



2009 Work Plan Oil Spill Recovery Institute

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Prince William Sound Oil Spill Recovery Institute

2009 Work Plan

I. Purpose and organization of this document

This document describes the Oil Spill Recovery Institute (OSRI) 2009 Work Plan in the context of the overall Science Plan approved by the OSRI Board in February 2005 for fiscal years 2005 through 2010. The Science 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 2009 Work Plan provides descriptions of projects proposed for funding in the 2009 fiscal year beginning October 1, 2008 and a brief description of projects funded in previous years that have funding continuing into fiscal year 2009 (FY09). 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 FY08 Work Plan New Projects

The Advisory Board of OSRI and the Executive Committee of the Board of Directors for the PWSSC conducted a strategic planning session in 2002. The purpose of the planning session was to evaluate the past, the present, and plan for the future of OSRI and the PWSSC through 2012. Four goals were identified as part of the strategic plan: Understand, Respond, Inform, and Partner (see OSRI Science Plan). The fiscal year 2009 Work Plan has been placed in the context of these four goals.

A. Goal #1 Understand:

To attain a four-dimensional interdisciplinary understanding of Prince William Sound (PWS) to enable detection and prediction of spill-related impacts and subsequent recovery.

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.

1. Physical science programs

The OSRI science plan outlines an approach for addressing goal #1. This approach is to develop and test modeling and observational capabilities by contributing to 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 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. For example, the high-resolution wind, wave and ocean current forecast products will provide improved information to recreational and commercial vessel and aircraft operators and enhance the safety of oil tanker traffic in PWS. The improved physical and ecological forecasting products will enable resource managers (e.g., PWS hatchery and commercial fishing organizations) to make informed and scientifically sound management decisions on food supply, predation, and human activities such as commercial and recreational fishing.

a. Meteorology (OSRI cost: \$5K telemetry, \$24K NRCS \$11K logistics [Total \$40K])

Meteorological and precipitation data for ocean circulation models

Understanding the circulation of Prince William Sound requires accurate measurements of wind fields and precipitation. Snow melt runoff and rain fall leads to a freshwater layer that sets up the surface circulation. Wind stress then modifies the circulation creating local and seasonal circulation patterns. By understanding the basic meteorological conditions we hope to improve our ability to model the meteorology of Prince William Sound, improve our understanding of the forcing driving seasonal changes in circulation, and provide oil spill response organizations with necessary data.

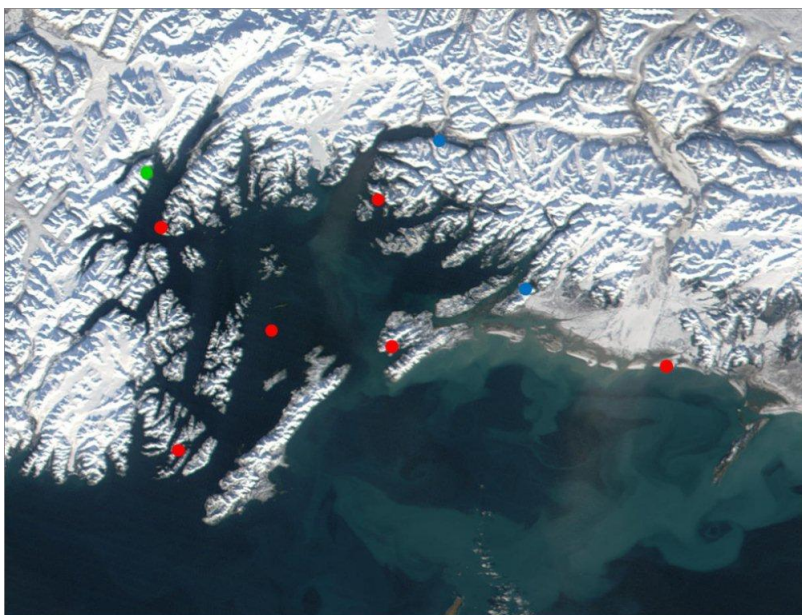
Snowpack Telemetry (SNOTEL) stations set up in partnership with the Natural Resources Conservation Service (NRCS), measure precipitation from snow and rain throughout the year and feed drought predictions. They are fully-automated, land-based stations that are usually set up in remote locations. Since the summer of 2005, six new SNOTEL stations have been deployed at sea level in PWS, and two stations at alpine elevations. Although three additional alpine stations were initially planned permitting and logistical issues has caused NRCS to abandon deployment of those stations. The fully deployed system in PWS is described in Table 1.

Each station in PWS measures wind speed and direction, air temperature, air pressure, precipitation from rain and snow, and solar radiation. Four stations (one sea level station in each quadrant of the sound) also have digital cameras that transmit pictures every fifteen minutes to the internet so the actual weather conditions in each area can be seen. Data transmitted by the weather stations will be accessible through the Alaska Ocean Observing System (AOOS, aoots.org) and PWSOS (pwsoos.org) web pages and archived at the University of Alaska Fairbanks.

The SNOTEL stations provide important information about the amount of freshwater stored as snow in the watershed of Prince William Sound, an important driver of summertime circulation in the Sound. Deployment of most of the SNOTEL Stations were funded by a combination of grants to the Prince William Sound Science Center (PWSSC) from the National Oceanic and Atmospheric Administration (NOAA), Exxon Valdez Oil Spill Trustees Council (EVOS) and AOOS (Congressional earmarks), PWS Regional Citizens' Advisory Council, and OSRI. In accordance with the OSRI Science Plan the annual maintenance costs for all stations will be provided by OSRI, at least, through 2010.

Table 1. Location of SNOTEL stations.

PWS Quadrant	Site name	Altitude	Deployment date
SW	Chenega Bay/Port San Juan	50 feet	2005
NW	Esther Island	60 feet	2005
NE	Tatitlek	50 feet	2005
	Sugarloaf Mt, Valdez	550 feet	2007
SE	Strawberry Reef/Copper River Delta	30 feet	2006
	Mt. Eyak	1,405 feet	2005
Central Basin	Seal Island	20 feet	2005
Hinchinbrook Entrance	Nuchek	50 feet	2005



Location of Snotel sites in Prince William Sound. Red dots are sea level installations and blue are existing alpine stations.

The annual operating cost for the weather stations is about \$5,000 per station per year. The operating costs include regular maintenance, calibration of sensors, access to the sites, and telemetry related expenses. The FY08 budget includes \$40K for maintenance of eight sites.

b. Oceanography (OSRI cost: \$160K)

Water exchange between PWS and the Gulf of Alaska and seasonal variations of hydrographic properties in central PWS

A primary component in improving our understanding of the circulation of Prince William Sound is the collection of oceanographic measurements. These measurements allow direct studies of circulation, the exchange of water between Prince William Sound and the Gulf of Alaska (GOA), and provide validation data for testing circulation models.

The OSRI funded oceanography work is a constituent of the Prince William Sound Observing System (PWSOS). In its current state, the program encompasses three components: 1) Long-term monitoring of the water exchange between the Gulf of Alaska and Prince William Sound, 2) Monitoring of the seasonal variability of the hydrographic properties and circulation in PWS, and 3) Long-term monitoring of sea water temperature, salinity and fluorescence at nearshore sites in northern and western PWS.

