted in 2005. Compiling information about potential projects, writing brief project descriptions and preparing project budget estimates.
- Implementing the work plan as approved by the Board. This includes drafting requests for proposals based on the Annual Work Plan priorities, and coordinating the peer review process with OSRI's Scientific and Technical Committee and with other organizations OSRI partners with for research projects.
- Coordinating with the Chair of OSRI's Scientific and Technical Committee (STC) to assure regular transfer of information between the OSRI Board and the STC. Also provide assistance, as requested by the STC Chair, in scheduling meetings.
- Meeting 2-3 times per month with the OSRI Executive Director (ED) to exchange information concerning program issues and contract awards. Work with the ED to develop a monthly program report for distribution to the OSRI Board.
- Assisting the Executive Director to ensure compliance with all policies and procedures of the OSRI Grant Policy Manual.
- Coordinating the processing of contracts for successful proposals. Monitor progress and final report deadlines for these contracts.

- Preparing bi-annual reports on OSRI grant awards and research and education programs for distribution to the OSRI Board.
- Preparing and publishing an annual report for broad distribution.
- Supervising maintenance of the OSRI website.
- Collaborating with the OSRI Executive Director to develop and maintain cooperative agreements with other organizations for research and education programs, for example with the Exxon Valdez Oil Spill Trustee Council, two Regional Citizens' Advisory Councils, the Alaska Department of Environmental Conservation, the Alaska Ocean Observing System (AOOS), the North Pacific Research Board, the UNH/NOAA Coastal Response Research Center, Bureau of Safety and Environmental Enforcement, Bureau of Ocean and Energy Management, and Joint Industry Programs.
- Periodically representing OSRI at professional meetings and workshops.
- Maintaining files and a library on oil pollution issues.
- Providing leadership in planning future research programs and work plans.
- Preparing technical reports on OSRI programs.
- Overseeing many outreach activities including presenting at workshops and conferences, maintaining the OSRI website, and publishing the OSRI annual report. Other outreach efforts are aimed to disseminate OSRI efforts through a wide array of media options, such as printed materials, radio broadcasts, and video or computer presentations.

OSRI funding will provide approximately $135.4K personnel (10.5 months), $8.8K travel, $13.2K contractual, and $0.6K commodities for a total of $158K.

2. OSRI Science and Technical Committee meetings (OSRI Cost: $8K).

Funds are set aside to support the functions of the OSRI Science and Technical Committee, and to support Board and STC travel related expenses associated with OSRI partnerships such as the JIP, NPRB, etc.

E. Partnerships

The use of partnerships is a goal outlined in the OSRI strategic plan. While there is not any funding that is dedicated solely to the development or maintenance of partnership programs, there are many existing partnerships and opportunities to develop new partnerships. We continue to partner with the Alaska Ocean Observing System (AOOS) to support an ocean observing system in Prince William Sound and to validate the physical and biological models developed through efforts by OSRI and AOOS. We are examining new partnerships with AOOS as they transition into their next five-year research plan. We continue to partner with NPRB to gain knowledge on the ecology of Alaskan waters and examine issues regarding oil toxicity. We are looking to partner with organizations like the Defenders of Wildlife and the North Slope Borough Wildlife Department that also have research related to understanding the impacts of oil spills.

To achieve our objectives under the Respond goal requires partnerships. We are looking to work with industry-sponsored research programs that align with OSRI's science plan. The Arctic Technology JIP includes six different programmatic areas, four of which are closely linked with the goals outlined in the OSRI science plan. Many of their projects will be completed in this year and gaps in their efforts identified for future funding opportunities. BSEE and USCG also have important programs to follow. BSEE recently had a call for white papers that included several topics related to improving spill response in the ice environment. The USCG continues work to test technologies in the ice environment. Their work provides a relatively low cost to test some emerging technologies.

Our Inform goal related projects are also heavily dependent on partnerships, most often developed by the programs we fund. OSRI contributes a portion of the cost of the education programs outlined. These programs gain additional funding from several private, corporate, and grant contributions. The Discovery Room is also a collaborative effort with the U.S. Forest Service and the Copper River Watershed Project. OSRI contributes small amounts to the Alaska Marine Science Symposium and the Alaska Forum on the Environment. The workshop of opportunity section is designed to provide an opportunity to develop new partnerships to achieve OSRI's goals.

