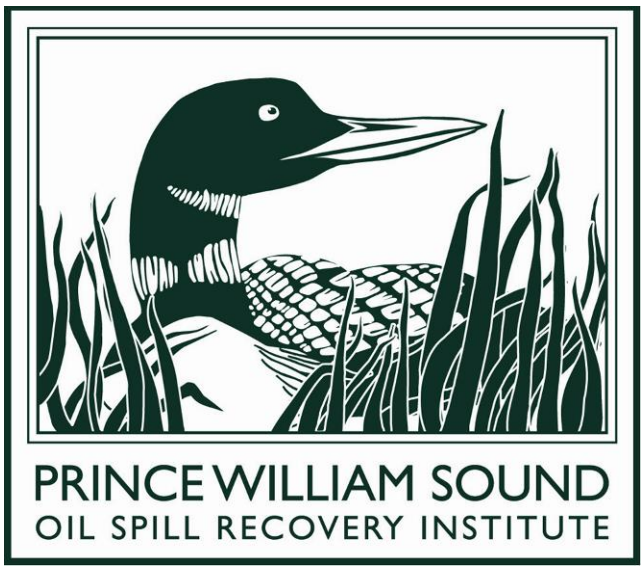

2015 Work Plan
Oil Spill Recovery Institute

October 2014

Contents

Prince William Sound Oil Spill Recovery Institute
2015 Work Plan

I. Purpose and organization of this document

This document describes the Oil Spill Recovery Institute (OSRI) 2015 Work Plan in the context of the overall Research Plan approved by the OSRI Board in February 2010 for fiscal years 2011 through 2015. 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 2015 Work Plan provides descriptions of projects proposed for funding in the 2015 fiscal year beginning October 1, 2014 and a brief description of projects funded in previous years that have funding continuing into fiscal year 2015 (FY15). 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 FY15 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 2008. 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 designed to respond to and understand the effects of 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 2015 Work Plan has been placed in the context of these four goals.

A. Goal #1 Understand:

Attain an interdisciplinary understanding of the fate and effects of spilled oil in Arctic and sub-Arctic marine environments and the recovery of those environments following a spill.

Real time physical observations of surface and subsurface current direction and magnitude, and biological observations on resources in the path of the spill are absolutely essential to effective and timely oil spill response. Without a reliable forecast of the direction and speed of a spill, and knowledge of the resources likely to be impacted, even the best clean up technologies in the world may be misapplied.

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.
- Emphasize the nearshore region.
- Identify the impacts of oil spill response options.
- Profile potential impacts from oil spills on the economy, life-style and well-being of communities and resource users.

This work plan describes projects totaling $310K 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 AOOS.

(2) Testing how new hydrological models affect modeled ocean circulation.

(3) Continuing partnership with NPRB for biological research.

(4) Oil toxicity research

1. Physical science programs

The OSRI science plan outlines an approach for addressing Goal #1. This approach builds upon lessons learned during the 2009 Sound Prediction experiment that tested the modeling and observational capabilities of the Prince William Sound Observing System (PWSOS). 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.

Coastal surface circulation is commonly determined by seasonal freshwater input. Our ability to predict freshwater fluxes in PWS is challenging due to: 1) high quantities of rainfall in southern Alaska, 2) few gauged rivers, 3) the amount of freshwater flowing in small creeks, and 4) the contribution of freshwater from glacial melt. Errors in the modeling of freshwater input lead to biases in the modeled salinity that can potentially lead to errors in modeled surface currents that are important to oil spill response. The

PWSOS includes several SNOTEL meteorological stations that are designed to help improve our understanding of freshwater input. We desire to utilize these stations to build an observation program designed to test the hydrological model.

These programs address the surface circulation portion of the OSRI Research Plan.

a. Meteorology (OSRI cost: $10K)

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. Wind stress then modifies the circulation creating local and seasonal circulation patterns. 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 more quantitatively test 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 FY14 budget includes $10K for upgrades and repairs to the eight existing systems.

b. Hydrological model input to ocean circulation models (OSRI cost: $100K)

During the past three years OSRI and AOOS have supported development of new hydrological models to improve the freshwater input into ocean circulation models. The hydrological model development and testing is nearing completion and we desire to learn how much change in modeled ocean circulation occurs in the Regional Ocean Model System (ROMS) modeling of Prince William Sound.

