GEM PROPOSAL SIGNATURE FORM

THIS FORM MUST BE SIGNED BY THE PROPOSED PRINCIPAL INVESTIGATOR AND SUBMITTED ALONG WITH THE PROPOSAL. If the proposal has more than one investigator, this form must be signed by at least one of the investigators, and that investigator will ensure that Trustee Council requirements are followed. Proposals will not be reviewed until this signed form is received by the Trustee Council Office.

By submission of this proposal, I agree to abide by the Trustee Council's data policy (*Trustee Council/GEM Data Policy**, adopted July 9, 2002) and reporting requirements *(Procedures for the Preparation and Distribution of Reports***, adopted July 9, 2002).

PROJECT TITLE: Oil exposure biomarkers and population trends of Prince William Sound marine vertebrates

Printed Name of PI: Dr. Brenda Ballachey

Signature of PI: _____ Date 4/15/04

Printed Name of co-PI: James Bodkin

Signature of co-PI: _____ Date 4/15/04

Printed Name of co-PI: Dr. David Irons

Signature of co-PI: _____ Date 4/15/04

* Available at http://www.oilspill.state.ak.us/pdf/admin/datapolicy.pdf

** Available at http://www.oilspill.state.ak.us/pdf/admin/reportguidelines.pdf

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Project No: _040774____
Date Received: _____

GEM PROPOSAL SUMMARY PAGE

Project Title: Oil exposure biomarkers and population trends of Prince William Sound marine vertebrates

Key Words: Exxon Valdez Oil Spill, oil exposure biomarkers, Cytochrome P450 1A, sea otters, marine birds, shorebirds, fish, vertebrates, Prince William Sound, population trends

Project Period: FY 04- FY 06

Proposer(s): Brenda E. Ballachey and James L. Bodkin, Alaska Science Center, USGS, and David Irons, US Fish and Wildlife Service 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 vertebrate populations and their exposure to hydrocarbons. Population recovery of sea otters 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. Surveys of population size and individual P450 measures of sea otters and marine birds will provide continuing information on population trend and individual exposure to lingering oil.

Funding:

EVOS Funding Requested:	FY 04	$ 178.0K	
	FY 05	$ 150.5	
	FY 06	$ 0.0	TOTAL: $328.6K
Non-EVOS Funds to be Used:	FY 04	$ 35.0K	
	FY 05	$ 47.5	
	FY 06	$ 17.0	TOTAL: $ 99.5K

Date: 15 April, 2004

GEM RESEARCH PLAN FOR PROJECT, TITLED

Oil exposure biomarkers and population trends of Prince William Sound marine vertebrates

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Jim Bodkin
US Geological Survey
Alaska Science Center

and

David Irons
US Fish and Wildlife Service
Anchorage, Alaska

I. NEED FOR THE PROJECT

A. Statement of Problem

Several years of study indicate lingering oil as a likely constraint to recovery of the nearshore ecosystems of western Prince William Sound (Bodkin et al. 2002, Esler et al. 2002, Peterson et al. 2003, Short et al. 2003). Specifically, the Nearshore Vertebrate Predator study (NVP), conducted from 1995-1999, indicated that vertebrate species in oiled areas of western Prince William Sound were exposed to lingering *Exxon Valdez* oil (EVO), based on elevated levels of cytochrome P4501A (CYP1A), an enzyme biomarker of aromatic hydrocarbon exposure (Ballachey et al. 2002). Continuing studies on harlequin ducks (through 2002, Bodkin et al. 2003), sea otters (through 2003, Ballachey et al. 2003), masked greenlings (through 2000, Jewett et al. 2002) and crescent gunnels (through 2002, NOAA ABL unpublished data) demonstrate continued oil exposure, although for harlequin ducks and sea otters, values between oiled and unoiled areas appear to be converging by the last year of study, suggesting diminishing exposure. Collectively, these data provide our best indication of chronic exposure to lingering EVO and the potential for lingering oil to be affecting recovery processes. Possibly, our most objective measure of the time when lingering oil may not be considered as a factor affecting recovery will be when the CYP1A biomarker values converge between oiled and unoiled areas.

We are proposing to conduct a comprehensive evaluation of potential exposure to lingering EVO through measurement of the CYP1A biomarker in a suite of vertebrates, including 1 mammal (sea otter), 4 bird (harlequin duck, Barrow's goldeneye, pigeon guillemot, and black oystercatcher) and 2 fish (masked greenling and crescent gunnel) species that reside and forage in intertidal habitats recognized to serve as reservoirs of lingering EVO. Additionally we will continue to monitor population trends of the birds and mammals.

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. Species of fishes, birds, and mammals that occupy and forage in intertidal habitats incur potential exposure to lingering EVO in intertidal sediments and habitats. The proposed work will allow continued evaluation of the status of vertebrate populations that previously exhibited exposure to lingering oil, measured by the CYP1A biomarker of hydrocarbon exposure and population change. 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.

II. PROJECT DESIGN

Study design: Capture and sample two species of fish (masked greenling and crescent gunnel), 4 species of birds (harlequin duck, Barrow's goldeneye, black oystercatcher, and pigeon guillemot) and one mammal (sea otter) at locations in close proximity to known oiled intertidal habitats at northern Knight Island (Figure 1), and unoiled reference areas (the sea otter and crescent gunnel samples will be collected and analyzed under a separate proposal, but reported on under this proposal). Each species of bird and mammal will be non-destructively sampled for tissues that that will subsequently be analyzed for CYP1A values.

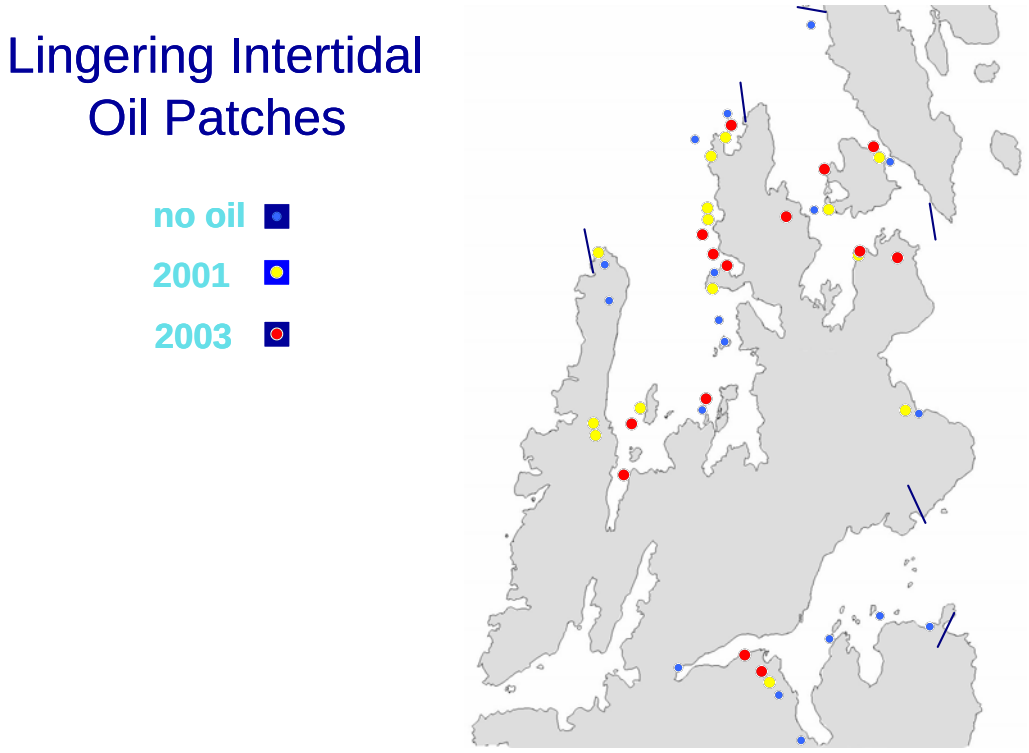

Figure 1. Locations of lingering oil patches at northern Knight Island in 2001 and 2003 (from NOAA Auke Bay Laboratory)

Methods will be used that will provide comparability with previous estimates obtained as part of the Nearshore Vertebrate Predator (1995-99) and continuing studies. Where appropriate, alternative methods that potentially provide more sensitive and powerful assays will be evaluated.

The populations of birds and sea otters will be assessed in the oiled and unoiled areas of PWS to evaluate their population changes. Methods of surveying will be identical to those used for the past 14 years.

A. Objectives

Objective 1. Obtain tissue samples from a suite of fishes, birds, and a mammal that previously exhibited elevated levels of biomarkers of exposure to PAH's

$H_{o:}$ Measured levels of biomarkers of oil exposure do not differ between known oiled sites and unoiled sites for each species

Sea otters provide one example of a species that occupies nearshore marine habitats and forages to some extent in intertidal habitats where lingering oil deposits are known to occur. Further, sea otters demonstrate, at least through 2002, elevated levels of the CYP1A enzyme produced to metabolize hydrocarbons (Fig. 2). Similar data have been

reported for the seven species identified above, with the exception of the Black oystercatcher, for which no prior biomarker measures are available. However, the Black oystercatcher is a species with known chronic effects from the spill, and one whose life history is strongly tied to residing, foraging, and reproducing in and around the intertidal zone.

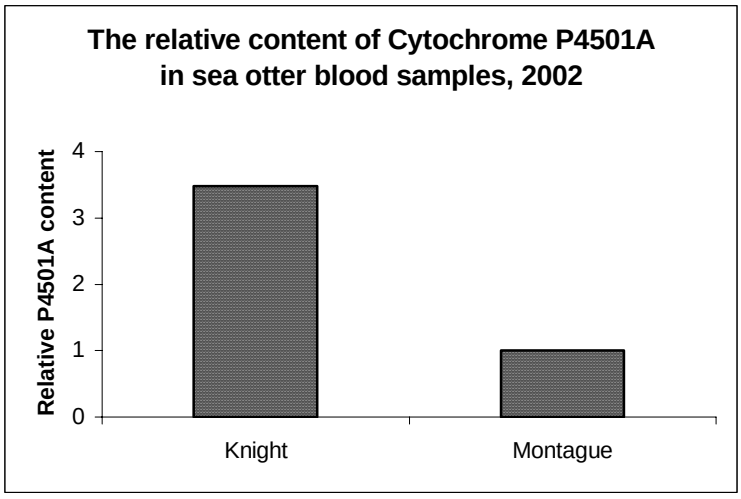

Figure 2. Relative cytochrome P4501A (CYP1A) content of blood lymphocytes from sea otters at oiled northern Knight Island and unoiled Montague Island, July 2002. (Note: mRNA for CYP1A quantified using real time PCR, and expressed in graph as CYP1A mRNA relative to mRNA for the housekeeping gene 18SrRNA).

