

FY16 PROJECT PROPOSAL SUMMARY PAGE
Continuing, Multi-Year Projects

Project Title: Long-term Oil Monitoring: Lingering Oil - Extending the Tracking of oil levels and weathering (PAH composition) in PWS through time

Project Period: February 1, 2016 – January 31, 2017

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Study Location: Sites in western Prince William Sound with persistent oil

Project Website: <http://www.gulfwatchalaska.org/monitoring/lingering-oil/lingering-oil-weathering-and-tracking/>

Abstract*:

This project is a component of the integrated Long-term Monitoring of Marine Conditions and Injured Resources and Services submitted by McCammon et al. The goal was to provide the EVOSTC with an assessment of persistent Exxon Valdez oil in Prince William Sound, describe its chemical characteristics, and initiate a routine, long-term monitoring program that will resample the same sites every five years over the next 20 years. The field work for the first sampling was completed earlier this year and laboratory analyses are underway. Beach sampling was similar to surveys conducted by Auke Bay Laboratories during 2001 to 2005. Sediment samples were collected to estimate amounts of remaining oil and passive samplers were deployed to provide information about biologically available oil. Objectives are to complete the laboratory analysis and 1) fingerprint oil, 2) determine oil sources, 3) report oil persistence and weathering over decades, 4) determine biological availability, 5) produce a synthesis report, and 6) archive hydrocarbon data in the Trustee-sponsored hydrocarbon database. These data, together with the recently completed retrospective analysis of biomarkers (which are the most environmentally persistent components of the oil), will help investigators understand potential exposure levels (past and present) and linkages to species at higher trophic levels.

Estimated Budget:

EVOSTC Funding Requested* (must include 9% GA):

FY12	FY13	FY14	FY15	FY16	TOTAL
\$19.6	\$13.1	\$8.7	\$169.2	\$6.5	\$217.1

Non-EVOSTC Funds to be used:

FY12	FY13	FY14	FY15	FY16	TOTAL
\$50.0	\$50.0	\$50.0	\$50.0	\$50.0	\$250.0

* Figures given in \$1,000 increments

Date: September 1, 2015

I. EXECUTIVE SUMMARY

Intertidal areas in western Prince William Sound were extensively coated with Exxon Valdez oil [1]. Oil remains in many beaches [2, 3], presumably with declining impacts on intertidal invertebrates (such as mussels [4, 5]) and predators such as sea otters and harlequin ducks [6-9]. Nine of the worst case sites were revisited in 2015 to continue the long term data set that tracks oil quantity and weathering composition in contaminated sediments, and established as long term oil monitoring sites to be re-sampled every 5 years over the next 20 years (Figure 1). Sites with a history of persistent subsurface oil were prioritized for monitoring based on: heavy subsurface oil surveyed in most recent years, a variety of shore types prone to oil retention, and those sites with a high probability of persistent oil [10]. The field work for the first sampling was completed earlier this year and laboratory analyses are underway. See Table 1 for sampled beaches.

Project objectives are to complete the laboratory analysis and 1) fingerprint oil, 2) determine oil sources, 3) report oil persistence and weathering over decades, 4) determine biological availability, 5) produce a synthesis report, and 6) archive hydrocarbon data in the Trustee-sponsored hydrocarbon database.

Fingerprinting oil will allow us to understand contamination source(s) and how they might influence aforementioned biota (objectives 1 and 2). Samples collected earlier this year will be analyzed to accomplish these objectives in FY16. Data will include PAHs, which can be modeled for source composition, geochemical biomarkers (triterpanes, hopanes, and steranes), which are particularly useful in definitive oil identification, and alkanes, which may provide additional insight on oil condition and source(s).

This project will produce a report in FY16 that reports current amounts of oil retained in beaches, including percent incidence, oiled area, and gravimetric estimates of oil mass (objective 3). These data will be combined with preceding time-series data to estimate oil persistence and re-assess long-term trends. The chemical analyses underway will allow us to estimate how much the oil has weathered, and this information will be compared to previous weathering data.

Passive samplers deployed in June 2015 during site surveys will be processed for hydrocarbons and assessed for biological availability (objective 4). These serve as surrogates for biological availability [11]; their 10 day deployment period coincided with sample dates (June 12 to June 21). All passive samplers were retrieved before beach disturbance. Total PAH estimates will provide estimates of exposure and contamination levels. As with sediments, the PAH composition in these samples should provide hydrocarbon source information, although this information will be less precise because at least two compartments (oil and water) are required for molecules to transfer into the samplers and thermodynamic processes (weathering) change composition.

This project will integrate previous survey and hydrocarbon data to produce a synthesis report and archive all analytical chemistry data in the hydrocarbon database (objectives 5 and 6). Thus, this project fills three needs: (1) understanding exposure levels (past and present) for species such as mussels, intertidal invertebrates, sea otters, and harlequin ducks, (2) understanding the natural degradation of quantity and composition of PAH over a long time course, and (3) definitive long-term source identification by triterpane, hopane, and sterane measurement. Understanding exposure doses is important to injured species, and this will complement biochemical biomarker evidence (cytochrome P4501A induction) of lingering exposure on sea otters and harlequin ducks [6-9]. Understanding oil loss over time and the probability of biological exposure is important for understanding full recovery of the habitat; in Alaska, this time course is apparently longer than in

lower latitude environments. This study complements and extends previous work, including the remediation studies by Boufadel in 2011-12 as well as the Irvine study outside of PWS in 2011-12.