In FY15 OSRI will seek proposals for a one-year project to take the hydrological models develop by a team lead by Dr. David Hill of Oregon State University and use it to provide the freshwater flux to the PWS ROMS model that has been run for AOOS by Dr. Yi Chao. We desire to learn if the new hydrological models alter circulation patterns observed in

the ROMS model. The desire is to look at comparisons of circulation for the past few years and if there are improvements in the salinity distribution and circulation between the ROMS model and observations collected during the 2009 Sound Predictions field experiment.

OSRI is budgeting $100K to support this effort in FY 15. The project is expected to be completed within a year.

2. Biological science programs

The current five-year research plan emphasizes nearshore biology and a desire for working in partnership. To understand the recovery from an oil spill requires a biological research program capable of both helping define baseline conditions and monitor recovery. To achieve the objective laid out in this Science Plan, OSRI expects to fund the following research program.

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

(OSRI cost: $100K)

The NPRB and OSRI have science plans that encourage research partnerships. 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.

b. Sublethal toxicity of dispersed oil on chum salmon (OSRI cost: $100K)

The use of chemical dispersants remains one of the response options during a spill. The application of dispersants is commonly believed to reduce risk of exposure to birds, mammals and intertidal organism from oiling. There remain questions about the impact to fish. OSRI has an opportunity to partner with the North Slope Borough (using funds from Shell) to support research on the sublethal effects of dispersed oil and dispersants on chum salmon. The focus will be on juvenile salmon because they are considered to

be more sensitive to lasting effects from the presence of toxins. The research would also allow for development of more facilities in Alaska where this type of research can be conducted.

The proposed work uses controlled exposure studies to assess cause and effect relationships between stressors and responses of organisms. The experiments will follow the CROSERF (Chemical Response to Oil Spills: Ecological Research Forum) protocols to 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, the research will examine 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. They will assess morphometrics, standard blood chemistry, and contaminant levels in tissues for exposed and unexposed fishes. 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.

A proposal to the North Slope Borough Wildlife Department for this work has been submitted by Dr. Dana Wetzel of the Mote Marine Lab. The work is in collaboration with researchers at the Alaska Sea Life Center. The proposal is for a two year project with a total budget of $456K. OSRI will contribute $100K in FY15 and consider an additional $100K in FY16 if needed and the project remains consistent with the next OSRI research plan.

B. Goal #2 Respond:

Enhance the ability of oil spill responders to mitigate impacts of spills 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:

- Fill knowledge gaps on behavior of spilled oil.
- Fill knowledge gaps on the use and effectiveness of specific mitigation techniques.
- Identify and evaluate new prevention and response technologies.

The components to achieve these objectives are described below.

1. Technology research and development

This work plan describes projects totaling $150K 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 Artic 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 JIP active we expect that there will be opportunities to contribute to their efforts as their laboratory exercises are just beginning to be developed. 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) The use of dogs or other novel techniques for detecting oil in and under 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.

C. Goal #3 Inform:

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

The objectives of this goal are to:

- Facilitate the exchange of information and ideas through education and outreach.
- Brief the scientific community and oil spill responders on OSRI products.
- Develop and maintain a web page that provides relevant and timely information.
- Provide graduate and undergraduate fellowships and internships.

