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GEM PROPOSAL SUMMARY PAGE

Project Title: Lingering oil and sea otters: Pathways of exposure and recovery status (continuation of project 030620)

Project Period: FY 04- FY 06

Proposer(s): James L. Bodkin and Brenda E. Ballachey, Alaska Science Center, USGS, 1011 E. Tudor Road, Anchorage, Alaska, 99503 (907) 786-3550

Study Location: Prince William Sound

Abstract: Some of the strongest evidence of continuing effects of lingering oil from the Exxon Valdez oil spill comes from long term monitoring of sea otter populations and their exposure to hydrocarbons. Population recovery remained incomplete as of 2002, and individual sea otters continue to exhibit elevated levels of the Cytochrome P450 1A biomarker in areas where lingering oil deposits are most prominent. Work in progress is quantifying home ranges of sea otters at northern Knight Island relative to known intertidal lingering oil deposits, but relocation sampling limits our ability to link foraging behaviors to oiled shorelines. To address the question of where individuals are foraging relative to lingering oil requires data on foraging depths. In 2003 USGS will be instrumenting 20 of the radio-instrumented sea otters at Knight Island with time-depth-recorders. These instruments will provide accurate information on the proportion of each individuals foraging that occurs in intertidal habitats, the area where known oil deposits remain, for one full year. Surveys of population size and individual P450 measures will provide continuing information on population trend and individual exposure to lingering oil.

Funding:	EVOS Funding Requested:	FY 04	\$ 134,200	
		FY 05	\$ 26,200	
		FY 06	\$ 6,500	TOTAL: 146,000
	Non-EVOS Funds to be Used:	FY 04	\$ 86,000	
		FY 05	\$ 46,000	
		FY 06	\$ 12,000	TOTAL: 144,000

Date: 11 June, 2002

GEM RESEARCH PLAN

Lingering oil and sea otters: Pathways of exposure and recovery status
(continuation of project 030620)
Jim Bodkin, Brenda Ballachey

I. NEED FOR THE PROJECT

A. Statement of Problem

Lingering oil from the *Exxon Valdez* oil spill persists in intertidal habitats in western Prince William Sound, and is particularly evident in those bays and passages where oiling was most severe in 1989. Further, evidence throughout the nearshore trophic web indicates an invertebrate pathway of exposure to upper trophic levels, including sea otters and sea ducks, with chronic effects resulting in delayed ecosystem recovery (Dean et al. 2000, Trust et al. 2000, Esler et al. 2000, Fukuyama et al. 2001, Bodkin et al. 2002, Esler et al. 2002). Studies conducted in 2001-2003 (EVOS projects 02585 and 030620) have documented the extent of residual oiling throughout the western Sound and the bioavailability of the oil to predators and their prey populations. Aerial surveys of sea otter abundance through 2002 fail to demonstrate population recovery in heavily oiled areas, and the biomarker of exposure to aromatic hydrocarbons, cytochrome P4501A (CYP1A), remains elevated among sea otters where recovery has not occurred (Bodkin et al. 2002). Radio-telemetry studies conducted in 2002-03 (EVOS project 030620) have documented home ranges and areas of use by sea otters in three heavily oiled locations in western Prince William Sound: 1) Herring Bay, 2) Bay of Isles, and 3) Lower Passage (Figure 1). Although relocations provide reasonable estimates of home ranges, inferring use of particular habitats (such as oiled shorelines) within those home ranges remains problematic because observation time encompasses such a small percentage (estimated at about .01-.02%) of the total time an individual occurs within its home range. Additionally, strong individual variation in foraging behavior, including diet and depth (Estes et al. 2003), likely contribute to variation in exposure to lingering oil among individuals. In 2003, we will be recapturing and re-sampling CYP1A in those sea otters instrumented with radios in 2002. USGS will be instrumenting 20 of these individuals with time-depth-recorders (TDR's) as part of their base sea otter research program. TDR's will provide continuous dive depth information on each individual for about 360 days, allowing identification of intertidal foraging, particularly in relation to known home ranges and shorelines serving as repositories for residual *Exxon Valdez* oil.

B. Relevance to GEM Program Goals and Scientific Priorities

Recovery of the Prince William Sound ecosystem from the *Exxon Valdez* oil spill may not be considered complete until individuals are no longer exposed to spilled oil and when populations reach pre-spill levels of abundance. Clearly, sea otters have not attained these recovery goals. The proposed work will allow continued evaluation of the state of the affected sea otter populations, through continued estimates of sea otter population size and quantification of a biomarker of hydrocarbon exposure. Further, the proposed collaborative effort will identify those nearshore habitats that may be responsible for providing exposure to lingering oil and, therefore, where restoration efforts may be of greatest potential benefit to nearshore species as a

group. The proposed work directly addresses items contained in the 2004 invitation for proposals pertaining to population data and foraging activities of sea otters in oiled areas.