F. FY16 New Programs Spending Summary

Area	Project	FY16 Work Plan
Understand		
	Meteorological Stations	$10K
	Marine Mammal Synthesis	$25K
	NPRB Partnership	$100K
	Biodegradation Agent Effectiveness	$75K
		$210K
Respond		
	Partnership Projects	$150K
	Field Guide to Spill Response	$100K
		$250K
Inform		
	Graduate Fellowships	$75K
	K-12	$55K
	Internship	$15K
	Ocean Science and Technology	$20K
	Workshops	$25K
		$190K
Other		
	Research Program Manager	$158K
	STC travel	$8K
		$166K
Subtotal		**$816K**
Administration		
	Based on 20% of total expenditure	**$204K**
Total		**$1020K**

III. Prior Years' Encumbered Projects Continuing in FY16

Because OSRI projects are started at the beginning of each quarter, many projects funded in previous years will continue into fiscal year 2016. The purpose of this section is to identify those projects so that the work plan aligns with the FY16 budget sheets. These projects are listed as the Prior Years' Encumbered portion of the budget. If an existing project is to get new funding in FY16 – multi-year grants – the project description exists in the previously provided section. Because the exact amount of funds that are being carried forward will not be known until sometime in October, there are no dollar amounts provided with the individual projects.

A. Goal #1 - Understand

a. Hydrological Model Validation (*Arendt, University of Washington Contracted through 6/30/16*)

Accurate knowledge of freshwater discharge into coastal Alaskan waters is important on many levels. The large magnitudes and variability of this discharge combine with the couples terrain and bathymetry of nearshore regions to produce valuable marine resources. From a physical point of view, freshwater fluxes are an important part of what controls the structure of the water column and, in turn, nearshore circulation patterns. These circulation patterns are significant because they transport nutrients, disperse marine organisms in passive (larval) life stages, and control the movement of surface contaminants, such as oil.

Predictive oceanographic models of circulations and particle trajectories are only as good as the equations upon which they are built and the boundary conditions that drive them. Present-day research and operational codes are robust and mature, with good representations of the physics governing fluid flow. However, most regions in Alaska are data poor, in the sense that observations of the variables (weather conditions, stream flow, etc.) that are needed to drive nearshore circulation models are scarce. This scarcity occurs primarily in the spatial sense, where very few data platforms are installed in vast regions, but it can also occur in the temporal sense, where a stream of interest is gaged highly intermittently. The impact of the scarcity of data was seen in the differences of modeled versus observed freshwater content during the 2009 Sound Predictions exercise. Since observations are scarce around Alaska's coastline, it is important to develop hydrological models that accurately predict freshwater input into the marine environment.

b. Hydrological Model and ROMS (*Hill, Oregon State University; Chao, Remote Sensing Solutions Contracted through 3/31/16*)

Predictive oceanographic models of circulations and particle trajectories are only as good as the equations upon which they are built and the boundary conditions that drive them. Present-day research and operational codes are robust and mature, with good representations of the physics governing fluid flow. However, most regions in Alaska are data poor, in the sense that observations of the variables (weather conditions, stream flow, etc.) that are needed to drive nearshore circulation models are scarce. This scarcity occurs primarily in the spatial sense, where very few data platforms are installed in vast regions, but it can also occur in the temporal sense, where a stream of interest is gaged highly intermittently. The Prince William Sound (PWS) watershed is an excellent example of all of the above. It is a strategic resource and it is characterized by spectacular variability in physical characteristics (terrain, weather, etc.) and in its response to its environment (complex circulations, residence time patterns).

This work brings together two recent modeling programs in the PWS region. The first is an oceanographic model and the second is a hydrologic model. The hydrologic model replaces an older one that was less physically-based and that was not well validated. The new model uses a robust physical-process approach and has been extensively validated (for precipitation, temperature, snow-water-equivalent, and streamflow). This linkage brings together the best available hydrologic information with a proven oceanographic model. Working together, these two models will provide highly-resolved (both in time and space) information on the complete physical oceanographic environment of PWS.

The specific scope of this project includes: (i) generating a 30-year hindcast of runoff boundary conditions in a file format that is readable by the oceanographic model, (ii) comparing three commonly used weather products, which have been shown to vary considerably, (iii) comparing the new streamflow results to the old model used for PWS, (iv) running oceanographic simulations of PWS with our new streamflow boundary conditions, and (v) testing the sensitivity of the oceanographic model to the streamflow boundary conditions with parametric sensitivity studies.

c. Black Turnstones in Prince William Sound

(*Bishop, PWSSC,* contracted through 12/31/2015)

Few studies have investigated breeding or migrating Black Turnstone because the population is relatively small (<100,000 birds) and sparsely distributed, and their preferred non-breeding rocky shoreline habitats are difficult to access. Only one major stopover site has been identified on their migration route to and from western Alaska: northern Montague Island in Alaska's Prince William Sound (Norton et al. 1990; Bishop and Green 2001). Because of its importance to Black Turnstones as well as Surfbirds, northern Montague Island was designated an Important Bird Area in 2006. Surveys conducted at Montague Island during spring 2010 by the Prince William Sound Science Center showed that numbers of turnstones stopping in spring have declined substantially in the 13 years since the previous surveys. In the mid-1990's more than

11,000 individuals were observed during in a single-day during spring migration counts while 2010 surveys observed less than 3,600 birds total during 20 days of extensive surveys spanning the entire spring migration period.