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 three 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 FY15. We anticipate all three will be continuing students. 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: Molecular Characterization of Arctic Marine Petroleum-degrading Microbial Communities and Comparison to the Deepwater Horizon
McFarlin, University of Alaska Fairbanks.
As the oil industry continues to explore drilling and production activities in the Arctic, it becomes imperative to understand how the marine microbial community will respond to petroleum inputs and their potential to biodegrade the contaminant. This research proposal will identify arctic marine microbial communities in the surface, sub-surface and deep waters in Shell Oil's 193 lease location in the Chuckchi Sea. It will determine if these same species are also located in nearshore environments of Barrow, AK. In addition to microbial species characterization and quantification, it is also important to determine their potential to biodegrade petroleum and chemically dispersed petroleum. High throughput pyrosequencing of bacterial 16S rRNA genes will be conducted on filtered seawater samples to provide information regarding the taxonomic identity of the microbial communities. Filtered seawater samples will also be analyzed by GeoChip microarrays. This powerful technology detects hundreds of thousands of different microbial functional genes simultaneously and is a measure of the biodegradation potential of a microbial community. This research proposal will also capitalize on preexisting filtered samples from mesocosms of Alaska North Slope (ANS) crude oil and chemically dispersed ANS incubated at -1˚C with indigenous microorganisms from fresh Chuckchi Sea water. Pyrosequencing and GeoChip data from these filters will be compared to deep-sea dispersed oil samples from the Deepwater Horizon blowout, in collaboration with Dr. Terry Hazen. During the Deepwater Horizon spill, Hazen *et al.*, 2011 performed the most comprehensive molecular microbial analyses ever performed on an oil spill, which also occurred in deep, cold waters (5°C). This proposal will provide an arctic microbial community baseline and insight into how this important region of the Alaskan arctic marine ecosystem would respond to inputs of petroleum and how it compares to another well-studied cold water system.

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

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 second 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 second year of OSRI support for this Ph.D. project.

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

OSRI will continue to support the Prince William Sound Science Center's Discovery Room school year programs in order to introduce younger students to the concepts important to understanding oil spill response and the recovery of the environment. Programs include 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 Discovery Room environmental and technical education at the K-12 level. OSRI will provide $55K in FY15. 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)

While the OSRI sponsored education program has been very strong, it has a limited geographic scope and is just beginning to include technology components. The development of hands-on activities associated with oil spill response technologies and options is desired.

OSRI will seek a one-year proposal up to $20K to develop educational activities with appropriate lesson plans and materials lists that allow the demonstration of recovery technologies and options. The proposal must include a description of how the materials would be made available to teachers and students 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) **Workshops of opportunity.** (OSRI cost: $15K) 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 $15K to support workshops that align with the OSRI mission.

D. Other Programs

1. Program coordination (OSRI cost: $154K). 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 $131.3K personnel (10.5 months), $8.8K travel, $13.4K contractual, and $0.5K commodities for a total of $154K.

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. The meteorology and oceanography programs described in the Understand section contribute to this partnership. We are partnering with AOOS on the hydrological model validation component as well. In the biological sciences we continue to partner with NPRB.

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. Industry is currently considering the development of six different programs, four of which are closely linked with the goals outlined in the OSRI science plan. 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. We are one of several groups that are contributing to a National Research Council study titled, "Responding to Oil Spills in Arctic Environments."

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. FY15 New Programs Spending Summary

Area	Project	FY15 Work Plan
Understand		
	Meteorological Stations	$10K
	Hydrological Model and ROMS	$100K
	NPRB Partnership	$100K
	Sublethal Toxicology	$100K
		$310K
Respond		
	Partnership Projects	$150K
		$150K
Inform		
	Graduate Fellowships	$75K
	K-12	$55K
	Internship	$15K
	Ocean Science and Technology	$20K
	Workshops	$25K
		$190K
Other		
	Research Program Manager	$154K
	STC travel	$8K
		$162K
Subtotal		**$812K**
Administration		
	Based on 20% of total expenditure	**$203K**
Total		**$1015K**

III. Prior Years' Encumbered Projects Continuing in FY15

Because OSRI projects are started at the beginning of each quarter, many projects funded in previous years will continue into fiscal year 2015. The purpose of this section is to identify those projects so that the work plan aligns with the FY15 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 FY15 – 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

1. Physical science projects

a. Hydrological Model Validation (*Hill, Oregon State University; Arendt, University of Alaska Fairbanks; Hood, University of Alaska Southeast. Contracted through 6/30/15*)
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.