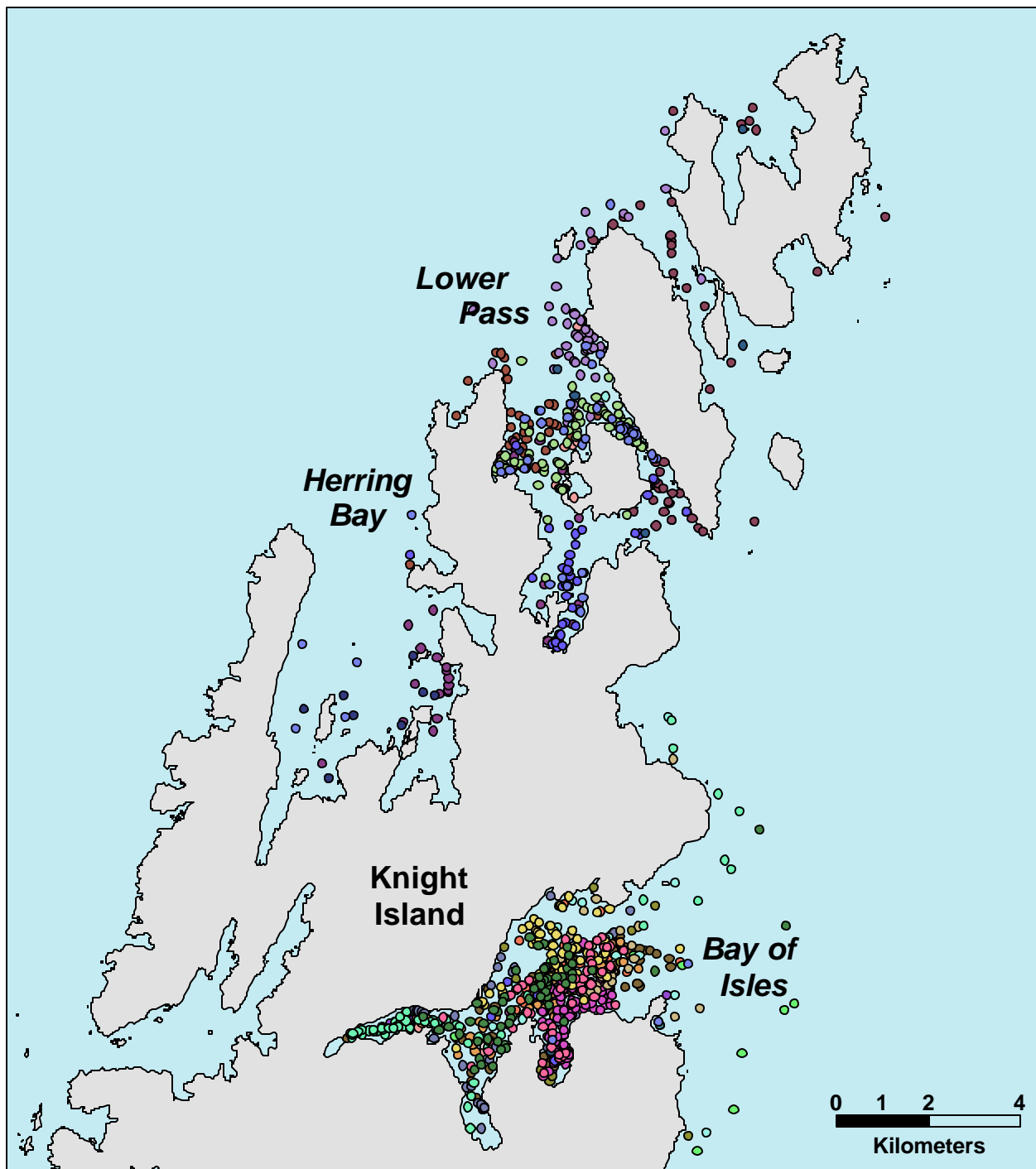


Figure 1. Locations of 27 individual sea otters instrumented with radio transmitters at Knight Island in July 2002. Each color represents an individual and not all re-sights are observable in the figure due to overlap. The number of relocations ranges from 26-142 per individual

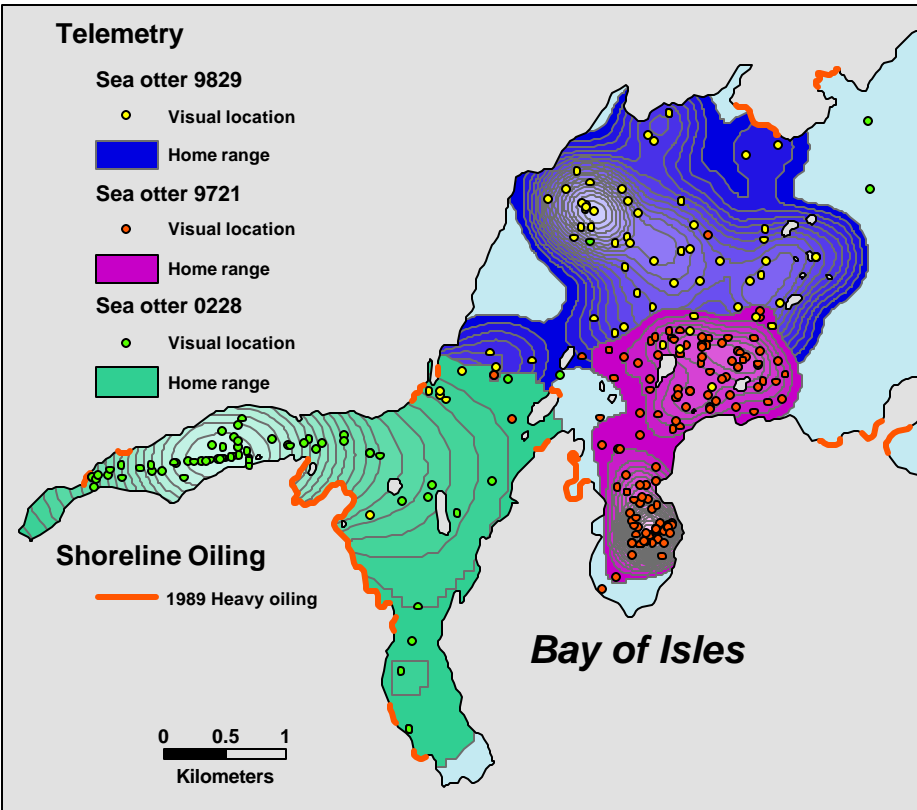


Figure 2. Kernal home ranges of three individual male sea otters in Bay of Isles and the proximity of home ranges and activity centers to known heavily oiled shorelines in 1989. Completion of the mapping of oiled shoreline habitats in 2003 will allow similar analyses with contemporary oiled habitats. Preliminary analyses indicate not all individuals are equally exposed to lingering oil.