Objective 2. Assess populations of the four bird species and sea otters in the oiled area and the unoiled area of PWS. Population trends have been be recorded from 1989 to 2000, data from 2004 and 2005 will be compared to previous trends to determine if population trends have changed to reflect the decreasing amounts of oil that have been ingested in recent years.

B. Procedural and Scientific Methods

Objective 1. Monitor exposure to lingering oil in a suite of seven vertebrates known to utilize intertidal habitats along the shores of Knight Island.

Birds (Barrow's goldeneye, black oystercatcher, harlequin duck, pigeon guillemot):

Capture and Sampling:
Pigeon guillemots and black oystercatchers will be captured in June 2004, using mist nets, dip nets and nest traps, and harlequin ducks and Barrow's goldeneyes will be captured during March 2005, using a modified floating mist net trap (Kaiser et al., 1995). Capture locations will be as close in proximity to known oiled beaches at northern Knight Island as feasible, and in known unoiled reference areas. Pigeon guillemot captures will

be at Naked Island (oiled area) and Jackpot Bay (unoiled area) for repeatability with past studies. Captured birds will be placed under Isofluorane® anesthesia and livers surgically biopsied to obtain a small (approximately 0.10 g) sample for CYP1A analysis. Immediately following biopsy, liver samples will be placed in a cryogenic vial and frozen in liquid nitrogen. Following recovery from surgery (at least 1 hour), birds will be released near their capture site.

Measurement of CYP1A by EROD:
Frozen liver samples will be shipped to the laboratory of Dr. John Stegeman at the Woods Hole Oceanographic Institute for subsequent preparation and analysis. Individual liver pieces will be homogenized in 7 ml final volume homogenizing buffer (0.05 M Tris, 0.15 M KCl, pH 7.4), and microsomes sedimented by differential centrifugation as described previously (Stegeman et al., 1979). Microsomes will be resuspended in approximately 2 ml per g tissue with resuspension buffer (0.05 M Tris, 0.1 mM EDTA, 1 mM DTT, 20% v/v glycerol, pH 7.4). Protein will be determined in a 96 well plate using the micro- procedure of Smith et al. (1985). 7-Ethoxyresorufin-O-deethylase (EROD), the catalytic function of hydrocarbon-inducible CYP1A, will be measured using a kinetic modification of the plate-based assay of Kennedy et al. (1993). EROD activity will be determined in duplicate in a 48 well plate at 20° C using a Cytofluor® fluorescent plate reader (Millipore, Bedford, MA). Each well will contain 200 µl consisting of 1µl of microsomes (4-15 µg protein), 2 µM 7-ethoxy resorufin in 50 mM Tris buffer, 0.1 M NaCl, pH = 7.8. Catalytic activity will be initiated by the addition of NADPH in buffer to a final 1.67 mM concentration. Fluorescence will be determined at 1 min intervals over 6 min, and the linear slope (fluorescence per minute) will be divided by the slope of the resorufin product standard curve (fluorescence per pmol) determined under the same conditions to yield pmol per minute per mg protein catalytic rates.

Fishes (masked greenling under this proposal; crescent gunnels under separate proposal submitted for FY04 by Rice et al. , NOAA ABL):

Collection and sampling:
Fish will be captured by USGS and Auke Bay Laboratory personnel, in locations close in proximity to known oiled beaches in the area of northern Knight Island and adjacent to nearby unoiled shorelines. (Masked greenlings are captured as part of this study proposal, and crescent gunnels will be caught as part of the Rice et al. NOAA-ABL proposal). Fish will be deeply anesthetized in Finquel® (MS-222, 300 mg/L), assigned a unique sample number, and preserved whole in 10% neutral buffered formalin. The ventral abdominal cavity will be slit open before fixation. To preserve antigenic structure of the CYP1A molecules, after 24 hours the formalin will be decanted and replaced with phosphate buffered saline (physiological pH and osmolality). Tissues will be shipped to Dr. Gary Marty at the University of California, Davis, for further processing.

Measurement of CYP1A by immunohistochemistry (IHC):
Tissues (liver, kidney) will be trimmed into one or two cassettes per fish. All cassettes will be processed routinely into paraffin and sectioned. At least two sections will be

made of each block. One section will be stained routinely using hematoxylin and eosin. The other section will be mounted on silanized slides (DAKO Corporation, product code 3003) to minimize tissue detachment from the slides during the automatic staining process.

To measure CYP1A, immunohistochemistry will be performed on formalin fixed paraffin embedded 3- m sections using a standard streptavidin-biotin - HRP detection system. The primary antibody will be a mouse anti-fish CYPlA clone C10-7 (a synthetic peptide corresponding to a amino acid sequence in rainbow trout CYP1A; Biosense Laboratories, Bergen, Norway). After some initial test runs to optimize the staining method, all immunohistochemical stains will be done using an automatic processing machine (DAKO Corporation). All CYP1A scoring will be conducted with neither collection location nor exposure history known during analysis.

Staining intensity and occurrence of CYP1A expression will be evaluated microscopically for liver tissue from each fish. Staining intensity and occurrence will be scored on a 5-point scale: none (0), very light (1), light (2), moderate (3), or strong/widespread (4). The product of the scores for intensity and occurrence will be used for statistical summaries as previously described (Marty et al. 1997).
Methods used to obtain and analyze tissue samples from each species will be identical to previous methods and include sampling liver and blood tissues.

Mammals (sea otters, conducted under separate proposal, #050620):

As in past years, the CYP1A biomarker will be measured using peripheral mononuclear blood cells collected by jugular venipuncture (Ballachey et al. 2001, 2003). 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.

Objective 2.

Survey methodology and design will remain identical to that of post-spill surveys conducted by the U. S. Fish and Wildlife Service in 1989, 1990, 1991, (Klosiewski and Laing 1994), March and July 1993 (Agler et al. 1994a), March 1994 (Agler et al. 1995a), March and July 1996 (Agler and Kendall 1997), March and July 1998 (Lance et al. 1999), and March and July 2000 (Stephensen et al. 2001). We will conduct two surveys: one during March and another during July 2002. We will use three 7.7 m fiberglass boats traveling at speeds of 10-20 km/hr to survey transects over two 3-week periods. For each survey, two observers will survey a sampling window 100 m on either side, ahead of, and above the vessel (Klosiewski and Laing 1994). When surveying shoreline transects, observers will also record sightings on land within 100 m of shore. Observers will sample continuously and use binoculars to aid in species identification. Observers will practice estimating distances with a duck decoy, and radars on the survey vessels will be used to assist in determining our distance from land on shoreline transects. We will

survey most transects when wave height is <30 cm, and we will not survey when wave height is >60 cm.

We will continue to use a stratified random sampling design containing three strata: shoreline, coastal-pelagic, and pelagic (Klosiewski and Laing 1994). The shoreline stratum will consist of waters within 200 m of land. Irons et al. (1988b) divided this stratum, by habitat, into 742 transects with a total area of 820.74 km^2. We will locate shoreline transects by geographic features, such as points of land, to facilitate orientation in the field and to separate the shoreline by habitat (Irons et al. 1988a,b). Shoreline transects will vary in size, ranging from small islands with <1 km of coastline to sections of the mainland with over 30 km of coastline. Mean transect length will be 5.55 km. During winter, we plan to survey 99 shoreline transects, but this number varies among years, due to weather conditions and ice blockage. During summer, we plan to survey 212 shoreline transects. All transects were randomly chosen, and the same transects are used each survey (Klosiewski and Laing 1994).

To sample the coastal-pelagic and pelagic strata of Prince William Sound, we will divide the study area into 5-minute latitude-longitude blocks. When a block includes >1.8 km of shoreline, we will classify it in the coastal-pelagic stratum, and we will classify blocks with $\leq$1.8 km of shoreline in the pelagic stratum (Klosiewski and Laing 1994). When coastal-pelagic or pelagic blocks intersect the 200 m shoreline stratum, they will be truncated to avoid overlap. We plan to survey 2 north-south transect lines, 200 m wide each, located 1 minute inside the east and west boundaries of each coastal-pelagic and pelagic block. We will use Global Positioning Systems and nautical compasses to navigate transect lines. In the coastal-pelagic stratum, we plan to survey $\leq$29 blocks in the winter and $\leq$46 blocks in the summer. In the pelagic stratum, we plan to survey $\leq$25 blocks during both seasons.

To examine population trends over time and to determine if populations injured by the spill are recovering, we will poststratify Prince William Sound into two zones, oiled and unoiled, based upon the pattern of oiling by the *Exxon Valdez* oil spill (Klosiewski and Laing 1994).

C. Data Analysis and Statistical Methods

Objective1.

Data generated in CYP1A assays will be tested for normality and if non-normal, will be analyzed using nonparametric tests, or transformed to achieve normality where feasible. Because a different CYP1A metric is obtained for sea otters vs. sea birds vs. fishes, species groups will be analyzed separately. The main effect of interest for all species is the comparison of areas (oiled vs unoiled). Depending on our ability to capture close to known oiled beaches, we may be able to group individuals within oiled and unoiled areas (i.e., by proximity to a specific segment of shoreline) and compare subgroups within each area. ANOVA will be performed to test for area effects. We will also examine trends in

CYP1A over time for species with multiple years of CYP1A measurement (all except black oystercatchers), using regression analysis. Finally we will examine relations between individual measures of CYP1A and proximity of individuals to known oiled shorelines at the time of capture.

Objective 2.

As in previous surveys (Klosiewski and Laing 1994, Agler et al. 1994a,b,c, 1995a,b, Agler and Kendall 1997, Lance et al. 1999, Stephensen et al. 2001), we will use a ratio estimator (Cochran 1977) to estimate population abundance. Shoreline transects will be treated as a simple random sample; whereas, the coastal-pelagic and pelagic transects will be analyzed as two-stage cluster samples of unequal size (Cochran 1977). To do this, we will estimate the density of birds counted on the combined transects for a block and multiply by the area of the sampled block to obtain a population estimate for each block. We then will add the estimates from all blocks surveyed and divide by the sum of the areas of all blocks surveyed. We will calculate the population estimate for a stratum by multiplying this estimate by the area of all blocks in the strata. Population estimates for each species and for all birds in Prince William Sound will be calculated by adding the estimates from the three strata, and we will calculate 95% confidence intervals for these estimates from the sum of the variances of each stratum (Klosiewski and Laing 1994).

