

Scientific Study and Evaluation Program (SSEP)
Project Summaries: 2003/2004

For more information on the SSEP, please contact Ms. Marian Ashe at (916) 324-9803 or by e-mail at mashe@ospr.dfg.ca.gov. For more information on a specific project, please contact the OSPR sponsor as listed below.

1. Project Title: Acute and Chronic Effects of Crude Oil and Dispersed Oil on Chinook Salmon Smolts (*Oncorhynchus tshawtscha*)

OSPR Sponsor: Mike Sowby: California Department of Fish and Game, Office of Spill Prevention and Response, 1700 K St., PO Box 944209, Sacramento, CA 94244-2090
msowby@ospr.dfg.ca.gov (916) 324-7629

Hypothesis to be tested: The toxic impacts of crude oil on chinook salmon smolt are increased by the application of chemical dispersants. The specific aims of this project are:

1. To conduct short-term exposures, using declining concentrations of water-accommodated fractions (naturally dispersed petroleum hydrocarbons) (WAF) and chemical enhanced water accommodated fractions (CEWAF) (using the dispersant Corexit 9500) of Prudhoe Bay crude oil (PBCO).
2. To culture surviving fish in clean (oil-free) seawater to determine influence of the short-term exposure on long-term growth and viability.

Cost: \$194,998 **Duration:** 3 years

2. Project Title: Investigating the Thermoregulatory Physiology of Washing Sea Otters

OSPR Sponsor: David A. Jessup, Senior Wildlife Veterinarian, Supervisor
1451 Shaffer Rd., Santa Cruz, CA. 95060 (831) 469-1726 djessup@ospr.dfg.ca.gov

Hypothesis: It is possible to wash oiled sea otters with detergents, rinse them and allow them to recover with access to warmed and softened fresh water without experiencing life threatening hypothermia and hypoglycemia.

Objectives: To determine the influence of various steps in the washing, rinsing and recovery process on core body temperature, other measures of heat loss and homeostasis, and on behavior, food intake and water repellency of fur in otherwise normal sea otters. Using a stepwise process test the effects of anesthesia and recovery, washing pelage with dilute detergent, rinsing with softened fresh water, recovery, initial swimming following recovery in softened and warmed fresh water and mixtures of warmed fresh and salt water on otherwise normal southern sea otters with implanted internal temperature sensitive VHF transmitters. A thermal imaging camera,

various serum hormone and blood tests, and behavioral observations will be used to monitor the effects of various treatments on the otters.

Cost: \$118,000 **Duration:** 2 - 3 years

3) Project Title: Common Murre Population Recovery from Oil Spills: An Investigation of Demographic Parameters and Density Dependency

OSPR Sponsor: Dr. Steve Hampton: California Department of Fish and Game, Office of Spill Prevention and Response, 1700 K St., PO Box 944209, Sacramento, CA 94244-2090, shampton@ospr.dfg.ca.gov (916) 323-4724

HYPOTHESES AND OBJECTIVES: The objective of this study is to derive rigorous estimates of key demographic parameters for Common Murres (*Uria aalge*) in central California. These parameters include: (1) survival of breeding adults from year to year, (2) survival of non-breeding sub-adults from fledging to recruitment, (3) age at first breeding during recruitment, (4) breeding propensity (the probability of breeding once breeding has been initiated), (5) age-dependent reproductive success (fecundity), and (6,7) immigration and emigration (Nur and Sydeman 1999). An additional objective is to publish these results in a peer-reviewed journal. These data are critical to accurate NRDA's. Additionally, this project will provide to OSPR a review of past literature examining and evaluating evidence for and against density-dependence as a important demographic process among seabird populations.

Cost: \$54,105 **Duration:** 1 year

4. Project Title: Analysis and Publication of the Results of Studies on the Fates of Beachcast Birds: Scavenging, Rewash, and Searcher Efficiency

OSPR Sponsor: Dr. Steve Hampton: California Department of Fish and Game, Office of Spill Prevention and Response, 1700 K St., PO Box 944209, Sacramento, CA 94244-2090, shampton@ospr.dfg.ca.gov (916) 323-4724

HYPOTHESES AND OBJECTIVES: Many NRDA cases have relied upon a Beached Bird Model to estimate total bird mortality. A key hypothesis of such a model is that not all beachcast bird carcasses remain on beaches and not all that remain are discovered by oil spill response personnel. Specifically, we hypothesize that some bird carcasses are removed by animal scavengers, some are swept from the beach by waves and deposited elsewhere or sink, and some of those carcasses that remain are not found despite the efforts of search crews. The primary objective of this work is to quantify the extent to which these hypotheses are true. The final objective of this work is to publish three papers (addressing scavenging, re-wash, and search efficiency) in peer-reviewed journals.