II. PROJECT DESIGN

A. Objectives

Objective 1. Conduct an aerial survey of sea otters in western Prince William Sound, including the heavily oiled areas of the northern Knight Island Archipelago.

H_0 : Sea otter population size in western Prince William Sound, or the northern Knight Island Archipelago, does not differ in 2002 from prior years.

Estimates of sea otter population size provide perhaps our best measure of the current status of sea otter populations affected by the *Exxon Valdez* oil spill. Standardized surveys have demonstrated an increase in western Prince William Sound (Figure 2), yet fail to demonstrate any increase in population size in the heavily oiled area of northern Knight Island since 1993 (Figure 3). Continued surveys likely will provide our most direct measure of population recovery.

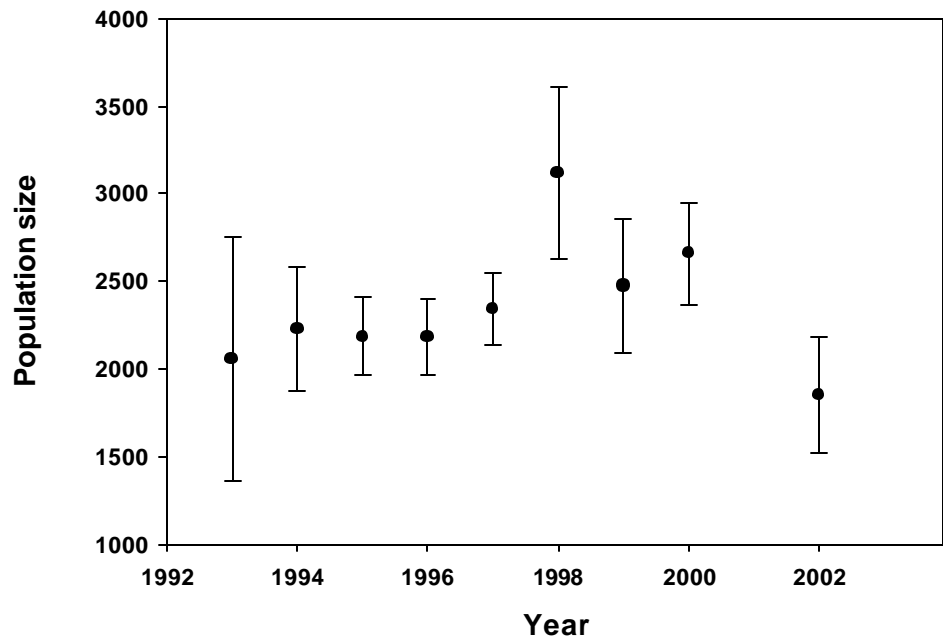


Figure 2. Western Prince William Sound sea otter population size estimates (\pm se), 1993-2002 (except 2001).

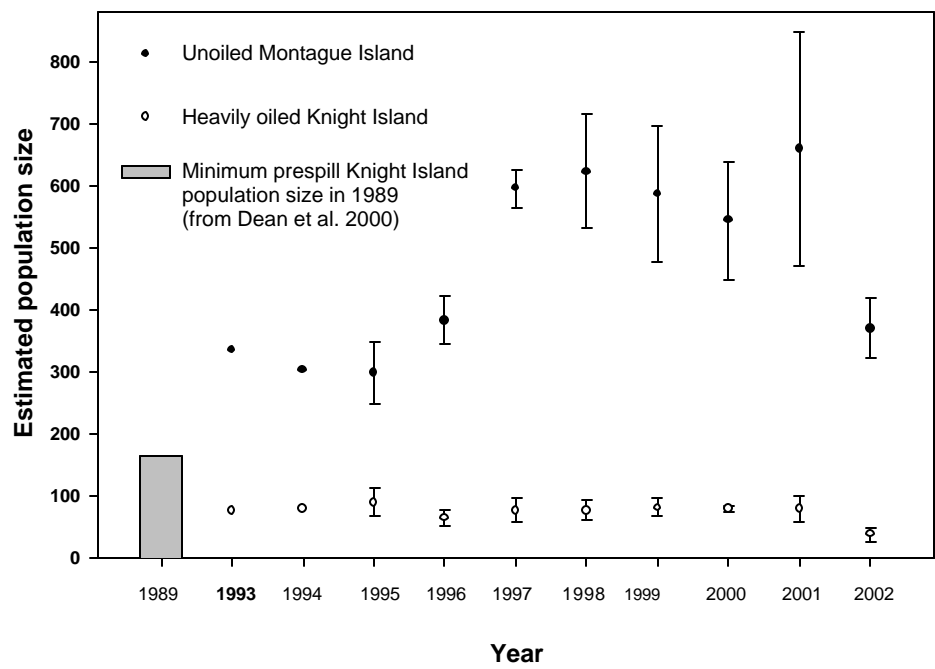


Figure 3. Sea otter population size estimates from unoiled Montague and heavily oiled Knight Island, Prince William Sound, AK, 1989-2002.

Objective 2. Instrument a sample of 20 sea otters in the northern Knight Island Archipelago with archival TDR's.

H_0 : Dive depth distributions of sea otters in Western Prince William Sound do not differ among individuals.

H_0 : Is the proportion of time sea otters spend foraging in shallow water habitats in or near locations of residual oil in western Prince William Sound related to their P4501A measures?