Population estimates for each species will be combined with other post-oil spill population estimates to determine population trends. We plan to use a homogeneity of slopes test (Freud and Littell 1981) to compare population trends between the oiled and unoiled zones of Prince William Sound to examine whether species with population estimates of >500 individuals have changed over time. To do this, we must assume that marine bird and sea otter populations increase at the same rate in the oiled and unoiled zones of Prince William Sound. The $\log_{10}$ of each population estimate will be calculated after adding 0.5 to the estimate to prevent effects from using log 0. Significantly different slopes would indicate that population abundance of a species or species group changed at different rates. For species or species groups showing a significant difference in slopes or ratios, we will determine the rate of change in each zone by linear regression analyses.

D. Description of Study Area

Sampling Locations: The samples will be collected in western PWS. Oiled and unoiled shoreline segments identified from projects 02585 and 030620 (NOAA and USGS) will be targeted for captures of birds and sea otters, and collections of fishes. Specifically, we will focus on Lower Passage (60.501, -148.667) and Bay of Isles (60.400, -148.667) at northern Knight Island, to the greatest extent possible depending on availability of individuals for capture. The exception will be pigeon guillemots, which will be captured at Naked Island (oiled site) and Jackpot Bay (unoiled site) for consistency with previous studies.

Populations of birds and sea otters will be assessed throughout PWS.

E. Coordination and Collaboration with Other Efforts

This research builds on work performed under the Nearshore Vertebrate Predator project (1995-99) and subsequent projects on sea otters and harlequin ducks (primarily //423). The proposed work will utilize the results of NOAA/ABL studies to determine the persistence, distribution and abundance of residual shoreline oiling in the area of northern Knight Island, allowing identification of known oiled shorelines along which to target captures. Collaborations in this project will be with Dr. Dan Esler of Simon Fraser University (sea duck captures), Dr. Gary Marty of UC Davis (analyses of CYP1A in fish species), Dr. John Stegeman and Bruce Woodin of Woods Hole Oceanographic Institute (analyses of CYP1A in bird species) and with NOAA/ABL (supplementary capture of masked greenlings).

Data from these surveys would be helpful for the sea otter, harlequin duck, studies. All data will be entered into the North Pacific Pelagic Seabird Database and will be available on the web to other scientists, and lay people that would like to see it or use it.

III. SCHEDULE

A. Project Milestones

Objective 1. Monitor exposure to lingering oil in a suite of seven vertebrates known to utilize intertidal habitats along the shores of Knight Island.
Collection of samples to be complete by March 30, 2005; laboratory analyses to be complete by December 31, 2005; final report to be completed by April 30, 2006.

B. Measurable Project Tasks

FY 04 3rd quarter: Obtain samples of black oystercatcher, pigeon guillemots

FY 04 4th quarter: Obtain samples of crescent gunnels, masked greenling and sea otter and collect population data for birds.

FY 05 1st quarter: Analyze samples collected in FY 04
Annual GEM Workshop, Anchorage

FY 05 2nd quarter: Obtain samples of Barrow's goldeneye and harlequin ducks and collect population data for birds.

FY 05 3rd quarter: Analyze samples collected in FY 05 and begin preparing report

FY 05 4th quarter: Finalize final report and begin manuscript preparation

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 the ongoing research in the project and related ones (this effort coordinated with project 050620 and new proposed work for FY04 by Rice et al). Contractual arrangements will be sought with members of local communities for vessel charters to support capture efforts.

B. Resource Management Applications

Results of the proposed work, together with results obtained as part of related projects 040620, 050620, new proposal by Rice et al., and will provide managers with information to make better decisions regarding locations of specific shoreline habitats with residual oil sufficient to influence the recovery of nearshore vertebrate species, and which may be designated for direct restoration activities. In addition, anticipated results of this work will allow managers to identify progress toward reclassification of injured species as "recovered" from the 1989 EVOS.

The US Fish and Wildlife Service is responsible for the management of all migratory birds, including marine birds. The Service spends 100's of thousands of dollars annually to manage seabirds and waterfowl and to determine population trends. However there are still many species in many areas for which the Service data are lacking. Simply put the Service cannot do it all. The population trends of the injured birds in Prince William Sound are of great importance to the Service, the local people and the scientific community at large. The length of time required for bird populations to recover from oil spills has never been well documented for many of the species injured in the EVOS. This information is important to the Service for managing birds after future oil spills and for general management of many of these species.

V. PUBLICATIONS AND REPORTS

Annual progress reports will be submitted to the Trustee Council on Sept 1, 2004 and Sept 1, 2005. A final report will be submitted by April 30, 2006. The suite of species included in the evaluation of the CYP1A biomarker provides a unique opportunity to determine how broadly the lingering oil is affecting nearshore communities. Further, trends over time will provide an indication of the point at which exposure levels in oiled and unoiled areas will converge, indicating no further exposure of biological significance. Because of life history differences, this point in time may vary across the species included in this study.

VI. PROFESSIONAL CONFERENCES

No funds are requested in this proposal for attending meetings.

VII. LITERATURE CITED

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Agler, B. A., and S. J. Kendall. 1997. Marine Bird and Mammal Population Abundance of Prince William Sound, Alaska: Trends following the *T/V Exxon Valdez* Oil Spill, 1989-96. Restoration Project No. 96159. Final Rep., U.S. Fish and Wildl. Serv., Anchorage, Alas.

Burn, D. M. 1994. Boat-based population surveys of sea otters (*Enhydra lutris*) in Prince William Sound, in response to the *Exxon Valdez* oil spill. NRDA Marine Mammal Study Number 6. U. S. Fish and Wildl. Serv., Anchorage, Alas.

Cochran, W. G. 1977. Sampling techniques. John Wiley and Sons, Inc., New York 428 pp.

DeGange, A. R., and C. J. Lensink. 1990. Distribution, age, and sex composition of sea otter carcasses recovered during the response to the T/V *Exxon Valdez* oil spill. Pages 124-129 in K. Bayha and J. Kormendy, eds. Sea otter symposium: proceedings of a symposium to evaluate the response effort on behalf of sea otters after the T/V *Exxon Valdez* oil spill into Prince William Sound, Anchorage, Alaska, 17-19 April 1990. U. S. Fish and Wildl. Serv., Biol. Rep. 90(12). 485 pp.

Dwyer, T. J., P. Isleib, D. A. Davenport, and J. L. Haddock. 1976. Marine Bird Populations in Prince William Sound Alaska. Unpubl. Rep., U. S. Fish and Wildl. Serv., Anchorage, Alas. 24 pp.

Ecological Consulting, Inc. 1991. Assessment of direct mortality in Prince William Sound and the western Gulf of Alaska resulting from the *Exxon Valdez* oil spill. Unpubl. Rep., Ecological Consulting, Inc., Portland, Oreg. 153 pp.

Exxon Valdez Oil Spill Trustee Council. 1994. *Exxon Valdez* oil spill restoration plan. *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alas. 56 pp. + appendices.

Freud, R. J., and R. C. Littell. 1981. SAS for linear models: a guide to the ANOVA and GLM procedures. SAS Institute Inc., Cary, N. C. 231 pp.

Garrott, R. A., L. L. Eberhardt, and D. M. Burn. 1993. Mortality of sea otters in Prince William Sound following the *Exxon Valdez* oil spill. Mar. Mamm. Sci. 9(4):343-59.

Hogan, M. E., and J. Murk. 1982. Seasonal distribution of marine birds in Prince William Sound, based on aerial surveys, 1971. Unpubl. Rep., U. S. Fish and Wildl. Serv., Anchorage, Alas. 22 pp. + appendices.

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Irons, D. B., D. R. Nysewander, and J. L. Trapp. 1988a. Prince William Sound sea otter distribution in relation to population growth and habitat type. Unpubl. Rep., U. S. Fish and Wildl. Serv., Anchorage, Alas. 31 pp.

Irons, D. B., D. R. Nysewander, and J. L. Trapp. 1988b. Prince William Sound waterbird distributions in relation to habitat type. Unpubl. Rep., U. S. Fish Wildl. Serv., Anchorage, Alas. 26 pp.

Isleib, P. and B. Kessel. 1973. Birds of the North Gulf Coast - Prince William Sound Region, Alaska. Biol. Pap. Univ. Alaska 14. 149 pp.

Klosiewski, S. P., and K. K. Laing. 1994. Marine bird populations of Prince William Sound, Alaska, before and after the *Exxon Valdez* oil spill. Exxon Valdez Oil Spill State and Federal Natural Resources Damage Assessment Final Reports, U. S. Fish and Wildl. Serv., Anchorage, Alas. 89 pp.

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Lance, B. K., D. B. Irons, S. J. Kendall, and L. L. McDonald. 1999. Marine Bird Population Abundance of Prince William Sound, Alaska: Trends following the *Exxon Valdez* oil spill. Restoration Project No. 98159. Final Rep., U.S. Fish and Wildl. Serv., Anchorage, Alas.

Nur, N. and D. G. Ainley. 1992. Comprehensive review and critical synthesis of the literature on recovery of marine bird populations from environmental perturbations. Final Rep., *Exxon Valdez* Restoration and Planning Work Group.

Piatt, J. F., C. J. Lensink, W. Butler, M. Kendziorek, and D. R. Nysewander. 1990. Immediate impact of the 'Exxon Valdez' oil spill on marine birds. Auk 107:387-397.

Piatt, J. F. and R. G. Ford. 1996. How many birds were killed by the *Exxon Valdez* oil spill?
Pages 712-719 in S. D. Rice, R. B. Spies, D. A. Wolfe, and B. A. Wright, eds. Proceedings of the *Exxon Valdez* oil spill symposium. American Fisheries Society Symposium 18. 931 pp.

Sauer, J. R., and P. H. Geissler. 1990. Estimation of annual indices from roadside surveys. Pages 58-62 in J. R. Sauer and S. Droege, eds. Survey designs and statistical methods for the estimation of avian population trends. U. S. Fish and Wildl. Serv., Biol. Rep. 90(1). 166 pp.