Cost: \$14,980 **Duration:** 1 year

5. Project Title: Compilation of At-Sea Seabird Survey Data for California

OSPR Sponsor: Dr. Steve Hampton: California Department of Fish and Game, Office of Spill Prevention and Response, 1700 K St., PO Box 944209, Sacramento, CA 94244-2090, shampton@ospr.dfg.ca.gov (916) 323-4724

HYPOTHESES AND OBJECTIVES: Under the sponsorship of the MMS, R. G. Ford Consulting prepared a data CD in 1998 which compiled much of the existing data on seabird distributions for the west coast into a common data structure and included software for analyzing, displaying, and exporting the results. The database can be accessed directly using software included on the CD, or exported in GIS compatible formats for further analysis and display. The purpose of this study would be to update the database to include other recent and relevant data sets, and to update the access software to include these new studies and to improve integration with GIS.

Several major data sources are not included on the original CD. These include OSPR training flights for the UCSC survey team, overflight data from spill responses (dependent on the current legal status of various cases), overflights for the J.S. Luckenbach response, MMS surveys in the Channel Islands, and USGS data for the Southern California Bight. In addition, there are two other sources based on the CalCOFI cruises and the NMFS Rockfish Assessment Cruises which can potentially be included. We expect that the total volume of data archived on the CD will increase by 50% to 80%, and that most of the new data will be more recent than that included on the existing CD.

The datasets, use of the access software, and integration with GIS systems would be presented to OSPR and other interested agencies at a workshop in Sacramento.

Cost: \$34,502 **Duration:** 1 year

6. Project Title: Shipwreck Literature Search

OSPR Sponsor: Jack Geck: California Department of Fish and Game, Office of Spill Prevention and Response, 1700 K St., PO Box 944209, Sacramento, CA 94244-2090, jgeck@ospr.dfg.ca.gov: (916) 323-4664

Objective

The objective of this project is to research existing literature to identify shipwrecks with the potential to leak significant amounts of petroleum products into the California marine environment. Wrecks identified will be ranked in order of spill potential, based on cargo, bunker fuel loads, location and age.

Cost: \$26,349 **Duration:** 1 year

7. Project Title: IDENTIFY the LOCATION of DEBRIS ACCUMULATION on SAN FRANCISCO BAY SHORELINES

OSPR Sponsors:

James E Hardwick, California Department of Fish and Game, Office of Spill Prevention and Response, 1700 K St., PO Box 944209, Sacramento, CA 94244-2090, (916) 327-0911, Fax: (916) 324-8829, jhardwic@ospr.dfg.ca.gov

HYPOTHESES AND OBJECTIVES: During most oil spills response resources are commonly deployed to protect shorelines where no oil strands on the shoreline. More sensitive shoreline could be protected if the limited response resources were deployed where the probability of shoreline oiling is greatest. Much time and money has been spent since the passage of the Lempert-Keene-Seastrand Oil Spill Prevention and Response Act to model the expected movement of spilled oil and estimate the probability of oiling the sensitive shorelines of San Francisco Bay (NOAA 2002). To date there has been no objective assessment of the accuracy of these models. Debris washes ashore throughout much of San Francisco Bay. Bands of debris on the shoreline were observed by OSPR staff during field trips made in the early 1990s to verify the presence of sensitive and vulnerable living resources and to develop response strategies to protect those resources (USCG, 2000). We quickly recognized that the presence of debris was an indicator of the risk of shoreline oiling. The investigators wish to use aerial photography to evaluate the risk of shoreline oiling and rank shorelines according to the amount of debris that has collected.

Cost: \$83,456 **Duration:** 2 - 3 years

8. Project Title: Monitoring Dispersed Oil and Its Effect in the Sea

OSPR Sponsor: Walter Nordhausen, Ph.D, California Department of Fish and Game, Office of Spill Prevention and Response: wnordhausen@ospr.dfg.ca.gov

PROBLEM STATEMENT AND JUSTIFICATION

The application of dispersants during oil spill responses calls for the use of the NOAA UF/Fluorescence-based SMART (Scientific Monitoring of Advanced Response Technologies). These Protocols are intended to provide a rapid quantitative field method for measuring water column concentrations of naturally- and chemically-dispersed oil (Henry et al. 1999; SMART 2000); however, the instruments are calibrated against a fluorescein dye (rather than oil), and the approach has never been calibrated against separate measurements of dissolved- and dispersed oil-droplet phases in the water column in the field.

