



2020 Work Plan Oil Spill Recovery Institute

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Prince William Sound Oil Spill Recovery Institute 2020 Work Plan

I. Purpose and organization of this document

This document describes the Oil Spill Recovery Institute (OSRI) 2020 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 2020 Work Plan provides descriptions of projects proposed for funding in the 2020 fiscal year beginning October 1, 2020 and a brief description of projects funded in previous years that have funding continuing into fiscal year 2020 (FY20). 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 FY20 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 response 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 2020 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 \$313K 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) Herder toxicity.
- (3) Arctic cod sensitivity to oil and impacts on growth.

a. Observation support (OSRI cost: \$9K)

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. OSRI would like to support the observing system in PWS and expand support to other areas of Alaska. 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. We will commit funds to help with repairs and data transmission from the PWS SNOTEL stations and will work with AOOS to provide similar support to other observing assets.

AOOS supports the annual operating cost for the weather stations (\$3.5K per station per year). The operating costs include regular maintenance, calibration of sensors, access to the sites, and telemetry related expenses. The OSRI FY20 budget includes \$9K for upgrades and repairs to the existing systems or to support similar ocean observing efforts around the state.

b. Impacts of oil on Arctic cod (OSRI cost: \$113K)

In the last 15 years, oil spill research at NOAA has focused on three major spill events: the 1989 Exxon Valdez spill in Prince William Sound, Alaska, the 2007 Cosco Busan spill in San Francisco Bay, and the 2010 Deepwater Horizon spill in the Gulf of Mexico. However, three key lessons were learned from these major events: 1) scientific response requires a multidisciplinary effort, 2) reactionary science can delay management response, and 3) species from different ecosystems respond very differently. Here we propose to examine the effects of an oil spill in the Alaskan Arctic by way of potential impacts on a keystone species, Arctic cod (*Boreogadus saida*) under current and future climate scenarios. Results from a 2017 pilot study indicated that Arctic cod are extremely sensitive to very low dose oil exposure, much more than other marine gadids from the Atlantic. In addition, juveniles that were exposed to oil as embryos grew significantly slower than control fish under identical environmental conditions. These findings elevated concerns of potential impact of oil on Arctic cod while raising a series of new questions as to how oil impacts survival and growth potential and what the minimum effective exposure concentrations are for this species.

Moreover, with predicted elevations in Arctic sea surface temperatures, there is a need for determining how oil toxicity will be influenced by combined temperature stress in Arctic cod. This project will proactively capitalize on a new oil exposure laboratory for Arctic cod to directly address these questions and mechanistically understand both the immediate and latent effects (> 6 months post-exposure) of low dose embryonic exposure to oil.

This is the second year of a three-year research project and OSRI expects to provide \$113K of support in FY20. Expected funding in FY21 is \$70K. The project is funded in partnership with NOAA.

c. Toxicity of crude oil treated with herders (OSRI cost: \$200K)

In recent years, there has been substantial research conducted on the toxicity of oil and dispersant mixtures. Yet, few have looked at chemical herders that may be used to enhance burning and skimming operations. While the application volumes are expected to be extremely low, it is still important to understand the potential lethal and sublethal effects of these compounds. We will seek a proposal to examine acute and sublethal toxicity studies of treated oil and burn residues of treated oil to examine changes in toxicity due to the use of herders.

This is the second year of a two-year research project and OSRI expects to provide \$200K of support in FY20.

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.

Projects to achieve these objectives are described below.

1. Technology research and development

This work plan describes projects totaling \$140K 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. Unmanned aerial vehicles usage during spills. (OSRI cost - \$40K)

The use of unmanned aerial vehicles (UAV), including drones, has become much more commonplace in recent years. They potentially have a wide range of applications during an oil spill. However, their use is likely to be restricted by a number of different agencies, oil companies, and landowners (Federal, State, and private) with various regulations. To enable the spill response community to understand the potential uses and restrictions, OSRI will seek proposals to produce a report that provides the following information: a general description of types of UAVs, their operational limits, and training requirements; the existing regulatory environment; who must be notified before flying, identify where conflicts may arise between regulatory agencies; best practices for UAV operation and data management, including real-time integration with spill response common operating pictures; and current state of science for drone use relevant to spill response. For example, if UAVs were used to identify wildlife impacts, what is the state of the science for using drones without harassing the animals, what are the regulations or guidelines that the resource agencies place on the use of drones, and are there conflicts between those regulations and other groups that may restrict use, such as the Federal Aviation Administration or the Air Ops in the Incident Command System.