2. Biological science projects

a. Black Turnstones in Prince William Sound

(*Bishop, PWSSC,* contracted through 3/31/2015)

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 single-day, peak 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?

b. Red knot migration

(*Bishop, PWSSC,* contracted through 6/30/2015)

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.

B. Goal #2 Respond:

1. Partnership projects

a. Oil spill trajectory analysis from the 2009 PWS field experiment

(*Beegle-Krause, Research4D*, Contracted through 06/30/15)
The proposed analysis of the observational data and model predictions from *Sound Predictions* is based on trajectory predictive ability. The intent is to identify areas of higher and lower predictive skill for the field conditions during the experiment, and provide insight and recommendations for future improvements. The proposal fits with OSRI's goal "To identify and develop the best available techniques, equipment and materials for dealing with oil spills in the Arctic and sub-Arctic marine environment" (http://www.pws-osri.org/).

The work will examine the effect of observational data assimilation in potential oil spill simulations by comparing observed and simulated drifter trajectories using the General NOAA Operational Modeling Environment (GNOME) model. Observed circulation fields (winds and currents), and two different types of the PWS circulation fields (nowcast and forecast) will be examined in order to isolate the effects of data assimilation without re-running the circulation models. The hindcast fields will have assimilated all available observations, while the forecast fields will not have the benefit of the observational program. Simulated trajectories will be compared with observed drifter trajectories during *Sound Predictions*, and the other observational data will be used to construct hypothesis for any trajectory differences. If necessary, a diagnostic circulation model will be constructed in GNOME to test these hypotheses.

b. Sonar detection of oil in and under ice

(*Maksym, Woods Hole Oceanographic Institution,* Contracted through 12/31/14)
A practical system for oil spill response in the sea ice environment must be capable of rapidly mapping the extent and quantity of oil over large areas and under a range of ice

and weather conditions. This project will test and validate the detection of oil under ice using single beam sonar and underwater cameras that can be readily mounted on an unmanned underwater vehicle (UUV). The aim is to develop a system for direct detection and quantification of oil from below so that oil spilled under broken or continuous sea ice can be detected, quantified, and its spill trajectory can be mapped. Such a system will have the advantages of being deployable in a range of ice conditions and capable of detecting and monitoring an oil spill in conditions that preclude traditional detection from above.

This project builds on previous successful tests performed by the present team and funded by OSRI. These tests, carried out in the outdoor ice tank facility at the US Army Cold Region Research and Engineering Laboratory in Hanover, New Hampshire demonstrated that thin slicks of oil can be detected under ice using a combination sonar and camera system. This project will perform further tests using the combined sonar/camera system in controlled laboratory ice tank experiments to:
1) Determine the acoustic signature of oil under sea ice, for both warm and cold oil,
2) Determine the evolution of the acoustic signature over time as the oil percolates into the porous structure and/or melts the ice underside, thus determining the coevolution of acoustic signature and oil/ice structure,
3) Determine the ability of sonar to detect oil as it becomes encapsulated in the ice,
4) Determine whether a camera system can reliably detect encapsulated ice (alone, or in conjunction with sonar), and
5) Provide recommendations for an optimized sensor system for deployment on a UUV.
Results of this study will allow us to construct quantitative models of the sensor response to oil under, or encapsulated within, ice and provide an empirical basis for interpretation of under ice measurements. These experiments will allow us to develop a complete sensor system to be integrated into UUVs for under ice operations at WHOI.

c. High speed recovery system

(*Kennedy, Pacific Petroleum Recovery*, Contracted through 06/30/15)

The PPR Open Water Skimming System is based on materials and technology currently in use in other maritime applications. It is extremely robust, scalable and capable of high recovery and continuous operation. It can be deployed and operated simply, and its use will be understandable to the industry. Towing tests have been conducted in Puget Sound and with oil at the OHMSETT facility for both calm water and wave conditions.