The goal of this project is to understand if the decline in observed numbers of Turnstones stopping at Montague Island represents a true population decline due to climate -change impacts on the breeding grounds, or if the reduced numbers reflect a shift in the migration route and stopover sites used in Prince William Sound. We received funding from ConocoPhillips ($50,000), National Fish and Wildlife Foundation ($75,000) as well as in-kind support from the Yukon Delta National Wildlife Refuge to conduct a 3-year (2013-2015) study (see Appendix I for study proposal). Our study is designed to address the following questions:

(a) If Black Turnstones are not stopping at Montague Island, are they using other stopover sites in Prince William Sound, and if so, for how long?;

b) Are there alternate stopover sites outside Prince William Sound (e.g., northern Aleutian Basin) that host large numbers of this species?; and,

(c) Is there evidence of a population decline on the breeding grounds in western Alaska that would explain the reduced numbers at Montague Island?

d. Red knot migration

(*Bishop, PWSSC,* contracted through 12/31/2015)

With an estimated population of 22,000 individuals, the Red Knot is one of the smallest and least studied shorebird populations in North America. During migration and winter, the Red Knot is tied to coastal habitats, generally preferring intertidal mudflats and sandflats. Because the Red Knot is dependent on coastal habitats, this species is vulnerable to habitat loss or degradation resulting from coastal pollution, such as oil spills, infrastructure development, and climate change effects across its range.

For the Copper/Bering River Deltas, aerial telemetry flights would occur daily from approximately May 8-25, 2015. Our aerial telemetry data from Red Knots stopping on the Copper and Bering River Deltas will provide baseline information critical to oil spill response planning and implementation, which will be useful for the Oil Spill Recovery Institute. Maps and other information will be made available to managers in a format that enables definition of habitat needs, conservation concerns, and modeling impacts of habitat-related changes, such as oil spills of varying sizes at important coastal sites. Our information will improve the ability to track impacts to and the recovery of the Red Knot population in the event of another oil spill.

e. Assessment of immediate and delayed sublethal responses of juvenile chum salmon to exposure to North Slope crude oil and Corexit 9500

(*Wetzel, Mote Marine Lab,* contracted through 09/30/2016)

Controlled exposure studies allow scientists to assess cause and effect relationships between stressors and responses of organisms. Lack of understanding of such relationships can limit the effectiveness of management and conservation decisions. Using CROSERF (Chemical Response to Oil Spills: Ecological Research Forum) protocols (adopted for the Deepwater Horizon NRDA), we will expose juvenile chum salmon (*Oncorhynchus keta*) to several Alaskan crude oils and Corexit 9500 dispersant concentrations under acute spiked exposure regimes. To assess significant sublethal responses of exposed fishes, we will conduct biomarker assays designed to measure genotoxicity, lipid composition, and cytokine levels (immune function), and then develop DNA expression and cytokine protein microarrays to assess changes in expression of genes regulating immunity. We will assess morphometrics, standard blood chemistry, and contaminant levels in tissues for exposed and unexposed fishes. Assessments will occur immediately after exposure and be repeated to assess delayed impacts. Results of these studies will document how exposures to oil and/or dispersant in the field could affect sustainability of salmon, and by extension other Alaskan fish stocks of commercial, subsistence, and ecological importance. Finally, the project facilitates creation of a regional center of excellence for controlled exposure studies using a range of life stages for other Arctic marine fishes and invertebrates of concern in Alaska and the Pacific Northwest. The proposed study is inclusive of all four strategic goals of the Oil Spill Recovery Institute (OSRI), namely to:

1. Understand: evaluate both short- and long-term effects of oil and dispersant exposure to nearshore species for determining their possible impacts on economics and the environment for future emergency response planning;
2. Respond: through careful assessment of effects of oil and dispersant exposures on key Alaskan species, information regarding a range of responses will be rigorously evaluated for judging the most prudent mitigation scenarios;
3. Inform: a combination of scientific presentations, publications, local community meetings and educational outreach will alert stakeholders and other interested parties to current scientific techniques and interpretations of exposure responses leading to important social, economic and environmental outcomes; and
4. Partner: some of the most notable accomplishments of this proposed work will be to help build local capacity for enhanced toxicity research in Alaska, form strong partnerships with the oil industry and create productive common interest research program collaborations with partners in the Arctic and Sub-Arctic regions of Alaska for a state wide integrated oil spill response coordination.

f. NPRB

The funding for these projects was provided to NPRB in full in FY 15 so there is no financial carryover into FY 16, however the work is continuing.