Lingering *Exxon Valdez* oil occurs in intertidal habitats, particularly at northern Knight Island. Sea otters are known to forage between the intertidal and about 100 m depth, but there is considerable variability among individuals in the proportion of forage dives at shallower depths (Figure 4). In western Prince William Sound, the available data on movements and behaviors of sea otters do not allow estimation of the time individuals utilize intertidal habitats. Deployment of TDR's will provide data on preferred forage depths of individual animals, and facilitate our understanding of the observed variability in measures of oil exposure (see Objective 3).

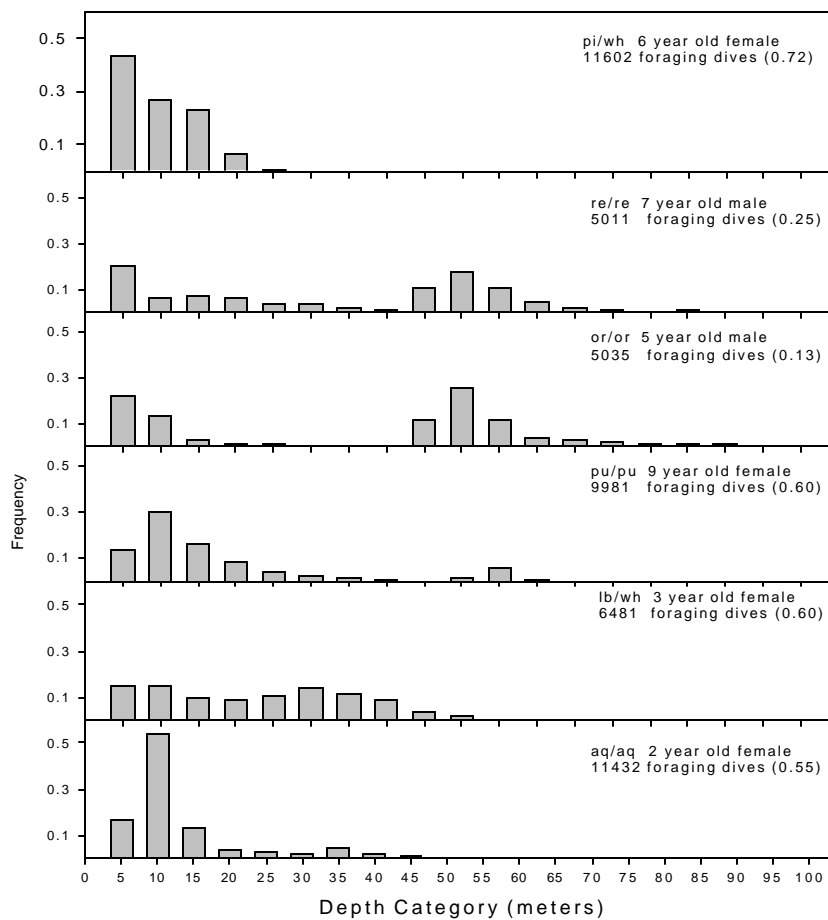


Figure 4. Distributions of forage dive depths of six individual sea otters from Southeast Alaska, resulting from time-depth recorder technology.

Objective 3. Measure Cytochrome P4501A values in the sample of 20 sea otters instrumented with TDR's.

H₀: Cytochrome P450 values do not differ among individuals foraging intertidally and in subtidal habitats,

H₀: Cytochrome P450 values do not vary over time.

Measurement of CYP1A in sea otters from heavily oiled Knight Island compared to unoiled Montague Island have demonstrated significant exposure to aromatic hydrocarbons at Knight Island; significant differences between the two areas have persisted through summer 2002 (Figure 5). However, over time the magnitude of the difference between areas has been diminishing, suggesting gradual recovery (Ballachey et al. 2001, Bodkin et al. 2002, USGS unpub. data). If differences between Knight Island and baseline extend through 2004, we will use these data to project a predicted point in time where biomarker values at Knight may attain the background levels measured at Montague Island.

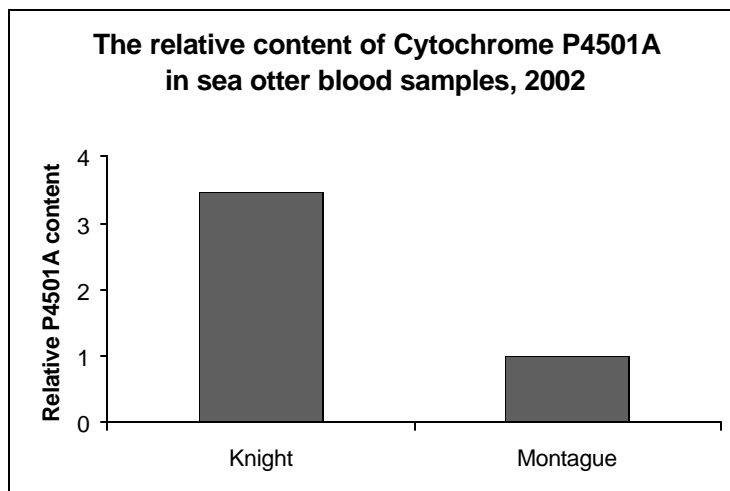


Figure 5. Relative cytochrome P4501A (CYP1A) content of blood lymphocytes from sea otters at oiled northern Knight Island and unoiled Montague Island, July 2002. (Note: mRNA for CYP1A quantified using real time PCR, and expressed in graph as CYP1A mRNA relative to mRNA for the housekeeping gene 18SrRNA).