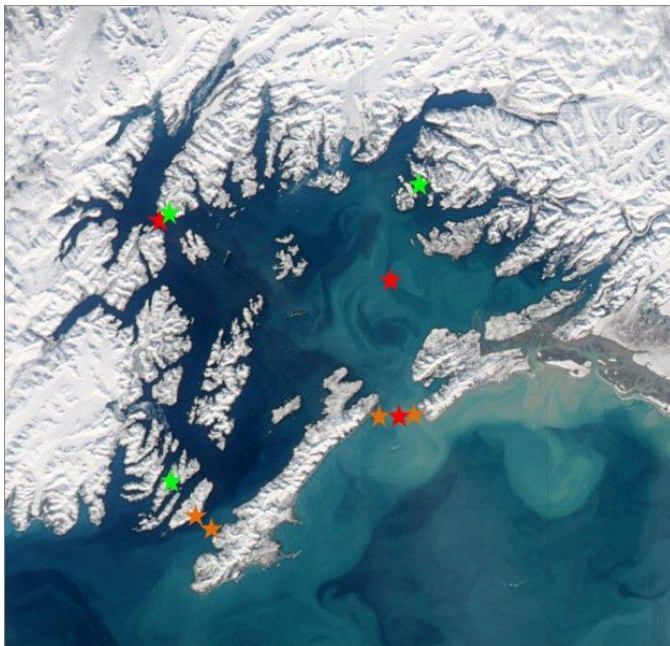
The goal of the water exchange component of the five-year observational oceanography program is to provide an improved description of the flow through the straits connecting PWS with the GOA. This is a necessary step towards a better understanding of the relationship between circulation variability and biological variability in PWS. The current mooring program addresses two limitations of previous mooring programs (lateral variations not accounted for and lack of data in the near surface part of the water column). Knowledge acquired from this five-year program should provide an understanding of measurements made using a single downward-looking ADCP at the NDBC buoys, which is the long-term monitoring planned for the area.

The “water exchange” moorings deployed by Prince William Sound Science Center (PWSSC) since June 2005 consist of 2 moorings in Hinchinbrook Entrance (HE) and 2 moorings in Montague Straits (MS). Each of these moorings is composed of 2 internally recording Acoustic Doppler Current Profilers (ADCP) and 3 conductivity-temperature (CT) sensors (Fig. 3). Both ADCPs are positioned around 100 m depth, one upward-looking and one downward-looking. The CTs are positioned at depths of 30 m and 100 m, and 10 m above the bottom. In addition the Seal Rocks NDBC buoy in Hinchinbrook Entrance has been equipped with a downward-looking ADCP and a near-surface CT and repositioned roughly mid-way between the two PWSSC moorings.

Initial costs for equipping the moorings at Hinchinbrook and Montague were supported by other entities, while OSRI funds support most of the semi-annual servicing and data analysis costs. The moorings will be in place through 2010.

The second component of the observational program consists of a regular monitoring of the hydrographic properties in the central basin of PWS and at the main entrances. A goal of this work is to acquire a description of the seasonal evolution of the hydrographic properties at these locations to be able to provide indications of mixed layer depth, and estimates of surface flow direction and speed for oil spill response planning. The work involves seasonal vessel-based hydrographic surveys (three to four cruises per year) during which conductivity-temperature-depth (CTD) profiles are acquired at a number of stations. For each survey, two transects (west-east, north-south) are visited, and extra stations may be added depending on the needs of the moment. The planned duration of this project is the same as for the “water exchange” moorings, that is through 2010.

The third component of the oceanography program began in 2007. This component is the addition of telemetered, near-shore moorings with temperature, conductivity, and fluorescence measurements. AOOS funded the design and installation of one mooring in 2007 with two additional moorings expected in 2008 and 2009. The first mooring uses equipment already owned by the Prince William Sound Science Center (PWSSC). The goal of the near-shore mooring program is to provide real-time data for model assimilation and to provide biological data within the surface waters of the Sound. It is expected that the data from this project will be analyzed at PWSSC.



Moorings locations. The gold stars represent the deep water moorings maintained by PWSSC for monitoring the water exchange with Prince William Sound. The red stars represent the location of the National Data Buoy Center’s oceanographic moorings. The green stars represent the planned deployment of near-shore, real-time moorings by the end of this fiscal year.

For the oceanography program, the data are being processed at PWSSC, archived and posted on an internet site at the University of Alaska Fairbanks (UAF). There will be a monthly quality control at PWSSC and the quality controlled data will be sent to replace the raw data. The data from these observational campaigns will be downloadable and

the diverse information relative to data acquisition and processing will be provided in downloadable data reports.

The approach to operating the programs described above is to fund a researcher at PWSSC. More detail about the approach is provided below.

PWSSC oceanography research fellowship; (OSRI cost: \$80K from the total \$160K in Oceanography)

This position is responsible for maintaining the equipment associated with the oceanographic program described above and analyzing the data collected in that program. The intent of the OSRI Oceanography Research Fellowship is to 1) research diverse issues relevant to the OSRI mission; 2) to maintain the highest caliber of research possible; and 3) provide research staff to the PWSSC. The length of the position is two years, with possible one-year extensions if the project warrants the extra time.

For the oceanography program, OSRI will fund a position to conduct basic and applied research in Prince William Sound and the Gulf of Alaska as described in the oceanographic program described above. The research focus will be on understanding the physical circulation and mixing of PWS waters and how these affect oil spill trajectories in space and time. The research area includes the Sound and the adjacent Gulf of Alaska. This position will be responsible for the routine seasonal (3 to 4 times per year) oceanographic transects across Hinchinbrook Entrance and Montague Strait, as well as maintaining fixed moorings. The position will also be responsible for maintaining the equipment associated with the program, collecting and processing data, maintaining quality control, and analyzing the data collected in this program. As this program is more than half way through the existing 5-year science plan we will be expecting a report on the quality of existing data and a plan for data analysis and manuscript preparation by the end of this fiscal year.

PWS oceanography (Program expenses); (OSRI cost: \$80K from the total \$160 in Oceanography)

In addition to the personnel costs, the oceanography program requires funds to deploy and maintain the equipment used in this program. A total of \$30K is used to maintain existing sensors and replace lost or damaged equipment. All conductivity and temperature are to be calibrated and maintained on at least a biennial basis. ADCPs require new batteries and other maintenance before each deployment. Mooring releases also require maintenance before each deployment.

An additional \$50K will be provided to contract for ship time and personnel to help with mooring deployment. Ship time is used to maintain the moorings and conduct hydrographic surveys. The moorings require additional and often specialized assistance for short periods of time so it is best to get that assistance through contracts.

2. Biological science programs

To improve our understanding of the impacts of *Exxon Valdez* oil spill and to improve the ability to assess impacts of future oil spills requires a biological research program. A socio-economic research program complements the biological program by connecting the biology to human use. To achieve the objective laid out in the Science Plan, OSRI will fund the following research programs.

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 IV.A.5.b.i of OSRI's science plan identifies a potential partnership with NPRB to support ecological research projects in arctic and sub-arctic climates, generally within the NPRB geographic area of interest, but with particular emphasis on the Gulf of Alaska and Prince William Sound. Both organizations have a strong interest in ocean observing, habitat, ecological and socioeconomic studies. The NPRB and OSRI have science and implementation plans that provide the foundation for defining research priorities of mutual interest in any given year.

Again this year, an opportunity exists to conduct collaborative research in the Gulf of Alaska and Prince William Sound. OSRI and NPRB each plan to commit \$100K for biological research in 2009. In the spring of 2007 the OSRI Scientific and Technical Committee (STC) identified the strongest areas of overlap between the two program areas as being, socioeconomic research and the near shore environment. It has been noted that the near shore 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. OSRI currently has an active socioeconomic project and will be reviewing how to develop that line of research so this year we are focusing on ecological issues, including the validation of biological models being developed for PWS. By developing a focused plan to study near shore ecology we will be able to pull together previous and future work to provide a comprehensive understanding of this subject.