Stephensen, S. W., D. B. Irons, S. J. Kendall, B. K. Lance, and L. L. McDonald. 2001. Marine Bird Population Abundance of Prince William Sound, Alaska: Trends following the *Exxon Valdez* oil spill. Restoration Project No. 00159. Final Rep., U.S. Fish and Wildl. Serv., Anchorage, Alas.

Taylor, B. L., and T. Gerrodette. 1993. The use of statistical power in conservation biology: the vaquita and northern spotted owl. Cons. Biol. 7(3):489-500.

Resumes

BRENDA E. BALLACHEY
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AREAS OF EXPERTISE

Sea otters: biochemical, physiological, population and ecological effects of oil exposure
Marine mammals: population status and indices of condition
Environmental toxicology; Biomarkers of contaminant exposure
Mammalian genetics and physiology; Quantitative genetics
Male reproduction: semen quality and relationship to fertility

EDUCATION

Oregon State University, Corvallis, Oregon - Ph.D., 1985
Major: Animal Breeding and Genetics; Minors: Genetics, Statistics
Thesis: Flow cytometric evaluation of spermatozoan viability and nuclear chromatin structure
(January 1984 to March 1985 - Relocated to South Dakota State University to conduct doctoral research)

Colorado State University, Fort Collins, Colorado - M.S., 1980
Major: Animal Sciences/Animal Breeding and Genetics
Thesis: Effect of diet and age on body composition of obese and lean mice

Colorado State University, Fort Collins, Colorado - B.S. with distinction, 1974
Major: Animal Sciences

PROFESSIONAL EXPERIENCE ***(1987 to present)***

Research Physiologist
Alaska Biological Science Center, U.S. Geological Survey, Anchorage, AK
(Formerly National Biological Service; Fish & Wildlife Service)
July 1990 to September 1996: Project leader for population status (sea otters, walrus) and sea otter oil spill studies.
October 1996 to present: Principal investigator (half-time appointment) on Exxon Valdez oil spill studies of sea otters and other vertebrate predators in coastal marine areas of Prince William Sound, Alaska.

General Biologist
Alaska Fish and Wildlife Research Center, U.S. Fish and Wildlife Service, Anchorage, AK
November 1989 to July 1990
Research on sea otters, with emphasis on studies of acute and chronic effects of the *Exxon Valdez* oil spill.

Staff Officer
Board on Agriculture, National Research Council (NRC), Washington, DC, USA
March 1987 to November 1989
Worked with Committee on Managing Global Genetic Resources to assess genetic diversity in agricultural species, including crops, livestock, forests and fisheries.

COLLABORATIONS

Purdue University, South Dakota State University, NOAA/ABL, USFWS**,** Woods Hole Oceanographic Institute, Dr. T.A. Dean, Coastal Resource Associates, Ms A.M. Doroff, USFWS, Dr. D. Esler, Simon Fraser Univ., Dr. J.A. Estes, USGS, Dr. D.B. Irons

USFWS, Dr. C.H. Peterson, Univ. North Carolina, Dr. John Piatt, Alaska Science Center, Dr S.D. Rice NOAA, Mr J.W. Short, NOAA, Dr P. Snyder, Purdue University, Ms. M. Staedler, Monterey Bay Aquarium

AFFILIATIONS

American Association for the Advancement of Science
Society for Marine Mammalogy
Society for Environmental Toxicology and Chemistry

SELECTED PUBLICATIONS

Ballachey, B.E., J. L. Bodkin, and A. R. DeGange. 1994. An Overview of Sea Otter Studies. Chapter 3 in Marine Mammals and the *Exxon Valdez*. T.R. Loughlin, Ed. Academic Press.

Ballachey, B.E., J.L. Bodkin, S. Howlin, A.M. Doroff and A.H. Rebar. 2003. Survival of juveniles sea otters in Prince William Sound, Alaska, 1992-93. Cdn. Jnl. Zoology

Ballachey, B.E., W.D. Hohenboken, and D.P. Evenson. 1987. Heterogeneity of sperm nuclear chromatin structure and its relationship to bull fertility. Biol. Reprod. 36:915-925.

Bickham, J.W., J.A. Mazet, J. Blake, M.J. Smolen, Y. Lou, and B.E. Ballachey. 1998. Flow-cytometric determination of genotoxic effects of exposure to petroleum in mink and sea otters. Ecotoxicology 7:191-199.

Bodkin, J.L. and B.E. Ballachey. 1996. Monitoring the status of the wild sea otter population: field studies and techniques. Endangered Species Update 13(12):14-19.

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.

Bodkin, J.L., B.E. Ballachey, K. Scribner and M.A. Cronin. 1999. Population demographics and genetic diversity in remnant and re-established populations of sea otters. Cons. Biol. 13:1378-1385.

Cronin, M.A., J.L. Bodkin, B.E. Ballachey, J.A. Estes and J.C. Patton. 1996. Mitochondrial DNA variation among subspecies and populations of sea otters (*Enhydra lutris*). J. Mammal. 77(2):546-557.

Esler, D., T.D. Bowman, K.A. Trust, B.E.Ballachey, T.A. Dean, S.C. Jewett and C.E. O Clair. 2002. Harlequin duck population recovery following the *Exxon Valdez* oil spill: progress, process and constraints. Mar. Ecol. Prog. Ser. 241:271-286.

Lipscomb, T.P., R.K. Harris, A.H. Rebar, B.E. Ballachey and R.J. Haebler. 1994. Pathology of Sea Otters. Chapter16 in Marine Mammals and the *Exxon Valdez*. T.R. Loughlin, Ed. Academic Press.

Loughlin, T.R., B.E. Ballachey and B. Wright. 1996. Overview of studies to determine injury caused by the *Exxon Valdez* oil spill to marine mammals. *In* Rice, S.D., R.B. Spies, D.A. Wolfe and B.A. Wright, Eds. Proceedings of the *Exxon Valdez* Oil Spill Symposium. American Fisheries Society Symposium Number 18:798-808.

Monson, D.H., D.F. Doak, B.E. Ballachey, A. Johnson and J.L. Bodkin. 2000. Long-term impacts of the *Exxon Valdez* oil spill on sea otters assessed through age-dependent mortality patterns. Proc. Natl. Acad. Sci., USA 97:6562-6567.

Mulcahy, D.M and B.E. Ballachey. 1994. Hydrocarbon residues in sea otters. Chapter 18 in Marine mammals and the *Exxon Valdez*. T.R. Loughlin, Ed. Academic Press.

Rebar, A.H., T.P. Lipscomb, R.K. Harris and B.E. Ballachey. 1995. Clinical and clinical laboratory correlates in sea otters dying acutely in rehabilitation centers. Vet. Clin. Path. 32:346-350.

Stegeman, J.J., B. Ballachey, J. Bickham, B. Hocker, S. Kennedy, H. Thompson and D. Vethaak. 1993. Implementation of biomarker-based studies. Chapter 3 in Strategy for Biomarker Research and Application in the Assessment of Environmental Health. D.B. Peakall and L.R. Shugart, Eds. Springer-Verlag, Belgium.

Udevitz, M.S. and B.E. Ballachey. 1998. Estimating survival rates with age structure data. Jnl. Wildl. Mgmt. 62(2):779-792.

Resume: James L. Bodkin March 2004

Research Wildlife Biologist, Alaska Science Center, USGS, 1011 E. Tudor Road, Anchorage, Alaska, 99503. phone 907-786-3550, fax 907-786-3636 email, james_bodkin@usgs.gov.

Education:
1985 -MS, California Polytechnic State University, San Luis Obispo, CA.Wildlife Biology)
1976- BS, Long Beach State University (Biology), Long Beach, CA
1972 - AS, Cypress College (Biology), Cypress, CA

Memberships:
Society for Marine Mammalogy
American Society of Mammalogists
Society for Conservation Biology
Wildlife Society
Western Society of Naturalists
National Geographic Society

Current Position: Research Wildlife Biologist GS 486-13

Jim leads Alaska sea otter research and the marine science program for the Alaska Science Center. The mission of the Center is to provide biological information and research findings to resource managers, policymakers, and the public to support sound management of biological resources and ecosystems in Alaska and throughout the North Pacific Ocean. The Alaska sea otter project is one of two USGS sea otter research programs, the other led by James Estes, located in Santa Cruz, CA.

He is responsible for designing, developing and directing multi-disciplinary research programs for studying North Pacific coastal marine ecosystems, focusing on sea otter populations and their role in structuring coastal marine communities in Alaska. Current research programs encompass three broad objectives, including, 1) designing, developing and testing methods to assess the status of sea otter populations, 2) describing processes responsible for structuring coastal marine communities, and 3) determining the status of recovery of sea otter populations affected by the 1989 Exxon Valdez oil spill in Prince William Sound, Alaska.

Scope of each of the three research programs:

> ***Designing, developing and testing methods to assess the status of sea otter populations***. Appropriate conservation and management of sea otter populations requires accurate knowledge on the status of populations relative to available resources, primarily food and space. Current projects to evaluate population status include measures of abundance (density), age and sex specific fecundity

and survival, individual condition and bio-markers, and activity-time budgets. Remote sensing devices (time-depth recorders) are currently being tested as a new method to estimate time budgets.

Describing processes responsible for structuring coastal marine communities. Processes responsible for driving the structure and function of north Pacific coastal communities are complex and not well understood, yet managers of coastal resources need to understand causes of variation and change in coastal communities. Current projects include a) defining coastal marine community structure in terms of physical character, biological productivity, and species composition and abundance of algae, macro-invertebrates, fishes, birds and mammals, and b) employing comparative and experimental methods to allow inference regarding cause of change in the coastal system.

Determine the status of recovery of sea otter populations affected by the 1989 Exxon Valdez oil spill in Prince William Sound, Alaska. Natural resources are subjected to increasing levels of anthropogenic disturbance, as exemplified by this nation's largest oil spill, the Exxon Valdez spill of 1989. Previous methods to understand the acute and chronic effects of disturbances at both species and ecosystem levels are poorly developed, often leading to uncertainty. Project objectives include developing new tools and approaches to improve our understanding of catastrophic perturbations and methods to describe the processes of how systems recover and to identify factors that can constrain system recovery.