B. Procedural and Scientific Methods

Objective 1. Aerial Surveys

We will continue to use previously developed aerial survey techniques which employ standardized strip transect counts along survey lines, and intensive search units (ISU's) to estimate a correction factor for each survey (Bodkin and Udevitz 1999). We will conduct a single survey of the entire western Sound in 2004. We will also conduct replicate surveys (3-5

replications per survey) of the heavily oiled northern Knight Island study site (previously sampled in the Nearshore Vertebrate Predators project and projects 02423 and 030620). Results of proposed surveys provide unbiased estimates of population size and density. Proportional standard errors of past surveys in Prince William Sound range from 0.09-0.18

Objective 2. Determine Foraging Depths

A key linkage between elevated biomarker levels in sea otters and lingering oil in nearshore habitats is the use of those nearshore habitats by sea otters that have elevated biomarkers. In 2002, 27 sea otters were captured, sampled for blood and liver biomarkers and instrumented with VHF radio transmitters under EVOS project 03620 (Lingering oil and predators: pathways of exposure and population status). These animals provide a sample of sea otters with measures of relatively recent (blood and liver CYP1A) and potential longer-term (liver histopathology) exposure to hydrocarbons. Further, monitoring the radioed individuals has provided estimates of their home ranges that include measures of proximity to known oiled shorelines (Figure 1). While the results of the radio-telemetry work clearly demonstrate the spatial relations between shorelines with known lingering oil and the home ranges of individual sea otters, the extent to which individual sea otters are using intertidal habitats within their home ranges remains unknown. In 2003, we will implant 20 TDR's into a subset of the 27 sea otters instrumented with radios in 2002. TDR's are an appropriate tool for addressing the question of foraging locations because they provide a continuous record of forage depths over long time periods. These instruments will record pressure (depth to within 0.25 m) at 4-second intervals for approximately 360 days. Data reduction from these readings will yield a continuous record of the diving of the individual, in terms of depth, duration of dive, surface interval, rate of descent and ascent and bottom time. Combined with relocation data accumulated over up to two years and the home range estimates, we will be able to identify the proportion of diving that occurs within the intertidal range of shorelines known to harbor residual oil. This information will allow us to identify those individuals most likely to be exposed to oil in the intertidal, and identify those shorelines at which restoration would most aid recovery of sea otters.

We are requesting under this proposal funds to supplement tracking of these individuals in 2003/2004 and to recapture, resample biomarkers, and recover the TDR's in summer 2004. We will also monitor survival of the instrumented otters by weekly aerial tracking flights to locate individual sea otters through July of 2004.

Sea otter home ranges are relatively small (Garshelis and Garshelis 1986, Riedman and Estes 1990), usually encompassing a few to ten's of km of shoreline. At least for some individuals, fidelity to foraging locations can be high, and dietary preferences can remain consistent over annual to decadal time scales (Riedman and Estes 1990, Estes et al. 2003). This combination of small home ranges, and forage depth and dietary specialization will allow confidence in conclusions regarding potential sources of exposure at the level of the individual sea otter.

Objective 3. Monitor Exposure to Lingering Oil

Elevations in CYP1A in sea otters captured at northern Knight Island do not appear to be due to background or natural hydrocarbon sources, as these were found to be negligible in intertidal areas of Prince William Sound (Short and Babcock 1996), nor to differential contamination of areas by PCBs (Trust et al. 2000; USGS unpub. data). Continued exposure to residual *Exxon*

Valdez oil is the most plausible explanation for CYP1A elevations. Residual oil is still stranded in intertidal areas of Prince William Sound (Babcock et al. 1996, Brodersen et al. 1999, Carls et al. 2001, Hayes and Michel 1999), providing a continuing potential source of contamination. However, the locations where sea otters may be acquiring continuing exposure to residual oil remained largely unknown until 2001/2002. With the data now available on distribution and abundance of lingering oil, we can identify those locations where sea otters and sea ducks are most likely acquiring their continued exposure, and prioritize areas for restoration. Further, we can evaluate relations between exposure of those individuals, based on their foraging locations and depths, their health and their subsequent survival.

As in past years, the CYP1A biomarker will be measured using peripheral mononuclear blood cells collected by jugular venipuncture (Ballachey et al. 2001). The cells are isolated from the blood in the field, cryopreserved in liquid nitrogen, and subsequently shipped to Purdue University for analyses in the laboratory of Dr. Paul Snyder. Previous assays of CYP1A on the blood cells have been done with a reverse transcriptase PCR assay (Snyder et al 2001). However, with the 2002 and 2003 samples, we are examining the utility of an improved (and potentially more sensitive) molecular assay, using real-time PCR. If we demonstrate a high correlation between CYP1A induction measured by the two assays, subsequent analyses on the 2004 samples will utilize only the real-time PCR method. However, if the correlation is not high, all samples will be assayed by the reverse transcriptase methods to assure comparability with data collected in previous years.

In addition to sampling blood for the CYP1A biomarker, we routinely collect blood and ship it to Quest Laboratories (Portland, OR) for hematology and clinical chemistry panels, which provide a general picture of animal health as well as supplementary data on liver and kidney function. We will also collect a small (approximately 2 mm) liver biopsy that will be fixed in formalin and examined histologically for abnormalities in the liver cells.

The proposed research will provide a means to relate observed levels of CYP1A induction and liver histopathology in sea otters from heavily oiled areas of northern Knight Island to locations and depths where those individuals forage. Although essentially all sea otters sampled at Knight show at least a low level of induction, only a small proportion exhibit relatively high CYP1A levels. Thus, it appears likely that exposure may vary across individuals, with only a small proportion of the animals using areas where oil is persistent, as opposed to all animals using all habitats equitably. This research also provides the opportunity to relate the abundance and behavior of sea otters to the proximity of lingering oil. Once sea otter density, foraging depths, and oil exposure history can be tied to known patches of lingering oil, direct restoration measures and locations can be identified and prioritized.

C. Data Analysis and Statistical Methods

Aerial survey data will be collected and analyzed following procedures described in detail in Bodkin and Udevitz (1999). The observer, pilot, and plane will be the same as in prior years (1994-2002).