Figure 1. Prioritized sites surveyed during June 2015 for monitoring lingering oil in western Prince William Sound.

Table 1. Long-term oil monitoring sites.

Location Name	Shore Segment	Initial oiling/cleanup	Remediation	Oil Survey Excavation History	Shore type prone to persistent oil	Michel Model Heavy SSO
1 Smith Is.	SM006B	Heavy oil 1990-1993	Boufadel 2005-12	1989-921, 20013, 20084	armored	>30%
2 Northwest Bay, Eleanor Is.	EL056C	Medium oil 1990-1993	Boufadel 2005-12	20013, 20074	rubble accumulations	>30%
3 Northwest Bay, Eleanor Is.	EL058B	Heavy oil 1989 only	Boufadel 2005-12	20013, 20053	breakwater	>30%
4 Sleepy Bay, Latouche Is.	LA018A-1	Heavy oil 1990-1993		1989-921, 20013, 20053	rubble, slope	5-15%
5 Green Is.	GR103B	Heavy oil 1990-1993		20013, 20053, 20074	armored, slope	1-5%
6 N. Evans Is.	EV039A	Heavy oil 1990-1993	PES-51® 1997	19932, 20053	edge effect	1-5%
7 Herring Bay, Knight Is.	KN0114A	Heavy oil 1990-1993		2003 3	breakwater	>30%
8 Herring Pt., Knight Is.	KN0300A-2	Medium oil 1990-1993		19932, 20053	breakwater	1-5%
9 Herring Pt., Knight Is.	KN0506A	Heavy oil 1990-1993		20013, 20053	edge effect	0-1%

Note for oil survey excavation history: 1. NOAA ORR surveys; 2. Gibeaut surveys; 3. NOAA ABL surveys; 4. Michel surveys.

II. COORDINATION AND COLLABORATION

A. Within a EVOTC-Funded Program

This study is closely linked with the benthic component of the Gulf Watch Alaska program and is designed to provide insight into the persistence and nature of EVO in the nearshore ecosystem and a method for long term monitoring. Contaminant samples (mussels and sediments) collected by the benthic component surveys have been sent through Auke Bay Laboratories (ABL) to maintain proper handling and chain of custody. Analyses not provided by ABL were managed by ABL staff to other NOAA contracted labs. ABL staff has also been available for interpretation of these analyses for deliverables and publications.

This project provides a chemical frame of reference for other studies in PWS and the Gulf of Alaska, including 1) definitive long-term source identification of lingering oil, (2) the weathering status of lingering oil, and 3) an understanding of exposure levels (past and present) for key prey species being monitored by the benthic component such as mussels for sea otters and sea ducks. This study complements and extends previous lingering oil work [2, 3, 10, 12, 13], continued management of the Trustee hydrocarbon database, analyses for the remediation studies by Boufadel during 2011-2012, and long term monitoring by Irvine studies outside of PWS [14-16].

B. With Other EVOSTC-funded Projects

N/A

C. With Trustee or Management Agencies

NOAA has trust responsibilities for oil spill response and restoration. Data collected under this study furthers our understanding of oil persistence in coastal habitats.

III. PROJECT DESIGN – PLAN FOR FY16

A. Objectives for FY16

Objectives are to complete the laboratory analysis and 1) fingerprint oil, 2) determine oil sources, 3) report oil persistence and weathering over decades, 4) determine biological availability, 5) produce a synthesis report, and 6) archive hydrocarbon data in the Trustee-sponsored hydrocarbon database.

B. Changes to Project Design

N/A

IV. SCHEDULE

A. Project Milestones for FY 16

Objective 1. Fingerprint oil. January 2016.

Objective 2. Determine oil sources. February 2016

Objective 3. Report oil persistence and weathering. Rough draft report April 2016

Objective 4. Determine biological availability. February 2016

Objective 5. Produce a synthesis report; rough draft April 2016

Objective 6. Archive hydrocarbon data. February 2016

B. Measurable Project Tasks for FY 16

FY 16, 1st quarter (February 1, 2016 - April 31, 2016)

Continue analyses

November: Attend Gulf Watch PI meeting

January: Attend AMSS

February: Annual Report to EVOTC

FY 16, 2nd quarter (May 1, 2016-July 30, 2016)

June: Complete & submit final report

FY 16, 3rd quarter (August 1, 2016 – October 31, 2016)

September: Complete all metadata and post data on Ocean Workspace

FY 16, 4th quarter (November 1, 2016- January 31, 2017)

N/A

V. PROJECT PERSONNEL – CHANGES AND UPDATES

N/A

VI. BUDGET

A. Budget Forms (Attached)

Completed budget forms have been provided.

B. Changes from Original Proposal

The project budget remains as proposed and implemented.

C. Sources of Additional Funding

NMFS equipment and expertise, including unfunded labor, are essential to completion of this project

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- [12] Short JW, Lindeberg MR, Harris PM, Maselko JM, Pella JJ, Rice SD. 2004. Estimate of oil persisting on the beaches of Prince William Sound 12 years after the Exxon Valdez oil spill. *Environmental Science & Technology* 38:19-25.
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- [15] Irvine GV, Mann DH, Short JW. 2006. Persistence of 10-year old *Exxon Valdez* oil on Gulf of Alaska beaches: The importance of boulder-armoring. *Mar Pollut Bull* 52:1011-1022.
- [16] Irvine GV, Mann DH, Short JW. 1999. Multi-year persistence of oil mousse on high energy beaches distant from the Exxon Valdez spill origin. *Mar Pollut Bull* 38:572-584.