What follows are the descriptions of the topics for the FY09 joint RFP.

PWS NPZ model validation

The Alaska Ocean Observing System has been involved with developing several oceanographic models for Prince William Sound. Included is a nutrient-plankton-zooplankton (NPZ) model coupled with a regional ocean model system (ROMS). There is a validation exercised planned to test the circulation model in the summer of 2009. We are requesting proposals to validate the NPZ model results. We expect an observational

program starting by July 2009 and possibly continuing into the fall to test the model's ability to forecast nutrient, plankton, and zooplankton distributions and levels through the summer. The observational program will need to coordinate with the modeling program to derive a measure of the success of the model results.

Rockfish habitat association in Prince William Sound

Rockfish are a diverse group of long-lived marine fish which can be prone to impacts from oil spills and overfishing. Because the *Exxon Valdez* Oil Spill Trustees list the recovery of rockfish in Prince William Sound from the Exxon Valdez Oil Spill as unknown we feel it is important to better understand rockfish habitat in Prince William Sound. Recent advances in technology and the completion of high-resolution bathymetric surveys may make possible better identification of rockfish habitat in Prince William Sound. We request proposals to identify rockfish habitat and to provide a measure of the quality of that habitat in Prince William Sound.

Larval drift, transport and distribution in Prince William Sound

Several ocean circulation models have been developed that cover the Gulf of Alaska and smaller regions within the Gulf. Several important fish and shellfish; including herring, crab, and clams, have planktonic life stages where the oceanographic circulation can determine their dispersal. Prince William Sound might serve as a nursery for some of these species. We request proposals to model the larval transport of a commercially harvested species in relation to Prince William Sound (i.e. out of or into the Sound). We desire the generation of probability maps of where settling may occur given a fixed spawn/hatch location, and several different years of ocean and meteorological conditions.

OSRI expects to contribute \$100K to this collaboration. With the NPRB contribution the total request will be for \$200K. No amounts have been specified for specific topics. All proposals received under this section will be competed against each other with a funding cap of \$200,000 for all categories. This section of the RFP is open to all organizations and individuals and is in no way restricted to those associated with OSRI or the Prince William Sound Science Center.

b. PWSSC Biological Research (OSRI cost: \$80K)

The PWSSC research fellowships are intended to fund short term focused investigations on biological issues relevant to the OSRI mission. This research program is to 1) research diverse issues relevant to the OSRI mission); 2) maintain the highest caliber of science possible; and 3) provide research staff to the PWSSC. The program is intended as partial support for the researcher who must also take a lead role in securing other funds to support process oriented studies that further our understanding of PWS, the Gulf of Alaska and the surrounding watersheds. To achieve the objective OSRI will fund proposals in the following types of programs.

- 1.) Synthesis of PWS ecology; This component looks to develop written or electronic syntheses of ecological information pertaining to Prince William Sound. A written synthesis should be aimed to describe what has been learned over the past 50 years and describe the important gaps in our understanding. An electronic synthesis should be designed to act as a living version of the Environmental Sensitivity Index (ESI) maps that can be used by spill responders and inform future updates to the ESI maps.
- 2.) Fisheries research; The desire of this component of the program is to fund fisheries research in areas of active oil and gas development activities or along transportation routes. The research should be designed as a pilot project that would be developed into a larger proposal to another organization, or as a short-term project that will fill critical information on populations that may be affected by an oil spill.
- 3.) Matching funds; Projects requiring matching funds will be considered. Proposals must align with OSRI's mission. Proposals must have at least a one-to-one match to be considered. STC approval of the project will be required before funding.

3. Modeling

The ability to predict the trajectory of spilled oil requires modeling of winds and currents. The models provide predictions of future conditions as well as estimates of the conditions between the sparse measurement locations. OSRI and the Alaska Ocean Observing System have sponsored the development of atmospheric and oceanic models for Prince William Sound. The plan continues funding the atmospheric modeling component as part of the oceanographic model validation exercise in 2009. The Alaska Ocean Observing System will sponsor the oceanographic modeling for this exercise.

a. Atmospheric circulation modeling (OSRI cost: 50K)

The model validation experiment is scheduled for summer of 2009. The atmospheric modeling is necessary as an input to ocean circulation and wave models, as well of interest to oil spill response models. OSRI has supported the Alaska Experimental Forecast Facility (AEFF) in their development of a Regional Atmospheric Model System (RAMS) and Weather Research and Forecasting Model (WRF). This funding is to allow those models to be run through the model validation exercises.

At the Alaska Experimental Forecast Facility (AEFF), a daily numerical weather forecast model— the Weather Research and Forecasting Model (WRF)— is operational for the region of Prince William Sound (PWS). As is true of all weather forecast models, this involves using a cluster of computers to solve a mathematical model approximating how we think the atmosphere works. In fact this is the same thing that the National Centers

for Environmental Prediction (NCEP) does for the National Weather Service (NWS). What is different with our project is that while NCEP does this for all of Alaska, AEFM concentrates available computing power on the region of Prince William Sound. This allows for a finer-scale grid spacing (4-km) than the NCEP models (12.5 km at best). This finer grid-scale hopefully resolves smaller scale topographic effects that are not in the NWS simulations.

In our study we exploit the capability of grid nesting, in effect telescoping down from a coarse grid-mesh grid that covers all of Alaska and surrounding oceans, to an intermediate grid that covers all of southern Alaska and the Gulf of Alaska, and ultimately down to the fine-mesh grid that covers PWS and its surrounding terrain/ocean.

The model simulations produce hourly (or less if necessary) 3-d forecast fields of a host of variables, including: temperature, pressure, winds (3-d), humidity, precipitation, and cloudiness. This is just a small sampling of variables of most interest to the typical user in PWS, a host of other 2- and 3-d variables are available and more can be calculated from the raw output.

The model provides estimates of the conditions between observation points. Several weather stations have been deployed in the Sound and there are several C-MAN stations and NDBC buoys in the Sound. Still there are several data-sparse sections in a region where weather and wave conditions can vary dramatically over a scale of 10 km or so. The model provides estimates of the conditions in those places where direct observations do not exist. These are, of course, predictions and so will never replace having an actual observation at a given point in space and time

In FY09 the focus is on supplying atmospheric predictions in support of ocean modeling efforts, and validation of the atmospheric model predictions. The final report must present a section on the validation of the model output and how the model was used by other components of the validation exercise.

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 science plan are to:

- a) Fill knowledge gaps on behavior of spilled oil.
- b) Fill knowledge gaps on the use and effectiveness of specific mitigation techniques.
- c) 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 \$165K for projects related to Goal #2, oil spill response, OSRI has elected to fund a portfolio of initiatives.

- (1) Co-sponsorship of a cold climate spill response project received by one of our partners.
- (2) The Joint Industry Program: Oil Spill Contingency for Arctic and Ice-laden waters, at the level of Minor Funder.
- (3) Model validation experiment.

a. Partnership proposals. (OSRI cost - \$70K)

A number of agencies and organizations fund research in oil spill response. The missions of the various groups can be diverse, but have 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, Minerals Management Service (www.mms.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/>), and the oil industry.