TDR data will be analyzed with Dive Analysis software (Wildlife Computers, Redmond, WA). Dive types will be classified by function as either; foraging, traveling, or other, based on dive attributes of observed dives with known functions (Bodkin et al. submitted). Data output will

consist of a proportional frequency distribution of dive depths in 5 meter increments from zero depth (the intertidal zone). Because all dives will be recorded between deployment and recovery, there will be no sampling error, and dive classification error rates are expected to be about 0.03 (Bodkin et al. submitted).

Blood and Liver Cytochrome P4501A

CYP1A data on a subset of sea otters will be obtained by both the reverse transcriptase and the real-time PCR assays. If there is a high correlation between the two methods, further analyses will be by the real-time PCR technique, and data from previous years will be transformed so that all years are comparable. An ANOVA will be conducted on the full data set (2 areas: northern Knight and Montague; 7 years: 1996-98, 2001-2004). Additionally, based on a regression analysis (CYP1A values by year), we will predict the point in time when CYP1A values, and exposure to aromatic hydrocarbons, will return to background levels at northern Knight Island.

D. Description of Study Area

The aerial surveys will be conducted in western Prince William Sound, with intensive replicate surveys at northern Knight Island. Sampling of oiled and unoiled shoreline segments for the abundance and behaviors of sea otters will be conducted at northern Knight Island. Oiled and unoiled shoreline segments identified from project 02585 and 030620 (NOAA and USGS) will serve as the foundation for our study design relating sea otter home ranges and foraging depths to oil exposure histories and potential use of oiled shorelines. Capture and relocations have been centered in Lower Passage (60.501, -148.667) and Bay of Islands (60.400, -148.667) at northern Knight Island, although relocations of some individuals have been recorded up to 24 km away from their capture location. Locations of observations will depend on animal movements and to date, all but a very few observations have been at Knight Island.

E. Coordination and Collaboration with Other Efforts

The proposed work builds on the long history of EVOS and Department of Interior study of sea otters in Prince William Sound (Nearshore Vertebrate Predator project, Doroff et al. 1994, Ballachey et al. 1994, Bodkin et al 1999, Bodkin et al 2002). Prior project numbers include 99025, 02423, 02585, and 03620. The scope of prior work includes annual sea otter population size estimates since 1993, estimates of reproduction, survival and mortality, diet, size and condition, and movements and home ranges. Assays of the CYP1A biomarker have been conducted since 1996 (no samples were collected in 1999 or 2000). The proposed work will utilize the results of NOAA (Auke Bay Laboratory) studies on the presence, distribution and abundance of oiled habitats at Northern Knight Island in 2001-2003, in terms of identifying proximity and foraging depths in relation to lingering oil. Surveys of sea otter abundance will be plotted with historic data to evaluate progress toward a recovery endpoint defined by estimated pre-spill abundance. Biomarker data will be contrasted to data collected in the same locations, and from some of the same individuals, during the period 1997-2002. Such contrasts will allow evaluation of trends observed from 1996-2002, suggesting a decline in the magnitude of the difference between oiled and unoiled habitats. Approximately 45% of the total cost of the work proposed for FY04 and FY05 will be funded by the Alaska Science Center, USGS, in the form of instrument acquisition (\$40,000), vessel support (\$8,000) salary costs (\$84,000) and facilities and equipment (\$12,000).

III. SCHEDULE

A. Project Milestones

For each project objective listed above (II.A.), specify when critical project tasks will be completed. Project reviewers will use this information in conjunction with annual project reports to assess whether projects are meeting their objectives and are suitable for continued funding. Please format your information like the following example.

- Objective 1. Aerial Surveys
Data acquisition to be completed by August 2004
Data analysis to be completed by December 2005
- Objective 2. Determine Foraging Depths
Data acquisition to be completed September 2004
Data analysis to be completed by April 2005
- Objective 3. Monitor Exposure to Lingering Oil
Data acquisition to be completed by November 2004
Data analysis to be completed by April 2005

B. Measurable Project Tasks

- FY 04, 1st quarter (October 1, 2003-December 31, 2003)
Initiate monitoring of instrumented individual locations
- FY 04, 2nd quarter (January 1, 2004-March 31, 2004)
Continue monitoring of instrumented individual locations
- FY 04, 3rd quarter (April 1, 2004-June 30, 2004)
Continue monitoring of instrumented individual locations
- FY 04, 4th quarter (July 1, 2004-September 30, 2004)
Continue monitoring of instrumented individual locations
- July 2004
Initiate recapture and recovery of instrumented sea otters
Obtain biomarker samples
- Aug-Sept. 2004
Initiate data recovery and analysis (surveys, TDR and Biomarker)
Submit annual report
- FY 05, 1st quarter (October 1, 2004-December 31, 2004)
Continue data analysis (January 1, 2005-March 31, 2005)
Annual GEM Workshop
- FY 05, 3rd quarter (April 1, 2005-June 30, 2005)
April 15
Submit final report to Trustee Council Office
- FY 06, 2nd quarter
Present results of project at Marine Mammal Conference

IV. RESPONSIVENESS TO KEY TRUSTEE COUNCIL STRATEGIES

A. Community Involvement and Traditional Ecological Knowledge (TEK)

We will be available to interact with local communities in meetings to explain and discuss ongoing restoration projects (this effort coordinated with similar activities for project 030423 and 030620). Contractual arrangements have been made with Cordova Air Service (907-424-3289) in Cordova to provide aerial support for survey and radio relocations. Contractual arrangements will be sought with other members of local communities for vessel charters to support recapture and other project needs.

B. Resource Management Applications

Results of the proposed work, in conjunction with the results of work completed under projects 99025, 02423 and 030620, should provide managers with adequate information to make decisions regarding locations of specific shoreline habitats where sea otter populations are gaining exposure to lingering oil and which may be suitable for direct restoration actions. In addition, anticipated results of this work will allow managers to identify progress toward reclassification of sea otters and other nearshore resources as “recovered” from the 1989 *Exxon Valdez* oil spill.