In addition to this shortfall, the SMART protocol does not include sampling, measurements, or observations of natural resource impacts. This deficiency and resulting uncertainty is only compounded by the effect influence of the environmental conditions on the overall impact to water column organisms as described above. Such monitoring is essential to the evaluation of environmental trade-offs justified as a decision to use dispersants under certain circumstances. Natural Resource Damage Assessment will be absent critical quantitative and qualitative information without a sound methodology for collection of water column data.

OBJECTIVES AND SIGNIFICANCE TO OSPR

Impacts to the environment are inevitable in the event of oil spills, and the Office of Spill Prevention and Response (OSPR) is tasked with minimizing these impacts to California's natural resources. Thus, the objective of this work is to develop an approach to monitor and evaluate impacts to aquatic organisms after a spill where dispersants are used or contemplated. The information gained from such a plan is needed to evaluate natural resource impacts which will be useful for Natural Resource Damage Assessments and could potentially effect decision making during future spills.

Cost: \$47,000 **Duration:** 2years

9. Project Title: Integration of satellite imagery with Surface Current Mapping radar in near real time

OSPR Sponsor: Judd Muskat California Department of Fish and Game, Office of Spill Prevention and Response, 1700 K St., PO Box 944209, Sacramento, CA 94244-2090, jmuskat@dfg.ca.gov: (916) 324-3411

Objectives: We propose to develop the methods for correlating satellite imagery with surface current velocity vectors in near real time to produce a tool for improved understanding of surface circulation. This program will advance fulfillment of three of the SSEP program intents: a) investigation and evaluation of applied prevention and response programs and technologies; e) best achievable protection strategies; i) baseline monitoring information.

Cost: \$150,000 **Duration:** 3 years

10. Project Title: DEVELOPMENT AND EVALUATION OF A COST-EFFECTIVE AERIAL IMAGING SYSTEM FOR OIL SPILL AND COASTAL IMPACT MONITORING.

OSPR Sponsor Investigator: Mr. Judd Muskat, CDFG OSPR 1700 "K" Street, Sacramento, CA 95814 (916) 324-3411, JMuskat@dfg.ca.gov

HYPOTHESES AND OBJECTIVES: Satellite and aerial imaging can, in principle, provide a convenient means to detect and precisely map marine and terrestrial oil spills and seeps, and to monitor the environmental effects of oil impacted soils. Significant advances have been made (primarily in Europe and Canada) in oil spill detection capabilities by UV/Vis/IR sensors and Synthetic Aperture Radars (SARs) (e.g. 1,2). Although utilized to aid oil spill recognition in Europe, satellite sensors have a number of disadvantages for their routine use in spill monitoring. These include low revisit frequency (2-6x/month), relatively low spatial resolution, high cost, and high false target occurrence. Aerial sensors offer the advantages of on-call availability, very high resolution, and various enhancements to minimize false targets. Very few aircraft SARs exist, however, and their use is extremely expensive. Likewise, most UV/Vis/IR sensors that have been shown to effectively detect oil-impacted surfaces are hyperspectral instruments which are expensive to operate and often difficult to mobilize and use. Our premise is that full hyperspectral capabilities are not required for efficient oil detection. A cost-effective, easy-to-

mobilize aerial sensor offering 4 wavelength channels spanning the UV/Vis/NIR range can be configured to provide adequate data for oil detection to support a variety of OSPR's activities.

Cost: \$101,155 **Duration:** 2years

11. Project Title: Natural & Human Oil & Gas Seeps at Summerland Assessing Risks with Potential Mitigation Strategies

OSPR Sponsor: Ken Wilson, California Department of Fish and Game, Office of Spill Prevention and Response, Santa Barbara CA. kwilson@ospr.dfg.ca.gov

RESEARCH HYPOTHESES

The primary research hypothesis is that oil seepage off Summerland beach exhibits interconnectedness between vents and wells. Interconnected seepage implies mitigation strategies at one leaking site will impact other vents (natural and anthropogenic).

A second research hypothesis is that oil emissions are transiently stored in kelp beds and seabed depressions leading to gradual, episodic, or periodic releases of oil from these reservoirs. Field demonstration helps decide if certain mitigation strategies are appropriate.

A third research hypothesis is that oil saturated sand and sediments play a significant role in determining the distribution, timing, and quantity of oil escaping from the seabed. Understanding the role of oil saturated sand and sediments helps determine whether or not mitigation strategies are appropriate.

Cost: \$50,753 **Duration:** 1.5 years