By pursuing potential partnerships OSRI can leverage its limited funds to engage in larger projects. It should be noted that it is inherently expensive to work in the Arctic and sub-Arctic regions, which increases the cost of proposals. OSRI will both assist with partner developed research topics and develop its own research topics for potential RFPs. If partnerships are unavailable for the OSRI developed research topics OSRI will consider releasing the RFP as the sole funding source. The research topics will be guided by the OSRI science plan response subjects.

- 1) Develop and/or apply novel and cost-effective methods and technologies for preventing, recovering, reducing, or eliminating spilled contaminants.
- 2) Develop new sensors and technologies to detect and quantify contaminants in the environment.
- 3) Develop and/or apply novel and cost effective technologies and methods to remediate contaminated sediments and water.

Project topics will be further refined by other guiding documents, such as the OSRI funded report titled, *Advancing oil spill response in ice-covered waters* (http://www.pws-osri.org/publications/OilIce_final.pdf).

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

- 1) Demonstration of balloon based remote sensing for oil spill recovery.
- 2) Breaking viscous shear for transfer of oil below the pour point temperature.
- 3) Determining the feasibility of using optical systems to detect oil under snow or ice.
- 4) Demonstration of the ability to track oiled ice using satellite remote sensing.
- 5) Developing an oil simulant for use in testing oil spill response equipment in Arctic waters.
- 6) Developing techniques to prevent ice buildup on recovery equipment.
- 7) Determination of the role of glacial sediments in the natural dispersion of oil.
- 8) Testing new spill recovery equipment in Arctic and sub-Arctic waters.
- 9) Developing techniques to remove oil from under ice.
- 10) Toxicological analysis of dispersants and dispersed oil.

A total of \$50K is expected to be used to fund one or more proposals under this topic area.

b. Joint Industry Program (JIP): Oil Spill Contingency for Arctic and Ice-laden Waters. (OSRI cost \$45K total, \$18K for joint RFP with CRRC, \$27K to cover unanticipated costs or a companion project. An additional \$5K for travel associated with the JIP program and steering committee of the joint proposal is included in the Research Program Manager's budget)

SINTEF has, on behalf of the oil companies ChevronTexaco, ConocoPhillips, Shell, Statoil, BP, TOTAL, and other prospective participants, performed a pre-project to prepare a state-of-the-art report on oil spill contingency in Arctic and ice-laden waters which identifies research and development needs in this area. Based on this, SINTEF, international R&D partners and the oil companies have formulated a Joint Industry Program (JIP) to advance Arctic oil spill contingency technology and knowledge. Further information on the JIP, including Questions and Answers, State of the Art Report, and the Joint Industry Program (JIP) Proposal can be found at http://www.pws-osri.org/programs/project_list.shtml. Reports from OSRI representatives attending steering committee meetings are also available online.

The overall objective of this JIP is:

- *Further development of tools and technologies for environmental beneficial oil spill response strategies for ice-laden waters.*

Program sub-objectives are:

- *To improve our ability to protect the Arctic environment against oil spills resulting from exploration, development, production and transportation activities.*
- *To provide improved basis for decision-making by responsible authorities:*
- *Advance the state-of-the-art in Arctic oil spill response:*
 - *Address key problems/scenarios faced by program partners.*

- *Demonstrate workable response options for different ice conditions and oil types.*
- *Define limiting conditions for alternate response strategies.*
- *Investigate and develop improved response capabilities and strategies.*

Testing, development and verification of approaches developed in this JIP will take place at different levels:

- Small-scale (bench-scale) laboratory experiments.
- Meso-scale basin experiments (e.g. SINTEF oil-in-ice basin and meso-scale flume basin and S.L. Ross test basin).
- Meso-scale field experiments at the fjord ice in Svea, Svalbard.
- Large-scale field experiments in Canada and Norway.

The participation fee (the total cost as described in the overall budget of the JIP) will be divided equally between the oil companies. Cooperating organizations, such as OSRI, are not expected to provide financial support to the projects, but may assist with the following types of in-kind support to planned activities:

Vessels and other logistics for field experiments

Results and data related to oil in ice experiments which has been carried out previously

Contribution in working groups

Contribution related to arrangement of workshops and similar field trips

Sponsorship of an auxiliary RFP for study of Biological Effects in the JIP

In 2006 OSRI began working with CRRC to develop an RFP for a study of biological effects to compliment the work of the JIP. This led to the development of a proposal to CRRC that has three components. The first is a study to examine how the growth of the ice affects the transport of various fractions of the hydrocarbons through the ice. The second is to examine the ability of microbes to degrade the oil at temperatures and salinities associated with sea ice. The third is to combine the results in models in order to estimate exposure and degradation potential. Several institutes collaborated in submitting the proposal and OSRI committed to fund the University of Alaska portion of the proposal. OSRI's funding commitment was \$45K in FY08 and another \$18K in FY09. The statement of work from the proposal submitted by UAF follows.

The contribution by the University of Alaska Fairbanks (Petrich and Eicken) to this project will consist of the following:

- (1) Develop and code a numerical model for simulating multiphase fluid dynamics in sea ice as relevant for the movement of oil and transport of water-soluble compounds (WSC) released from oil entrained into sea ice. This work will build on earlier work for single-phase flow and brine-flux simulations.

(2) Carry out a series of model runs to assess the sensitivity of oil and WSC movement to relevant boundary conditions and parameterizations of key processes, including ice growth rate and temperature, ice permeability, oil layer properties and thickness.

(3) Consult and participate in laboratory experiments at SINTEF, Norway on oil release into sea ice and its potential impacts on ice microbial communities. This work includes analysis of ice microstructure and stratigraphy and potential ancillary experiment to characterize predominant mode of oil entrainment.

(4) Work with other team members at SINTEF, Norway and other institutions to synthesize results from model studies and laboratory experiments.

Since one role of the minor funders is to help with logistical support and logistical costs have risen dramatically since the inception of the project, \$27K is budgeted to contribute to logistical overruns. If the funding is not needed then OSRI will look for projects that can complement the JIP efforts or sponsor travel of Alaskan responders to observe the cleanup efforts. An additional \$5K is budgeted under the Research Program Manager position for travel to attend the JIP planning meetings and the biological effects project steering committee meetings.

c. Model Validation Experiment (OSRI cost \$50K)

Over the last several years OSRI has contributed to the development and refining of atmospheric and oceanic models, and installation and upgrade of measurement systems. To test their capabilities requires experiments that collect the data required as inputs to the models, and validation data that provides a measure of the output of the models. The Alaska Ocean Observing System is planning such an experiment which is now expected to be conducted in 2009. A brief description of the AOOS experiment follows.

Objective: To quantitatively evaluate the performance of forecast models in Prince William Sound including the Weather Research and Forecast model (WRF), Regional Ocean Model System (ROMS) model, the Simulating Waves Nearshore (SWAN) wave model, and the General NOAA Oil Modeling Environment (GNOME) oil spill trajectory model.

Methods: Model performance evaluations will be based on comparisons with 1) observational data collected during a two field experiments in 2009, and 2) model performance during the 2004 experiment. The overarching questions are:

How well are the models able to predict atmospheric and oceanic water properties, wave conditions, and circulation patterns in PWS?

Have the model forecasts for the central basin improved from those in 2004?

What is the cost/benefit of the AOOS for oil spill trajectory modeling?