The physiological effects of dispersants and dispersed oil on a sentinel cold water species, the bay mussel. (*Counihan, Alaska SeaLife Center)*
Increasing oil development around Alaska also elevates the risk for another oil spill. Dispersants are chemicals applied to oil spills to break the oil into droplets in an effort to accelerate natural degradation processes. Dispersed oil, or the dispersant itself, may be more toxic than oil alone. However, there is limited research on the effect of dispersed oil on cold water species and ecosystems. Therefore, we propose to conduct exposure tests with bay mussels in seawater with non-dispersed oil, Corexit 9527, Corexit 9500, oil dispersed with different concentrations of Corexit 9527, and oil dispersed with different concentrations of Corexit 9500 and then assess how the different treatments influence mussel health at different time points. Corexit 9527 is stored in Alaska for use in the event of an oil spill, and Corexit 9500 is a newer version of Corexit 9527 that may also be used. Bay mussels, which are found in Arctic and subarctic coastal waters, will be used in experiments because they are of commercial and subsistence value, are easy to collect for monitoring projects, and our laboratory has validated methods to assess the effects of contaminants on their health. Determining the influence of dispersed oil on mussel health will be important for agencies to determine where dispersants can safely be used in Arctic and subarctic regions in order to protect sensitive habitats. Many communities depend on coastal resources, including mussels, so it is imperative to know if dispersed oil is more toxic than oil alone. This project will be valuable for increasing our knowledge about the risk of using dispersants during an oil spill in Arctic and subarctic ecosystems.

Growth and dispersal of early life history stages of Arctic cod and saffron cod under variable climate forcing. (*Mueter, University of Alaska Fairbanks)*
We propose to develop a biophysical transport model to simulate the dispersal of early life history stages of the two most abundant fish species, Arctic cod (*Boregadus saida*) and saffron cod (*Eleginus gracilis*), in the Chukchi Sea and Beaufort Sea. These species form a crucial link from lower trophic levels to seabirds, marine mammals, and humans and have been recognized as potential target species for new fisheries in the Arctic. We combine observations of late larval and early juvenile stages of both species during the summer of 2012 and 2013 with laboratory-derived estimates of their temperature dependent growth to parameterize an individual particle tracking model (TRACMASS) that includes growth and vertical movement. The model will be linked to a recently developed pan-arctic ocean circulation model (PAROMS) to test hypotheses about the origin and fate of young-of-the-year Arctic and saffron cod. Specifically, we aim to (1) identify likely spawning locations by tracking particles backward in time from known summer aggregations in the Chukchi Sea and (2) simulate pathways of dispersal from these aggregations to downstream nursery areas, which may include areas in the Beaufort Sea. Improved understanding of the growth, distribution, and movements of early life history stages of Arctic cod and saffron cod in the region, and of the

connectivity between the Chukchi Sea and Beaufort Sea, has several immediate and long-term benefits. It directly addresses research priorities identified in the Arctic Fisheries Management Plan, enhances required descriptions of Essential Fish Habitat for two key prey species, and provides benchmarks against which to assess future changes to the Arctic marine ecosystem that may result from new development in the Arctic and from anthropogenic climate change.

B. Goal #2 Respond:

C. Goal #3 Inform:

1. Education

c. Headwaters to Ocean

(Bien, PWSSC, Contracted through 12/31/16)

The Prince William Sound Science Center (PWSSC) requests support from the Oil Spill Recovery Institute to support the direct engagement track of our ***Headwaters to Oceans Education Program (H20)*** (previously known as *Science of the Sound*). This proposal addresses the School Year Programs portion of OSRI's FY15 Work Plan. *H2O* consists of three tracks that target different sectors of society and our direct engagement track consists of programs (described below) for elementary and high school students in Cordova and other communities in coastal Alaska.

Discovery Room provides hands-on science education to students in Cordova's elementary school with the goal of inspiring life-long passion for science and increasing scientific literacy. PWSSC proposes to further refine, deliver and share lessons and materials related to OSRI's mission of understanding the effects of oil spills and recovery of Arctic and subarctic marine environments. OSRI funding will support program delivery, development of marketing materials, and web-based distribution. These experiences will give students the knowledge and skills needed to understand how natural systems function and respond to climate change and other human impacts.

Outreach Discovery program extends *Discovery Room* programming to audiences outside of Cordova, and increases the number of individuals served by Science Center education programs. Many of the students served by the *Outreach Discovery* program qualify as "underserved populations" and often have limited access to science and environmental education resources and opportunities. This request seeks to use OSRI funds to support the continued delivery of marine-themed *Outreach Discovery* programs to youth from northwest Alaska as well as enhancement of our remotely operated vehicles kits.

High School Outreach programs allow PWSSC to keep older students engaged in marine science-centric activities that promote critical thinking, problem solving and ecological literacy skills. OSRI funding will support program delivery of lessons about ocean sciences to high school students in *Outreach Discovery* and *National Ocean Sciences Bowl* programs, as well as preparation of one or more NOSB teams.