Selected Publications:

Bodkin, J.L. 1988. Effects of kelp forest removal on associated fish assemblages in central California. Journal of Experimental Marine Biology and Ecology. 117:227-238.

Bodkin, J.L. and R. Jameson. 1991. Patterns of seabird and marine mammal carcass deposition along the central California coast, 1980-1986. Can J. Zool. 69:1149-1155.

Bodkin, J.L. and L. Browne. 1992. Molt frequency and size-class distribution in the spiny lobster (Panulirus interruptus), at San Nicolas Island, California. California Fish and Game. 78(4):136-144.

Bodkin, J.L., B.E. Ballachey, M.A. Cronin and K.T. Scribner. 1999. Population demographics and genetic diversity in remnant and re-established populations of sea otters. Conservation Biology 13(6):1278-1385.

Bodkin, J. L. and M.S. Udevitz. 1999. An aerial survey method to estimate sea otter abundance. in: Garner, G.W., S.C. Amstrup, J.L. Laake, B.F.J. Manly, L.L. McDonald, and D.G. Robertson, (eds.) Marine mammal survey and assessment methods. Balkema Press, Netherlands pg. 13-26

Bodkin, J.L., A.M. Burdin and D.A. Ryzanov. 2000. Age and sex specific mortality and population structure in sea otters. Marine Mammal Science 16(1):201-219.

Bodkin, J.L. 2001. Marine Mammals: Sea otters. Pages 2614-2621. in Steele, J. S.Thorpe and K. Turekian (eds.) Encyclopedia of Ocean Sciences. Academic Press, London UK. (invited ms)

Bodkin, J.L., B.E. Ballachey, T.A. Dean, A.K. Fukuyama, S.C. Jewett, L.M. McDonald, D.H.Monson, C.E. O'Clair and G.R. VanBlaricom. 2002. Sea otter population status and the process of recovery from the Exxon Valdez oil spill. Marine Ecology Progress Series. 241:237-253.

Peterson, C.H., S.D. Rice, J.W. Short, D. Esler, J.L. Bodkin, B.E. Ballachey, D.B. Irons. 2003. Long-term ecosystem response to the Exxon Valdez oil spill. Science 302:2082-2086.

Collaborators:
Dr B.E. Ballachey, USGS, Dr. T.A. Dean, Coastal Resource Associates, Ms A.M. Doroff, USFWS, Dr. D. Esler, Simon Fraser Univ., Dr. J.A. Estes, USGS, Dr. D.B. Irons USFWS, Dr. C.H. Peterson, Univ. North Carolina, Dr. John Piatt, Alaska Science Center, Dr S.D. Rice NOAA, Mr J.W. Short, NOAA, Dr P. Snyder, Purdue University, Ms. M. Staedler, Monterey Bay Aquarium

David B. Irons
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Anchorage, Alaska 99503
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Phone 907/786-3376

Education

B. S. Environmental Resource Management 1976	Pennsylvania State University
M. S. Wildlife Ecology 1982	Oregon State University
Ph. D. Biology 1992	University of California, Irvine

Recent Professional Experience

1999-2003	Alaska Seabird Coordinator, Migratory Bird Management, U.S. Fish and Wildlife Service
1993-1998	Marine Bird Monitoring Coordinator, Migratory Bird Management, U.S. Fish and Wildlife Service
1984-1992	Biologist, Migratory Bird Management, U.S. Fish and Wildlife Service

Committees

Alaska Region Representative, North American Colonial Waterbird Conservation Plan
Chair, Alaska Seabird Working Group
Chair, Circumpolar Seabird Group
Past-Chair, Pacific Seabird Group
Seabird Coordinator, Circumpolar Arctic Flora and Fauna (CAFF), Circumpolar Biodiversity Monitoring Network.

Professional Societies

Ecological Society of America
The Wildlife Society
Pacific Seabird Group
Waterbird Society
American Ornithologists' Union
British Ornithologists' Union
Cooper Ornithological Society
Wilson Ornithological Society
Association of Field Ornithologists

Selected Publications

Peterson, C.H., S.D. Rice, J.W. Short, D. Esler, J.L. Bodkin, B.E. Ballachey, D.B. Irons. 2003. Long-term ecosystem response to the Exxon Valdez oil spill. Science 302:2082-2086.

Lance B. K., D. B. Irons, S. J. Kendall, L. L. McDonald. 2001. An evaluation on marine bird population trends following the Exxon Valdez oil spill, Prince William Sound, Alaska. Marine Pollution Bulletin 42:298-309.

Irons, D. B., S. J. Kendall, W. P. Erickson, L. L. McDonald, and B. K. Lance. 2000. Chronic effects of the *Exxon Valdez* oil spill on summer marine birds in Prince William Sound, Alaska. Condor 102:723-737.

Golet, G. H., K. J. Kuletz, D. D. Roby, D. B. Irons. 2000. Adult prey choice affects chick growth and reproductive success of Pigeon Guillemots. The Auk 117:82-91.

Hunt, G. L., F. Mehlum, R. W. Russell, D. B. Irons, M. B. Decker, and P. Becker. 1999. Physical processes, prey abundance, and the foraging ecology of seabirds. In: Adams, N. and Slowtow, R. (Eds.) 22 International Ornithological Congress, Durban, South Africa, University of Natal.

Agler, B.A., Kendall, S.J., Irons, D.B., and Klosiewski, S.P. 1999. Declines in Marine Bird Populations in Prince William Sound, Alaska Coincident with a Climatic regime Shift. Waterbirds 22:98-103.

Golet, G. H., and D. B. Irons. 1999. Raising young reduces body condition and fat stores in Black-legged Kittiwakes. Oecologia 120:530-538.

Irons, D. B. 1998. Foraging area fidelity of individual seabirds in relation to tidal cycles and flock feeding. Ecology 70:647-655.

Golet, G. H., D. B. Irons, and J. A. Estes. 1998. Survival costs of chick rearing in Black-legged Kittiwakes. Journal of Animal Ecology 67:827-841.

Irons, D. B. 1996. Size and productivity of Black-legged Kittiwake colonies in Prince William Sound before and after the *Exxon Valdez* oil spill. Pages 738-747, *in* S. D. Rice, R. B. Spies, D. A. Wolfe, and B. A. Wright, editors. Exxon Valdez Oil Spill Symposium. Am. Fisheries Soc. No. 18.

Irons, D. B., R. G. Anthony, and J. A. Estes. 1986. Foraging strategies of glaucous-winged gulls in a rocky intertidal community. Ecology 67:1460-74.

Irons Collaborators:

Ainley, David, H.T. Harvey and Associates	Kendall, Steve, USFWS
Anker-Nilssen, Tycho, NINA, Norway	Kuletz, Kathy, USFWS
Benson, Jeb UAF	Lance, Brian, NMFS
Brown, Evelyn, UAF	Maniscalco, John, Seward Sealife Center
Byrd, Vernon, USFWS	McDonald, Lyman, West Inc.
Decker, Mary Beth, Yale U	Ostrand, Bill, USFWS
Drew, Gary, USGS	Piatt, John, USGS
Dragoo, Don, USFWS	Roby, Dan, OSU
Erickson, Wally, West Inc.	Schmutz, Joel USGS
Estes , Jim, USGS	Stephensen, Shawn, USFWS
Ford, Glenn, R.G. Ford Consulting	Suryan, Rob, OSU
Golet, Greg, TNC	Turco, Kathy, self employed
Hunt, George, UCI	Visser, G.H, Centre for Isotope Res., The Netherlands
Jodice, Pat, Clemson U.	
Kaufmann, Max UAF	Wohl, Kent, USFWS

BUDGET JUSTIFICATION FY 2004

Project Title: Oil exposure biomarkers and population trends of Prince William Sound marine vertebrates.

Irons, Bodkin, and Ballachey,

FY 04

Budget category: Personnel	Amount Requested: $50.2K
Request Explanation: A person is needed to lead the project (GS13) must possess supervisory skills to govern the activities of several subordinate workers and technical skills to analyze and interpret the data. We will need biological technicians to assist in capturing the birds. Capturing activities are labor intensive. The project leader will allocate 3.8 months to the project; which includes field preparation, data collection ,data analysis and report writing.	

Budget category: Travel	Amount Requested: $4.5K
Request Explanation: Several people will be traveling throughout Prince William Sound and will need money for per diem. A tunnel fee is assessed to every vehicle traveling through the tunnel near Portage and the truck/boat will make several round trips during the study.	

Budget category: Contractual	Amount Requested: $80.2K
Request Explanation: Prince William Sound is large and requires extensive travel by boat. The least expensive method of working in the Sound when surgery is taking place is to rent a boat large enough to house the field crew and the veterinarian and his laboratory. Most of the contracts are for boats used for this purpose. Additional contracts were let for analyses of the samples.	

Budget category: Commodities	Amount Requested: $27.4K
Request Explanation: The largest single item in the commodities category is the surgical costs of obtaining a sample.	

Budget category: Equipment	Amount Requested: $1.0K
Request Explanation: Most of the equipment needed to conduct the survey will be supplied by our organization, however, some equipment may fail and need to be replaced. We propose $1.0k to cover those costs.	

Budget category: In-kind Contributions	Amount Contributed: $31.0K
Contribution Explanation: We will provide the salaries of two principal investigators (GS13) for 2 months. The USGS and USFWS are supplying much of the equipment needed in the field to collect samples and to survey birds. Three boats that are owned by FWS/GS will be used. The standard user fee rate of $200 per day per boat has been charged to other agencies that have rented the boats from us. We will use that amount to determine the in-kind contribution amount for the boats. Miscellaneous equipment and trucks needed to complete the survey is also supplied by FWS.	

FY 05

Budget category: Personnel	Amount Requested: $43.8K
Request Explanation: A person is needed to lead the project (GS13) must possess supervisory skills to govern the activities of several subordinate workers and technical skills to analyze and interpret the data. We will need biological technicians to assist in capturing the birds. Capturing activities are labor intensive. The project leader will allocate 3.0 months to the project; which includes field preparation, data collection ,data analysis and report writing.	

Budget category: Travel	Amount Requested: $0K
None requested	

Budget category: Contractual	Amount Requested: $74.6K
Request Explanation: Prince William Sound is large and requires extensive travel by boat. The least expensive method of working in the Sound when surgery is taking place is to rent a boat large enough to house the field crew and the veterinarian and his laboratory. Most of the contracts are for boats used for this purpose. Additional contracts were let for analyses of the samples.	