Observational data: The Alaska Ocean Observing System is now providing access to real-time and historical observational data for PWS from one data portal. These data are available to the developers of the atmospheric and ocean circulation models and the wave model to facilitate model validation and correction. During the field experiment, drifting buoys will be repeatedly deployed, retrieved, and redeployed during two one-week periods in the late summer (July or August). There will be an emphasis on model validation of surface and deeper currents in the central basin, so the majority of drifter deployments will occur within the High-Frequency Radar field of view. The HF radar will be deployed prior to the experiment and will provide a view of the central basin. Additional deployments will occur around the perimeter of the Sound to validate the velocity of surface currents forced predominantly by fresh water runoff and track the fate of Lagrangian drifters that mimic Coast Guard Search and Rescue targets as well as oil spill trajectories.

Model performance evaluation: 1) Evaluate for product performance - Has the AOOS demonstration project in PWS improved the ability of NOAA Hazmat models to forecast the trajectory of Lagrangian drifter buoys? 2. Evaluation of data utilization by partnering organizations – Does this data provide a useful service to other partnering organizations such as the USCG search and rescue operations? 3. Evaluation of the mechanics of data transfer – Is relevant data readily accessible between model developers and AOOS and from AOOS to NOAA Hazmat and other data users? 4. Evaluate for improvements in the understanding of dispersion in Prince William Sound – Has the development of the existing observational array and suite of models improved our understanding of the circulation and mixing in PWS? 5. Evaluate for improvements to the observing system - Do the models provide information on where new observation platforms are needed and where existing observation platforms are redundant?

OSRI is prepared to contribute up to \$50K in FY09 for deploying and recovering buoys, collecting hydrographic data, processing the data, and preliminary analysis of the skill of the models for predicting the buoy trajectories. This analysis must be part of the final report. Further funding in FY10 is expected for a complete analysis of the comparison between field measurements and model predictions.

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:

- a) Facilitate the exchange of information and ideas through education and outreach.
- b) Brief the scientific community and oil spill responders on OSRI products.

- c) Develop and maintain a web page that provides relevant and timely information.
- d) Provide graduate and undergraduate fellowships and internships.

1. Education (Total OSRI cost: \$67K for the programs described below)

OSRI intends to continue building upon the existing regional outreach programs. In addition, within the next year, OSRI will seek out partnering opportunities to broaden the geographic influence of the PWSSC education programs to state and national audiences and share expertise among a consortium of other education and outreach institutions.

a. School Year Programs: Discovery Room, Outreach Discovery, Community Programs (OSRI Cost: \$40K)

The Discovery Room and Outreach Discovery programs create the opportunity for hands-on science in both classroom and outdoor settings. The Discovery Room enhances the science curriculum for Cordova students in third through sixth grade by providing hands-on lessons and activities. The program's goals are to encourage students to better understand and appreciate the PWS region while working within state science standards. The Discovery room is conducted as a partnership between PWSSC, the Forest Service, Cordova School District, and the Copper River Watershed Project. Additional funding for the program comes from BP, Conoco-Phillips, EPA, and community donors.

Due to budget cuts and personnel changes the program is refocusing in FY09. The numbers of grades covered are being reduced and there is a shift to strengthen the monitoring programs and reduce the number of classroom station activities. In FY09 the fifth graders will be provided a program based on the oil spill curriculum with monitoring of storm water. Third and fourth grades will start with a salmon curriculum that has been used in the past and monitoring of salmon streams. The sixth grade class will be working with technology to build a small-scale oil recovery system of their own design.

Outreach Discovery takes Discovery Room lessons to the villages of Chenega Bay and Tatitlek. These lessons greatly enhance the limited resources these schools have available for science education. One visit to each community will occur during the upcoming school year.

Community Programs serve adults and families in Cordova primarily through a regular seminar series that covers current science being conducted in the region. The community programs are now run in partnership with the Marine Advisory Program, U.S. Forest Service Cordova Ranger District, and PWS Audubon Society.

b. Summer Programs: Forest to the Sea, Weekend Workshops (OSRI Cost: \$12K)

From the Forest to the Sea program provides the tools and guidance for participants to understand the interdependence of all ecosystems. Hands-on education in the outdoor classroom and scientific knowledge, combined with positive experiences in the outdoors, builds a foundation for campers to grow into good environmental stewards and wise decision-makers. While immersed in their surroundings, participants learn how ecosystems are connected through interactive studies of the temperate rainforest, glacier, wetlands, and ocean. The Forest to the Sea program involves a wide array of activities and funding sources.

Forest to the Sea programs includes activities for students of all ages. The OSRI contribution will go towards three science camps for 8 to 15 year olds that connect the various ecosystems described above and factors that affect them. It will contribute to a high school program that develops environmental leadership through a week to 10 day course on an environmental topic that includes a marine component. It will also contribute towards day events, such as tide pooling for tots, which involves children and their parents in marine ecology programs.

The summer programs are run in partnership with the US Forest Service, Alaska River Expeditions, and others. These programs are advertised throughout the state and scholarships are available to help attract students from other communities. The total cost of the Forest to the Sea program exceeds \$70K with additional funding coming from other grants, contributions, fees, and volunteer support. This allows OSRI funding to be focused on the components closely connected to OSRI's mission.

c. Coastal community outreach and education (OSRI Cost: \$10K)

For 14 years the Prince William Sound Science Center has augmented local education curriculum with hands-on science programs and, in addition to Cordova students, has delivered these programs to Tatitlek and Chenega Bay. They have provided adult education opportunities through a community seminar series and field trips. To reach a broader audience in Alaska they have partnered with the Imaginarium and the Alaska Natural History Association to create hands-on programs for youth and adults. In FY09 there will be a focus on continuing to reach a broader audience through the development of outreach materials for Alaskans and tourists alike. A clearly identified need is for a brochure explaining the *Exxon Valdez* Oil Spill and the lessons learned since that time. The brochure would be made available on the ferry system and to tour operators. A follow up activity will be the development of a "State of the Sound" report designed as an insert for newspapers. It would include sections covering research being conducted, natural history of the sound, culture, and educational activities.

d. National Ocean Sciences Bowl (OSRI Cost: \$5K)

OSRI will provide institutional sponsorship for the Alaska Tsunami Bowl, the regional competition for the National Ocean Science Bowl and the Cordova NOSB team. This program encourages high school students to excel in math and science studies by involving them in a quiz-bowl competition focused on ocean sciences.

2. Technology Scholarship (OSRI cost: \$25K) Beginning in 2007 one of the Graduate Research Fellowship positions was changed in to a “Technology Scholarship” aimed at an undergraduate student in a field related to oil spill response technology. That student is required to conduct an internship with an oil spill response organization. The scholarship is for a two year period at a total funding level of \$25K so the scholarship extends into FY010. One student is currently funded and we will be recruiting a second student in the fall of 2008. OSRI is committing \$25K for this program in FY09

3. Graduate Research Fellowships (OSRI cost: \$25K per student per year, \$50K total)

Under Goal#3 of the OSRI strategic plan, the suggested focus areas for research projects funded by the OSRI fellowship program are: Social science, education, and outreach; economic, sociological, and/or anthropological research applicable to the effects of oil spills on coastal communities; application of ocean observing system products in coastal community education programs.

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, and improve public awareness and understanding of marine and estuarine ecosystems.

There are two Graduate Research Fellowship projects that extend into FY08.

a. Promoting Sustainable Oil and Gas Development on Alaska’s North Slope through Local-Scale Integration of Geophysical and Traditional Knowledge; Matthew Druckenmiller, Ph. D. student, (funded for 2007-2009, University of Alaska) \$25K will be awarded in FY09 for M. Druckenmiller to continue his research.