This proposal will fund a demonstration the system, revised for higher current conditions. This positive pressure, open water skimming system is unique in that it relies on robust, modified “off-the-shelf” components such as a common trawl net with liner and fish pumps. The net components can be easily replaced and are relatively inexpensive to produce. The system is scalable with the net opening easily expandable.

This open water demonstration is meant to provide feedback that can be incorporated in the design for a system that includes an ice management feature that is being funded by BSEE.

d. Aerostat participation in Arctic Shield

(*Wiggins, Inland-Gulf Maritime*, Contracted through 6/30/15)

Inland-Gulf Maritime LLC developed the Aerostat-IC surveillance system, which can capture and transmit real time EO/IR video and still images from an altitude of up to 500 feet to various vessels and/or on shore command center or command vessels.

IGM in partnership with the Oil Spill Response Institute will bring the complete Aerostat-IC surveillance system to the USCG Arctic Shield 2014 Exercise to be held in Alaska during August 2014. IGM will modify the sensor/airborne chassis in order to integrate the USCG TRIDENT communications system to work in conjunction with the existing Aerostat-IC system. Once integration has been completed, IGM will pre-test the complete system by performing live flights at the JMTD Little Sand Island Facility prior to delivering it to Seward, Alaska.

During the Arctic Shield exercise IGM personnel will operate and demonstrate the Aerostat-IC system, integrated with the TRIDENT communications payload to facilitate the remote sensor requirements as set forth by the USCG RDC team.

C. Goal #3 Inform:

1. Education

a. GRF: Remediation monitoring using microbial DNA profiles

(Saum, University of California Riverside, Contracted through 06/30/15)

Lingering oil pockets still found in the beaches of the Prince William Sound (PWS) demonstrate that petroleum hydrocarbons can persist and continue to damage ecosystems decades after initial cleanup efforts following a marine oil spill. Currently, the methods of monitoring marine oil bioremediation efficiency are chemical processes that can take over a month to return results and can cost up to $1,000 per assay if outsourced commercially. The goal of this research project is to develop molecular biology tools to monitor the state of polycyclic aromatic hydrocarbon (PAH) degradation in oil contaminated beach sediments in near real-time by tracking the dominant bacterial species and their associated dioxygenase genes that function for oil degradation. Bacterial populations of PWS beaches will be collected via sediment sampling as well as activated carbon sampling columns. The extracted and purified microbial DNA will be amplified at both the 16S rRNA and dioxygenase gene sequences via polymerase chain reaction (PCR), and analyzed with terminal restriction fragment length polymorphism (TRFLP) through capillary electrophoresis. In order to quantify the

16S rRNA gene sequences, each purified DNA sample will also be analyzed via real-time PCR using primers for bacterial species of interest. The community composition and dioxygenase enzyme patterns will then be used to train a neural net statistical program for pattern recognition of PAH degradation status. Chemical analyses will be conducted via gas chromatography to verify the PAHs present in each sample.

The results of this project will produce a more rapid and inexpensive method of monitoring the rate of marine oil degradation by microbial communities. Potential application of the data generated by this procedure includes evaluation and addition of the dominant bacterial species' trace nutrient requirements in order to achieve effective biostimulation in the PWS.

b. GRF: Molecular Characterization of Arctic Marine Petroleum-degrading Microbial Communities and Comparison to the Deepwater Horizon

(McFarlin, University of Alaska Fairbanks, through 6/30/15)