Budget category: Commodities	Amount Requested: $19.7K
Request Explanation: The largest single item in the commodities category is the fuel of obtaining a sample.	

Budget category: Equipment	Amount Requested: K
None requested	

Budget category: In-kind Contributions	Amount Contributed: $47.5K

Contribution Explanation: We will provide the salaries of two principal investigators (GS13) for 2 months. The USGS and USFWS are supplying much of the equipment needed in the field to collect samples and to survey birds. Three boats that are owned by FWS/GS will be used. The standard user fee rate of $200 per day per boat has been charged to other agencies that have rented the boats from us. We will use that amount to determine the in-kind contribution amount for the boats. Miscellaneous equipment and trucks needed to complete the survey is also supplied by FWS.

CURRENT AND PENDING SUPPORT FORM

The following information must be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Brenda Ballachey, James Bodkin, David Irons	Other agencies to which this proposal has been/will be submitted: None. No other support anticipated for this work.

Support: X Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title: Monitor seabird colonies in Prince William Sound and St. Lawrence Island

Source of Support: USFWS (Irons project)
Total Award Amount: $65.0K Total Award Period Covered: FY2004
Location of Project: Prince William Sound and St. Lawrence Island
Months of Your Time Committed to the Project: 2 FY04 FY 05 FY06 06 Sumr: 1

Support: X☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title: Surveys to monitor Marine Birds in PWS

Source of Support: EVOSTC (Irons project)
Total Award Amount: $175.0 Total Award Period Covered: FY2004
Location of Project: PWS
Months of Your Time Committed to the Project: 2 FY 04 2 FY 05 FY 06 Sumr: 0

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Months of Your Time Committed to the Project: FY04 FY 05 FY 06 Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Months of Your Time Committed to the Project: FY 04 FY 05 FY 06 Sumr:

*If this project has previously been funded by another entity, please list and furnish information for immediately preceding funding period.

(USE ADDITIONAL SHEETS AS NECESSARY)

DATA MANAGEMENT

Objective 1

1. Study Design

Capture and sample two species of fish (masked greenling and crescent gunnel), 4 species of birds (harlequin duck, Barrows goldeneye, black oystercatcher, and pigeon guillemot) and one mammal (sea otter) at locations in close proximity to known oiled intertidal habitats at northern Knight Island, and reference, or unoiled areas (the sea otter and crescent gunnel samples will be collected and analyzed under a separate proposal, but reported on under this proposal). Each species of bird and mammal will be non-destructively sampled for tissues that that will subsequently be analyzed for CYP1A values. Numbers of samples required are determined by field logistics, availability of individuals to be sampled, and available funding.

2. Criteria/Acceptable Data Quality

Sample collection and CYP1A determinations: The USGS Alaska Science Center's Sea Otter Project has in place a data management plan, developed from the EVOS NVP project. All data will be collected, proofed, and stored under guidelines delineated in the DM plan. The original NVP DM plan included sampling of fishes and birds, so those components of the plan will be utilized in this study.

3. Metadata

a. Metalite Metadata information:
Identification_Information:
Citation:
Citation_Information:
Originator: USGS Alaska Science Center
Publication_Date: 20060415
Title: Biomarkers of oil exposure in selected vertebrates using intertidal habitats in Prince William Sound, Ballachey, Bodkin, Irons
Geospatial_Data_Presentation_Form: map
Publication_Information:
Publication_Place: Anchorage, Alaska, United States
Publisher: USGS
Description:
Abstract: Datasets created by this project will contain species identification information, collection location information, date and time of collection, and results of biomarker assays on selected tissues from the individuals sampled.
Purpose: The datasets created through the proposed work will allow continued evaluation of the state of the vertebrate populations that previously exhibited exposure to lingering oil through biomarkers of oil exposure. Further, they 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

Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 20050401
Ending_Date: 20060415
Currentness_Reference: ground condition
Status:
Progress: Planned
Maintenance_and_Update_Frequency: As needed
Spatial_Domain:
Bounding_Coordinates:
West_Bounding_Coordinate: -147.2
East_Bounding_Coordinate: -147.983
North_Bounding_Coordinate: 60.75
South_Bounding_Coordinate: 60.15
Keywords:
Theme:
Theme_Keyword_Thesaurus:
Theme_Keyword: nearshore
Theme_Keyword: vertebrate predators
Theme_Keyword: oil
Theme_Keyword: biomarker
Place:
Place_Keyword_Thesaurus:
Place_Keyword: Prince William Sound
Access_Constraints: None
Use_Constraints: None
Spatial_Data_Organization_Information:
Direct_Spatial_Reference_Method: Point
Distribution_Information:
Distributor:
Contact_Information:
Contact_Person_Primary:
Contact_Person: James L. Bodkin
Contact_Organization: USGS Alaska Science Center
Contact_Address:
Address_Type: Mailing and Physical Address
Address:
Alaska Science Center
1011 East Tudor Road
City: Anchorage
State_or_Province: Alaska
Postal_Code: 99503
Country: United States
Contact_Voice_Telephone: 907.786.3550

Contact_Facsimile_Telephone: 907.786.3636
Contact_Electronic_Mail_Address: james_bodkin@usgs.gov
Distribution_Liability:
Metadata_Reference_Information:
Metadata_Date: 20040413
Metadata_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person: James L. Bodkin
Contact_Organization: USGS Alaska Science Center
Contact_Address:
Address_Type: Mailing and Physical Address
Address:
Alaska Science Center
1011 East Tudor Road
City: Anchorage
State_or_Province: Alaska
Postal_Code: 99503
Country: United States
Contact_Voice_Telephone: 907.786.3550
Contact_Facsimile_Telephone: 907.786.3636
Contact_Electronic_Mail_Address: james_bodkin@usgs.gov
Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata
Metadata_Standard_Version: FGDC-STD-001-1998

b. Dataset category: species specific measurements: fields: species code, individual ID, date collected, region, site, easting, northing, time, tissue type, analysis type, analysis lab, CYP1A, notes. Additional information pertaining to each individual sampled will either be added to this dataset (e.g. sex, age, length, weight, repro status) or stored in its own dataset with accompanying metadata.

4. Algorithms

No algorithms will be utilized in this project.

5. Sample Collection, Handling, Custody, Storage

Sample collection and CYP1A determination: For sea otters, as in past years, the CYP1A biomarker will be measured using peripheral mononuclear blood cells (PBMC) collected by jugular venipuncture (Ballachey et al. 2001a). 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. Sample identifications are tied to the otter ID number and collection date that are located on the capture data sheets for each individual. Samples from fish and birds will be collected using protocols established during the EVOS NVP project. All samples requiring freezing are stored in liquid nitrogen while in the field and transferred to ultracold (-80) freezers upon return. All samples will be shipped to the appropriate analysis labs as soon as possible, using dry shippers (liquid nitrogen temperatures, without the liquid).

The USGS Alaska Science Center's Sea Otter Project sample management plan is followed in documenting, inventorying, and tracking all samples. Chain of custody forms are used when shipping samples to other facilities for analysis. Surplus PBMC samples are stored at Purdue University. Surplus serum samples are stored in an ultracold freezer at USGS Alaska Science Center. Any additional samples collected during the capture are stored appropriately (frozen or preserved) at USGS Alaska Science Center.

6. Analytical Instrumentation

Analytical instruments will not be utilized in this project.

7. Data Reduction and Reporting

CYP1A, Capture/collection, and Blood: Off the shelf statistical software (e.g. SAS, SYSTAT, SigmaStat) will be used for descriptive statistics and simple between areas (oil exposed vs non-exposed) comparisons. A statistical consulting group might be contracted if the data warrants.

Habitat Use: SAS Statistical software, pre-packaged programs from the TDR manufacturer (Wildlife Computers), and ArcInfo or ArcGIS will be used to determine home ranges of VHF implanted otters as well as proportion of time spent in proximity to lingering oil. SAS and ArcInfo/ArcGIS will also be used to correlate CYP1A data with collection locations for fish and bird species, based on known/published home ranges. Further analyses and potential modeling have yet to be determined and will be based on results of preliminary data analysis.

Objective 2.

Data Management and Quality Control Statement

Study Design and Statistical Analyses:

Survey methodology and design will remain identical to that of post-spill surveys conducted by the U. S. Fish and Wildlife Service in 1989, 1990, 1991, (Klosiewski and Laing 1994), March and July 1993 (Agler et al. 1994a), March 1994 (Agler et al. 1995a), March and July 1996 (Agler and Kendall 1997), March and July 1998 (Lance et al. 1999), and March and July 2000 (Stephensen et al. 2001). We will conduct two surveys: one during March and another during July 2002. We will use three 7.7 m fiberglass boats traveling at speeds of 10-20 km/hr to survey transects over two 3-week periods. For each survey, two observers will survey a sampling window 100 m on either side, ahead of, and above the vessel (Klosiewski and Laing 1994). When surveying shoreline transects, observers will also record sightings on land within 100 m of shore. Observers will sample continuously and use binoculars to aid in species identification. Observers will practice estimating distances with a duck decoy, and radars on the survey vessels will be used to assist in determining our distance from land on shoreline transects. We will

survey most transects when wave height is <30 cm, and we will not survey when wave height is >60 cm.

We will continue to use a stratified random sampling design containing three strata: shoreline, coastal-pelagic, and pelagic (Klosiewski and Laing 1994). The shoreline stratum will consist of waters within 200 m of land. Irons et al. (1988b) divided this stratum, by habitat, into 742 transects with a total area of 820.74 km^2. We will locate shoreline transects by geographic features, such as points of land, to facilitate orientation in the field and to separate the shoreline by habitat (Irons et al. 1988a,b). Shoreline transects will vary in size, ranging from small islands with <1 km of coastline to sections of the mainland with over 30 km of coastline. Mean transect length will be 5.55 km. During winter, we plan to survey 99 shoreline transects, but this number varies among years, due to weather conditions and ice blockage. During summer, we plan to survey 212 shoreline transects. All transects were randomly chosen, and the same transects are used each survey (Klosiewski and Laing 1994).