M. Druckenmiller’s abstract describing his studies: “Increased oil and gas activities in Alaska’s Beaufort and Chukchi Seas may serve as a catalyst to more thoroughly investigate the research methodologies and institutional practices that incorporate local and traditional knowledge (LTK), thus promoting a sustainable future for North Slope communities, the coastal ecosystem, and the oil and gas industry itself. Most climate models and sea-ice investigations operate at resolutions not suited for observing the critical processes and variability that exist on the local level; therefore, information required by local institutions and oil and gas developers is often not readily available. Given that many Iñupiat Eskimos possess a valuable and nonreplicable understanding of local and regional sea-ice dynamics and unexpected and rare sea-ice events, their

knowledge may greatly contribute to decisions made regarding oil and gas development and oil spill response planning and operations.

A systematic investigation of local scale sea-ice system services (SISS) and sea-ice hazards provides a framework for identifying stakeholder-relevant sea-ice variables and collecting and documenting LTK. This project will: (1) investigate the landfast ice and adjacent pack ice in the Bering Strait and the Chukchi and Beaufort Seas using geophysical techniques, such as SAR satellite imagery and coastal radar, and the observations of various Iñupiat sea-ice experts, and (2) systematically document SISS and hazards through sea-ice use mapping and interviews. While my research in the broadest context will involve a diverse set of stakeholders, I intend to focus on sea-ice information relevant to oil and gas development and oil spills in ice-covered waters. The main product of this work will be a GIS-based map for use by planners and developers that geographically organizes sea-ice information by the local services and hazards it provides, while also temporally organizing key events in the ice-year, such as when landfast ice stabilizes or becomes dynamic in a specific location.”

b. Assessment of River Otter Recovery *Kaitlin Ott* University of Wyoming. Masters student. \$25K will be awarded in FY09 for K. Ott to continue her research.

These funds are being requested for a second year of the Graduate Research Fellowship project as described in the following abstract.

River otters (*Lontra canadensis*) were one of the first resources to recover from the impact of the 1989 *Exxon Valdez* oil spill (EVOS) in Prince William Sound (PWS). Nonetheless, genetic evidence suggests that the numerical recovery of otters in oiled sites resulted from recolonization from adjacent areas rather than from local reproduction. Because increased trapping pressure on otters in recent years occurs mainly in non-oiled areas of PWS, previously-oiled sites may become important source locations for these animals. Whether otter reproduction has been attained in previously-oiled areas, however, is unknown. In this project we propose to determine whether reproduction was recovered in otter populations inhabiting previously-oiled areas of PWS, using genetic tools and non-invasive fecal sampling. We will estimate abundance, genetic structure, and relatedness. We predict that if otter reproduction recovered, genetic similarity in previously-oiled areas as well as the degree of relatedness of individuals will be comparable to those in non-oiled areas. In addition, we will estimate dispersal of individual animals originating in previously-oiled areas to non-oiled areas from fecal DNA analyses and GIS mapping to evaluate whether previously-oiled areas can serve as sources for sustainable otter harvest.

4. Outreach

a. OSRI Advisory Board discretionary workshops (OSRI cost: \$17K)

These funds are for workshops or special projects at the discretion of the OSRI Advisory Board. Workshops being considered for FY09 support include:

(1) **Alaska Marine Sciences Symposium.** (OSRI cost: \$2K) 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 \$2K to support this workshop, which will be held in late January in Anchorage.

(2) **Alaska Forum on the Environment.** (OSRI cost: \$15K) In 2009, the Annual Forum will be held February 2-6, 2009, at the Egan Center and the new Dena'ina Center in Anchorage. Of particular interest to OSRI will be the sessions related to the lessons learned since the *Exxon Valdez* oil spill. It will have been 20 years since the accident and much has been learned about Prince William Sound and oil spill response in cold waters. This forum provides an opportunity to share the lessons learned. Member agencies have been asked to allocate funds towards this workshop. OSRI will allocate \$15K to the Alaska Forum on the Environment, and staff is encouraged to attend the workshop with waived registration fees.

b. Update of Darkened Waters exhibit (OSRI cost: \$15K) The Darkened Waters exhibit was originally built as an informal education tool discussing the *Exxon Valdez* oil spill. The exhibit was updated approximately 10 years ago and toured museums at that time. It has been in storage in Kansas for much of the last 10 years due to a lack of funding and space to return it to Cordova. The funds requested here are to be used to assist in returning the exhibit to Cordova and begin updating the exhibit to include the lessons learned over the past 20 years. This funding should be used as matching funds for other requests that will be needed to complete the work.

c. OSRI web page maintenance and upgrades (OSRI cost: \$5K, Support for upgrading the OSRI web site and ongoing maintenance).

d. Annual report (OSRI cost: \$8K). The OSRI will contract for printing of an annual report for FY08 that details the programmatic activities and provides a summary financial status report. This report serves as a document of recording and evaluating the process of the OSRI program.

D. Other Programs

1. Program coordination (OSRI cost: \$123K). The position of OSRI Research Program Manager is a programmatic expense. The total costs include salary, benefits, travel and commodities. The Research Program Managers responsibilities include:

- Preparation of annual work plan in consultation with the Board-appointed Work Plan Committee and in accordance with the Five-Year Science Plan adopted in

2005. Compile information about potential projects, write brief project descriptions and prepare project budget estimates.

- Implement 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.
- Coordinate 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.
- Meet 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.
- Assist the Executive Director to ensure compliance with all policies and procedures of the OSRI Grant Policy Manual.
- Coordinate the processing of contracts for successful proposals. Monitor progress and final report deadlines for these contracts.
- Prepare bi-annual reports on OSRI grant awards and research and education programs for distribution to the OSRI Board.
- Coordinate publication in the late fall/early winter of an Annual Report for broad distribution.
- Supervise maintenance of the OSRI website.
- Collaborate 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, and the Alaska Department of Environmental Conservation, the Alaska Ocean Observing System (AOOS), the North Pacific Research Board, the UNH/NOAA Coastal Response Research Center, US Minerals Management Service, and Norwegian SINTEF's Joint Industry Program.
- Periodically represent OSRI at professional meetings and workshops.
- Maintain files and a library on oil pollution issues
- Provide leadership in planning future research programs and work plans.
- Prepare technical reports on OSRI programs.

2. OSRI Science and Technical Committee meetings (OSRI Cost: \$15K).

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. In FY09, the STC plans to schedule a longer 2-3 day meeting for development of a new 5-year plan.

E. FY09 New Programs Spending Summary

Area	Project	FY09 Work Plan	Science Plan
Understand			
	Meteorological Stations	\$40K	\$40K
	Physical Oceanography	\$160K	\$150K
	NPRB Partnership	\$100K	\$100K
	PWSSC Biology Fellowship	\$80K	\$85K
	Atmospheric Modeling	\$50K	\$0K
		\$430K	\$420K
Respond			
	Partnership Projects	\$70K	\$150K
	JIP	\$45K	Subset of partnership
	Model Validation	\$50K	\$0K
		\$165K	\$150K
Inform			
	Discovery Room	\$40K	\$85K
	Forest to the Sea	\$12K	
	Community Outreach	\$10K	
	NOSB	\$5K	
	Technology Scholarship	\$25K	\$0K
	Graduate Fellowships	\$50K	\$100K
	Workshops	\$17K	\$15K
	Darkened Waters	\$15K	\$0K
	Web Page	\$5K	\$6K
	Annual Report	\$8K	\$10K
		\$187K	\$216K
Other			
	Research Program Manager	\$123K	\$90K
	STC travel	\$15K	\$15K
		\$138K	\$105K

III. Prior Years' Encumbered Projects Continuing in FY09

Because the OSRI projects are started at the beginning of each quarter many projects funded in 2008 will continue into fiscal year 2009. The purpose of this section is to identify those projects so that the work plan aligns with the FY09 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 FY09 – multi-year grants – the project description will reference 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 programs

a. Meteorology (Contracts through 06/30/09)

Meteorological and precipitation data for ocean circulation models

These funds are being carried forward for the maintenance of SNOTEL sites being conducted by the National Resource Conservation Service and MicroSpecialties as described on page 4 of this plan.