As the oil industry continues to explore drilling and production activities in the Arctic, it becomes imperative to understand how the marine microbial community will respond to petroleum inputs and their potential to biodegrade the contaminant. This research proposal will identify arctic marine microbial communities in the surface, sub-surface and deep waters in Shell Oil's 193 lease location in the Chuckchi Sea. It will determine if these same species are also located in nearshore environments of Barrow, AK. In addition to microbial species characterization and quantification, it is also important to determine their potential to biodegrade petroleum and chemically dispersed petroleum. High throughput pyrosequencing of bacterial 16S rRNA genes will be conducted on filtered seawater samples to provide information regarding the taxonomic identity of the microbial communities. Filtered seawater samples will also be analyzed by GeoChip microarrays. This powerful technology detects hundreds of thousands of different microbial functional genes simultaneously and is a measure of the biodegradation potential of a microbial community. This research proposal will also capitalize on preexisting filtered samples from mesocosms of Alaska North Slope (ANS) crude oil and chemically dispersed ANS incubated at -1˚C with indigenous microorganisms from fresh Chuckchi Sea water. Pyrosequencing and GeoChip data from these filters will be compared to deep-sea dispersed oil samples from the Deepwater Horizon blowout, in collaboration with Dr. Terry Hazen. During the Deepwater Horizon spill, Hazen *et al.*, 2011 performed the most comprehensive molecular microbial analyses ever performed on an oil spill, which also occurred in deep, cold waters (5°C). This proposal will provide an arctic microbial community baseline and insight into how this important region of the Alaskan arctic marine ecosystem would respond to inputs of petroleum and how it compares to another well-studied cold water system.

c. Oil Spill Technology Adoption Workshop

(Robertson, Nuka Research, Contracted through 06/30/15)

The purpose of the Oil Spill Technology Adoption Workshop is to support the Oil Spill Recovery Institute (OSRI) to identify the key factors involved in determining which oil spill response technologies advance from the research and development phase to widespread adoption and application to improve oil spill response. This information will be used to inform OSRI's funding of research and development of novel technologies. This project will provide coordination and logistics for a workshop to help identify pathways that research must go through to reach a stage where it might be adopted.

d. Headwaters to Ocean

(Hoffman, PWSSC, Contracted through 12/31/14)

The Prince William Sound Science Center (PWSSC) requests $55,000 from the Prince William Sound 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 FY14 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.

e. Internship: Chadux

(Burns, Chadux, Contracted through 06/30/15)

The Alaska Chadux Corporation (ACC) intends to host an intern from June 15, 2014 until November 15, 2014. This person will be recruited from outside the oil spill response industry (i.e a student looking to enter the field or an individual looking to change careers). Chadux will provide training and work experience to introduce the intern to several elements of the response industry including planning, incident management, response logistics, response tactics, safety, and environmental issues.

The overall objective of this internship is to recruit an individual into the response industry and provide them with the basic qualifications to work as a spill response technician in the state of Alaska. This includes appropriate training under OSHA's Hazard Waste Operations and Emergency Response (HAZWOPER) standard (29 CFR 1910.120) and training and hands-on experience with standard marine spill response equipment. Since on-water response activities are only a small part of spill response, this internship is intended to expose the individual to all elements of the response process. Individuals will receive accredited incident management training, learn to develop and promote a safe working environment, and have an opportunity to receive logistics training. The end result of the internship should be an individual with a broad background in incident response who could fill a variety of roles during a spill response.

f. Internship: ASRC Energy Services

(Blankenship, ASRC, Contracted through 06/30/15)

ASRC Energy Services (AES) is proposing the idea of hosting an internship opportunity with Marshall Blankenship over the summer of 2014. AES is the largest Alaska-based, minority owned, oil and gas service company in the state of Alaska. AES is a wholly owned subsidiary of Arctic Slope Regional Corporation (ASRC), and AES offers a full range of services for all phases of an oil field's lifecycle, from exploration and field development to production optimization and decommissioning, as well as offshore oil response and planning.

The proposed objective of the internship is for Mr. Blankenship to work with both AES Response Operations (ARO) and AES Regulatory & Technical Services (RTS) divisions. His time with ARO would allow him the ability to increase his knowledge of offshore oil spill response, cleanup, and contingency planning capabilities. In addition, the internship would provide him with introductory oil spill response training, along with familiarizing him with the local regulatory regime of the Alaskan Outer Continental Shelf (OCS). His time with RTS would allow him the opportunity to engage in stakeholder and

community outreach & development programs. His time with the RTS division would also allow Mr. Blankenship the opportunity to bridge his understanding of the responsibilities that exist in oil spill contingency planning, oil spill response operations, and the importance of those elements related to ecological and regulatory compliance.