Sea otter populations throughout the Aleutian Archipelago, the Alaska Peninsula, and as far east as Kodiak Island, have experienced declines in abundance ranging from about 50-90% since about 1985 (Estes et al. 1998). Although cause of the decline is unclear, predation is thought to be a contributing factor, at least in the Aleutians. The proposed survey effort in Western Prince William Sound will continue the longest annual sea otter population data set in Alaska and will be of benefit to the Fish and Wildlife Service, Marine Mammals Management (Rosa Meehan, 907-786-3349) who is responsible for sea otter management in Alaska.

V. PUBLICATIONS AND REPORTS

An annual progress report will be submitted to the Trustee Council on 1 September, 2004 and a final report will be submitted by 15 April, 2005. The results of the TDR work will provide new information on sea otter diving and foraging behavior that has not previously been published and will make a new contribution to the primary scientific literature. The results of the biomarker studies will provide an unprecedented view of the duration and relative magnitude of exposure to a top-level nearshore predator following a large-scale oil spill. Because the persistence of *Exxon Valdez* lingering oil was unanticipated and unprecedented, the linkage between lingering oil and pathways of exposure to higher trophic levels will also provide an original contribution to the primary literature on oil spill effects.

VI. PROFESSIONAL CONFERENCES

We anticipate the results of the proposed work will be suitable for presentation at the 2006 International Biennial meeting of the Society for Marine Mammalogy to be held in South Africa during the winter of 2005/2006. Because of the global nature of oil spills, the unanticipated

magnitude and duration of EVOS effects, and the apparent susceptibility of marine mammals to such events, this will be a particularly valuable opportunity to present the results of this work. We anticipate presenting two papers at the conference, one pertaining to pathways of exposure and another on the use and interpretation of biomarkers as a tool for defining exposure to and recovery from spilled oil.

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Resume

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Education

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1976 - BS, Long Beach State University (Biology), Long Beach, CA
1972 - AS, Cypress College (Biology), Cypress, CA

Publications

Dean, T.A., **J.L. Bodkin**, A.K. Fukuyama, S.C. Jewett, D.H. Monson, C.E. O'Clair, and G.R. VanBlaricom. 2002. Food limitation and the recovery of sea otters in Prince William Sound. *Marine Ecology Progress Series*. 241:255-270

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Resume

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Education

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Publications

Bodkin, J.L., **B.E. Ballachey**, T.A. Dean, S. Jewett, L. McDonald, D. Monson, C. O'Clair, and G. VanBlaricom. 2002. Recovery of sea otters in Prince William Sound following the *Exxon Valdez* oil spill. *Mar. Ecol. Prog. Ser.* 241:237-253.

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Other Publications

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**EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 04- FY 06**

Budget Category:	Proposed FY 04	Proposed FY 05	Proposed FY 06	TOTAL PROPOSED
Personnel	\$22.0	\$24.0	\$0.0	\$46.0
Travel	\$0.0	\$0.0	\$6.0	\$6.0
Contractual	\$99.2	\$0.0	\$0.0	\$99.2
Commodities	\$1.0	\$0.0	\$0.0	\$1.0
Equipment	\$1.0	\$0.0	\$0.0	\$1.0
Subtotal	\$123.2	\$24.0	\$6.0	\$153.2
General Administration (9% of subtotal)	\$11.1	\$2.2	\$0.5	\$13.8
Project Total	\$134.3	\$26.2	\$6.5	\$167.0

Cost-share Funds:

In this box, identify non-EVOS funds or in-kind contributions used as cost-share for the work in this proposal. List the amount of funds, the source of funds, and the purpose for which the funds will be used. Do not include funds that are not directly and specifically related to the work being proposed in this proposal.

USGS:

Time-depth recorders and radio transmitters: \$40K
 Salary: Bodkin 3 months FY04 and FY05: \$84K
 Salary Bodkin and Ballachey FY 06: \$12K
 Vessel use FY04 and FY05: \$8K
 Equipment and facilities, FY 04 and FY 05: \$12K

Total cost-share funds: \$144K

FY 04

Prepared: June 14, 2003

Project Number:
Project Title: Lingering oil and sea otters: Pathways of exposure and recovery status
Lead Agency: DOI--USGS

**FORM 3A
TRUSTEE
AGENCY
SUMMARY**

**EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 04- FY 06**

Contractual Costs:		Contractual
Description		Sum
Airplane contract for aerial relocations 2 per mo. @ \$1300/flight		31.2
Vessel charter for recapture, and removal of instruments 20 days in July 2004 @ \$1800/day		36.0
Veterinary services for instrument removal and biomarker surveys		20.0
airplane costs for aerial surveys of western PWS 50 hrs @ \$220/hr		11.0
blood analyses		1.0
If a component of the project will be performed under contract, the 4A and 4B forms are required.		Contractual Total
		\$99.2
Commodities Costs:		Commodities
Description		Sum
food and misc supplies		1.0
		Commodities Total
		\$1.0

FY 04

Project Number:
Project Title: Lingering oil and sea otters: Pathways of exposure and recovery status
Lead Agency: DOI--USGS

FORM 3B
Contractual &
Commodities
DETAIL

**EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 04- FY 06**

New Equipment Purchases:		Number of Units	Unit Price	Equipment Sum
Description				
	radio tracking equipment (antenna, cables, switches)			0.0
				1.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
			New Equipment Total	\$1.0
Existing Equipment Usage:		Number of Units	Inventory Agency	
Description				

FY 05

Project Number:
Project Title: Lingering oil and sea otters: Pathways of exposure and recovery status
Lead Agency: DOI--USGS