2. Biological science programs

a. Fish habitat association (*Rob Bochenek, Axiom, Contracted through 6/30/09*)

This project evolved out of the OSRI and NPRB joint RFP. None of the original proposals were considered to be sufficiently developed at the time of the joint funding decision. Because of unspent funds in the biological science program and the Science and Technical Committee's strong support of the program the proposers were requested to revise their proposals to address reviewer's comments and resubmit them directly to OSRI. The revised proposals were reviewed by members of the STC and a proposal selected. The abstract of the proposal follows.

Pacific herring has been identified as a critical species for North Pacific marine ecosystems. Current data sets regarding herring are in a dispersed state and have not been coupled to shore zone and habitat classification in a standard geospatial framework. The investigators propose to consolidate and integrate herring datasets and shore zone classification data into a common geospatial framework and perform analyses that test that framework for correlations between reproductive activities (herring spawn) in the vicinity of shore zone habitat types and subsequent age class recruitment.

The investigators propose to build upon an existing herring data system, the Prince William Sound Herring Data Portal (www.pwsherringportal.org), which currently houses herring shoreline spawn, biomass and Age Sex Length Weight (ASLW) observation data from 1973 to present. The various data are in a geospatially and temporally explicit state (work performed in 2007 for EVOSTC project 070822 and in 2008 for EVOSTC project 08082).

The effort detailed within this proposal will expand the data holdings of the Herring Data Portal to include shoreline spawn, biomass and and Age Sex Length Weight data

for the Kameshak Bay region (1978 – 2002). In addition, this proposal will integrate existing shorezone mapping datasets (www.coastalaska.net) and other shorezone habitat classifications (environmental sensitivity index) into the data system. This data integration will provide the investigators with consistent information regarding two separate herring populations. This information will describe herring spawning activities near defined shorezone habitat types with resulting age class recruitment success. Statistical and analytical correlations can be performed regarding herring spawn occurrence and proximity to shorezone habitat types and resulting age class recruitment both temporally and spatially. If a correlation can be found regarding this relationship, resource managers can use this information to protect stocks in specific habitat areas and isolate critical habitat types for pacific herring.

b. PWSSC Fellowship (*Bishop and Powers, PWSSC and USA, Contracted through 6/30/09*)

A joint project between Mary Anne Bishop of PWSSC, and Sean Powers of the University of South Alabama titled, “Tracking Movements of Lingcod *Ophiodon elongatus* in Prince William Sound Using Acoustic Tags and Arrays: Expanding PWSSC Partnerships, Infrastructure and Capacity” was funded. This project follows on previous OSRI funded work related to tracking of marine species. It utilizes the OSRI and other funding to leverage funding from the Pacific Ocean Shelf Tracking project. The abstract from the proposal follows.

The goal of this project is to create new partnerships and collaborations for the fisheries research program being conducted at the Prince William Sound Science Center. Specifically, the long-term Prince William Sound (PWS) Science Center/Dauphin Island Sea Lab fisheries research program will partner with the Pacific Ocean Shelf Tracking (POST) project to deploy a large-scale acoustic array in PWS that will become a significant component of the POST project. We also will partner with Kintama Research for a public workshop and PWSSC staff training that will expand our local capacity to effectively and efficiently design and deploy acoustic arrays. This project will also create new collaborations and synergise with efforts of Ocean Tracking Network (OTN) and the Tagging Ocean Predators Project (TOPP) in PWS. We will achieve our goal using funding from the PWS Oil Spill Recovery Institute and in-hand equipment and/or funds from three other partners (Ocean Tracking Network, Rasmuson Foundation, and PWSSC) to match a grant from POST.

The proposed project includes three main components: a) a workshop by Kintama Research on designing large-scale telemetry arrays; 2) training of PWS Science Center personnel by Kintama Research on how to assemble and deploy large-scale array installations; and, 3) acoustic tagging and tracking of lingcod. With assistance from Kintama Research, we will deploy across the mouth of Port Gravina an acoustic array consisting primarily of VR3 underwater receivers. Two smaller arrays of VR2W underwater receivers will also be deployed at Gravina Island and Gravina Rocks, two sites located near the VR3 array.

Once the arrays are in place, we propose to capture and tag lingcod with acoustic transmitters in and around the arrays, and track their movements and residency in Prince William Sound. Lingcod, a bottomfish species unique to the coastal waters of the Pacific Coast of North America, support an important commercial and recreational fishery. Because of their depressed stock sizes, lingcod are currently a species of critical concern to fisheries managers throughout the Pacific Coast. The project would also rely on data from acoustic arrays being installed in 2009 by Ocean Tracking Network at the entrances to Prince William Sound to detect lingcod movements out of and back into the Sound. This combination of projects will further develop a comprehensive, ecosystem-based understanding of the importance of lingcod within the North Pacific Region and will increase the scope and capacity of POST for monitoring fish movements in Alaska.

(Cooney and *Campbell*, Contracted through 6/30/09)

The second fellowship project funded in FY 08 is for planning a synthesis of the ecology of Prince William Sound. The proposal titled, "Planning workshop for a research and socioeconomic review and synthesis on Prince William Sound" was submitted by Ted Cooney and Rob Campbell. The outcomes of the proposed work include putting together a writing team, a workshop to guide the efforts, an outline of the synthesis, and a proposal for funding the effort. Their proposal abstract follows.

This proposal requests funds to hold a workshop to plan a synthesis of past marine science and socio-economic studies in Prince William Sound, Alaska. Specifically, we propose to host a 3-day workshop in Cordova to outline the contents, determine writing assignments, and design a proposal to fund its publication. A preliminary meeting was held in late January to gauge the interest among potential contributors to this synthesis project; this proposal takes the project to the next step and will involve a smaller, working group of 7-10 scientists and others knowledgeable about the region.

3. Socioeconomic

a. Social disruption from oil spills and spill response (*Thomas Webler, SERI, Contracted through 6/30/10 all funding committed from the FY08 budget*)

This project is a supplement to a project funded by the Coastal Response Research Center. The project is designed to examine the social disruption from oil spills and spill response. In particular, to characterize effects, vulnerabilities, and the adequacy of existing data to inform decision-making. OSRI's contribution will add Cordova, Alaska to their study sites. This provides a study site that has had a relatively long period for the effects to be fully realized. It also builds on the previous research done in relation to the *Exxon Valdez* oil spill. The proposal abstract follows.

Oil spill response planners never disregard the human dimensions of oil spills. In fact, the National Contingency Plan requires that items of economic and environmental

importance that are threatened by a spill be covered in the plan. However, the strength of ecological concerns and the wealth of information on ecological sensitivity tend to be primary drivers in contingency planning. The socioeconomic lags behind the ecological in terms of readily available information and tools to assess sensitivity. Social endpoints that are acutely threatened *are* protected in an emergency response, but the systematic assessment of social and economic effects is not widely done in area-based contingency planning processes. This research project investigates what is involved in bringing a systematic assessment of socioeconomic vulnerability considerations into area-based oil spill contingency planning. While this project has one eye on the ultimate goal of producing practical decision-support or social impact assessment tools, it presupposes that several types of information need to be collected, evaluated, and synthesized before such tools can be constructed. Specifically: (1) human dimensions endpoints threatened by oil spills need to be systematically identified; (2) the relationships between these endpoints, effects, and planning and management actions should be evaluated; (3) the sufficiency of existing data and data-analysis tools to characterize and anticipate these causal relations must be assessed. Initial inquiries with emergency responders and contingency planners into these questions have validated their importance.