This is expected to be a one-year project and OSRI expects to provide \$40K of support in FY20.

b. Herder/burner partnership project. (OSRI cost - \$100K)

Recent advances in chemical herders that can be used to thicken slicks to provide a more efficient burn have shown a need to advance the systems used to deploy herders and apply an ignition source. OSRI is partnering with ExxonMobil and the Bureau of Safety and Environmental Enforcement to develop new tools that combine the application of herders with an ignitor system, and to develop tools appropriate for use with unmanned aircraft. Combining the herder dispensing and ignition tools will allow a helicopter to make a single trip instead of one to apply the herder and a second to apply an ignitor. The use of unmanned aircraft for the same purpose is desirable to further reduce the risk to personnel and to be able to apply herders and ignition when helicopters are not available.

A total of \$100K is expected to be available to contribute to the partnership in 2020. This partnership is expected to continue through FY21.

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 \$210K 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: \$90K 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 FY20. We anticipate two continuing students and OSRI will release an RFP for the selection of up to one new student. Up to \$30K of support per year will be available to each fellowship. A twenty five percent match by the proposing institution is required.

Continuing fellowship: Cost-effective monitoring of anthropogenic impacts and environmental change in marine Arctic ecosystems Gonzalez, University of Washington.

Detecting and understanding potential biological impacts of oil spills in the Arctic requires characterizing and understanding dynamics of fish and macrozooplankton communities. One efficient approach uses stationary active acoustics to characterize and monitor seasonally ice-covered waters of Arctic marine ecosystems. But to understand the scope of the measurements, the spatial area that is represented by acoustic point source measurements (i.e. representative range) must be quantified to ensure an effective characterization and monitoring of pelagic community dynamics.

This project will characterize spatial and temporal variability in densities and vertical distributions of fish and macrozooplankton, and quantify the representative range of temporally-indexed, acoustic measurements in the Chukchi Sea. Up to 6 years of multifrequency acoustic data from an Acoustic Zooplankton Fish Profiler (AZFP) echosounder that is part of the Chukchi Ecosystem Observatory (CEO) located at Hanna Shoal, will be compared to acoustic data from two mobile surveys: the 2015 Arctic Marine Biodiversity Observing Network (AMBON) cruise, and the 2017 Arctic Shelf Growth, Advection, Respiration and Deposition (ASGARD) cruise. Wavelet analysis will be used to describe scales of spatial and temporal variation of animal vertical distributions and densities. Multiple methods that calculate representative ranges of means and variances will be used and compared to assess the consistency of estimated representative ranges. Results from this work will increase our ability to detect and monitor biological responses to oil spills, help design distributed monitoring networks, and, more generally, monitor environmental change in Arctic ecosystems.

OSRI will provide \$30K of support for this Ph.D. project. This is the third year of a three-year proposal.

Continuing fellowship: Investigating microbial biodegradation of crude oil in Arctic marine sediments via shotgun metagenomics and compound specific hydrocarbon analyses. Walker, University of Alaska Fairbanks.

As rapid change is occurring in the Arctic marine environment due to climbing atmospheric temperatures, current models predict nearly ice-free Arctic summers by 2030. Previously ice-covered waters are becoming more accessible to human activities, increasing the likelihood of anthropogenic disturbance and contaminant exposure through oil and gas development, increased commercial shipping, and other activities. Microbial biodegradation is the primary means of petroleum removal from the marine environment following a spill, and oil biodegradation potential should thus be quantified for each ecosystem compartment (i.e. shoreline, sea ice, sea surface, water column, and benthos) to support accurate prediction of the fate and effects of oil contamination and development of effective cleanup strategies. The benthos has received relatively little attention with respect to oil biodegradation studies even though conservative estimates suggest roughly 20-30% of oil from a spill remains in the benthos. The proposed work expands on current research quantifying degradation rates of Alaska North Slope (ANS)

crude oil in Chukchi Sea surface sediments, and characterizing associated microbial communities. The work proposed here would further advance our knowledge of the following with respect to Arctic marine sediments: 1) the oil degradation genes and pathways involved in the biodegradation of fresh and weathered ANS crude oil, 2) species-level identification of benthic oil-degrading microbes, 3) the rate and extent of degradation of individual petroleum hydrocarbons, and 4) relative rates of oil degradation in seawater vs. surface sediments.

OSRI will provide \$30K of support for this Ph.D. project. This is the second year of a two-year proposal.

b. K-12 Programs: (OSRI Cost: \$60K)

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 geographic areas outside of Southcentral, 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 \$60K in FY20. 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.

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.