FORM 3B
Equipment
DETAIL

**EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 04- FY 06**

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Personnel Sum
Name	Description					
Ballachey			3.0	8.0		0.0
						24.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Subtotal			3.0	8.0	0.0	
Personnel Total						\$24.0
Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Travel Sum
Description						
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Travel Total						\$0.0

FY 05

Project Number:
Project Title: Lingering oil and sea otters: Pathways of
exposure and recovery status
Lead Agency: DOI--USGS

FORM 3B
Personnel
& Travel
DETAIL

**EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 04- FY 06**

Contractual Costs:		Contractual Sum
Description		
If a component of the project will be performed under contract, the 4A and 4B forms are required.		Contractual Total
		\$0.0
Commodities Costs:		Commodities Sum
Description		
		Commodities Total
		\$0.0

FY 05

Project Number:
Project Title: Lingering oil and sea otters: Pathways of exposure and recovery status
Lead Agency: DOI--USGS

FORM 3B
Contractual &
Commodities
DETAIL

**EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
 DETAILED BUDGET FORM FY 04- FY 06**

New Equipment Purchases:		Number of Units	Unit Price	Equipment
Description				Sum
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
New Equipment Total				\$0.0
Existing Equipment Usage:		Number of Units	Inventory Agency	
Description				

FY 06

Project Number:
 Project Title: Lingering oil and sea otters: Pathways of
 exposure and recovery status
 Lead Agency: DOI--USGS

FORM 3B
 Equipment
 DETAIL

**EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
 DETAILED BUDGET FORM FY 04- FY 06**

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Personnel Sum
Name	Description					
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Subtotal			0.0	0.0	0.0	
Personnel Total						\$0.0
Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Travel Sum
Description						
Anchorage to South Africa		2.0	2	10	100.0	6.0
16th Biennial marine mammal conference						0.0
Bodkin, Ballachey						0.0
(Conference in FY 06)						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Travel Total						\$6.0

FY 06

Project Number:
 Project Title: Lingering oil and sea otters: Pathways of
 exposure and recovery status
 Lead Agency: DOI--USGS

FORM 3B
 Personnel
 & Travel
 DETAIL

**EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 04- FY 06**

Contractual Costs:		Contractual Sum
Description		
If a component of the project will be performed under contract, the 4A and 4B forms are required.		Contractual Total
		\$0.0
Commodities Costs:		Commodities Sum
Description		
		Commodities Total
		\$0.0

FY 06

Project Number:
Project Title: Lingering oil and sea otters: Pathways of exposure and recovery status
Lead Agency: DOI--USGS

FORM 3B
Contractual &
Commodity
DETAIL

**EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 04- FY 06**

New Equipment Purchases:		Number of Units	Unit Price	Equipment
Description				Sum
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
New Equipment Total				\$0.0
Existing Equipment Usage:		Number of Units	Inventory	
Description				Agency

FY 06

Project Number:
Project Title: Lingering oil and sea otters: Pathways of
exposure and recovery status
Lead Agency: DOI--USGS

**FORM 3B
Equipment
DETAIL**

040620 Budget Justifications.

Bodkin and Ballachey

Lingering oil and sea otters: Pathways of exposure and recovery status

Total project cost 311 K. 144 K provided by USGS/ASC. Requested from EVOS 167 K. The costs not covered by the Agency include acquisition of objectives 2 (in part) and 3 (in total). The project is not legislatively mandated, but will provide information valuable to both sea otter management (USFWS and the Alaska Sea Otter Commission) and the EVOS Trustee Council in terms of understanding sea otter population dynamics, behavioral ecology and recovery from the *Exxon Valdez* oil spill. Indirect costs have been previously arranged between the EVOS office and Trustee Agencies.

FY 2004

Amount requested \$ 134.3 K

Personnel 22.0 K Funds will provide the additional salary support necessary to monitoring and biomarker objectives. USGS will be providing 36 K in additional salary support.

Travel: none requested from EVOS. USGS/ASC will provide field research travel costs in Alaska.

Contractual: 99.2K 42.2 K is requested for aerial relocations (31.2 K) and population abundance surveys (11.0 K). 37.0 is requested for vessel support and sampling of tissues for biomarker assays and blood chemistry, and 20 K for veterinarian and laboratory services to obtain and analyze biomarker samples. USGS/ASC is providing 40 K for toward the cost of TDR and radio transmitter instruments.

Commodities: 1.0 K is requested for food and miscellaneous commodities such as tools, paper, disks...). USGS/ASC will provide existing commodities in the form of office supplies, fuel...)

Equipment: 1.0 K is requested for miscellaneous radio tracking equipment such as antennas, switch boxes, and cables. USGS/ASC will be providing radio receivers for tracking purposes at a cost of 6.0 K. and vessel costs of 4 K.

FY 2005

Amount requested \$ 26.2 K

Personnel 24.0 K The salary support in FY 05 will be for the management, analysis and reporting of the population survey, movements, and biomarker objectives of the proposed research. USGS/ASC will provide an additional 36 K in salary for analysis and reporting of the dive attribute and dive depth distribution data

Travel: none requested from EVOS or USGS/ASC

Contractual: none requested from EVOS or USGS/ASC

Commodities: none requested from EVOS or USGS/ASC

Equipment: none requested from EVOS or USGS/ASC

FY 2006

Amount requested \$ 6.5 K

Personnel: none requested from EVOS. 12 K supplied by USGS/ASC as salary costs to prepare for and attend the 2006 Biennial Marine Mammal Conference

Travel: 6.0K requested to support travel to the 2006 Biennial Marine Mammal Conference. Two papers will be presented on the results of the proposed research.

Contractual: none requested from EVOS or USGS/ASC

Commodities: none requested from EVOS or USGS/ASC

Equipment: none requested from EVOS or USGS/ASC