Drawing on existing data wherever possible, we propose to review qualitative data to reveal the types of human dimensions endpoints that matter in oil spills. In Phase 1, we will document how the importance of endpoints can be understood and, eventually, measured using the conceptual framework of vulnerability. We will meet with experienced personnel as part of three case studies to identify endpoints of concern and use the conceptual framework of vulnerability to identify key factors influencing losses. The information we gather will be structured in a way that facilitates planning interventions. In Phase 2, we will investigate to what extent existing data are capable of depicting the human dimensions considerations identified in Phase 1 and we will propose recommendations for how a planning process that has been strongly led by ecological considerations can be broadened to also include the most important human dimensions. These recommendations will also summarize how oil spill planning can proceed using a perspective that highlights the coupled human and natural systems.

4. Modeling

One modeling effort will continue into FY09.

a. Atmospheric circulation modeling *(by Peter Olsson, AEFF, Contracted through 6/30/09)*

These funds are being carried forward for the atmospheric modeling being conducted by the University of Alaska as described on page 11 of this plan.

B. Goal #2 Respond:

1. Joint Industry Program (JIP): Oil Spill Contingency for Arctic and Ice-laden Waters. (*Hajo Eicken, UAF, Contracted through 06/30/09*)

Monies are being carried forward to fund a portion of the biological research program. The JIP program is more completely described on page 14 of this plan.

2. Oil-Spill-Recovery Prize through InnoCentive (Contracted through 6/30/09)

These funds are being carried forward for the technology prize process being conducted by InnoCentive. In FY07, OSRI began an alternative approach towards solving R&D challenges in the oil spill response field. Rather than developing an annual RFP to fund research that often only makes incremental steps towards meeting challenges, OSRI established a purse prize to reward a successful, innovative solution to a challenge facing the oil spill response community. OSRI dollars pay for a successful solution rather than an individual attempts to provide a solution. This exciting new approach seems to be ever more prevalent in industry and technology.

The company, InnoCentive, has been identified to assist in this process (www.innocentive.com). InnoCentive matches top scientists to relevant research and development challenges facing leading companies around the globe. At InnoCentive groups posing problems (challenges) are called "Seekers" and individuals offering solutions are called "Solvers".

The development of challenges began with subjects identified in a workshop conducted in February 2007. Additional concepts were developed by the OSRI Research Program Manager. The concepts were then presented to the STC for comments and acceptance before the process of developing the final draft of the challenges. The challenges include providing theoretical solutions to the following problems:

- 1) A method to prevent the formation of ice on oil spill recovery equipment.
- 2) A new design for a boom system to be used in ice covered waters.
- 3) A new method for detecting oil on the ocean surface from a ship when visibility is reduced by fog or rain.

C. Goal #3 Inform:

1. Education

a. Technology education demonstration (*Jessica Ryan, ASLC, Contracted through 6/30/09*)

Funding is being carried forward for the successful proposal to the technology education demonstration RFP. The abstract of the project follows.

Alaska SeaLife Center (ASLC) education staff will develop a standards-based curriculum on the science of oil spill recovery and disseminate this curriculum in a three-day workshop for 12 middle and high school teachers. The workshop will provide teachers with the hands-on experience and scientific knowledge needed to present this curriculum to their students. Participating teachers will then utilize the curriculum within the 2008/2009 school year and provide ASLC with feedback on its effectiveness. This feedback will be used by ASLC education staff to modify the curriculum, which will then be made available at no cost through the ASLC web site.

By using national and state standards and grade-level expectations (GLEs) in science and math, ASLC education staff will develop a curriculum for Alaska students in grades 8 to 11. The curriculum will include an overview of the chemistry of oil (liquid petroleum hydrocarbon) and a brief history of past oil spills in Alaska, including its effects on aquatic life such as seabirds and sea otters. Through the use of the scientific method, teachers (and subsequently their students) will observe, test, and make recommendations for oil spill detection and response. These hands-on laboratory exercises will include: testing oil to determine its chemical composition, i.e., is it crude oil, gasoline, diesel, or something else; experimenting with chemical cleanup and containment options based on chemical composition; learning how scientists effectively save and re-release hundreds of marine animals that would die without human intervention; subsurface exploration of oil-spill after-effects with student-built Remotely Operated Vehicles (ROVs); and role-playing scenarios that encourage students to determine a best-management-plan in the event of a local oil spill.

Conducting the workshop on-site at the ASLC will allow teachers to learn how to build ROVs, conduct hands-on laboratory lessons, and learn about oil spill response from Alaska's spill response professionals. In addition, they will observe many of the animals and ocean systems that are most vulnerable to an oil spill and meet with scientists who rehabilitate these animals at the Center. For teachers seeking Continuing Education credit, arrangements will be made with the University of Alaska Fairbanks to offer one credit at the teacher's expense.

Teachers will leave the workshop armed with five classroom lessons. ASLC staff will determine curriculum effectiveness in the classroom through follow-up contact. ASLC will refine the curriculum based on this feedback and produce an online oil-response curriculum available at no cost through an ASLC education website download.

By teaching teachers, ASLC will disseminate information about oil spill history, response, and recovery methods far beyond our doors. For each of the 12 teachers who attend this workshop, approximately 25 students will receive classroom instruction within the year. This amounts to about 300 students total—a very cost-effective distribution of knowledge about oil-response and clean-up measures.

2. Technology Scholarship (Brian Reith, KPC, Contracted through 6/30/09)

These funds are being carried forward to complete the technology scholarship described on page 19.

3. Graduate Research Fellowships

a. Surface circulation in Prince William Sound; James Alanko, University of Alaska Ph.D. student. (Contracted through 6/30/09)

Funds are being carried forward for the third year of this Graduate Research Fellowship.

J. Alanko's abstract describing his studies: "The temporal variability in Prince William Sound surface current patterns occurs over interannual, seasonal, synoptic, and tidal time scales and the spatial variability associated with these circulation patterns is significant. Yet the variability has been under sampled in both time and space. I propose to use newly available High Frequency radar technology to measure and analyze the surface currents of Prince William Sound and provide the first comprehensive study of the variability of surface circulation patterns. This technology will be used to provide hourly maps with spatial resolutions of approximately 2 km. I will also investigate the relationship of the surface current patterns to wind forcing, flow through Hinchinbrook Entrance and Montague Strait, and tides. As part of this project, I will investigate the use of surface current maps from High Frequency radar for trajectory analysis for oil spill contingency planning and for use in search and rescue scenarios. This work will address the research focus area specified in the GRF Program Description "Observations and Modeling": seasonal and interannual variation of oceanic or atmospheric circulation, stratification, and mixing.

b. Promoting Sustainable Oil and Gas Development on Alaska's North Slope through Local-Scale Integration of Geophysical and Traditional Knowledge; Matthew Druckenmiller, University of Alaska Fairbanks Ph. D. student (Contracted through 6/30/08)

These funds are being carried forward for the Graduate Research Fellowship as described on page 19 of this plan.