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 FY20 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: \$10K) The Alaska Oil Spill Technology Symposium is held biennially. It brings together oil spill response practitioners and researchers to exchange information on new research and identified needs. OSRI will allocate \$10K for support of the Alaska Oil Spill Technology Symposium.

(3) **Workshops of opportunity.** (OSRI cost: \$5K) 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. OSRI will allocate a total of \$5K to support workshops that align with the OSRI mission.

b. Outreach Approach and Implementation (OSRI cost: \$35K)

Outreach to the public, researchers, and spill responders is important in maximizing the benefits from OSRI's projects. Understanding how best to reach various audiences and the types of media that may be most effective in delivering content requires the development of a formal outreach strategy. We also desire to have sample products developed to have a better understanding of the level of effort required to develop appropriate products. A key topic of interest in the upcoming year is outreach associated with the impacts of the Oil Pollution Act of 1990 on oil spills.

OSRI will allocate a total of \$35K to support one or more proposals that provide outreach strategies and sample products.

D. Other Programs

1. Program coordination (OSRI cost: \$110K). 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 \$87.6K personnel (6.0 months), \$10.05K travel, \$10.4K contractual, and \$1.95 K commodities for a total of \$110K.

2. OSRI Science and Technical Committee meetings (OSRI Cost: \$5K).

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 look for other opportunities to partner with agencies and organizations.

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. We are working with ExxonMobil to develop new technology for the use of herders and ignition systems. 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. FY20 New Programs Spending Summary

Area	Project	FY20 Work Plan
Understand		
	Observation support	\$9K
	Arctic cod	\$113K
	Toxicity of herders	\$200K
		\$322K
Respond		
	UAV regulations	\$40K
	Herder/Burner JIP	\$100K
		\$140K
Inform		
	Graduate Fellowships	\$90K
	K-12	\$60K
	Workshops	\$25K
	Media outreach	\$35K
		\$210K
Other		
	Research Program Manager	\$110K
	STC Travel	\$5K
		\$115K
Subtotal		\$787K
Administration		
	Based on 20% of total expenditure	\$197K
Total		\$984K

III. Prior Years' Encumbered Projects Continuing in FY20

Because OSRI projects are started at the beginning of each quarter, many projects funded in previous years will continue into fiscal year 2020. The purpose of this section is to identify those projects so that the work plan aligns with the FY20 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 FY20 – 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. Degradation additive effectiveness

In FY16 OSRI released a request for proposals to address the effectiveness of degradation agents. 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.

OSRI selected to fund a proposal from Dr. Leigh of the University of Alaska Fairbanks. The work aims to 1) evaluate the effectiveness of Oil Spill Eater II on crude oil and marine diesel degradation and detoxification in Arctic and sub-Arctic seawater, 2) determine its mode(s) of action, 3) compare its efficacy to that of chemical dispersants (Corexit 9500A), and 4) to assess effects on indigenous microbial communities. The proposal outlined a three-year research project to address these objectives.

B. Goal #2 Respond:

C. Goal #3 Inform:

1. Graduate Research Fellowships

Continuing fellowship: Fate and Effects of Petroleum Contamination and Chemical Dispersants in Arctic Marine Environments Gofstein, University of Alaska Fairbanks.

This study examines how Arctic marine ecosystems may be impacted by petroleum contamination by examining the fate of petroleum contaminants and chemical dispersants, their interactions with the environment, and the factors which influence their biodegradation. This project seeks to: 1) assess the influence of the dispersant Corexit 9500 on oil biodegradation processes in Arctic seawater; 2) investigate the fate of Corexit in marine environments; 3) study the effects of chemical dispersants on microbial community structure and function and identify the organisms responsible for degrading each in the Arctic; and 4) to investigate the extent of the role that nutrients play in driving the biodegradation of hydrocarbons, including identifying any nutrients that are possible limiting factors. Incubations of seawater from the Arctic Ocean in the presence of Alaska North Slope crude oil, Corexit 9500, and both together will be performed over a 60-day time course. Degradation of both components will be measured by GC/MS for the crude oil and by LC/MS/MS for the Corexit. Microbial analyses will be performed for each treatment using 16S rRNA sequencing using an Illumina MiSeq. Nutrients (NO_2^- , NO_3^- , NH_4^+ , PO_4^{3-} and SiO_4^{4-}) will be measured flow injection analysis and total iron by atomic absorption spectroscopy. Results from this study will help enable decision makers to make an informed choice of appropriate response strategies in the event of a spill as well as increase our general understanding of petroleum biodegradation in the Arctic marine environment.