To sample the coastal-pelagic and pelagic strata of Prince William Sound, we will divide the study area into 5-minute latitude-longitude blocks. When a block includes >1.8 km of shoreline, we will classify it in the coastal-pelagic stratum, and we will classify blocks with $\leq$1.8 km of shoreline in the pelagic stratum (Klosiewski and Laing 1994). When coastal-pelagic or pelagic blocks intersect the 200 m shoreline stratum, they will be truncated to avoid overlap. We plan to survey 2 north-south transect lines, 200 m wide each, located 1 minute inside the east and west boundaries of each coastal-pelagic and pelagic block. We will use Global Positioning Systems and nautical compasses to navigate transect lines. In the coastal-pelagic stratum, we plan to survey $\leq$29 blocks in the winter and $\leq$46 blocks in the summer. In the pelagic stratum, we plan to survey $\leq$25 blocks during both seasons.

To examine population trends over time and to determine if populations injured by the spill are recovering, we will poststratify Prince William Sound into two zones, oiled and unoiled, based upon the pattern of oiling by the *Exxon Valdez* oil spill (Klosiewski and Laing 1994).

As in previous surveys (Klosiewski and Laing 1994, Agler et al. 1994a,b,c, 1995a,b, Agler and Kendall 1997, Lance et al. 1999, Stephensen et al. 2001), we will use a ratio estimator (Cochran 1977) to estimate population abundance. Shoreline transects will be treated as a simple random sample; whereas, the coastal-pelagic and pelagic transects will be analyzed as two-stage cluster samples of unequal size (Cochran 1977). To do this, we will estimate the density of birds counted on the combined transects for a block and multiply by the area of the sampled block to obtain a population estimate for each block. We then will add the estimates from all blocks surveyed and divide by the sum of the areas of all blocks surveyed. We will calculate the population estimate for a stratum by multiplying this estimate by the area of all blocks in the strata. Population estimates for each species and for all birds in Prince William Sound will be calculated by adding the

estimates from the three strata, and we will calculate 95% confidence intervals for these estimates from the sum of the variances of each stratum (Klosiewski and Laing 1994).

Population estimates for each species will be combined with other post-oil spill population estimates to determine population trends. We plan to use a homogeneity of slopes test (Freud and Littell 1981) to compare population trends between the oiled and unoiled zones of Prince William Sound to examine whether species with population estimates of >500 individuals have changed over time. To do this, we must assume that marine bird and sea otter populations increase at the same rate in the oiled and unoiled zones of Prince William Sound. The $\log_{10}$ of each population estimate will be calculated after adding 0.5 to the estimate to prevent effects from using log 0. Significantly different slopes would indicate that population abundance of a species or species group changed at different rates. For species or species groups showing a significant difference in slopes or ratios, we will determine the rate of change in each zone by linear regression analyses.

To determine optimum survey frequency, we conducted a power analysis to estimate the probability of detecting trends in abundance using linear regression from a given number of samples (Taylor and Gerrodette 1993). We examined our power to detect trends when coefficient of variation (CV) of the population was 0.30 (greater than the mean CV from previous surveys for 73% of the injured species; Fig. 1) and when the CV = 0.13 (the mean summer CV for *Brachyramphus* murrelets, an injured species; Fig. 3). Models of seabird population growth predict most species increase no more than 12% per year (Nur and Ainley 1992), so we used 10% for our comparisons.

With CV=0.30 the probability of detecting an average annual change of 10% would be 55% with the 7 surveys completed to date (Fig 1). The probability would increase to ~ 71% in 2004 (8 surveys). If 10 surveys were completed the probability would be 92%. For murrelets the power to detect a 10% change is now 95% (Fig. 3). This would increase to 100% with the completion of the 2004 surveys (Fig. 3).

Metadata Form:

Below is a copy of the North Pacific Pelagic Seabird Database metadata form which conforms to the FGDC standards.

IDENTIFICATION INFORMATION HELP

Abstract: Surveys conducted under the OCSEAP program.

Purpose: Surveys conducted under the OCSEAP program.

Supplemental Information:

DATA SET CREDIT INFORMATION

Last Name: DeGange
First Name: Anthony M.I. R.

CONTACT INFORMATION (ADDRESS ETC.)

Street 1:
Street 2
City:
State/Province
Zip/Postal Code:
Phone:
Email:
Fax:

SURVEY INFORMATION

Trip ID: FW7042
File Name: FNEW.145
Publication Date (YYYY/MM/D: 1997/04/24
Other Citation Details:

START DATE OF SURVEY (enter 9999, 99, 99 if unknown

Year (YYY: 1977 Month (MM): 06 Day (DD): 23

END DATE OF SURVEY (enter 9999, 99, 99 if unknown)

Year (YYY: 1977 Month (MM): 06 Day (DD): 26

BOUNDING COORDINATES (in decimal degrees)

North: 58.18278 South: 54.44167
East: -152.10000 West: -169.35972

OBSERVERS (if known)

Last Name		Last Name	
1:	DeGange	6	
2	Sowls	7	
3		8	
4		9	
5		10	

ADDITIONAL SURVEY INFORMATION

Survey Platform: Ship greater than 100 ft
Vessel Name: Survevor
General Area: Western Gulf of Alaska + Bering Sea
Local Area: Kodiak to St. Matthew
Data Type: Discrete
Minimum Unit of Measure: 10 minute transect
General Survey Effort: Four day survey in Western G.O.A. and Bering Sea
# of Transect: 62
# of Station Count:
# of Observations: 62
Frequency of Survey: unknown

CURRENT PRINCIPAL INVESTIGATOR INFORMATION

Last Name: Piatt
First Name: John M.I: F.
Street 1: ABSC/USGS-BRD
Street 2: 1011 E. Tudor Rd.
City: Anchorage
State/Province: AK
Zip/Postal Code: 99503-
Phone: 907.786.3549
Email: john_piatt@usgs.gov
Fax: 907.786.3636

DATA USE RESTRICTION / CONTACT INFORMATION

Restrictions: Unrestricted
Last Name: Piatt
First Name: John

DATA QUALITY INFORMATION

Positional Accuracy:
Project Name: OCSEAP
Reference:
Reference:
General Comments:

Our data fit into your Taxonomic Sampling category. The fields associated with our data can be found in the list below:

Lat., Lon, hour, minute, second, year, month, day, record number, type, distance, depth, species, number, behavior, side, transect, obs cond., weather, direction, wind, vessel, seas, in obs, out obs, salinity, air temp, water temp.

All data will be used as it was collected, that is not reduced, although species numbers will be averaged for the individual transects and will analyzed as discussed earlier in this section. Paradox or Access will be used with SAS to do analyses.

Outline and budget for new EVOS lingering oil proposal

Title: Biomarkers of oil exposure in selected vertebrates using intertidal habitats in Prince William Sound

Authors; Brenda Ballachey, Dave Irons and Jim Bodkin

Justification: Several years of study indicate lingering oil as a likely constraint to recovery of the nearshore ecosystems of western Prince William Sound (Bodkin et al. 2002, Esler et al. 2002, Peterson et al. 2003). Specifically, through at least 1998, sea otters and harlequin ducks from heavily oiled Knight Island exhibited significantly elevated levels of the cytochrome P4501A enzyme used to metabolize PAH's, compared to reference areas. Similar data collected during 2000-2003 identified continued differences in P450 measures, but at least for harlequin ducks, values had appeared to converge between oiled and unoiled areas by 2003. These data provide possibly our best indication of the potential for lingering oil to be affecting recovery processes, and as values converge, possibly our most objective definition of when lingering oil may not be considered as a factor affecting recovery. We are proposing to conduct a comprehensive evaluation of potential exposure through the P450 biomarker, to a suite of mammals, birds and fishes that reside and forage in intertidal habitats recognized to serve as reservoirs of lingering *Exxon Valdez* oil.

Study design: Capture and sample two species of fish (masked greenling and crescent gunnel), 4 birds (harlequin duck, goldeneye, black oystercatcher, and pigeon guillemot) and one mammal (sea otter) at location in close proximity to known oiled intertidal habitats at northern Knight Island, and reference areas (the sea otter and gunnel samples will be collected and analyzed under a separate proposal). Each species will be non-destructively sampled for tissues that that will subsequently be analyzed for P450 values. Methods will be used that will provide comparability with previous estimates, but may also include alternative methods that potentially provide more sensitive and powerful assays.

From here down is nuts and bolts of what we proposed:

Sample 60 individual from each of 5 species (greenling, hadu, bago, bloy and pigu), cost est. 200/sample x 300 = 60K (we originally proposed 4 birds and 3 fish with 40 samples each for 280 K but feel more samples on fewer species would be a better approach).

Bloy, pigu, and fish sampling would take place in June 04
Duck sampling would take place in March 05

Brenda Ballachey would be the PI, responsible for study design, selecting and contracting for analyses and data analysis, interpretation and reporting.

Dave Irons would be the PI for tissue acquisition and surveys of bird populations.

Jim Bodkin is the 3rd wheel.

Budget: We received preliminary approval for $302,500 that includes 9% GA (leaving $277,522 for operations.

Salary
Ballachey 30K
Irons 20K (capture salaries, 3 technicians for 8 weeks)

Sample analysis
300 samples @ $200 ea = 60K

Vessel charters
40 d @ 2K/d = 80K

Population survey (spring 05)
87K

Total 277K

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 05- FY 07

	PROPOSED TRUSTEE AGENCY TOTALS (FY 04-06				
	ADEC	ADF&G	ADNR	USFS	D
					$328.

Budget Category:	Proposed FY 04	Proposed FY 05	Proposed FY 06	TOTAL PROPOSED
Personnel	$50.2	$43.8	$0.0	$94.0
Travel	$4.5	$0.0	$0.0	$4.5
Contractual	$80.2	$74.6	$0.0	$154.8
Commodities	$27.4	$19.7	$0.0	$47.1
Equipment	$1.0	$0.0	$0.0	$1.0
Subtotal	$163.3	$138.1	$0.0	$301.4
General Administration (9% of subtotal)	$14.7	$12.4	$0.0	$27.1
Project Total	$178.0	$150.5	$0.0	$328.5

Cost-share Funds:
USGS:
Salary Bodkin 1 month FY04 : $9K
be split between
Salary Bodkin 1.5 months FY 05: $13.5K
Salary Bodkin 1 month FY 06: $9K
Vessel use FY04 and FY05: $4K
Equipment and facilities, FY 04 and FY 05: $12K
FWS:
Salary Irons 1 month FY04 : $8K
Salary Irons 2 months FY 05: $16K
Salary Irons 1 month FY06 : $8K
Vessel use FY04 and FY05: $12K

Note: Money from EVOSTC is to
USGS and USFWS as follows
FY 04 USFWS -- $108.7K
FY04 USGS -- $69.3K

FY 05 USFWS -- $ 43.1K
FY 05 USGS -- $ 107.5K

FY 04-05

Project Number: 040774
Project Title: Oil exposure biomarkers and population trends of PWS marine vertebrates
Lead Agency: DOI--USGS

Date Prepared: revised 5/18/04

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 05- FY 07

Budget Category:	Proposed FY 04	Proposed FY 05	Proposed FY 06		TOTAL PROPOSED	
Personnel	$30.4	$24.0	$0.0		$54.4	
Travel	$0.0	$0.0	$0.0		$0.0	
Contractual	$15.2	$74.6	$0.0		$89.8	
Commodities	$18.0	$0.0	$0.0		$18.0	
Equipment	$0.0	$0.0	$0.0		$0.0	
Subtotal	$63.6	$98.6	$0.0		$162.2	
General Administration (9% of subtotal)	$5.7	$8.9	$0.0		$14.6	
Project Total	$69.3	$107.5	$0.0		$176.8	

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.

Cost-share Funds:
USGS:
Salary Bodkin 1 month FY04 : $9K
Salary Bodkin 1.5 months FY 05: $13.5K
Salary Bodkin 1 month FY 06: $9K
Vessel use FY04 and FY05: $4K
Equipment and facilities, FY 04 and FY 05: $12K

FY 04

Project Number: 040774
Project Title: Oil exposure biomarkers and population trends of PWS marine vertebrates
Agency A: USGS

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 05- FY 07

Personnel Costs:		GS/Range/	Months	Monthly	
Name	Description	Step	Budgeted	Costs	Overtin
Brenda Ballachey	Research Physiologist	GS 13/1	3.8	8.0	
	Subtotal		3.8	8.0	0
					Personnel To
Travel Costs:		Ticket	Round	Total	Da
Description		Price	Trips	Days	Per Die
					Travel To

FY 04

Project Number: 040774
Project Title: Oil exposure biomarkers and population trends of PWS marine vertebrates
Agency A: USGS

Contractual Costs:

Description

Masked greenlings, IHC assays at UCD (Marty), 80 @ $40
Bird EROD assays, WHOI, 100 @ $120

If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual To**

Commodities Costs:

Description

Surgical costs - 180 birds @ $100 each

Commodities Tot

FY 04

Project Number: 040774
Project Title: Oil exposure biomarkers and population trends of PWS marine vertebrates
Agency A: USGS

EXXON VALDEZ **OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 05- FY 07

New Equipment Purchases:	Number of Units	U Pri
Description		
	New Equipment To	

Existing Equipment Usage:	Numb of Un
Description	
Most of the equipment used in the field is owned by the USGS and FWS	

FY 04

Project Number: 040774
Project Title: Oil exposure biomarkers and population trends of PWS marine vertebrates
Agency A: USGS

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 05- FY 07

Personnel Costs:		GS/Range/	Months	Monthly	
Name	Description	Step	Budgeted	Costs	Overtir
Brenda Ballachey	Research Physiologist	13	3.0	8.0	
	Subtotal		3.0	8.0	0
					Personnel To

Travel Costs:	Ticket	Round	Total	Da
Description	Price	Trips	Days	Per Die
				Travel To

FY 05

Project Number: 040774
Project Title: Oil exposure biomarkers and population trends of PWS marine vertebrates
Agency A: USGS

Contractual Costs:

Description

Dr. Dan Esler, Simon Fraser University
boat charter $45 K
personnel $15.5K
travel $3.0K
supplies $1.5K

Bird EROD assays, WHOI, 80 @ $120 each

If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual To**

Commodities Costs:

Description

Commodities Tot

FY 05

Project Number: 040774
Project Title: Oil exposure biomarkers and population trends of PWS marine vertebrates
Agency A: USGS

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 05- FY 07

New Equipment Purchases:	Number of Units	U Pri
Description		
		New Equipment To

Existing Equipment Usage:	Numb of Un
Description	

FY 05

Project Number: 040774
Project Title: Oil exposure biomarkers and population trends of PWS marine vertebrates
Agency A: USGS

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
DETAILED BUDGET FORM FY 05- FY 07

Personnel Costs:		GS/Range/	Months	Monthly	
Name	Description	Step	Budgeted	Costs	Overtir
	Subtotal		0.0	0.0	0
					Personnel To

Travel Costs:	Ticket	Round	Total	Da
Description	Price	Trips	Days	Per Die
				Travel To

FY 06

Project Number: 040774
Project Title: Oil exposure biomarkers and population trends of PWS marine vertebrates
Agency A: USGS

Contractual Costs:	
Description	
If a component of the project will be performed under contract, the 4A and 4B forms are required.	**Contractual To**
Commodities Costs:	
Description	
	Commodities Tot

FY 06

Project Number: 040774
Project Title: Oil exposure biomarkers and population trends of PWS marine vertebrates
Agency A: USGS

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 05- FY 07

New Equipment Purchases:	Number of Units	U Pri
Description		
		New Equipment To

Existing Equipment Usage:	Numb of Un
Description	

FY 06

Project Number:
Project Title:
Agency A:

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 05- FY 07

Budget Category:	Proposed FY 04	Proposed FY 05	Proposed FY 06		TOTAL PROPOSED	
Personnel	$19.8	$19.8	$0.0		$39.6	
Travel	$4.5	$0.0	$0.0		$4.5	
Contractual	$65.0	$0.0	$0.0		$65.0	
Commodities	$9.4	$19.7	$0.0		$29.1	
Equipment	$1.0	$0.0	$0.0		$1.0	
Subtotal	$99.7	$39.5	$0.0		$139.2	
General Administration (9% of subtotal)	$9.0	$3.6	$0.0		$12.5	
Project Total	$108.7	$43.1	$0.0		$151.7	
Other Funds						

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.

Cost-share Funds:
FWS:
Salary Irons 1 month FY04 : $8K
Salary Irons 2 months FY 05: $16K
Salary Irons 1 month FY06 : $8K
Vessel use FY04 and FY05: $12K
Equipment and facilities, FY 04 and FY 05: $8K

FY 04-06

Project Number: Project Number: 40774
Project Title: Oil exposure biomarkers and population trends of PWS marine vertebrates
Agency B: FWS

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 05- FY 07

Personnel Costs:		GS/Range/	Months	Monthly	
Name	Description	Step	Budgeted	Costs	Overtin
TBD	biotechnicians summer capture	5 and 6	6.0	3.3	
	Subtotal		6.0	3.3	0
					Personnel To

Travel Costs:	Ticket	Round	Total	Da
Description	Price	Trips	Days	Per Die
Per diem (camp rate), 8 people, 30 days summer capture			240	3
Per diem (travel rate), 8 people, 4 days summer caputre			32	118
				Travel To

FY 04

Project Title: Oil exposure biomarkers and population trends of PWS marine vertebrates
Agency B: FWS

Contractual Costs:

Description

Vessel charter for summer bird captures 30 days in June 2004 @ $2K per day

Dr. Greg Golet (summer bird capture)

If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual To**

Commodities Costs:

Description

Scheduled equipment maintenance summer capture

Scientific supplies (batteries for radios and other equipment, waterproof notebooks and paper, wind gauges)
Boat fuel (10 gal/boat/day) 60 boat days @ $3.00/gal summer capture

Commodities Tot

FY 04

Project Title: Oil exposure biomarkers and population trends of PWS marine vertebrates
Agency B: FWS

New Equipment Purchases:	Number of Units	U Pri
Description		
Emergency replacement of equipment		
		New Equipment To

Existing Equipment Usage:	Numb of Un
Description	
Most of the equipment used in the field is owned by FWS and USGS	

FY 04

Project Title: Oil exposure biomarkers and population trends of PWS marine vertebrates
Agency B: FWS

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 05- FY 07

Personnel Costs:			GS/Range/	Months	Monthly	
Name		Description	Step	Budgeted	Costs	Overtin
TBD	for winter surveys	biotechnicans	5 and 6	6.0	3.3	
		Subtotal		6.0	3.3	0
						Personnel To

Travel Costs:	Ticket	Round	Total	Da
Description	Price	Trips	Days	Per Die
				Travel To

FY 05

Project Title: Oil exposure biomarkers and population trends of PWS marine vertebrates
Agency B: FWS

Contractual Costs:

Description
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual To**

Commodities Costs:

Description
WINTER SURVEYS: Boat fuel (70 gal/day/boat) 60 boat-days/winter; @ $3.00/gal Outboard oil (4 gal/boat/survey) 3 boats, 1 survey @ $12.00/gal Food ($15.00/person/day) 9 people for 30 days/winter Rain gear, rubber boots and gloves for 6 people @ $200/person Scientific supplies (batteries for radios and other equipment, waterproof notebooks and paper, wind gauges
Commodities Tot

FY 05

Project Title: Oil exposure biomarkers and population trends of PWS marine vertebrates
Agency B: FWS

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 05- FY 07

New Equipment Purchases:	Number of Units	U Pri
Description		
		New Equipment To

Existing Equipment Usage:	Numb of Un
Description	

FY 05

Project Title: Oil exposure biomarkers and population trends of PWS marine vertebrates
Agency B: FWS

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 05- FY 07

Personnel Costs:		GS/Range/	Months	Monthly	
Name	Description	Step	Budgeted	Costs	Overtin
	Subtotal		0.0	0.0	0
					Personnel To

Travel Costs:	Ticket	Round	Total	Da
Description	Price	Trips	Days	Per Die
				Travel To

FY 06

Project Title: Oil exposure biomarkers and population trends of PWS marine vertebrates
Agency B: FWS

Contractual Costs:
Description
If a component of the project will be performed under contract, the 4A and 4B forms are required. **Contractual To**
Commodities Costs:
Description
Commodities Tot

FY 06

Project Number:
Project Title:
Agency B:

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
DETAILED BUDGET FORM FY 05- FY 07

New Equipment Purchases:	Number	U
Description	of Units	Pri
		New Equipment To

Existing Equipment Usage:	Numb
Description	of Un

FY 06

Project Number:
Project Title:
Agency B: