

19.08.05

(585)

00462

# Effect of Disease on Pacific Herring Population Recovery in Prince William Sound

Project Number: 00462  
 Restoration Category: Research and Monitoring  
 Proposer: University of California, Davis  
 Lead Trustee Agency: ADFG  
 Cooperating Agencies: None  
 Alaska SeaLife Center: no  
 Duration: 2<sup>nd</sup> year, 3-year project  
 Cost FY00: \$24.9 (UCD) + 49.7 (ADFG) = \$74.6  
 Cost FY01: \$29.5 (UCD) + 52.2 (ADFG) = \$81.7  
 Cost FY02: none  
 Geographic Area: Prince William Sound  
 Injured Resource/Service: Pacific herring, commercial fishing, subsistence

RECEIVED

EXXON VALDEZ OIL SPILL  
 TRUSTEE COUNCIL

## ABSTRACT

The Pacific herring population of Prince William Sound has not recovered from severe population decline in 1993. Viral hemorrhagic septicemia virus and the fungus *Ichthyophonus hoferi* were identified as the two main diseases in these fish. Prevalence of *Ichthyophonus* decreased after 1995, but increased prevalence of viral hemorrhagic septicemia virus in 1997 and 1998 has been associated with delayed recovery. To determine if disease continues to impair recovery, and to document recovery when it occurs, we propose to continue to monitor the prevalence of the two major diseases in Pacific herring in Prince William Sound in November 2000 and April 2001.

## INTRODUCTION

The population of Pacific herring (*Clupea pallasii*) in Prince William Sound (PWS), Alaska has not recovered since the estimated spawning biomass decreased precipitously from over 100,000 tons in 1992 to less than 20,000 tons in 1994 (Figure 1). Study of the population since 1993 has revealed that viral hemorrhagic septicemia virus (VHSV) and the fungus *Ichthyophonus hoferi* are the two major diseases in Pacific herring, and that VHSV probably contributed most to population decline in 1993 (Meyers et al. 1994; Marty et al. 1998). Prince William Sound Pacific herring fisheries were severely curtailed in 1993, and were never opened in 1994 or 1995. The population began to recover in 1996, and a small bait fishery was opened in November of 1996. All fisheries were opened in 1997, but an unexpected increase in prevalence of VHSV in spring samples (15% in 1997 vs. 0% in 1996) was associated with abnormal spawning activity. In the first year of this project (99462), the prevalence of virus was again high (14% in 1998).

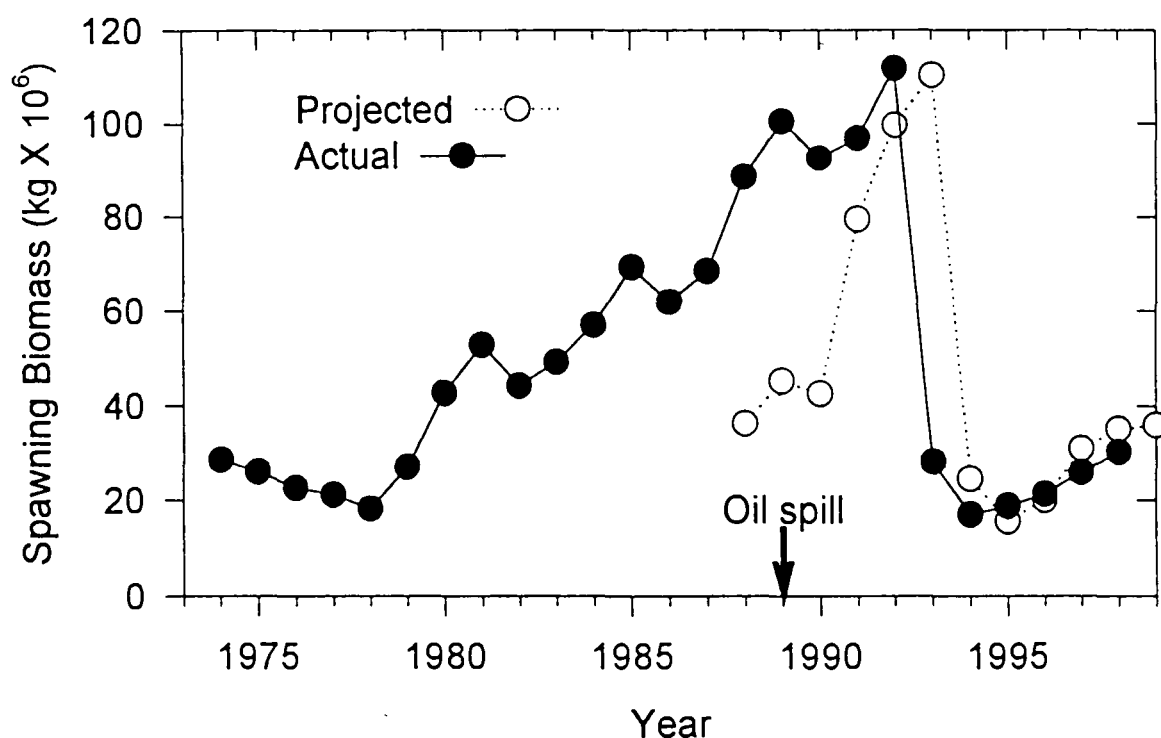


Figure 1. Biomass estimates of mature Pacific herring in Prince William Sound, Alaska. Unexploited spawning biomass is estimated using an age-structured assessment model.

After the major crash of 1993, the Pacific herring population continued to decline in 1994 and project 94320-S was initiated under emergency conditions to determine causes of herring morbidity (sickness), with particular emphasis on the role of VHSV. Beginning in 1995, a 4-year multidisciplinary project was initiated to explore the role of VHSV, *Ichthyophonus hoferi*, and other parasites on population change (95320-S, 96162, 97162, and 98162). Study in 1995 and 1996 included examination of fish from a reference site, Sitka Sound, in which the herring fishery was strong and there was no history of a large oil spill.

It soon became obvious that the results from this study had broad significance beyond the two populations being studied. We were beginning to answer basic questions about how disease contributes to mortality of free-ranging, pelagic, schooling fish. To more fully answer these basic questions, the U.S. National Science Foundation (Biological Oceanography) funded a 3-year project to continue disease research in PWS. The NSF project is closely linked to this project (00462). This proposal asks the Trustee Council to continue to fund fish necropsy, tissue sampling, and virus analysis. NSF has committed to fund analysis of blood and tissues (histopathology) as well as a modeling component through Dr. Terrance Quinn of the University of Alaska, Fairbanks. Both organizations benefit from high quality, multiyear research, but at a fraction of the cost of supporting the entire project. The NSF component of the project cannot continue unless the Trustee Council continues to fund sample collection. In funding the sampling and virus analysis components of the study, the Trustee Council will have access to the same types of data generated from 1994-1998, with the addition of a modeling component to determine the role of disease in stock assessment. We propose to continue monitoring the health of the Pacific herring population in PWS through spring of 2001.

Preliminary surveys suggested that the 1994 or 1995 year-classes were the most likely to recruit at numbers large enough for population recovery by 1999 or 2000. Unfortunately, the prevalence of VHSV increased to 15% among all Pacific herring sampled in spring 1997 (Figure 2), and 23% of the 71 fish that were from 1994 year-class had VHSV. In 1998, the prevalence of VHSV remained high (14%), and 28% of the 64 fish from 1995 year-class had VHSV (Figure 3). The effect of the VHSV outbreak on population biomass in 1997 and 1998 does not appear to be as severe as in 1993, but the viral outbreak will limit the contribution of the 1994 and 1995 year-classes to population recovery. This project is most closely linked to other Pacific herring projects, and details are given in the dedicated section below.

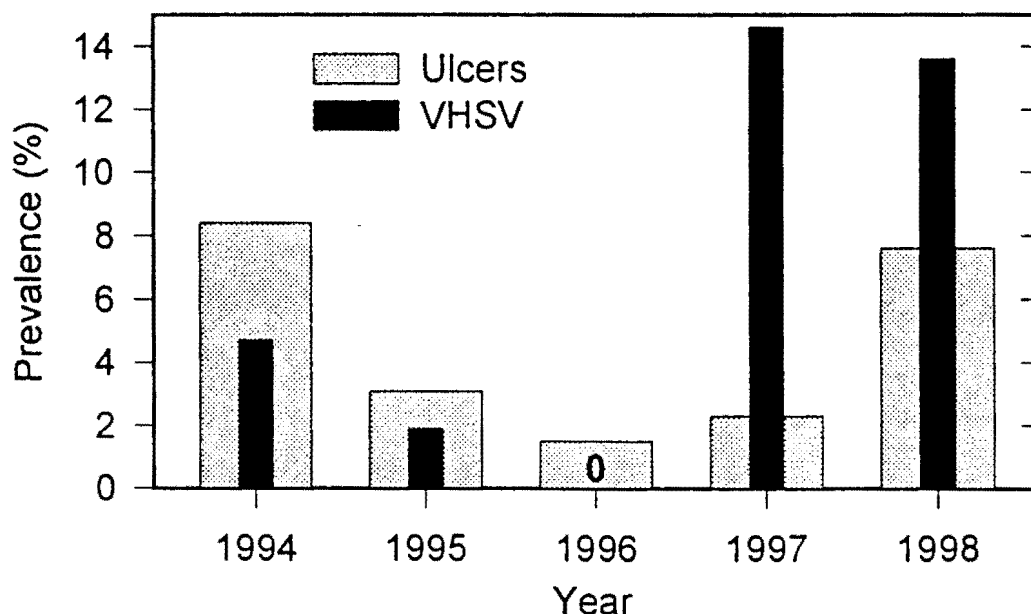


Figure 2. Prevalence of severe focal skin reddening (ulcers) and VHSV in adult Pacific herring sampled from Prince William Sound, Alaska.

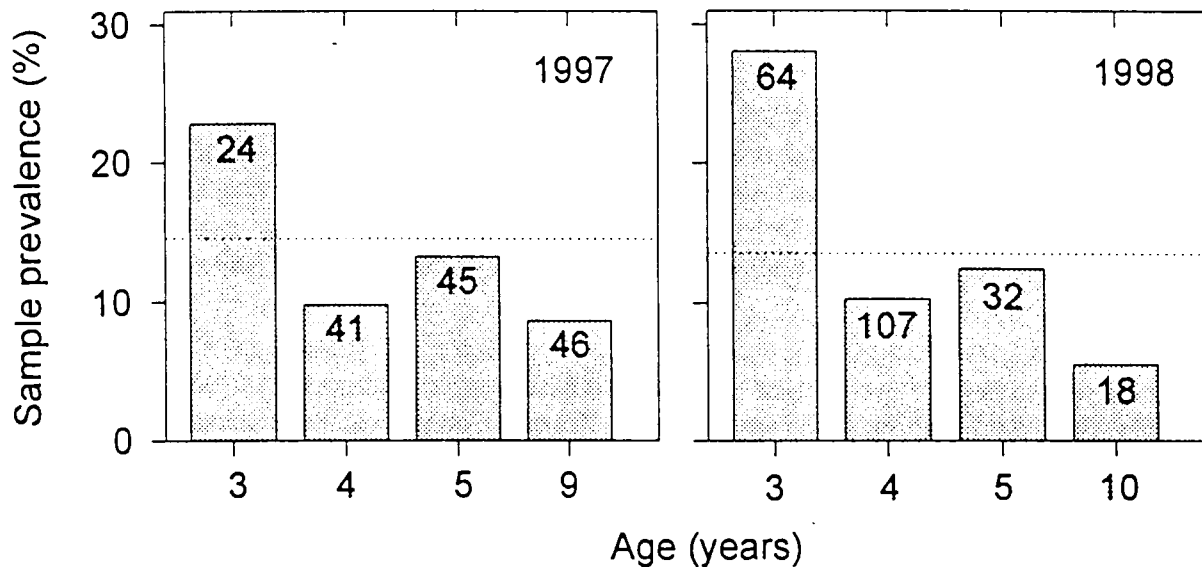


Figure 3. VHSV prevalence in Prince William Sound Pacific herring.  
 Reference line = overall sample VHSV prevalence.  
 Numbers within bars = sample size for each age.

## NEED FOR THE PROJECT

### A. Statement of Problem

Pacific herring are an injured biological resource in Prince William Sound (PWS) classified as recovering. Although commercial fishing for herring started again in 1996, after being closed for three years, population recovery has been very slow, resulting in lost services. Also, several thousand pounds of herring and herring spawn on kelp are harvested annually for subsistence purposes and form an important part of the local native culture of Chenega and Tatitlek. Delay in recovery of herring populations results in lost resources for subsistence use. Continued study is needed to examine how disease may be limiting recovery and to document when recovery has occurred.

### B. Rationale/Link to Restoration

This project should be done because it will provide information on what might be limiting population recovery and it will monitor when fish are healthy and recovery has occurred. Continued sampling fish twice a year is needed to determine the dynamics of disease in the population. During the first 6 years of disease research already funded by the Trustee Council, we established that VHSV and *Ichthyophonus hoferi* were the most significant causes of disease. Prevalence of VHSV can be determined by virus isolation and prevalence of *Ichthyophonus hoferi* can now be estimated fairly closely by gross examination.

### **C. Location**

Study will be done in Prince William Sound, Alaska. Information will benefit fisheries managers as they consider alternatives for managing Pacific herring fisheries. As the resource is enhanced, users throughout PWS could potentially benefit.

## **COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE**

Dr. Marty has a solid record of local contact and dissemination of information, and continued collaboration with local users is proposed for FY 00. For example, Dr. Marty will be leading a herring dissection and necropsy demonstration for the Youth Area Watch in Cordova on April 19, 1999. Contact with fishers and ADFG managers occurs through participation in conference telephone calls, personal contact while in Anchorage and Cordova, and via e-mail.

To aid in dissemination of information, project personnel are available by phone for interviews and will respond quickly to requests from the Restoration Office for general information and articles for newsletters. The project's principal investigator is based in California, but Dr. Kathy Burek of Alaska Veterinary Pathology Services (one of only two board-certified veterinary pathologists residing in Alaska) has been contracted as a necropsy pathologist in 1995, and 1996, and 1999, and she has indicated her interest to serve as the second pathologist in April 2000. Alaska residents will be hired by ADFG for sampling logistics and recording data, and ADFG will charter vessels from local residents for collecting and processing fish.

## **PROJECT DESIGN**

### **A. Objectives**

The restoration objective states that "Pacific herring will have recovered when the next highly successful year class is recruited into the fishery and when other indicators of population health are sustained within normal bounds in PWS." The population cannot be classified as healthy until individuals within that population are healthy. Continued high prevalence of VHSV in spring 1998 samples was consistent with a population at risk. Field sampling to determine the ongoing disease status is a high priority of this project. Objectives include:

1. Determine the prevalence of major diseases in Pacific herring.
2. Determine the interaction of gender, age, and season on disease prevalence.
3. Determine if disease prevalence correlates with population trends.

### **B. Methods**

Pacific herring will be randomly sampled from PWS in November (at the end of the feeding season,  $n = 100$ ) and in April (near the time of spawning,  $n = 300$ ). Each fish will be examined for abnormalities (e.g., *Ichthyophonus hoferi*), and tissues from each fish will be assayed for VHSV.

This proposal has two specific hypotheses to test:

1. Prevalence of external lesions, VHSV, or *Ichthyophonus hoferi* is different from previous years.
2. Gross lesions, VHSV, or *Ichthyophonus hoferi* are related season, age, or gender.

To test the hypothesis that reproductive stage affects the development of disease, sampling is needed during the spawning season (spring) and during the period of gonadal development and peak condition (fall). Nearly 80% of the PWS Pacific herring biomass schools in the waters on the northern and western edge of Montague Island during November, and the fish remain in this area until after they spawn in April. All fish will be sampled from this region. During the summer, fish disperse throughout the Sound. The other 20% of the PWS Pacific herring biomass overwinters and spawns in the Northeast region of PWS; these fish were sampled for disease study on as part of the spawn-on-kelp investigations, and trends in viral prevalence were similar to fish in the Montague area (Hershberger In press). To provide a minimum number of fish from which at least the dominant year class can be analyzed in detail, we propose sampling 300 fish in April. Fish are easier to capture in the spring, and the age distribution in the spring is most consistent with data used in the historical age-structured assessment model. With a sample size of 300, diseases with a prevalence as low as 1% can be detected with 95% confidence, and a 6% difference in sample prevalence (e.g., 10 vs. 16%) can be detected with a statistical power of 0.80 (Becker and Grieb 1987). To test hypotheses of age differences, the dominant year class--often >40% of the sampled population--will be compared with combined groups of smaller year classes. To detect seasonal differences, and minimize costs, 100 fish will be sampled in the fall. A sample size of 100 is sufficient to have 95% confidence that disease with a prevalence of 3% will be detected in at least one fish sampled (Becker and Grieb 1987).

Proposed study is designed to minimize bias associated with gear type, capture, and holding (Holst 1996). All fish will be sampled using commercial purse seines. In the event that large numbers of fish begin to spawn in areas too shallow for commercial seines, fish will be captured using cast nets. All necropsies will be completed < 4 hours after the seine is pursed around the fish.

To best characterize the condition of herring in Prince William Sound, herring will be subjected to complete necropsy using the following sampling schedule (as field conditions allow) during the three years of proposed study:

Dates	Reproductive Stage	Number of Fish
FY00: Oct./Nov., 1999 (2 nights)	peak condition/ gonadal development	100
mid-late April, 2000 (4 days)	Spawning/post-spawning	300
	Total Fish, FY00:	400

Dates	Reproductive Stage	Number of Fish
FY01: Oct./Nov., 2000 (2 nights)	peak condition/ gonadal development	100
mid-late April, 2001 (4 days)	spawning/post-spawning	300
Total Fish, FY01:		400

Fish for necropsy will be anesthetized in tricaine methane sulfonate (Finquel®) and visually screened for external lesions (Marty et al. 1998), which are ranked as none (0), mild (1), moderate (2), or severe (3). Prevalence of *Ichthyophonus* will be estimated by gross examination of internal organs, especially the heart. With funding from NSF, histopathological analysis will be done on 10 organs to determine *Ichthyophonus* prevalence.

Measurements on each fish include body weight, standard length, age (from scales), liver weight, and gonad weight. Otoliths are archived for later use if information on annual growth rates is desired. This study is designed to diagnose gross lesions and the two major diseases: VHSV and *Ichthyophonus hoferi*. Results will be compared with previous years of study. Several samples will be collected, but only selected samples will be analyzed:

- a. Virus isolation - To assay fish for virus, anterior kidney, spleen, and any severe skin lesions will be put into individually labeled plastic bags and stored on ice (for each fish, one bag will hold kidney and spleen, and a separate bag will be used for skin lesions). Samples will be shipped by air to the ADFG fish pathology laboratory in Juneau (under the direction of Dr. Ted Meyers) for analysis every 48 to 72 hours. Isolation using EPC cell lines will be as previously described (Meyers et al. 1994). The application of polymerase chain reaction (PCR) techniques for primary diagnosis of VHSV has been explored (R.M. Kocan and J.R. Winton, personal communication); to date, PCR has not proved more useful than virus isolation, but work is still underway.
- b. Bacteriology - for each fish with severe gross lesions, a sterile loop is stabbed into the anterior kidney and then streaked on Trypticase Soy Agar (TSA) and Marine agar for bacterial isolation. Ulcers will be preserved for histopathology or virology, but they will not be cultured for bacteria (superficial bacteria can be diagnosed on histopathology).

Other samples will be collected and analysis will be done using funding from NSF:

- a. Histopathology (fix in 10% neutral buffered formalin) - gill, spleen, liver, gonad, heart, stomach, intestinal tract, exocrine pancreas, trunk kidney, skeletal muscle, skin, brain, and other gross lesions. Also, a touch prep of kidney from each fish is made on a glass slide.
- b. Hematology - blood will be drawn from the caudal vein into a Lithium-heparinized syringe and stored on ice. Packed cell volume (PCV) is determined on site. A blood smear is made on a glass slide, dried, and archived. Plasma is separated by centrifugation (3,000 g for 7 min) and frozen within 3 h of collection.

- c. Immunology - plasma for IgM determination and a blood smear for leukocyte differential counts will be collected.

In previous study, spring samples from PWS had several other parasites, but these did not seem to be significant on the population level. Gross lesions and other observations will be scored as in previous years. Although all lesions are described in a "comments" section on our data sheet, only the most common gross findings are scored for statistical analysis: caudal fin fraying, caudal fin reddening, fin base reddening, focal skin reddening, diffuse skin reddening, iris reddening, branchial copepods, number of 0.5-mm-diameter white foci on gills, number of peritoneal Anisakidae, and gonadal fullness. Parasites requiring histopathology for diagnosis will be scored using NSF funds.

The ADFG fisheries laboratory in Cordova, Alaska, will handle logistics for sampling fish for necropsy, collecting age and length data, preparing formalin and containers for tissue fixation, providing a data recorder for one pathologist on site, and ship all samples. Results from virus isolation will be reported as a VHSV titer.

Quality control and quality assurance are part of all examinations. For necropsy examination, the senior pathologist (Dr. Marty) is on site at all times; when questionable or difficult lesions are encountered, the second pathologist can consult with Dr. Marty. In the event that Dr. Marty is unavailable for necropsy, five other pathologists have experience on the herring necropsy team, and services of these pathologists would be secured.

Statistical analysis in this study will focus on determining changes in disease prevalence over time. The association of selected categorical variables (e.g., VHSV status versus external lesion scores) will be evaluated using chi-square methods for categorical data analysis; comparisons will be considered valid only if individual expected cell frequencies are  $>1$  and no more than 20% of the cells have expected cell frequency  $<5$ . Odds ratios will be calculated only for standard (2x2) two-way contingency tables. Significance of changes in disease prevalence will be tested using chi-square or Fisher's Exact test. For all analyses, comparisons will be considered significant when  $P < 0.05$  and highly significant when  $P < 0.01$ .

### **C. Cooperating Agencies, Contracts, and Other Agency Assistance**

This proposal includes significant contributions from ADFG as the lead agency. The project is being run through ADFG because Dr. Marty has worked closely with ADFG on several Trustee Council-funded projects during this decade. ADFG has unique local knowledge on Pacific herring in PWS, including the necessary experience and expertise to secure all necessary charters and ship hazardous materials from Cordova to Davis. Close collaboration with ADFG allows for seamless transfer of disease information to fishery managers, and rapid transfer of disease information to commercial and subsistence fishers. No other agencies are requesting funds for this section of the project, and no other agencies or universities will be contracted for this work. Note, however, that Dr. Richard Kocan, University of Washington, is submitting a proposal to study disease in juvenile Pacific herring and determine if other forage fishes in PWS carry VHSV. Dr. Marty and Dr. Kocan worked closely on the initial multiyear herring disease project (98162 et al.), and they

will continue to share information on these new projects.

## **SCHEDULE**

### **A. Measurable Project Tasks for FY00**

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<b>DATES</b> <b>(results due on final date)</b>	<b>ACTIVITY</b>
<b>Fall Samples:</b>	
Oct. 1 - Nov. 30, 1999:	Collect samples; Person in charge: Gary D. Marty, UC Davis
Nov. 1 - Dec. 31, 1999:	Scale analysis (age); Person in charge: Greg Carpenter, ADFG, Cordova, AK
Nov. 1, 1999 – Feb. 28, 2000:	Virology and bacteriology; Person in charge: Ted Meyers, ADFG, Juneau, AK
March 1- Aug. 1, 2000:	Statistical analysis; Person in charge: Gary D. Marty
January, 2000 (5 days):	Attend Restoration Science Workshop (Gary D. Marty)
<b>Spring Samples</b>	
April 1 - April 30, 2000:	Collect samples; Person in charge: Gary D. Marty
April - July 31, 2000:	Scale analysis (age); Person in charge: Greg Carpenter, ADFG, Cordova, AK
April - Sept. 30, 2000:	Virology and bacteriology; Person in charge: Ted Meyers, ADFG, Juneau, AK
Oct. 2000 - Feb. 1, 2001:	Statistical analysis; Person in charge: Gary D. Marty
Jan. 11, 2000 –April 15, 2000:	Annual report writing; Person in charge: Gary D. Marty
open:	Opportunities for public comment

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### **B. Project Milestones and Endpoints**

#### **Review of Objectives:**

1. Determine the prevalence of major diseases in Pacific herring.
2. Determine the interaction of gender, age, and season on disease prevalence.
3. Determine the effect of disease on population trends.

Objectives will be met when each year of results is reported in the annual report, but the most complete information will be available when the multi-year study is completed and the final synthesis report is submitted April 15, 2002.

#### **D. Completion Date**

Basic project objectives will be met at the end of the third year of proposed study. Note, however, that each additional year of disease study in Prince William Sound provides more information on the recovery of the Pacific herring population. The first year of this project (99462) found continued evidence of viral expression in the population. High viral prevalence among recruiting populations of both the 1994 and 1995 year-classes seems to have severely limited the capacity of these year classes to contribute to population recovery. Preliminary evidence indicates that the 1996 year-class is small, but the 1997 year-class may be larger. Even if the 1997 year class is as large as the last major year class (1988), recovery cannot be fully documented until that year class is 5 years old: in 2002 (a year after the current project ends). Therefore, termination of study in 2001 is not likely to be sufficient to document population recovery. Comments from reviewers of my NSF proposal were favorable, but most reviewers agreed that following the population through a full cycle—probably 16 to 20 years—would be needed to understand how disease and population size are linked. Currently funded study through 2001 will provide us with 8 years of disease information, and this is already the most comprehensive study ever conducted on disease in a wild fish population. However, 8 years of study will provide information on no more than ½ of a population cycle. Extending this project (\_\_\_462) another 5 years through the Restoration Reserve cost sharing with NSF will greatly enhance our understanding of how and when the Pacific herring population recovers. Such an extension is not being proposed now, but possibility of a long-term extension will be discussed with the chief scientists as details of the restoration reserve become known.

#### **PUBLICATIONS AND REPORTS**

No publications are anticipated from this work in FY00. Because the study is primarily monitoring, and proposed for three years, publication will be most beneficial to the scientific community after all three years of data are collected and analyzed. Results from fall 1998 samples (project 99462) will be incorporated into manuscripts being prepared as part of the final report for the field component of project 98162, but funds needed for that work have already been appropriated.

**PROFESSIONAL CONFERENCES** - No funds are requested.

**NORMAL AGENCY MANAGEMENT** - Not applicable.

#### **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

Continuation of proposed disease research in PWS is critical for obtaining other funding. In late 1998, the National Science Foundation's Division of Biological Oceanography funded an unsolicited proposal to continue complete analysis of the samples collected as part of project \_\_\_462. The three-year \$286.4K NSF project has no funds for sample collection, and depends

entirely on Trustee Council funds for sample collection. The NSF project includes collaboration with ADFG (through John Wilcock) and the University of Alaska, Fairbanks (Dr. Terrance J. Quinn). Using Dr. Quinn's expertise, the NSF project includes a modeling component to mathematically determine the relation of disease and changes in population biomass. Trustee Council-funded studies of herring disease since 1994 were highlighted in the NSF proposal as a significant source of matching funds (about \$2.2 million over the life of the project). NSF normally does not fund unsolicited proposals for more than \$150K per year. Because the Trustee Council funded the first year of this project (99462), and committed to an additional 2 years of funding, NSF saved about \$207K on its project. At the same time, the Trustee Council will benefit from \$286.4K worth of analysis funded entirely by NSF.

This project is designed to provide the same types of data that were generated during detailed disease study since 1994 (94320S, 95320S, 96162, 97162, 98162, 99462). Each year of research produces some new findings, but with each year the significance of the project becomes greater than its individual parts. The addition of two more years of data on the most important diseases will only add to the significance of this work. Proposed study has two specific interactions: 1) fish captured at the same time as disease samples will be available for, but not replace, age-weight-length studies conducted under normal ADFG management or research studies; 2) Dr. Marty will continue to share information with Dr. Kocan as he proposes separate but related research on VHSV in PWS.

**EXPLANATION OF CHANGES IN CONTINUING PROJECTS** – no changes other than minor adjustments in the budget.

**PROPOSED PRINCIPAL INVESTIGATOR (Field Component)**

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School of Veterinary Medicine  
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e-mail: gdmarty@ucdavis.edu

**1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**  
October 1, 1998 - September 30, 1999

*Approved R 8-9-99*

Budget Category:	Authorized FFY 1999	Proposed FFY 2000						
Personnel	\$16.1	\$12.9						
Travel	\$0.0	\$0.0						
Contractual	\$44.5	\$47.4						
Commodities	\$9.0	\$9.0						
Equipment	\$0.0	\$0.0						
Subtotal	\$69.6	\$69.3	LONG RANGE FUNDING REQUIREMENTS					
General Administration	\$5.5	\$5.3	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003			
Project Total	\$75.1	\$74.6	\$81.7					
Full-time Equivalents (FTE)	0.4	0.4						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:								
This project proposal includes two components:								
1. University of California, Davis: Fish necropsy								
a. Funds for writing the annual report in FY01 are included in the FY00 request.								
2. Alaska Department of Fish and Game: Logistical and analytical support (costs are less than last year because one technician in the budget in FY99 has been eliminated from the budget).								

**2000**

Project Number: 00462  
Project Title: Effect of Disease on Pacific Herring Population Recovery in Prince William Sound  
Agency: AK Dept. of Fish & Game

FORM 3A  
AGENCY  
PROJECT  
DETAIL

# 1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 2000	
PM	Name	Position Description						
	G. Carpenter	Fishery Biologist II	16D	1.5	5,817		8.7	
	Vacant	Fish & Wildlife Technician II	9A	0.5	3,229	2,614	4.2	
Subtotal				2.0	9,046	2,614	\$12.9	
Those costs associated with program management should be indicated by placement of an *.							Personnel Total	\$12.9
Travel Costs:			Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 2000	
PM	Description							
Those costs associated with program management should be indicated by placement of an *.							Travel Total	\$0.0

2000

Project Number: 00462  
 Project Title: Effect of Disease on Pacific Herring Population Recovery in  
 Prince William Sound  
 Agency: AK Dept. of Fish & Game

FORM 3B  
 Personnel  
 & Travel  
 DETAIL

# 1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Contractual Costs:		Proposed
Description		FFY 2000
PWS Fall Sampling	Vessel Charter (hotel boat/sampling platform 4d @ 900/d)	3.6
	Vessel Charter (seiner to locate fish, 4d @ 1100/d)	4.4
	Shipping	0.2
PWS Spring Sampling	Vessel Charter (hotel boat/sampling platform, 7d @ 900/d)	6.3
	Vessel Charter (seiner to locate fish, 7d @ 1100/d)	7.7
	Shipping	0.3
Contract with Univ. of California Davis for analyses and report writing		24.9
When a non-trustee organization is used, the form 4A is required.		
Contractual Total		\$47.4
Commodities Costs:		Proposed
Description		FFY 2000
Misc. sampling supplies (tubes, jars, preservative, coolers, totes etc.) (approximately \$500/sample event - 2 events)		1.0
Pathology Laboratory - Virology/Bacteriology Supplies (400 samples @ \$20/sample)		8.0
Commodities Total		\$9.0

2000

Project Number: 00462

Project Title: Effect of Disease on Pacific Herring Population Recovery in Prince William Sound

Agency: AK Dept. of Fish & Game

FORM 3B  
Contractual &  
Commodities  
DETAIL

## October 1, 1998 - September 30, 1999

2000

Project Number: 00462
Project Title: Effect of Disease on Pacific Herring Population Recovery in Prince William Sound
Agency: AK Dept. of Fish & Game

FORM 3B  
Equipment  
DETAIL

# 1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Budget Category:	Authorized FY 1999	Proposed FY 2000					
Personnel		\$10.4					
Travel		\$5.8					
Contractual		\$2.4					
Commodities		\$2.3					
Equipment		\$0.0					
Subtotal	\$0.0	\$20.9	LONG RANGE FUNDING REQUIREMENTS				
Indirect		\$4.0			Estimated FY 2001	Estimated FY 2002	
Project Total	\$0.0	\$24.9			\$29.5	\$0.0	
Full-time Equivalents (FTE)		0.2					
Dollar amounts are shown in thousands of dollars.							
Other Resources							

Comments: Indirect Costs include the standard overhead rates and applications for the Institute of Toxicology and Environmental Health (ITEH) at the University of California, Davis (18.9%).

Other funds - A 3-year \$286.4K grant was funded by the National Science Foundation (NSF), 2-1-99 through 1-31-02, with Dr. Gary D. Marty as principal investigator. The NSF grant includes complete blood analysis, histopathology, and population modeling not included in this proposal. This proposal (00462) can stand on its own, but completion of the NSF grant is entirely dependent on access to samples collected as part of this project. The Trustee Council benefits by getting complete analysis of all samples collected, including population modeling, at no additional cost.

Proposal includes funds (here, direct costs) for report writing (0.5 month time for G. Marty, \$400 of the supply budget), community involvement (0.2 month time for G. Marty, \$50 for long distance phone calls), the annual workshop and a technical review session (travel and per diem). The proposal does not include funds for NEPA compliance, publications, or professional conferences (the NSF grant provides funds for publication and for Dr. Marty to attend one professional meeting per year). Increased cost for the final year covers extra time by Dr. Marty (0.5 month) for final report writing.

FY00

Project Number: 00462

Project Title: Effect of Disease on Pacific Herring Population Recovery in Prince William Sound

Name: University of California, Davis

Agency: ADFG

FORM 4A  
Non-Trustee  
SUMMARY

October 1, 1998 - September 30, 1999

FY00

6 of 8

Agency: ADFG

7/12/99

**1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1998 - September 30, 1999

<b>Contractual Costs:</b>		Proposed
Description		FY 2000
150 fish necropsies @ \$15.75/fish (professional services of consulting pathologist)		2.4
<b>Contractual Total</b>		<b>\$2.4</b>
<b>Commodities Costs:</b>		Proposed
Description		FY 2000
Materials and supplies (for sampling supplies, report writing, long distance phone, film, computer disks)		1.7
statistical analysis		0.4
ITEH supplies		0.2
<b>Commodities Total</b>		<b>\$2.3</b>

**FY00**

Prepared:

7 of 8

Project Number: 00462

Project Title: Effect of Disease on Pacific Herring Population Recovery in Prince William Sound

Name: University of California, Davis

Agency: ADFG

FORM 4B  
Contractual &  
Commodities  
DETAIL

4/12/99

# 1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

New Equipment Purchases:		Number of Units	Unit Price	Proposed FY 2000
Description				
	none			0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
Those purchases associated with replacement equipment should be indicated an "R."			<b>New Equipment Total</b>	<b>\$0.0</b>
Existing Equipment Usage:		Number of Units		
Description				
	IEC clinical centrifuge equipped with rotors for on site plasma separation and packed cell vol. determination	1		
	Revco -80° freezer for archiving plasma	1		
	YSI Model 55 hand-held dissolved oxygen meter for checking fish holding conditions before necropsy	1		
For report writing and correspondence:				
	Pentium 90 IBM-PC desktop computer with 64Mb RAM, Ethernet card, and internal 14,400 baud modem	1		
	486-100 IBM-PC color notebook computer with 16MB RAM and internal 14,400 baud modem	1		
	HP4L LaserJet printer	1		
	Codonics NP-1600 Color Photographic Network Printer, for publication grade printing of digital images	1		

**FY00**

Prepared

8 of 8

Project Number: 00462

Project Title: Effect of Disease on Pacific Herring Population Recovery in Prince William Sound

Name: University of California, Davis

Agency: ADFG

FORM 4B  
Equipment  
DETAIL

12/99



## **Recovery Status of Barrow's Goldeneyes**

Project Number:	00466-CLO
Restoration Category:	Research
Proposer:	D. Esler/USGS-BRD
Lead Trustee Agency:	DOI
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	Cont'd
Duration:	2nd yr. 2 yr. project
Cost FY 00:	\$14.8
Cost FY 01:	\$0.0
Cost FY 02:	\$0.0
Geographic Area:	Prince William Sound
Injured Resource/Service:	Barrow's goldeneye

### **ABSTRACT**

Data available at the onset of this project (population trends and indices of contaminant exposure) raised concern that Barrow's goldeneye populations may have been injured by the oil spill, may not be fully recovered, and may continue to suffer deleterious effects of the spill. This project is designed to critically assess the recovery status of Barrow's goldeneye populations through assemblage and analysis of all existent, relevant data. This work will lead to definition of recovery status, identification of any data gaps limiting understanding of recovery status or impediments to recovery, and, if warranted, proposal of directed research to fill those gaps in subsequent years. Most data analyses were conducted during FY 99; FY 00 funds are requested for final data analyses and compilation of analysis results and other information into the final report and manuscripts.

## INTRODUCTION

Barrow's goldeneyes (*Bucephala islandica*) occur in nearshore habitats of Prince William Sound (PWS), the environment that received about 40% of the oil spilled after the *Exxon Valdez* ran aground (Galt et al. 1991). PWS is almost exclusively a wintering area for Barrow's goldeneyes. Estimates of sound-wide goldeneye numbers (which include a small proportion of common goldeneyes [*B. clangula*]) during 1996 were approximately 36,000 in winter and 400 in summer (Agler and Kendall 1997). Although concerns about nearshore recovery and restoration have resulted in a suite of studies sponsored by the Exxon Valdez Oil Spill Trustee Council (EVOSTC), assessments of Barrow's goldeneye recovery status and constraints to recovery had not been conducted prior to the onset of this project.

Barrow's goldeneyes may be particularly susceptible to injury and constraints to recovery from the oil spill. Because of their close affiliation with intertidal habitats, which still contain oil in some areas, Barrow's goldeneyes may continue to be exposed. Data from the first year of this study demonstrate that Barrow's goldeneyes preferred areas of mixed substrate over rocky substrate and they preferred unexposed areas over exposed; the types of habitats preferred by Barrow's goldeneyes have been shown to be the most likely to hold residual oil. Further, winter diets of Barrow's goldeneyes consist almost entirely of mussels (*Mytilus trossulus*; Koehl et al. 1982, Vermeer 1982), which have been demonstrated to contain hydrocarbon residues as recently as 1995 (Babcock et al. 1997). Also, Barrow's goldeneyes, like other sea ducks, are long-lived with relatively low annual productivity. Population dynamics of species with these life history characteristics have relatively low rates of potential population growth (Goudie et al. 1994, Schmutz et al. 1997). Thus, recovery of Barrow's goldeneye populations (if injured by the oil spill) would be expected to take many years, even in the absence of long-term, chronic effects.

This species warrants concern not only for population recovery, but also because Barrow's goldeneyes are an important subsistence resource for local residents. For example, in Chenega goldeneyes were harvested by over 25% of households and constituted the majority of harvested waterfowl (Scott et al. 1996). PWS residents have expressed concern over recovery of populations of harvested waterfowl species, including Barrow's goldeneyes (Dan Rosenberg, ADFG, pers. comm.).

This project capitalizes on data collected during NVP studies on the primary study sites of northern Knight Island (oiled) and Montague Island (unoiied). These data were collected during efforts addressing sea otter (*Enhydra lutris*) and harlequin duck (*Histrionicus histrionicus*) recovery. However, they also can be used to critically assess Barrow's goldeneye recovery. This project does not propose work that is already funded under NVP, but rather proposes to either (1) reanalyze data used to assess sea otter or harlequin duck recovery to address questions specific to goldeneyes or (2) analyze data specific to Barrow's goldeneyes that were collected as an aside when conducting NVP field studies. Data collected during NVP that will be used to assess goldeneye recovery include: mussel size class and abundance (collected to assess sea otter recovery), goldeneye abundance and distribution (collected during harlequin duck surveys), goldeneye body condition and diet (from birds collected for NVP copredator studies), and cytochrome P4501A induction of goldeneyes (from collected birds).

Other data that will be assessed with regard to Barrow's goldeneye recovery status include survey data from USFWS, Migratory Bird Management, mussel contaminant level data from NOAA, Auke Bay Lab, and immediate post-spill data collected during ADFG harlequin duck studies. All analyzed and compiled data will be incorporated into the NVP recovery assessment framework as described in Methods.

Based on results from analyses and compilation of available data, the proposed work will lead to conclusions regarding the status of recovery and will generate recommendations for specific research to fill any remaining data gaps. If necessary, additional research would be recommended following the logic and organization of the NVP project, which addressed potential demographic, trophic, and health constraints to recovery of nearshore vertebrate predators, and the nearshore environment generally. Along with addressing questions specific to Barrow's goldeneye recovery, the work conducted under this proposal, as well as any additional research, will serve as another window into recovery of the nearshore system (Holland-Bartels 1995).

## **NEED FOR THE PROJECT**

### **A. Statement of Problem**

At the onset of this project, several pieces of evidence were available that suggested that Barrow's goldeneyes suffered injury from the oil spill and that recovery had not occurred. Sound-wide population surveys have suggested divergent population trends between oiled and unoiled areas (Agler and Kendall 1997; Brian Lance, USFWS, pers. comm.), as of March 1998. Further, comparisons of pre- and post-spill data suggest population reductions in oiled versus unoiled areas at several geographic scales of analysis (David Irons, USFWS, pers. comm.). Also, levels of P4501A expression in goldeneyes were significantly higher on oiled Knight Island than unoiled Montague Island (Esler, unpubl. data). These data, along with the life history characteristics that indicate susceptibility of Barrow's goldeneyes to oil spill effects, strongly suggest that a more complete evaluation of the status of recovery, and potential impediments to recovery, is an important restoration objective.

### **B. Rationale/Link to Restoration**

Barrow's goldeneye restoration requires assessment of recovery status and definition of impediments to recovery (demographic, trophic, or health/oil exposure). This proposed work represents a comprehensive approach to understanding the factors that affect population dynamics and definition of critical bottlenecks to recovery. Without an understanding of the underlying processes that dictate population change, we can not prescribe specific activities to enhance recovery.

### **C. Location**

Data to be compiled will come from throughout Prince William Sound. NVP data that will be used to assess Barrow's goldeneye recovery were collected on northern Knight Island (Bay of Isles and Herring Bay) and Montague Island. There is no field component for proposed work.

## **COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE**

All efforts will be made throughout the restoration process to participate in and provide public involvement in the implementation of this project. Project staff will be available to present information to local communities or prepare articles or photographs for Trustee Council publications.

## **PROJECT DESIGN**

### **A. Objectives**

1. Analyze data collected during NVP studies and report on results regarding:
  - a. Foraging ecology of Barrow's goldeneyes, including body composition, diet composition, and mussel size class selection.
  - b. Factors influencing distribution and abundance of Barrow's goldeneyes, including mussel abundance, habitat characteristics, and oiling history.
2. Summarize data from other sources relevant to assessment of Barrow's goldeneye recovery status and impediments to recovery.
3. Generate conclusions regarding recovery status, identify impediments to recovery (if any), and recommend research needed to fill in data gaps to fully evaluate recovery status or impediments to recovery (if necessary).

### **B. Methods**

Following the NVP framework, the proposed work will ask the questions: "Is there evidence for lack of recovery or continued injury from the oil spill?" and "If so, is recovery limited by trophic, demographic, or health constraints?"

#### Trophic Interactions

Data collected during NVP studies will prove valuable for understanding potential limiting effects of prey availability. Mussel availability and abundance data for NVP study sites will be used to assess food limitation. Lower biomass of mussels (in size classes consumed by goldeneyes) per goldeneye on the oiled study area would be consistent with a hypothesis of potential food limitation of recovery. Preliminary analyses conducted during FY99

demonstrated that abundance and density of mussels was comparable or higher on oiled Knight Island than unoiled Montague Island, suggesting that food is not limiting population recovery.

Waterfowl body mass and condition have been shown to be related to both contaminant exposure (see below) and food availability. Further, body mass and condition have been shown to affect subsequent survival (Conroy et al. 1989, Longcore et al. 1991, Bergan and Smith 1993) and productivity (Esler and Grand 1994). Lab analyses of lipid and protein levels were conducted for each Barrow's goldeneye collected for NVP copredator studies. Under this proposal, these data will be analyzed to assess variation in body condition related to sex, age, season, and oiling history (i.e., study area). Poorer body condition in oiled areas than unoiled areas, in conjunction with lower food availability, would be consistent with a hypothesis of food limitation of recovery. Analyses conducted in FY99 found that body mass, after accounting for effects of age, sex, and season, did not differ between areas, further suggesting that food is not limiting population recovery. Condition data are still being analyzed.

### Demography

Data regarding goldeneye distribution and abundance were collected during NVP harlequin duck surveys. These data were analyzed to assess variation in goldeneye density related to mussel abundance, habitat characteristics, and oiling history. This will assess recovery status by determining whether densities of goldeneyes on oiled study areas are comparable to those on unoiled areas after accounting for intrinsic differences in habitat and food. Preliminary analyses conducted in FY99 demonstrate that Barrow's goldeneye densities were not lower on oiled than unoiled areas after accounting for intrinsic differences area differences.

Migratory Bird Management, USFWS, has conducted surveys throughout Prince William Sound following the spill. This project proposes interpretation of data through the most recent (March 1998) survey, in light of other data regarding Barrow's goldeneye population health.

Survival and movements data are not available for Barrow's goldeneyes. These parameters have proven critical for understanding the progress and process of harlequin duck recovery status and may be appropriate for future research on Barrow's goldeneye recovery.

### Indices to Health/Oil Exposure

Oil exposure of collected Barrow's goldeneyes was evaluated by measurements of cytochrome P4501A. Results from harlequin duck work strongly indicate that induction of P4501A reflects continued exposure to *Exxon Valdez* oil. For many nearshore predators, including Barrow's goldeneyes, elevated cytochrome P4501A was expressed in oiled sites. These data will be interpreted in light of other results.

Because Barrow's goldeneye diets consist almost exclusively of mussels during winter, mussel hydrocarbon contamination data from NOAA, Auke Bay Lab, will be reviewed to determine whether foraging represents a potential pathway of continued oil exposure. Mussel bed sampling will be conducted during summer 1999 (Pat Harris, pers. comm.); this information will be

incorporated into considerations of goldeneye recovery.

Waterfowl body mass has been demonstrated to be related to contaminants (Hohman et al. 1990). Body mass and condition data were interpreted in light of measures of oil exposure. Lowered body mass, in conjunction with differences in P450 induction, would be consistent with a hypothesis of health related constraints to recovery. However, analyses conducted during FY99 found that body mass was not related to P450 induction, after accounting for sex, age, and season differences.

### **C. Cooperating Agencies, Contracts, and Other Agency Assistance**

This proposal relies on data collected by a number of researchers funded by the EVOSTC, including the principal investigator, Chuck O'Clair (NOAA), Pat Harris (NOAA), David Irons (USFWS), and Dan Rosenberg (ADFG).

## **SCHEDULE**

### **A. Measurable Project Tasks for FY 00**

Throughout: Analyze and summarize data regarding Barrow's goldeneye recovery status and impediments to recovery.

April 15: Submit final report, as described below.

### **B. Project Milestones and Endpoints**

This project will be completed upon submission of the final report prior to 15 April 2000.

### **C. Completion Date**

All project objectives will be met during FY2000.

## **PUBLICATIONS AND REPORTS**

A final report of activities will be submitted to the Restoration Office before 15 April 2000. The report will consist of 3 documents:

1. A report on status and constraints to recovery of Barrow's goldeneyes based on all available data.
2. A draft manuscript regarding foraging ecology of Barrow's goldeneyes, including diet and body composition variation within and between oiled and unoled study areas.

3. A draft manuscript addressing factors related to density of Barrow's goldeneyes, including habitat variables, mussel biomass, and oiling history.

## **PROFESSIONAL CONFERENCES**

None in FY 00.

## **NORMAL AGENCY MANAGEMENT**

The work proposed here is not part of normal agency management and is related specifically to research addressing oil spill restoration concerns. No similar work has been conducted, is currently being conducted, or is planned using agency funds.

## **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

As described above, this research relies on incorporation of data from other Trustee sponsored research. The major objectives of this work require interaction with other investigators and integration of all available data that are relevant to the question of Barrow's goldeneye recovery status. Also, this proposal relies on data collected during NVP studies by the principal investigator.

## **PROPOSED PRINCIPAL INVESTIGATOR**

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# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Revision 1-8-99  
Approved TC 8-9-99

Budget Category:	Authorized FY 1999	Proposed FY 2000					
Personnel	\$10.6	\$12.0					
Travel		\$0.0					
Contractual		\$0.0					
Commodities		\$1.0					
Equipment		\$0.0					
Subtotal	\$10.6	\$13.0	LONG RANGE FUNDING REQUIREMENTS				
General Administration	\$1.6	\$1.8			Estimated FY 2001	Estimated FY 2002	
Project Total	\$12.2	\$14.8			\$0.0	\$0.0	
Full-time Equivalents (FTE)		0.2					
Dollar amounts are shown in thousands of dollars.							
Other Resources							
Comments: Submitted FY00 budget is higher than projected in FY99 proposal, due to higher than anticipated salary costs.							

**FY00**

Project Number: 00466  
Project Title: Recovery Status of Barrow's Goldeneyes  
Agency: DOI-BRD

FORM 3A  
TRUSTEE  
AGENCY  
SUMMARY

Prepared:

October 1, 1999 - September 30, 2000

**FY00**

Project Number: 00466
Project Title: Recovery Status of Barrow's Goldeneyes
Agency: DOI-BRD

FORM 3B  
Personnel  
& Travel  
DETAIL

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		Proposed
Description		FY 2000
4A Linkage		0.0
When a non-trustee organization is used, the form 4A is required.		
<b>Contractual Total</b>		\$0.0
<b>Commodities Costs:</b>		Proposed
Description		FY 2000
Manuscript Publication Costs (Barrow's Goldeneye Foraging Ecology and Body Condition Variation)		0.5
Manuscript Publication Costs (Factors Related to Distribution and Abundance of Barrow's Goldeneyes)		0.5
<b>Commodities Total</b>		\$1.0

**FY00**

Project Number:00466  
Project Title: Recovery Status of Barrow's Goldeneyes  
Agency: DOI-BRD

FORM 3B  
Contractual &  
Commodities  
DETAIL

Prepared:

October 1, 1999 - September 30, 2000

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**Effects of Oiled Incubation Substrate on Pink Salmon Reproduction**

Project Number: 00476  
Restoration Category: Research  
Proposer: R. Heintz/NOAA  
Lead Trustee Agency: NOAA  
Cooperating Agencies: None  
Alaska SeaLife Center: No  
New or Continued: Cont'd  
Duration: 2nd yr.  
3 yr. project  
Cost FY 00: \$74.8  
Cost FY 01: \$36.0  
Cost FY 02: \$0.0  
Geographic Area: Little Port Walter  
Injured Resource/Service: Pink salmon

**ABSTRACT**

This project will examine the effects of oil exposure during embryonic development on the gamete viability of pink salmon that survive to spawn. The objective is to determine if exposure to oil during incubation could explain the reduced gamete viability reported for pink salmon in Prince William Sound under Project /191A. In that project, gametes taken from pink salmon returning to oiled streams had higher mortality rates than gametes taken from salmon in unoiled streams. These data suggest a dramatic effect of oil on vertebrate reproduction that has not previously been described. The plausibility of reduced gamete viability is indicated by the effects demonstrated by Project /191B, which include reduced marine survival and growth of returning adults. However, this effect still requires unequivocal demonstration. During FY 99, fry were exposed, marked and released. During FY 00, adults will be recovered and their gametes crossed to demonstrate their viability. In FY 01, estimates of viability will be obtained and used to complete a model of life cycle effects resulting from incubation of eggs in oiled gravel.

## INTRODUCTION

This experiment tests the hypothesis that incubation in water contaminated by oiled gravel produces adult pink salmon with reduced reproductive capacity. After the Exxon Valdez oil spill (EVOS), pink salmon embryos developing in oiled streams experienced increased mortality (Bue et al. 1995). Further experiments reported by Bue et al. (1998) indicated that adult fish returning to oil contaminated streams had reduced gamete viability. In these experiments, gametes were collected from adults returning to oil contaminated and uncontaminated streams and incubated in a hatchery before they could be exposed to oil. Despite the identical incubating environments, the gametes derived from oil contaminated streams consistently produced fewer viable embryos than gametes derived from uncontaminated streams. This difference was thought to result from differences in the incubating environments experienced by the adults contributing the gametes and therefore suggested a previously undescribed long-term effect of oil on reproductive ability.

Demonstrating a long-term effect of oil on pink salmon reproduction has important implications for managers in Prince William Sound as well as managers seeking to restore wildlife populations in other locations. The effects observed in pink salmon after the EVOS were a direct result of their dependence on the intertidal environment for early development. This implies that other species with similar dependencies were also at risk. Furthermore, the exposure levels shown capable of causing long-term impacts on growth and marine survival in pink salmon are less than or equal to the Alaska State water quality criteria, which are among the most rigorous in the United States. This suggests that water quality criteria in locations outside Alaska may limit the potential for restoring fish populations in streams located near hydrocarbon sources such as urban runoff.

The intent of this experiment is to examine the effects of oil exposure on pink salmon reproduction under controlled laboratory conditions. Environmental exposures will be simulated by incubating embryos in gravel with a known concentration of oil from fertilization to emergence in a simulated intertidal environment. The fish will be marked and released. Upon maturity, returning adults will be recovered and the viability of their gametes will be compared to those taken from unexposed, but similarly handled, fish.

The procedure proposed here repeats the experiments performed under Restoration 191B, but with the sole purpose of testing the hypothesis that incubating in oiled gravel impairs the reproductive ability of salmon that survive to maturity. Consequently, we have limited the exposures to two doses, released sufficient numbers of fish to guarantee an adequate number of returning adults, and marked the fish externally so that exposure levels can be readily discerned when the fish return to spawn. These procedures significantly reduce the cost of the study.

Projects 191B and 076 were successful in measuring oil impacts to marine survival and straying,

but the coded-wire tags required to identify the treatment groups in that study had to be recovered and decoded before adult pairs could be matched for mating. The delays encountered while decoding hundreds of tags led to reduced gamete viability in all the treatments, which may have masked any oil related effects. This follow-up study uses external marks to alleviate that problem and is designed specifically to test for oil effects on gamete viability.

## **NEED FOR THE PROJECT**

### **A. Statement of the Problem**

Field and laboratory work conducted after the EVOS by Restoration Study 191A suggested that pink salmon in contaminated streams had reduced fitness when they were exposed to low concentrations of polynuclear aromatic hydrocarbons (PAH). Field evidence for reduced fitness included observations of increased embryo mortality in contaminated streams (Bue et al. 1995) and reduced viability in gametes taken from adults returning to contaminated streams (Bue et al. In press). These data have been supported by laboratory studies (Heintz et al. 1995 and Wertheimer et al. 1996) that have shown the sensitivity of pink salmon embryos to water contaminated with very low concentrations of oil.

The laboratory studies provided a basis for estimating the total reduction in fitness for pink salmon exposed to water contaminated with oil at concentrations approaching those prescribed by the Alaska State water quality criteria. The reductions in embryo survival, growth, and marine survival can be integrated to calculate a total reduction in the average fitness for exposed populations of nearly 50%. However, reduced gamete viability among individuals as reported by Bue et al. (In Press) has not been adequately demonstrated among the survivors of the laboratory exposures. In 1995, gametes taken from fish exposed as embryos in the 1993 experiments appeared to have reduced viability, but inadequate numbers of fish prevented statistical verification of this observation. In 1997 we recovered sufficient numbers of fish that had been exposed as embryos in 1995 experiments, however high mortality rates were observed in all the treatment groups including the controls, possibly masking elevated mortality rates in the exposed groups. The source of these high mortality rates is unknown, but is probably related to the time required to hold the gametes prior to spawning in order to find sufficient numbers of mates among all the returning fish.

The effects already described for pink salmon that incubate in oil gravel suggest the plausibility of reduced gamete viability. These include effects on fitness related characters such as growth and marine survival. In addition, histopathological examination of fry emerging from oiled gravel demonstrated an effect of oil on gonad development (Marty et al. 1997). Previous attempts to demonstrate gamete viability have provided results that are highly suggestive of oil related effects, and have generally included exposure to a number of doses to allow generation of dose response curves. In the study proposed here, the design is aimed at demonstrating an effect of oil exposure on gamete viability. Thus, we have limited the number of treatments in order to maximize the number of fish that survive to adult, and we will mark fish externally to identify exposure level to minimize the holding time for gametes prior to fertilization.

## **B. Rationale/Link to Restoration**

Pink salmon are an ideal species for identifying prolonged population effects resulting from embryonic oil exposure. Pink salmon have been widely studied because of their commercial value and relatively simple life history, and their dependence on the intertidal for incubating in PWS made them a premier sentinel species for detecting oil damage after EVOS. Consequently, a large amount of effort and money was expended towards understanding how oil affected pink salmon populations. This work has led to important advances in our understanding of the scope and mechanisms of oil toxicity and has led to developing a model describing the average reduction in reproductive fitness of exposed populations. Laboratory confirmation of Bue et al.'s claim of an oil effect on gamete viability for pink salmon is the last piece of data required to construct a new paradigm for oil toxicity.

Confirmation of the field observations of reduced gamete viability (Bue et al. 1995) will provide managers with a more comprehensive model for the long-term effects of oil on pink salmon. This information is important to managers working to restore salmon populations in PWS as well as locations in less pristine locations. Concentrations found to be effective at reducing average fitness (Heintz 1995) are significantly lower than those required by the Alaska State water quality criteria and are typical of concentrations in urban locations (Maltby et al. 1995). Of additional value is the demonstration that oil has life long effects for organisms exposed during embryonic development. Both the exposure mechanism and the extent of the effects described in this work represent significant advances in the understanding of oil toxicity.

## **C. Location**

This project is underway at Little Port Walter (LPW), a research hatchery operated by NMFS in southeastern Alaska. This location is appropriate because it has been the site of these studies since their inception. The facility provides easy access to the intertidally spawning pink salmon stock that has been the subject of previous experiments. In addition, the exposure apparatus requires a simulated intertidal environment and such a system is in operation at LPW.

## **COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE**

This project will take place in southeastern Alaska, but depends on contract labor for marking fish for a period of 6 weeks in the spring of 2000. All efforts will be made to advertise our labor requirements in the spill zone. We will continue to provide information to interested public (primarily fishermen) who visit the station; we will be displaying at the facility the posters developed for the Restoration Workshop for 97191B and 97076 as interpretative tools. In addition, in 1999 we have traveled to Cordova to present a summary of our results to the public.

## **PROJECT DESIGN**

### **A. Objectives**

1. Determine the effect of incubating in oiled gravel on reproductive capacity of pink salmon.
2. Complete the model of life cycle impacts from incubation in oiled gravel.

We are currently testing the hypothesis that incubating in gravel contaminated with oil leads to reduced gamete viability. Fish have been exposed, marked and released. Gametes will be collected at the end of FY 00. Examination of gamete viability will provide information for completing a life-history model for oil toxicity which allows us to quantify the effect of oil on each of the major life-history stages of pink salmon in terms of reduced survival. Thus far, we have demonstrated that embryos developing in oil contaminated gravel have reduced survival, and fry that survive incubation have reduced growth and reduced survival to maturity. These observations account for a 50% reduction in the average survival of a population of pink salmon exposed to PAH concentrations equal to the Alaska State water quality standard. The proposed study will refine the model by providing an estimate of the specific loss in reproductive ability in exposed individuals. To our knowledge this type of analysis does not exist for any vertebrate and these effects occur at concentrations that are commonly seen in urban locations.

### **B. Methods**

The exposure mechanism and fish culture procedures followed those described in previous proposals for Restoration Study 191B. Gametes were taken from an intertidally spawning pink salmon stock, transferred to our hatchery at Little Port Walter where they were incubated beginning in FY98. The eggs were exposed to effluent from either oil-coated or untreated gravel. In FY99, approximately 60,000 surviving fry from each exposure group were marked by excising the adipose fin and one pelvic fin depending on exposure regime. Marked fish were held for a short period to recover from the marking procedure and then released. Exposures began in September of 1998; between 50 and 500 mature fish representing each treatment are expected to return in September 2000.

All pink salmon returning to the Sashin Creek weir will be inspected for marks during the 2000 escapement period (FY00). Marked fish will be sorted by treatment groups into holding pens since the external marks will provide for immediate identification of exposure level. On a given spawning date, sufficient numbers of fish will be removed from each pen and spawned, ensuring minimal holding times for gametes prior to spawning. Spawning will be directed by a contracted expert in fish reproduction to ensure maximal survival. Previously, we have released fish from multiple treatments which necessitated the use of coded-wire tags for identifying them upon return. This approach allowed us to quantify oil effects on growth, marine survival, and homing fidelity but not gamete viability due to the long time periods associated with tag recovery decoding on a given spawning date.

Gamete viability will be determined for the oil treatment and the control groups. Three experiments will be performed to evaluate the reproductive viability of the parents. The objective of the first experiment will be to determine the average offspring survival of parents exposed to oil during incubation. The importance of this experiment is that all the possible crosses within an exposure group can be made and the overall average survival measured, however the primary source of variation will be measurement error and no information will be available on individual variation. Therefore, the second experiment's objective will be to estimate how much of the variability in offspring survival is due to individual variation. This experiment will determine individual variability and thus provide control for the interpretation of the results of the first experiment. Lastly, the objective of the third experiment is to identify the genetic component to variability or heritability of offspring survival. The benefit of this third experiment, besides demonstrating a genetic effect of oil, is that calculation of the genetic heritability of the damage provides a basis for calculating how long the effect will persist in the exposed population. In all experiments survival will be measured to fertilization, eyeing, and emergent fry stages. The numbers of defective or dead progeny will be compared between treatment groups. Because these gametes will not be incubated in an oiled environment, any observed increases in mortality or defective individuals can be attributed to oiling effects upon the first generation.

#### First Experiment

Average offspring survival will be estimated in the first experiment by measuring the survival in pools of gametes comprising all the possible pairwise crosses. On each day of spawning, 2 embryo pools will be formed per treatment. Upon formation of an embryo pool, 6 subsamples, each of approximately 150 embryos, will be randomly selected and incubated in an individual cell within a Heath tray. On a given day, pools will be formed by randomly assigning half the males and females from a treatment group to one of two subgroups. Each female in a subgroup will contribute approximately 900 eggs to a common pool, the pool will be mixed and the mixture divided into a number of aliquots equal to the number of males in the subgroup. Each male in the subgroup will fertilize one aliquot, and the fertilized eggs will be recombined in a common container, mixed and divided into six aliquots that will be incubated in randomly assigned locations. Thus, the average survival of a treatment group on a given day will be the mean of the average survivals in each of the two subgroups.

The estimates of mean survival of the treatment groups will be compared with  $t$  tests after assuming that variability between groups of like-treated incubators is negligible. A  $t$  test between, for example, treatment 1 and 2, when there are  $d$  spawning days,  $q$  treatments,  $p$  subgroups per treatment, and  $r$  cells per subgroup will have the following form:

$$t_{((p-1)*q*d)df} = \frac{\frac{1}{d} [\overline{sv_{11}} + \dots \overline{sv_{1d}} - \overline{sv_{21}} \dots - \overline{sv_{2d}}]}{\sqrt{\frac{1}{d^2} * \frac{s_c^2}{p * r} * 2 * d}}$$

where,

$\overline{sv_{ij}}$  = Survival rate for treatment  $I$  on day  $j$

$s_c^2$  = Combined Between-Pools Mean Square obtained by ANOVA.

Comparisons will be made between each of the doses and the control and the overall  $\alpha$  will be maintained at 0.05.

### Second Experiment

For the second experiment, fish from the oil and control doses will be mated using a fully-crossed half-sib design (Falconer 1981). In this design, the remaining eggs from an exposed female and a control female are each split into two aliquots. One aliquot from each female is fertilized with aliquots of sperm from the same oil-exposed male, and one aliquot from each female is fertilized with aliquots of sperm from the same control male. This 2 x 2 breeding matrix will be replicated so that every female is represented in a breeding matrix or until there are 30 breeding matrices for each treatment, whichever is greater. Each half-sib family will be incubated in an individual container.

### Third Experiment

The third experiment will be performed under contract by the University of Alaska using gametes collected at the same time as those used in the previous experiments. The fish will be used to produce ten 2 x 3 mating sets: 'oiled' females crossed with oiled males and ten 2 x 3 mating sets: 'unoiled' females crossed with unoiled males. Within each set, eggs from each female will be separately fertilized using semen from 3 males. Therefore, each set will produce 6 families, resulting in a total of 60 oiled families and 60 unoiled families (oiled and unoiled F1). Each family will be divided in 2 parts, each of which will be randomly placed in an incubator compartment. Data to be collected for each of the 240 incubator compartments includes: mortality rate at eye, hatch, and emergence, and developmental rate to eye, hatch, and emergence.

Additive genetic, maternal, non-additive genetic, and phenotypic variances will be estimated and heritabilities, and ratios of maternal and nonadditive genetic variances to phenotypic variances will be calculated using an animal model solved by applying a derivative free technique for estimating variance components employing restricted maximum likelihood (Graser et al., 1987).

Prepared 4/12/99

Project 00476

The derivative-free restricted maximum likelihood (DFREML) analysis procedure of Meyer (1988) will be utilized. The technique has been utilized to analyze data from breeding experiments of fish (Crandell and Gall, 1993). Heritability estimates may be used to predict expected genetic change due to natural selection for a range of selection intensities (Van Vleck, 1987).

### **C. Cooperating Agencies, Contracts and Other Agency Assistance**

Fish spawning and handling of gametes in FY 00 will be directed by a contracted expert in the field of fish reproduction. The statistical analysis of the results for experiment 1 have been designed by the Alaska Department of Fish and Game (ADF&G). The design and execution of experiment 3 will be contracted to University of Alaska through ADF&G.

## **SCHEDULE**

### **A. Measurable Tasks for FY 00 (October 1, 1999 - September 30, 2000)**

Sept. 2000: Collect gametes from returning adults and cross them.

### **B. Project Milestones**

Completed:

Sept. 1998: Set-up exposure apparatus, collect gametes, begin exposures.

May 1999: Release marked fry

Underway:

Sept. 2000: Examine oil effect on gamete viability by recovering and spawning marked adults when they return to weir.

Aug 2001: Complete analysis of gamete viability.

### **C Completion Date**

Final Report will be submitted on August 15, 2001 in FY 2001.

## **PUBLICATIONS AND REPORTS**

FY 99: Annual Report describing the doses, exposure apparatus and effects on early incubation.

FY 00: Final Report

Other manuscripts planned:

Heintz, R. 2000. Effect of incubating in oil on pink salmon reproductive capacity.

Journal Unknown.

Heintz, R. 2000. Incubating in oiled gravel damages the entire life-history of pink salmon. Journal Unknown.

## **PROFESSIONAL CONFERENCES**

No conferences planned in FY 00, travel to 2000 Oil Spill Symposium is covered in other Proposed Project Plans.

## **NORMAL AGENCY MANAGEMENT**

This project will complete the work begun under Restoration 191B which has been performed cooperatively between the Trustees and NMFS from the outset. However, NMFS proposes providing most labor requirements for this project and seeks funding for primarily contractual labor and commodities. There is no charge for project support costs which include management of the LPW facility and project budget, production of reports or hydrocarbon chemistry to verify dosing. There was no charge for setting up the experiment in FY98 and early FY99, NMFS covered costs associated with setting up the exposure apparatus, spawning pink salmon, and maintaining the incubation for 9 months. In outlying years, NMFS will cover costs associated with the several man-weeks associated with spawning the returning fish, and evaluating their gamete viability.

## **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

This project will be coordinated with continuation of ADF&G research and monitoring efforts regarding pink salmon embryo survival under Restoration 191A. This study also coordinates the results of Restoration 191B and 076 by completing a life-history model for oil effects on pink salmon. Investigators and agencies will coordinate by sharing data. NOAA/NMFS will coordinate with the Trustees by providing labor requirements and laboratory overhead.

## **PROPOSED PRINCIPAL INVESTIGATOR**

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Prepared 4/12/99

Project 00476

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Revision 7-1-99  
Approved TC 9-99

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel	\$19.8	\$20.7						
Travel	\$6.0	\$6.5						
Contractual	\$33.0	\$34.6						
Commodities	\$10.0	\$7.5						
Equipment	\$0.0	\$0.0						
Subtotal	\$68.8	\$69.3	LONG RANGE FUNDING REQUIREMENTS					
General Administration	\$5.3	\$5.5			Estimated FY 2001	Estimated FY 2002		
Project Total	\$74.1	\$74.8			\$36.0			
Full-time Equivalents (FTE)		0.2						
Dollar amounts are shown in thousands of dollars.								
Other Resources		\$68.4						
Comments: NOAA Contribution:  Principle Investigator R. Heintz, 3.75 = mo = \$27.4 Fishery Research Biologist R. Bradshaw 3.2 mo = \$21.4 Fishery Research Biologist, J. Maselko 2 mo. = \$9.6  Additional Operating Costs of Little Port Walter Field Station = \$10.0  Total NOAA Contribution = \$68.4								

**FY00**

Project Number: 00476  
Project Title: Oil Effects on Pink Salmon Reproduction  
Agency: National Oceanic and Atmospheric Administration

FORM 3A  
TRUSTEE  
AGENCY  
SUMMARY

## 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

<b>Personnel Costs:</b>		<b>GS/Range/ Step</b>	<b>Months Budgeted</b>	<b>Monthly Costs</b>	<b>Overtime</b>	<b>Proposed FY 2000</b>
Name	Position Description					
R Heintz	PI : Fishery Research Biologist	4	2.8	7.4		20.7
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
<b>Subtotal</b>			2.8	7.4	0.0	
<b>Personnel Total</b>						\$20.7
<b>Travel Costs:</b>		<b>Ticket Price</b>	<b>Round Trips</b>	<b>Total Days</b>	<b>Daily Per Diem</b>	<b>Proposed FY 2000</b>
Description						
Little Port Walter Field Station -- 4 staff, 6 crew, multiple trips						0.0
Beaver Charters		1.0	5			5.0
						0.0
Anchorage, EVOS Symposium, (Heintz)		0.5	1	4	0.2	1.3
Miscellaneous (Car rental, telephone chgs, POV mileage, etc)						0.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
<b>Travel Total</b>						\$6.5

**FY00**

**Project Number:** 00476  
**Project Title:** Oil Effects on Pink Salmon Reproduction  
**Agency:** National Oceanic and Atmospheric Administration

**FORM 3B**  
**Personnel**  
**& Travel**  
**DETAIL**

October 1, 1999 - September 30, 2000

**FY00**

**Project Number: 00476**  
**Project Title: Oil Effects on Pink Salmon Reproduction**  
**Agency: National Oceanic and Atmospheric Administration**

page 3/4

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

New Equipment Purchases:		Number of Units	Unit Price	Proposed FY 2000
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
				0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		<b>New Equipment Total</b>		<b>\$0.0</b>
Existing Equipment Usage:		Number of Units	Inventory Agency	
Description				
Incubation units		4	NOAA	
nets and frames		8	NOAA	
Weir		1	NOAA	

**FY00**

Project Number: 00476  
 Project Title: Oil Effects on Pink Salmon Reproduction  
 Agency: National Oceanic and Atmospheric Administration

FORM 3B  
 Equipment  
 DETAIL



**Effects of food stress on survival and reproductive performance of seabirds**

Project Number: 00479  
Restoration Category: Research  
Proposed By: USGS, University of Washington  
Lead Trustee Agency: DOI  
Cooperating Agencies: University of Washington  
Duration: 2<sup>nd</sup> year, 4-year project  
Cost FY 00: \$125,200  
Cost FY 01: \$129,600  
Cost FY 02: \$75,000  
Geographic area: Cook Inlet, Gulf of Alaska  
Injured resource: Common Murre, Pigeon Guillemot,  
Black-Legged Kittiwake

RECEIVED  
72 10  
EXXON VALDEZ OIL SPILL  
TRUSTEE COUNCIL

**ABSTRACT**

Traditional field methods of assessing effects of fluctuations in food supply on the survival and reproductive performance of seabirds may give equivocal results. Here we propose to apply an additional tool: The measure of stress hormones in free-ranging seabirds. Food stress can be quantified by measuring base levels of stress hormones such as corticosterone in the blood of seabirds, or the rise in blood levels of corticosterone in response to a standardized stressor: capture, handling and restraint. We will apply these techniques to seabirds breeding in Lower Cook Inlet and also use captive birds for controlled experiments. This study provides a unique opportunity for a concurrent field and captive study of the behavioral and physiological consequences of stress in seabirds. Moreover, it will provide the basis for management of seabird populations in the areas affected by the *Exxon Valdez* oil spill, and it will have broader applications for seabird monitoring programs.

## INTRODUCTION

During the last decade, reduced productivity, increased mortality and subsequent population declines occurred among some seabirds and marine mammal species in the Gulf of Alaska. It has been suggested that declines in food availability resulted in food-related stress (Merrick *et al.* 1987, Piatt & Anderson 1996). Oil pollution from the Exxon Valdez oil spill may have exacerbated these stress-related effects. In this context, nutritional stress can be defined as changes in the physiological conditions of individuals that experience a long-term shortage of food or rely on low quality and/or contaminated food resources that impair their ability to reproduce successfully. Alternatively, less severe food shortages may allow reproduction to proceed, but additional stress such as from anthropogenic sources may precipitate reproductive failure. It is frequently difficult, or impossible, to detect these possible types of perturbations by using traditional field methods (Piatt & Anderson 1996).

An approach using well-characterized responses of hormones to stress can provide a sensitive indicator of chronic stress in the environment, or the potential impact of future stressors (Wingfield *et al.* 1997). Food-related stress is associated with elevated levels of corticosteroids (also known as "stress hormones") in the peripheral system of affected animals (Axelrod & Reisine 1984; Wingfield, 1994). In seabirds, corticosterone levels were elevated in free-living Magellanic penguins exposed to oil pollution (Fowler *et al.* 1995), and in Black-legged Kittiwakes breeding under poor foraging conditions (Kitaysky *et al.*, in press *a*). Chronically elevated corticosteroid levels are known to result in regression of the reproductive system, suppression of memory and immune systems, lead to muscle wasting and cause neuronal cell death (e.g. Sapolsky 1987; Wingfield 1994). Exposure to oil pollution and decreased food availability can have similar debilitating effects on foraging and reproductive behaviors in seabirds. The effects of the stress can be detected and monitored through measurements of baseline plasma levels of corticosterone in the peripheral system of potentially affected seabirds. The pattern and extent of a corticosterone increase following application of a standardized stressor such as capture, handling and restraint then indicate potential for stress effects. Furthermore, experimental manipulations with corticosterone levels in wild and captive seabirds provide a way to examine the mechanisms by which increased mortality and decreased reproduction are expressed.

The factors regulating seabird populations are poorly understood. Variations in mortality of adult birds and reproductive success due to natural fluctuations in the availability of food and anthropogenic impacts are probably among the most important factors (Cairns 1992). Life-history theory predicts that in long-lived animals, an increase in parental investment in current reproduction may impair post-breeding survival of parents and the probability of their successful reproduction in the future (Williams 1966, Charnov & Krebs 1974, Stearns 1992). Being long-lived animals, with an estimated life span of about 25-30 years (e.g., Ydenberg 1989), seabirds might buffer the cyclic variability of food resources by pursuing long-term reproductive strategies (Ricklefs 1990). For example, some seabirds can maintain their investment in reproduction at a constant level despite a large variation in foraging conditions (Pugesek 1981,

Bolton 1995, Kitaysky 1996). This parental strategy can result in large fluctuations in reproductive success but relatively small variations in the post-breeding survival of parent seabirds. Other seabirds are known to adjust their effort in current reproduction in relation to foraging conditions during a particular breeding season (Burger & Piatt 1990, Shea & Ricklefs 1985, Shea & Ricklefs 1996, Kitaysky 1996, Kitaysky et al. submitted b). For example, if feeding conditions are poor, adults should increase foraging effort to raise young. This parental strategy results in relatively low variation in bird reproductive success, but large variation in post-breeding survival of parent seabirds. In both scenarios, a trade-off between reproduction and survival must be balanced to maintain populations.

In contrast to regular, natural fluctuations in food availability, anthropogenic impacts such as oil pollution or commercial fisheries are unpredictable. These may also shift the balance between the processes of reproduction and survival in seabird populations. We hypothesize that the shift in the balance between reproduction and survival is responsible for the marked decline of some seabird populations in the Gulf of Alaska. It is also well known that unpredictable events in the environment have the potential to be severely stressful in terms of increased secretion of corticosteroids. Thus circulating levels of corticosterone in seabirds indicate not only current stress state, but the pattern of secretion in response to capture and handling also provides a simple test of vulnerability of the population to stress as well. We predict that the patterns in reproduction and survival of the affected population of seabirds can be altered in two possible ways. First, low reproductive rates can result from the decreased post-fledging survival of juvenile seabirds that have experienced long-term food shortages or were fed poor quality food during their development. Second, the post-breeding survival of parent seabirds that reproduced during food shortages may be decreased.

In this study we propose to examine the possible consequences of food-related stress by measuring circulating levels of plasma corticosterone as an indicator of current and potential stress. Although the impacts of stress on behavior and physiology of individuals are potentially very important to the processes of reproduction and mortality in seabird populations, the physiological mechanisms underlying these relationships are not known. We also propose to investigate the influence of the foraging and parental behaviors altered by stress on survival and reproduction of several species of seabirds that breed in the Gulf of Alaska and have been affected by the *Exxon Valdez* oil spill. The results of EVOS-funded of 1996, 1997 and 1998 show clearly that the hormone aspects of the proposed study are effective and will be powerful indicators of current stress state and equally important, may point to populations that are vulnerable to future stress.

## NEED FOR THE PROJECT

### A. Statement of the Problem

Immediate and potential long-term effects of food-related stress on foraging and reproductive behavior in seabirds are not completely known. Recent declines of seabird populations in the Gulf of Alaska may be a result of a decrease in reproductive success due to an elevated mortality of food-stressed chicks after fledging, and/or the increased mortality of parents that rear their young under poor feeding conditions. Traditional field methods of assessing potential pollution-related stress on the survival and reproductive performance of seabirds may give equivocal results. Lack of knowledge of the long-term effects of pollution-related stress on physiology and behavior prevents us from developing a successful rehabilitation program for seabird populations in the areas affected by the *Exxon Valdez* oil spill. The basic problem is that we do not know the mechanisms of how and at what stage of a bird's life the effects of stress might most strongly affect survival and reproductive performance. Furthermore, we know even less about the recovery of populations from stressful episodes in their life cycles. The latter is critical if we are to implement future programs to successfully manage seabird populations.

### B. Rationale

Long-term effects of pollution and stress on seabird reproductive biology are poorly known mostly because, to date, there have been no possibilities for a concurrent study of stress, survival and the monitoring of foraging conditions in seabirds. A critical concurrent assessment of variation in foraging conditions and survival of seabirds in Lower Cook Inlet will be provided by on-going projects that are designed specifically for these purposes (APEX project #00163, Restoration Project #00338). An ideal natural experiment to study effects of food stress can be conducted in Cook Inlet because seabirds at one study colony (Chisik Island) are chronically deprived of food, while seabirds at another study colony (Gull Island) have a surplus of food. From these studies, we will develop a protocol to monitor populations of seabirds at other colonies for possible effects of both natural and human-induced environmental perturbations.

### B. Location

The proposed field studies will be based out of Homer, Alaska. Studies will be conducted at the colonies in Kachemak Bay, and in western Cook Inlet. Captive-rearing, learning, and foraging efficiency trials will be conducted at the University of Washington.

## COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

None for this phase of the project.

## PROJECT DESIGN

We propose to investigate whether profiles of corticosterone in free-living seabirds reflect stress status and vulnerability to environmental stress, and how increased corticosterone levels affect reproduction and survival of individual seabirds. To address these questions we will investigate hypotheses and predictions on the relationships among stress physiology, behavior and reproduction in seabirds that breed in the areas affected by the *Exxon Valdez* oil spill. The first set of hypotheses states that the observed population declines are due to a decrease in post-breeding survival or reduced reproductive performances of adult seabirds that reproduce in the areas affected by the *Exxon Valdez* oil spill. In particular, parent seabirds that rear their chicks in the area affected by pollution complete the reproductive season in poorer physiological conditions and suffer greater post-breeding mortality compared with birds that rear young under favorable environmental conditions. These hypotheses predict that: (a) pollution-related stress results in chronically elevated concentrations of corticosterone in the peripheral system of parent seabirds; (b) prolonged increases in concentration of corticosterone cause reproductive failure and an increase in the post-breeding mortality. The second set of hypotheses states that the observed population declines are due to a decrease in post-fledging survival of juvenile seabirds in the areas affected by the *Exxon Valdez* oil spill. In particular, seabirds chicks that were reared in the area affected by pollution complete the reproductive season in poorer physiological conditions and suffer greater post-fledging mortality compared with young reared under favorable environmental conditions. These hypotheses predict that the recovery of seabirds from pollution or food-related stress depends on: (a) age- and species-specific responses to stress in general; (b) the degree to which individuals are stressed and how debilitated they may become by exposure to chronically high corticosterone levels; and (c) foraging conditions after exposure to stress.

Thus, our main objective is to explore the relationships among endocrinological parameters, foraging conditions and survival of seabirds that breed in the areas affected by the *Exxon Valdez* oil spill

### A. Background and Preliminary Results

Decreases in the availability of food can account for the increased mortality of seabird chicks in nests. Nevertheless, a high tolerance of juvenile seabirds to intermittent or low rates of food provisioning by their parents can buffer against an immediate loss in reproductive success (Kitaysky 1996). Juvenile seabirds possess an ability to retard growth processes in response to the dietary restrictions and might fledge successfully despite severe food shortages during their development (Øyan & Anker-Nilssen 1996). Controlled experiments have shown that food-related growth retardation can account for the lower body mass and smaller body size of the young at fledging when compared to the young raised on *ad libitum* nutritional regimes (Kitaysky 1996). However, low body mass of young seabirds at fledging is not a reliable predictor of post-fledging survival (Lloyd 1979, Hedrgren 1981, Harris & Rothery, Harris et al.

1992). Potential deleterious effects of retardation in morphological development (other than effects of low body mass at fledging) on post-fledging survival of food-stressed individuals have never been studied in seabirds. Chronic stress in mammals affects hippocampal regions of the brain (Sapolsky et al. 1986) which can result in less efficient learning of new behavioral methods, e.g. foraging techniques, by stressed young. Long-term effects of food-related stress during early development in Zebra finches (*Poephila guttata*) include reduced body size and possibly lower reproductive success during the adult stage of their life (Boag 1987, Boag & Grant 1981, Zink 1983). Thus, there is a possibility that food-stress in young seabirds results in increased post-fledging mortality due to a low ability of the retarded young to learn foraging techniques and/or a reduction in their foraging efficiency.

Results of EVOS-funded studies in 1996 and 1997 revealed that the types and quantities of different forage fish available to seabird parents can affect the physiological condition of their young at fledging. Black-legged Kittiwake chicks that were raised on restricted amounts of food, or poor-quality diets (APEX Project 98163N), had significantly elevated levels of corticosterone compared to the control chicks (Kitaysky et al. in press *d*; Fig. 1). These results allowed us to establish an empirical relationship between daily energy intake and corticosterone levels in Black-legged Kittiwake chicks. We used this relationship to estimate daily energy intake of wild Black-legged Kittiwake at the Gull Island colony in 1997 (Fig. 1). The estimated values of daily energy intake were very similar to those obtained from conventional methods (growth rates, asymptotic mass), giving us confidence that secretion of corticosterone reflects the nutritional status of Black-legged Kittiwake chicks.

Results of our studies have shown that Black-legged Kittiwake and Common Murre chicks respond to a standardized stressor such as capture, handling and restraint, by increasing plasma levels of corticosterone (Fig. 2 & 3). Specifically, food-restricted Black-legged Kittiwake chicks had significantly higher stress-response compared to individuals that were fed larger quantities of food (Fig. 2). Similarly to the baseline levels of corticosterone, acute stress-induced levels of corticosterone reflected daily energy intake of Black-legged Kittiwake chicks (Fig. 2). Also, Common Murre chicks reared by their parents on the food-poor colony (Chisik Island) had higher stress-response compared to chicks on the food-rich colony (Gull Island) (Fig. 3). The increased adrenocortical response to the standardized stressor reflects poor physiological condition, in particular, depleted endogenous fat reserves, of food-stressed seabird chicks and indicates their susceptibility for further stress (Kitaysky et al. in press *d*).

Corticosterone appears to be involved in the regulation of begging behavior by young Black-legged Kittiwakes and Common Murres (Kitaysky et al., submitted *c*). An increase in begging intensity among the stressed chicks influences food-provisioning behavior of their parents, and might result in an increase in the parents' investment in foraging for the young. An increase in parental investment in current reproduction can potentially decrease post-breeding survival of parent birds and the probability of their successful reproduction in the future (e.g., Jacobsen et al. 1995, Pugesek & Diem 1990, Golet et al. 1998).

Studies of the effects of food shortages on parental behavior of seabirds have shown that the duration of the chick-rearing period may be extended if food conditions are poor (e.g., Harris & Rothery 1985, reviewed in Ydenberg 1989). Changes in food availability, for instance food shortages that follow El Niño events, did not affect growth of young seabirds suggesting that parents were able to compensate for a decrease in food availability by adjusting their efforts in chick-provisioning for the changed feeding conditions or pursuing brood reduction strategy (Shea & Ricklefs 1996). An increase in the duration of parental care and a possibility of additional investment of parent seabirds in reproduction during food shortages might lead to an increase in post-breeding mortality. For example, results of field experiments indicated that parent Atlantic puffins that were experimentally exposed to a prolonged chick-rearing period were in poor physiological condition at the end of breeding season compared to control birds (Erikstad et al. 1997). This raises a possibility that seabirds which reproduce during seasons of food shortages would suffer a greater post-breeding mortality compared to the birds that reproduce under conditions that are favorable for reproduction.

Results of our studies have shown that parent Black-legged Kittiwakes and Common Murres respond to a standardized stressor such as capture, handling and restraint, by increasing plasma levels of corticosterone (Kitaysky et al. in press *a*, and in prep.). These results indicated that the hormonal response of adult seabirds can be used to assess susceptibility to stress as might be expected during food shortages. Specifically, in 1997, when Black-legged Kittiwakes nesting on Chisik Island showed the first signs of food shortages at the egg-laying stage they also modulated their stress response compared with those of birds in the egg-laying on Gull Island colony (Fig. 6). Continued food shortages resulted in a further significant elevation of circulating baseline levels of corticosterone (Fig. 4) and a suppression of stress response in kittiwakes breeding on Chisik Island (Fig. 6). Black-legged Kittiwakes failed to produce any chicks on Chisik Island in 1997 (Piatt et al., unpublished). Using endocrinological parameters alone, it was possible to predict this failure at the egg-laying stage of their reproductive season (Kitaysky et al., in press *a*).

On the other hand, chick-rearing under favorable foraging conditions does not alter the physiological condition of parent Black-legged Kittiwakes. In particular, exposure to the standardized stressor did not indicate a significant difference in the hormonal response of birds raising young compared to those with experimentally removed chicks (Wingfield et al. in prep.). This raises a possibility that not chick-rearing *per se*, but an additional effort in foraging for the young during food shortages can alter the physiological conditions of parent Black-legged Kittiwakes and result in decreased post-breeding survival of adults. Moreover, the pattern and extent of a corticosterone increase following application of the standardized stressor allows us to assess changes in physiology of a parent in relation to its normal effort in reproduction as opposed to changes associated with food-stress (Kitaysky et al. in press *a*).

In 1997, we did not find an increase in circulating levels or a suppression of stress levels of corticosterone in breeding Common Murres at early stages of reproduction on Chisik Island compared to Gull Island (Kitaysky et al. in prep). However, we observed a rapid increase in

circulating levels of corticosterone during the chick-rearing stage, and this increase occurred earlier in the season among murres breeding on Chisik Island than on Gull Island (Fig. 5). The phenology of reproduction was similar between the colonies suggesting that, in addition to the species-specific seasonal increase of corticosterone secretion, food shortages affected the physiological condition of parent murres on Chisik Island. The experimental manipulation revealed that parent murres respond to elevation of corticosterone by fledging their young (Table 1). To verify this result, we compared the age of fledglings between Chisik and Gull Islands and found that parent murres fledged their young at earlier age at Chisik Island, where feeding conditions are poor (Fig. 7). We also manipulated the corticosterone levels in murre chicks but did not find an effect of the experimentally elevated corticosterone levels on the age of chicks at fledging (Fig. 8). Thus, parent Common Murres can avoid food-related stress during reproduction by fledging their young at an early age. Therefore, it is less likely that a population decrease of Common Murres on Chisik Island is related to high mortality of adult birds breeding under poor foraging conditions. It can, however, result from a low recruitment of young at this colony because of either low survival of chicks that left nests at an early age or a delay in reproductive maturation of young birds that experienced nutritional stress during early development. However, the effects of stress on physiological condition, foraging behavior and future survival of food-stressed murre chicks have yet to be investigated.

Overall, the results of EVOS-funded studies during 1996-1998 provide a strong background for the proposed research on the effects of food-related stress on physiological condition and reproductive behaviors of seabirds. Our findings fully justify the general assumption of the proposed research that monitoring and experimental manipulations with stress-hormones will allow us to identify and investigate the effects of the food-stress on reproductive biology of seabirds in areas affected by the *Exxon Valdez* oil spill.

## **B. Objectives**

1. Establish whether populations at Gull and Chisik Islands are chronically stressed. Determine baseline levels of corticosterone in relation to varying foraging conditions.
2. Investigate the potential for future stress in populations at Gull and Chisik Islands. Measure circulating levels of corticosterone in response to a standardized stressor: capture, handling and restraint.
3. Examine the effects of variation in daily energy intake on baseline levels of corticosterone in Common Murre chicks. Determine the effects of food-related stress on behavior, morphological development and rate of corticosterone secretion of juveniles in captivity.
4. Determine the relationship between circulating levels of corticosterone and post-breeding survival of parents at Gull and Chisik Islands. Monitor survival and reproduction of the affected individuals during subsequent reproductive seasons.

## C. Methods

We will focus on the comparison of the endocrinological characteristics of seabirds breeding at Gull Island, where foraging conditions were continually good during the last few years, with those nesting under poor feeding conditions at Chisik Island.

### 1. Correlations among corticosterone levels, reproductive stage and varying foraging conditions.

To assess whether seabirds from the different populations are chronically stressed or not, we will determine baseline levels of corticosterone in relation to the reproductive stages, pre-incubation, incubation and chick-rearing. Adult birds will be captured at the breeding colonies by using a noose pole. We will collect a blood sample (approximately 100-150  $\mu$ L) from the brachial vein of the wing immediately after capture. To determine the potential for stress in different populations we will measure circulating levels of corticosterone in response to a standardized stressor, capture, handling and restraint. For that, additional samples of blood (15-30  $\mu$ L) will be collected from the same birds over a period of 1 h after capture (at 5, 10, 30 and 60 min intervals). To collect blood samples from chicks we will use similar methods as for adult birds, except that the first sample will be smaller (30-50  $\mu$ L).

The results of our pilot study indicate that a sample size of  $N > 7$  (per each group of birds) was sufficient to detect significant inter- and intra-specific differences in baseline concentrations of corticosterone in adult birds and juveniles (Figures 1-6). Therefore, approximately 7-10 adult birds and chicks will be sampled at each colony at every stage of the reproductive period (total 25-30 birds of each species per colony/year). After sampling, adult birds will be released at the colony and chicks returned to their nests. Previous field and captive studies indicate that taking blood does not affect the long-term physiological condition or behavior of birds (J. Wingfield, personal observations). In 1996, 1997 and 1998, Black-legged Kittiwakes and Common Murres released after bleeding at Gull Island and Chisik Island were sighted at their nests within 1-10 min period. Similarly, bleeding captive seabird chicks does not appear to affect their behavior or development (A. Kitaysky and M. Romano, personal observations).

### 2. Captive study of the effects of food-related stress.

To test whether the food/pollution-related stress affects behavior, morphological development and physiological condition of young seabirds, we will raise Common Murre chicks on three different nutritional regimes in captivity. For the experimental treatments (15 chicks per each treatment) we will use the methods described by Romano and co-authors (Romano et al., unpublished; Kitaysky et al. in press *d*) where either quantity and quality of the chick diets will be altered or a supply of mineral oil will be given to chicks with food. In particular, one group of young will be raised on reduced quantities of the high quality food (sandlance, *Ammodytes hexapterus*, and capelin, *Mallotus villosus*, or herring, *Clupea harengus*). Chicks from the second experimental treatment will be raised on sufficient amounts of food of poor quality

(juvenile pollock, *Theragra chalcogramma*). Chicks from the control group will be raised on the food of high and poor quality given *ad libitum*.

To assess whether the food/pollution stress affects the physiological condition of Pigeon Guillemot chicks, this component of the study will be coordinated with a study of captive Pigeon Guillemot chicks at the Alaska Sealife Center (Restoration Project #00327).

### 3. Correlations among corticosterone levels, foraging conditions and postbreeding survival.

To determine the relationship between variation in circulating levels of corticosterone and post-breeding survival of parents at Gull and Chisik Islands we will monitor hormonal levels (as described above), survival and reproduction of the affected individuals during subsequent reproductive seasons. This component of the study will be coordinated with EVOS-funded project (Restoration Project #00338) that is specifically designed to address the issue of survival of adult murres and kittiwakes in relation to foraging condition. We anticipate that a sample size of 200 individuals of each species (as proposed in Restoration Project #00338), would allow us to make a conclusive statement about the relationships between stress and survival in Black-legged Kittiwakes and Common Murres in Lower Cook Inlet.

### 4. Laboratory analyses.

In parallel to the field and captive research we will conduct the laboratory analyses of blood samples taken from the birds during the experimental manipulations. All blood samples will be taken from the brachial vein of the wing, blood plasma will be separated from blood cells and then frozen at  $-10^{\circ}\text{C}$ . All plasma samples will be transported to the laboratory at the University of Washington and processed according to the radio-immuno assay techniques (see Wingfield et al. 1991 for the details).

## D. Contracts and Other Agency Assistance

The field and captive experiments, and laboratory analyses will be carried out by Dr. Alexander Kitaysky, a research associate in the Zoology Department at University of Washington, Seattle, with the aid of one full-time assistant and one field assistant. Dr. John Piatt of the US Geological Survey will serve as field supervisor, providing logistical support and hiring the assistant and volunteers. Radio-immuno assay analyses of blood samples collected during the proposed research will be conducted in Dr. Wingfield's laboratory at UW. Dr. Wingfield will provide the supervision of laboratory analyses, and provide logistical support.

## SCHEDULE

### A. Project Tasks for FY 00 (October 1, 1999 - September 30, 2000)

January-April:	preparation for field work, hiring personnel
February:	Annual Report on FY 99 results
May-June:	blood sampling during pre-incubation stage, setting study plots for the experimental work
July:	blood sampling during incubation stage, study plot monitoring
August:	blood sampling during chick-rearing stage, colony work: implanting birds with the hormonal implants, monitoring parental feeding rates and chick survival
July-October:	chick-rearing in captivity at the University of Washington
FY01:	lab analyses, data analyses, reports, etc.

## B. Project Milestones and Endpoints

The ultimate goals of this study are (i) to assess whether or not populations of seabirds breeding in Lower Cook Inlet are chronically stressed; (ii) to quantify potential for stress at different stages of a bird's life-cycle under varying foraging conditions; (iii) to develop a "field endocrinology" protocol to monitor populations of seabirds in different habitats for possible effects of environmental disturbance both natural and human-induced. Objectives *i* and *ii* will require at least three years of field and laboratory work to quantify the relationships between baseline levels of corticosteroids and foraging conditions before final conclusions can be made. Objective *iii* will be accomplished after all field and laboratory tasks are completed. .

If the objectives are achieved, it should be possible by year 2002 to evaluate current status and potential for stress at the colonies in Lower Cook Inlet. Moreover, it will reveal how effects of stress on reproduction and survival are expressed in seabird populations. This will provide the basis for management of seabird populations in the areas affected by the oil spill.

## C. Completion Date

The study will be completed in December of 2002, after two reproductive seasons at the colonies in Lower Cook Inlet, laboratory analyses and sufficient time for analyses of results and preparation of manuscripts for publication.

Originally we proposed three years of captive trials on post-fledging foraging efficiency and recovery from stress at Alaska SeaLife Center (see previous version of the proposal). We will further explore the possibility of using the facilities of Alaska SeaLife Center for a study of recovery from stress. Meanwhile, the captive experiments will be conducted at the University of Washington.

## PUBLICATIONS AND REPORTS

- February 15, 2000: Annual report on work accomplished in summer-fall period of 1999, and preliminary results.
- February 15, 2001: Annual report on work accomplished in summer-fall period of 2000, extensive analyses of results and preliminary conclusions.
- February 15, 2002: Annual report on work accomplished in summer-fall period of 2001, and preliminary results.
- September 30, 2002: Final report on work accomplished and results obtained, 1998-2002.

We also plan to publish interim and final results of this study in conference proceedings and scientific journals. Note that results of our studies in 1996 and 1997 are already in press or submitted to peer-reviewed journals for publication.

## **NORMAL AGENCY MANAGEMENT**

None of the proposed research described here would normally be conducted by the USGS.

## **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

This study addresses a number of questions related to conservation and management of Alaskan seabirds. The proposed research will be coordinated with on-going projects being supported by the Exxon Valdez Oil Spill Trustee Council and US Geological Survey.

## **EXPLANATION OF CHANGES IN CONTINUING PROJECTS**

The design of the proposed work has not changed, and the budget is the same as that originally proposed and accepted by the EVOSTC in FY98.

## **PRINCIPAL INVESTIGATORS**

Principal Investigator and Project Leader - Dr. Alexander S. Kitaysky, Research Associate with the University of Washington, Seattle. Obtained a Ph.D. in Ecology and Evolutionary Biology from University of California in 1996 (dissertation on behavioral, physiological and reproductive responses of seabirds to environmental variability). Since 1986, studied seabird behavior and physiology at colonies in Okhotsk Sea and on the Aleutian Islands, and foraging behavior of seabirds at sea in Bering Sea, Aleutian Islands and in Gulf of Alaska.

Dr. John F. Piatt (Research Biologist GS-14, Alaska Biological Science Center, USGS, Anchorage, AK) obtained a Ph.D. in Marine Biology from Memorial University of Newfoundland in 1987. His dissertation involved seabird-forage fish interactions. Since 1987, he has studied seabirds both at colonies and at sea in the Gulf of Alaska, Aleutian Islands, and Bering and Chukchi seas. His is an author on over 75 peer-reviewed scientific publications about seabirds, fish, marine mammals, and effects of oil pollution on marine birds.

## **OTHER KEY PERSONNEL**

Professor John Wingfield (University of Washington, Seattle). Financial and logistic support for laboratory analyses in his lab at UW. He is an author on over 250 scientific publications. Prof. Wingfield is Chair of the Zoology Department at UW and an internationally recognized leader in the field of avian endocrinology.

Table 1. Behavioral response of parent Common Murres to an experimental increase in circulating levels of corticosterone. At the experimental nests (n=6, chick age = 13.5 (SD=2.51) days after hatching) parents were implanted subcutaneously with two 25 mm silicon tubes filled with the cristallized cotricosterone, parents at the control nests (n=6, mean chick age = 13.0 (SD=2.45) days after hatching) were implanted with empty tubes. Direct observations (during two days between 7 a.m. and 21 p.m.) were carried out 24 hours after the implantation. By that time, implanted parents fledged their chicks, whereas most of controls stayed with their chicks at the colony (difference between the treatments is statistically significant:  $\chi^2 = 8.57$ ,  $p=0.003$ ).

Experimental treatment	Behavioral response of parents	
	Fledged their chicks	Stayed at the nest with chicks
Controls	1*	5
Implanted	6	0

\* - number of nests where parents were manipulated.

Figure 1. Black-legged Kittiwake chicks that were raised on restricted diets (low lipids to proteins ratio, Romano M., unpublished data), had significantly elevated baseline levels of corticosterone (open circles, mean  $\pm$  SE). Analysis of covariance with the diet composition as a factor and the energy intake as a covariate has shown significant effects of both, diet composition ( $F_{2,39}=3.38$ ,  $p=0.04$ , not shown) and energy intake ( $F_{1,39}=28.77$ ,  $p<0.001$ ). Solid circle shows baseline plasma concentrations of corticosterone of wild Black-legged Kittiwake chicks at Gull Island in 1997. According to the observed levels of corticosterone, daily energy intake of wild chicks were ca.  $\sim 530$  kJ day<sup>-1</sup>, which was similar to actually recorded values (Piatt J.F., unpublished data). Data from Kitaysky et al. in press *a*.

Figure 2. Comparison of stress response to the standardized stressor (capture, handling and restraint) among food-restricted (solid circles), well fed (open circles) and wild Black-legged Kittiwake chicks (squares). Data from Kitaysky et al. in press *a*.

Figure 3. Comparison of stress response to the standardized stressor (capture, handling and restraint) among Common Murre chicks reared by their parents at food-poor (Chisik I.) and food-rich (Gull I.) colonies in 1997.

Figure 4. In 1997, baseline levels of corticosterone were significantly elevated in kittiwakes breeding at Chisik Island (poor foraging conditions) compared to those of birds breeding at Gull Island (favorable foraging conditions) (colony effect:  $F_{1,55}=13.24$ ,  $p=0.001$ ).

Figure 5. In 1997, increase in baseline levels of corticosterone occurred earlier in Common murres breeding at Chisik Island than in those at Gull Island (mean  $\pm$  SE).

Figure 6. Comparison of stress response to handling between Black-legged Kittiwakes breeding under poor foraging conditions at Chisik Island (solid circles and bars represent mean  $\pm$  SE, sample sizes are 7 and 7 individuals in the egg-laying and chick-rearing stages, respectively) and under favorable conditions at Gull Island (open circles,  $n=10$  and  $n=8$  in the egg-laying and chick-rearing stages, respectively). At Chisik Island, breeding kittiwakes modulated their response to a standardized acute stressor compared to those of birds at Gull Island (repeated measures ANOVA, time after capture  $\times$  colony effect:  $F_{4,112}=6.64$ ,  $p<0.001$ ). Data from Kitaysky et al. in press *d*.

Figure 7. In 1997, Common murre chicks were fledging at a younger age at the food-poor colony on Chisik Island compared to food-rich colony on Gull Island (mean  $\pm$  SE).

Figure 8. The experimental increase in circulating levels of corticosterone does not change a duration of chick development in the nest in the Common Murre (mean  $\pm$  SE). Experimental chicks were implanted subcutaneously with one silicon 25 mm tube filled with the crystallized hormone. Controls were implanted with empty tubes.

**Figure 1. Effects of food-restriction on baseline levels of corticosterone in captive Black-legged Kittiwake chicks**

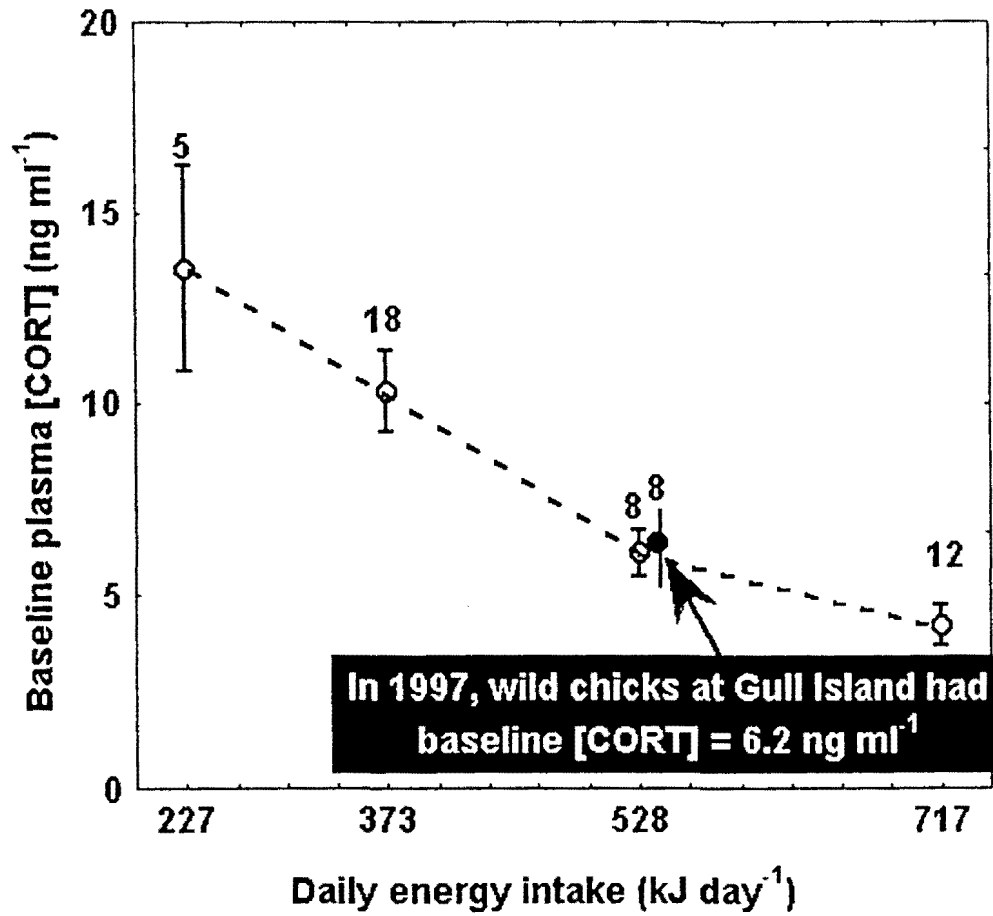


Figure 2. Adrenocortical response to a standardized acute stressor in food-restricted captive and wild kittiwake chicks

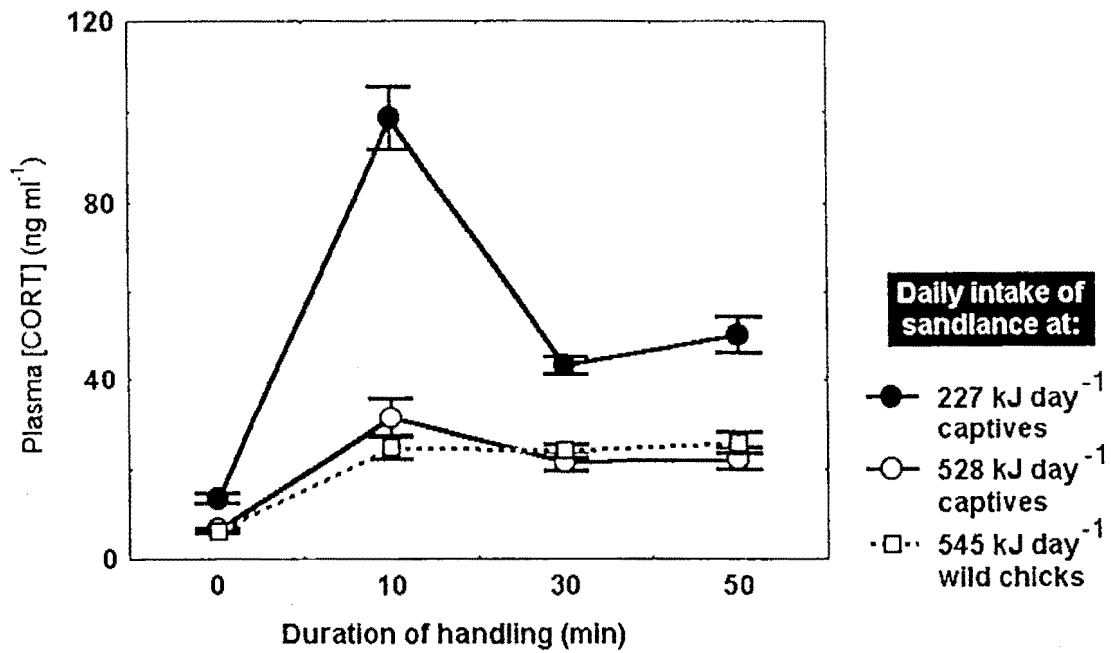


Figure 3. Adrenocortical response to a standardized acute stressor  
in Common Murre chicks  
on food-poor (Chisik I.) and food-rich (Gull I.) colonies in 1997

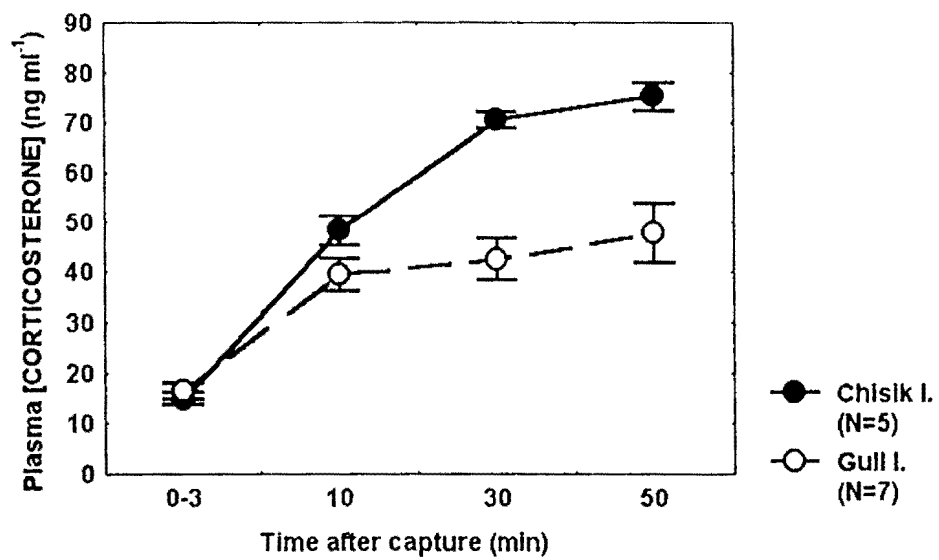


Figure 4. Seasonal dynamics of baseline plasma corticosterone in adult Black-legged kittiwakes breeding on food-poor (Chisik I.) and food-rich (Gull I.) colonies

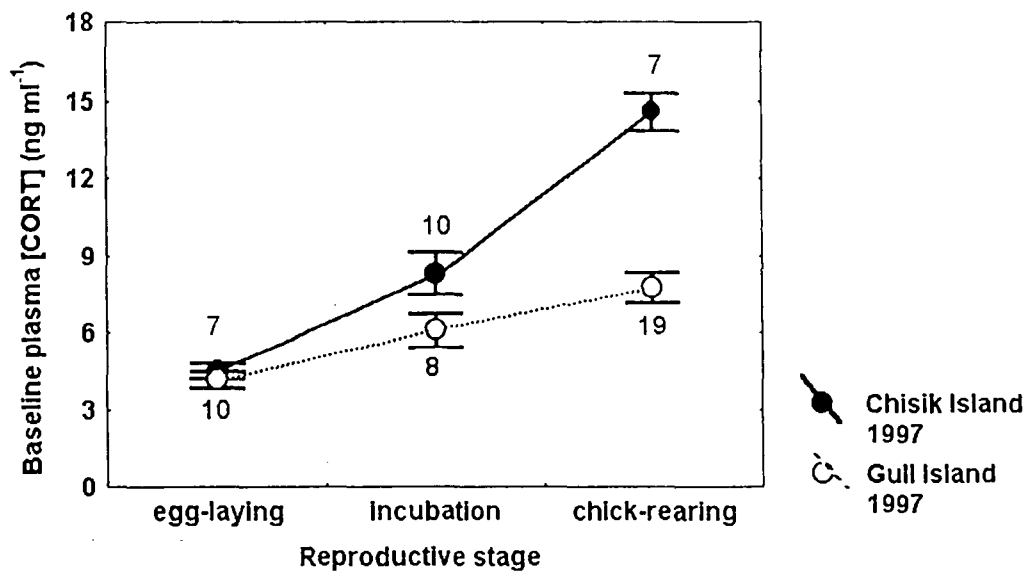


Figure 5. Seasonal dynamics of baseline plasma corticosterone  
in adult Common Murres breeding  
on food-poor (Chisik I.) and food-rich (Gull I.) colonies

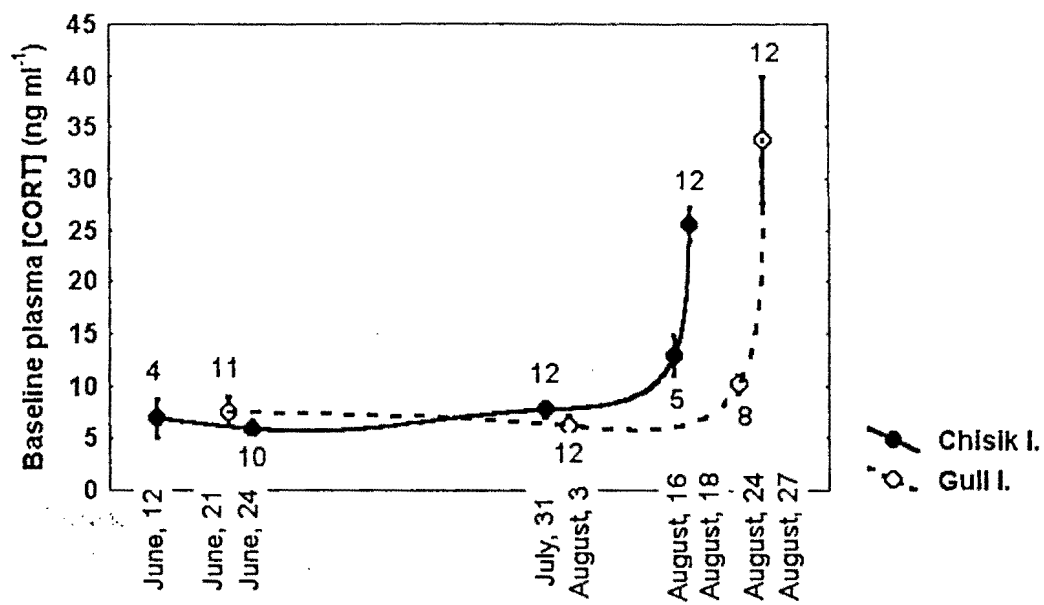
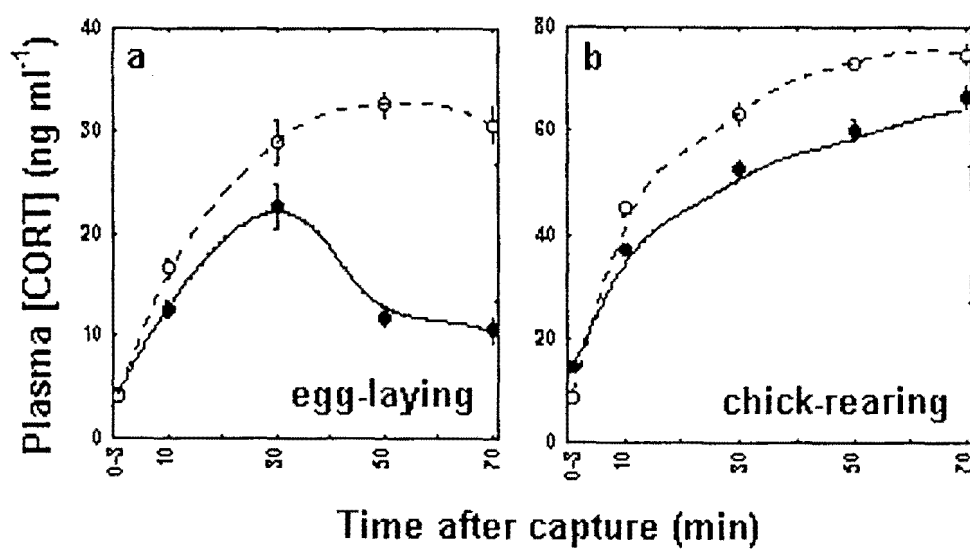


Figure 6. Adrenocortical response to a standardized stressor of adult Black-legged kittiwakes breeding on food-poor (Chisik I.) and food-rich (Gull I.) colonies in 1997



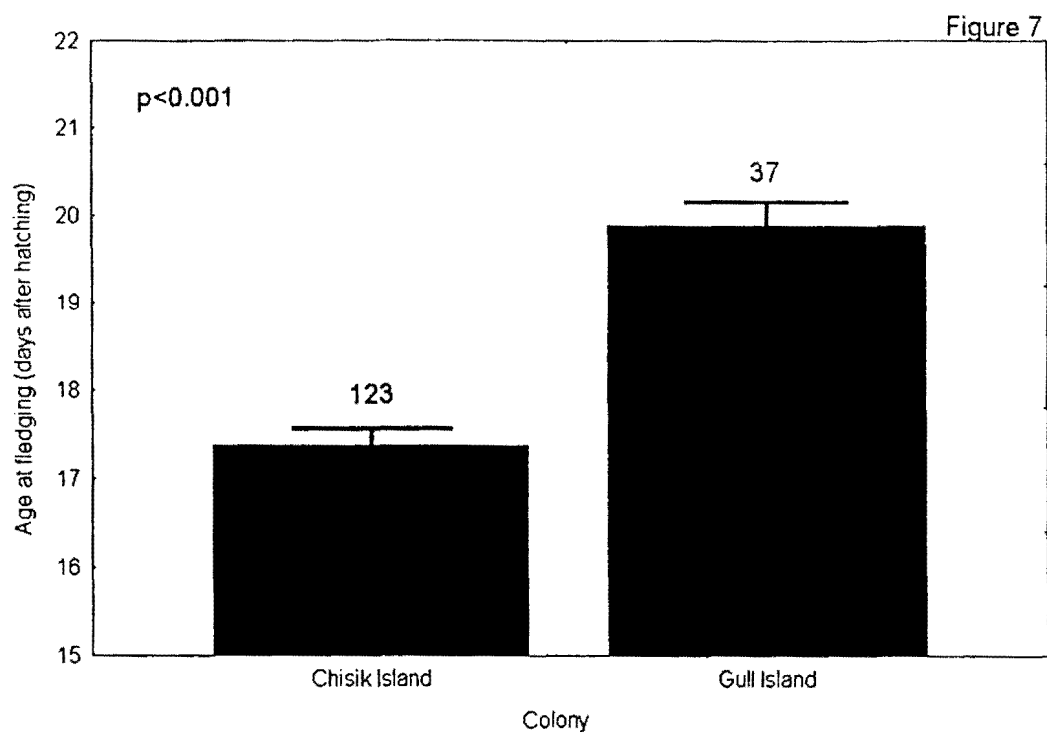
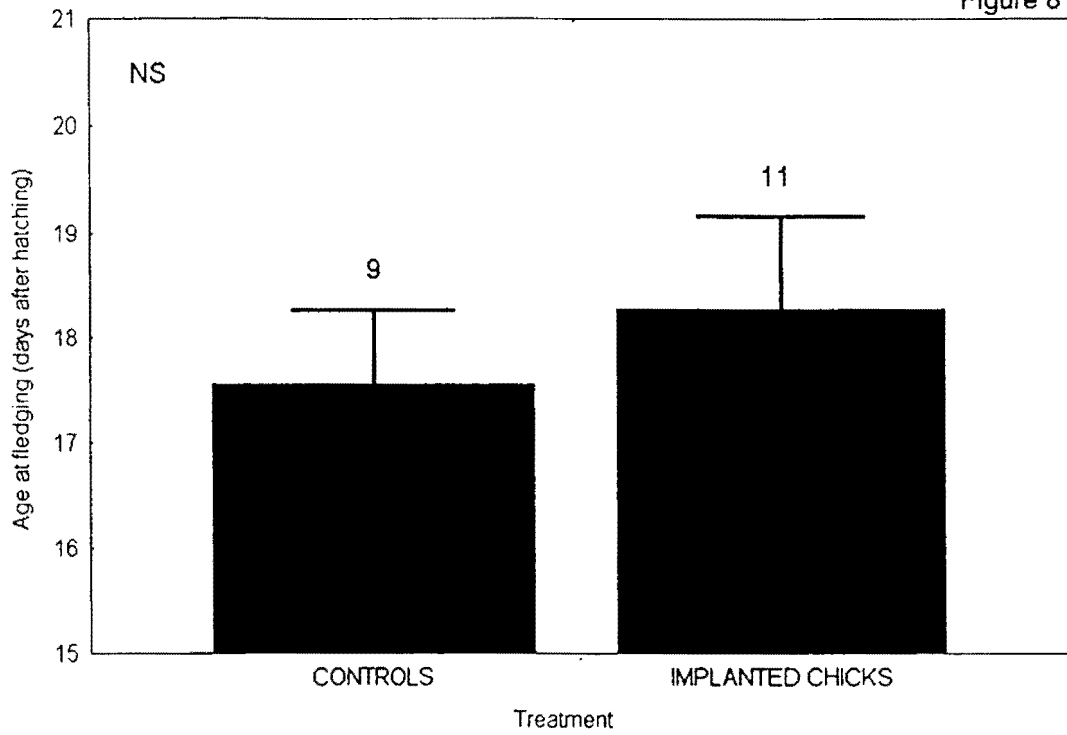


Figure 8



**2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

*Approved TC 8-9-99*

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$12.4						
Travel		\$2.4						
Contractual		\$90.0						
Commodities		\$5.2						
Equipment		\$7.0						
Subtotal	\$80,000.0	\$117.0	LONG RANGE FUNDING REQUIREMENTS					
General Administration	\$4,700.0	\$8.2			Estimated FY 2001	Estimated FY 2002		
Project Total	\$84,700.0	\$125.2			\$129.6	\$75.0		
Full-time Equivalents (FTE)		0.3						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:								

**FY00**

Project Number: 00479  
 Project Title: Effects of food stress on survival and reproductive  
 performance of seabirds  
 Agency: U.S. Geological Survey

**FORM 3A  
 TRUSTEE  
 AGENCY  
 SUMMARY**

Prepared: 4/11/99

October 1, 1999 - September 30, 2000

**FY00**

Project Number: 00479  
Project Title: Effects of food stress on survival and reproductive performance of seabirds  
Agency: U.S. Geological Survey

FORM 3B  
Personnel  
& Travel  
DETAIL

2000 EXXON VALDEZ TRU                      .OUNCIL PROJECT BUDGET  
October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		Proposed
Description		FY 2000
University of Washington Research Work Order		
Post-doc Salary + Benefits + GA= 65K		65.0
Lab Assistant		25.0
When a non-trustee organization is used, the form 4A is required.		
<b>Contractual Total</b>		<b>\$90.0</b>
<b>Commodities Costs:</b>		Proposed
Description		FY 2000
Food		1.5
Fuel		1.5
Misc. field supplies		1.0
Fish for seabird growth expts		1.2
<b>Commodities Total</b>		<b>\$5.2</b>

FY00

Project Number: 00479  
Project Title: Effects of food stress on survival and reproductive performance of seabirds  
Agency: U.S. Geological Survey

**FORM 3B**  
**Contractual &**  
**Commodities**  
**DETAIL**

Prepared:

October 1, 1999 - September 30, 2000

**FY00**

# FORM 3B Equipment DETAIL

4 of 8



*Revision 7-26-99  
Approved TC 8-9-99*

## **Optimization of Rapid Diagnostic Test Kits for Paralytic Shellfish Poisoning and Amnesic Shellfish Poisoning**

Project Number: 00482-BAA

Restoration Category: General Restoration

Proposer: J. Jellett/Jellett Biotek Limited

Lead Trustee Agency: NOAA

Cooperating Agencies: None

Alaska SeaLife Center: No

New or Continued: New

Duration: 1st yr.  
1 yr. project

Cost FY 00: \$55.6

Cost FY 01: \$0.0

Cost FY 02: \$0.0

Geographic Area: Prince William Sound, Kodiak

Injured Resource/Service: Clams, mussels, subtidal communities

### **ABSTRACT**

This project will optimize rapid screening tests to detect two marine biotoxins that affect the Alaskan shellfishery, amnesic shellfish poisoning (ASP) and paralytic shellfish poisoning (PSP). The tests will be optimized for subsistence harvest areas in the Kodiak Island area. ASP and PSP can cause sickness and even death in individuals who consume contaminated shellfish. With a reliable field testing method, coastal communities and shellfisheries will be able to ensure shellfish is safe to eat before harvesting. This will lead to safer subsistence harvesting of shellfish, which can replace the lost or decreased availability of injured resources such as harbor seals, sea lions, herring and ducks. In an attempt to make the rapid tests as simple as possible for beach monitoring, the tests will be optimized and validated to work without an acid extraction process, permitting raw shellfish tissues to be tested.

## INTRODUCTION

This project is being proposed to help ensure that shellfish is safe to harvest in communities within the Prince William Sound and Kodiak areas. The shellfishery can be a valuable food resource from a subsistence harvest perspective, as a replacement for other food sources that were affected by the oil spill. These species include harbour seals, sea lions, ducks and herring. The Prince William Sound and Kodiak Island areas suffer from serious outbreaks of paralytic shellfish poisoning (PSP) and occasionally amnesic shellfish poisoning (ASP). This project plans to test and modify (as required) our state of the art prototype immunochromatograph field screening tests for these two marine biotoxins. Marine biotoxins occur naturally when, under certain conditions, specific species of algae "bloom". These occurrences are frequently known as "red tides". Bivalves such as mussels and clams are filter feeders and will ingest these toxic algae and become toxic for human consumption. Harvesting and consuming shellfish at these times can cause illness and death to those who consume them, but the shellfish will subsequently clear the toxins and become safe to eat over time.

During the past Alaskan toxin season from April 1998 to December 1998, Jellett Biotech Limited received funding from the Alaska Science and Technology Foundation to field trial our current cell based test kits for PSP. This trial was very successful, particularly in laboratory settings, but pointed to the need for an easy to use, single use field test for PSP.

Jellett Biotech has received funding from Alaska Science and Technology Foundation for the technical development of the rapid screening tests for ASP and PSP. Jellett Biotech now have a working prototype for both the PSP and ASP rapid tests and are confident that the tests can be optimised for the profile of toxin analogues found in Alaskan waters. The tests will be evaluated with extracted shellfish tissue gathered and archived by the DEC lab in Palmer over the 1999 toxin season (April to October), beginning in September or October 99. The DEC lab is saving a portion of the extracts used for the mouse bioassay and will use this on the rapid tests and compare the results to the mouse bioassay and HPLC that were done as part of the routine monitoring program.

The ASTF funding also has provision for field tests of the rapid tests, starting in April 00. We plan to use a number of commercial sites who normally submit samples to the DEC lab for routine biotoxin monitoring and some participants that were involved in our cell based trial last year. With these sites we will split the shellfish tissue samples collected, have the site perform a field extraction, and test the samples with the rapid tests. The DEC lab will also perform its normal acid extractions on the other part of the same shellfish sample and perform both a rapid test and a mouse bioassay (PSP) and a HPLC (ASP) test on the samples. The data from the various tests will be compared.

This current EVOS proposal focuses on the potential to use the rapid tests as a beach-monitoring tool for subsistence harvesters in coastal communities within the Prince William Sound and Kodiak Island areas.

The purpose of the first phase of this project is to assess the ability of the tests to effectively screen for these marine biotoxins in a variety of raw shellfish meat rather than commercial

shellfish that uses an acid extraction process on the shellfish. This is an attempt to make the test kits as simple as possible to use, with as few steps as possible to minimise the chance of operator error.

This project may be directly linked to the proposed Youth Intern Research Project (Youth Area Watch) for Kodiak Island and indirectly linked to the clam bed restoration project.

## **NEED FOR PROJECT**

### **A. Statement of the Problem**

There has been a loss or reduction in available subsistence food resources in the oil spill affected areas with species such as harbour seals, sea lions, ducks and herring. With the availability of a cost effective, simple marine biotoxin testing technology, coastal communities can test to ensure the safety of shellfish beds, thus opening up this resource for safe subsistence harvesting.

Current shellfish testing for all of Alaska is performed at the Alaska Department of Environmental Conservation (ADEC) regulatory lab in Palmer. This involves collecting shellfish samples, shipping them to the lab; where the toxin extracted from the shellfish tissue is injected into live mice. The amount of time it takes for the mouse to die from respiratory paralysis is an indication of the amount of PSP toxicity present in the shellfish. The current regulatory limit is 80ug of saxitoxin per 100 grams of shellfish tissue. In the case of amnesic shellfish poisoning, or ASP, HPLC tests (high performance liquid chromatography) tests are done at the ADEC lab to ensure the shellfish samples are free of domoic acid, which causes ASP. Samples from commercial shellfisheries receive priority at the ADEC lab for testing under the state program, leaving many beaches and recreational shellfish areas without monitoring for PSP or ASP. The cost for having a PSP test performed by the ADEC lab is \$125 per sample, if the sample is not covered under the state regulatory testing program. An ASP test is \$100 per sample.

Jellett Biotek Limited plans to optimise its simple- to- use immunochromatographic tests (similar to home pregnancy tests) that screen for PSP and ASP to ensure they can detect the toxin profiles typically found in the Prince William Sound and Kodiak areas. These will be simple yes/no tests to indicate whether or not the shellfish is affected by these two marine biotoxins. These tests will not provide a quantitative result, and are not meant to replace the regulatory test for the commercial shellfishery, but will be a reliable initial screen for toxicity, at a substantially lower cost than the mouse bioassay and HPLC tests. Jellett Biotek plans to have these tests approved by global regulatory authorities (USFDA in the US) as a pre-screen for ASP and PSP.

Jellett Biotek has representatives attending the Interstate Shellfish Sanitation Committee meeting in New Orleans the week of July 19<sup>th</sup> to develop and agree on the procedures required to validate the rapid tests. We also have agreement with the Canadian Department of Health and the Canadian Food Inspection Agency to run collaborative validation tests on the rapid tests.

## **B. Rationale/Link to Restoration**

This project should be undertaken to help validate a rapid, inexpensive test for monitoring for marine biotoxins that affect the shellfishery in the Prince William Sound and Kodiak areas. By testing the shellfish beds in the area, windows of harvest opportunity may be found, making the harvesting of shellfish for subsistence or recreational purposes much safer. This may eventually lead to a cost effective, broadly based biotoxin monitoring program in areas currently not monitored for toxicity and permit access to the shellfish resource that is currently not available. The access to the shellfishery will help replace subsistence food resources lost or limited as a consequence of the oil spill in the affected areas. Examples of the affected species include harbour seals, sea lions, ducks and herring.

Enhanced public safety may result as individual harvesters will have access to a screening methodology that will help protect against harvesting contaminated product, leading to potential economic development in tourism or a commercial shellfishery in the restoration area.

Jellett Biotech wants to optimise our rapid kits to toxicity profiles found in the affected areas and to demonstrate that these tests are simple, robust and effective at screening for PSP and ASP and protecting communities and individuals from harvesting contaminated shellfish.

The first phase of this project will permit in-house testing and validation of the prototype test kits to shellfish samples from Kodiak Island, Alaska. We also propose that field trials take place in a later phase where shellfish testing will be done on site with the results compared to the current regulatory testing methods that are recognised by the Alaska State government as being effective public health screens for these toxins.

## **C. Location**

We have requested the assistance of the Ouzinkie Tribal Council, the Tatitlek IRA Council as well as the Kodiak Tribal Council in providing shellfish samples for the research work. We will select representative shellfish sites in the Prince William Sound and Kodiak Island. All coastal communities with potential shellfisheries may be affected by the results of these trials.

## **Community Involvement and Traditional Knowledge**

This project will rely heavily on local knowledge of the tribal councils for identifying potentially important traditional shellfish harvesting areas and for developing sample collection plans. This project will co-ordinate with the proposed Kodiak Youth Area Watch. Students in Kodiak Island will be trained to collect representative shellfish samples.

We will focus our efforts on areas where there are potentially large subsistence consumers of shellfish.

Upon completion of the project, Jellett Biotech will provide an easy to understand report on the efficacy of the field tests with the samples from the affected area. We will also be submitting a

later proposal to establish field trials of these tests in appropriate communities as a prelude to a beach-monitoring program. Data from the initial optimisation research will be widely distributed to interested community groups and placed on our web site.

## **PROJECT DESIGN**

### **A. Objectives**

The objective of the project is optimise the prototype rapid tests for ASP and PSP to demonstrate the rapid tests will effectively detect the toxicity profiles in both extracted and unextracted shellfish tissue from the Kodiak Island area.

### **B. Methods**

Jellett Biotek has received funding from the Alaska Science and Technology Foundation to develop antibody based, rapid tests for PSP and ASP, optimised to the toxicity profile found in extracted shellfish samples. After testing the efficacy and optimising the tests using extracted shellfish samples we retained from our Alaska trial of the MIST™ cell based technology last year, we plan to have prototype tests available by September or October that will be tested using shellfish extracts archived over the 1999 toxicity season by the Department of Environmental Conservation Lab.

We have retained 67 extracted shellfish samples from the 1998 MIST™ cell based trial that originated in the Kodiak region, which we will use initially between October and December, 1999, to evaluate the response of the rapid tests, compared to the mouse bioassay results performed by the DEC lab last year. These samples will also be used to begin the optimisation process to adjust the antibody mix to ensure test effectiveness with Kodiak Island samples. A report will be prepared by February 00. Unfortunately we do not have raw shellfish tissue from the 1998 study, so must collect raw shellfish tissue from Kodiak Island to be able to assess the profiles and test the rapid tests without the extraction process.

Individuals with the tribal councils or the Youth Intern Research Project (Youth Area Watch) will be trained to obtain shellfish samples using a variety of species from several areas within the affected area. The training will take place in April and the shellfish sampling procedure will continue from April 00 to August 00. During that period at least 10 samples per month will be collected (50 samples in total), the samples homogenised and shipped to Jellett Biotek where we will conduct rapid tests on both the unextracted and extracted tissue. We will send a sample of the tissue to the Canadian Food Inspection Agency for an extraction and a mouse bioassay to corroborate our results. A key issue here is that the antibody will detect "C" toxins in a shellfish sample, however these toxins are converted to a more toxic form during the acid extraction process. The mouse bioassay does not respond to "C" toxins, but will respond to the higher "GTX" toxins after the extraction process. We must ensure that the antibody correctly identifies the "C" toxins in the raw shellfish samples, knowing that after the extraction they will be converted to "GTX" toxins. We will contract the National Research Council of Canada to

perform HPLC profiles on all tissue that does not agree in the rapid test and the control mouse bioassay to determine which toxin profiles we have experienced difficulty. This will again permit us to optimise the tests. We will contract the Canadian Food Inspection Agency to perform HPLC analysis on all the domoic acid tests, to which we will compare the rapid test results.

The results of the rapid tests and mouse and HPLC results will be compared and a report written and submitted to the Trustee Council by October 00. The report will clearly show the comparative results of all testing methods with and without extraction of the shellfish, as well as the HPLC profiles of shellfish samples.

Depending upon the outcome of the initial research, Jellett Biotek will submit a proposal for Phase 2 field trials to start by April 01.

In summary we are requesting Trustee Council funding of the rapid test optimisation research to begin October 99, where we will conduct in-house testing of the tests using 67 existing extracted shellfish samples, then the collection of 50 more samples around the Kodiak/Prince William Sound area, during the April 00 to September 00 toxin season. The kits will then be tested using both raw and extracted tissue and results compared to the mouse bioassay and HPLC results. Positive PSP samples will be sent for toxicity profiles so the toxicity profiles of unextracted tissues can be determined. The mouse bioassay control and HPLC domoic acid control will be performed by the Canadian Food Inspection Agency in Halifax or Moncton, and the shellfish HPLC profiles will be generated by the Dr. Mike Quilliam at the National Research Council Institute of Marine Biosciences, Halifax.

### **C. Co-operating Agencies, Contracts and other Agency Assistance**

Jellett Biotek has received funding from the Alaska Science and Technology Foundation to develop to rapid diagnostic kits for ASP and PSP. This will involve the successful placement of the antibody mix on immunochromatographic membranes with a colour indicator. We will then validate the tests using shellfish extracts collected during the 1999 toxin season by the DEC lab in Palmer. After optimising the test kits based on these extracts, we will then hold field trials at a number of commercial aquaculture sites where the rapid tests will be tested in parallel with the mouse bioassay and HPLC performed as part of the state biotoxin monitoring program. In addition the ASTF funding covers the costs to acquire immunochromatographic prototype production equipment and the costs of developing a secure supply of antibodies for both rapid tests.

Assistance from the Exxon Valdez Trustee Council is requested to enable the rapid tests to be optimised for the use of raw and extracted shellfish the Kodiak Island area. We believe it is important to ensure the tests function properly without the need for a shellfish extraction process to ensure the tests are as simple as possible to use and will minimise operator error. There appears to be a real need for a reliable, cost-effective biotoxin monitoring program at the community or even individual level, in addition to regulatory and commercial aquaculture site monitoring.

The private sector partners in this project will include Jellett Biotek, who will provide the research involved in optimising the rapid diagnostic tests, a training program for sample collection and preparation, technical and analytical support to the trials and project management. The collaborating tribal councils and trained members of the Kodiak Youth Area Watch will collect and prepare and ship shellfish samples to Jellett Biotek.

The Canadian Food Inspection Agency, (Canadian Government) Halifax and Moncton, will provide analytical support in the form of mouse bioassays and HPLC. CFIA was chosen due to the substantially cheaper analytical costs than quoted by the DEC lab in Palmer and simplified logistics in handling the samples.

The Institute of Marine Biosciences, National Research Council, or the Canadian Department of Health will be contracted to provide toxicity profiles on samples where the rapid tests and mouse bioassay or HPLC do not agree. We know of no other organisations that can do this very specialised work.

In summary the following is work to be covered under the ASTF funding versus Trustee Council funding:

#### ASTF funding

**April to September:** Purchase of prototyping equipment, assessment of antibodies in wet Elisa's, modify to immunochromatograph format  
Develop a secure supply of antibodies (ongoing)

**September to December:** Manufacture prototype test kits for optimisation using Alaskan extracted samples collected from the 1998 MIST™ cell based trials.

**January 00 to March 00:** Test rapid kits using extracted shellfish samples collected by the DEC lab over the 1999 toxin season. Compare results to mouse bioassay performed during the regulatory season. Modify test kits as needed for trigger level, sensitivity etc.

**March to April 00:** Manufacture prototype kits for field trials at aquaculture sites in parallel with DEC lab

**April 00 to December 00:** Field trials with aquaculture sites, compared with mouse bioassay and HPLC at DEC lab. Data analysis.

**December 00 to March 01:** Final report preparation and delivery

#### EVOS Trustee Council Funding and Schedule

**October99 to December99:** Testing kits using 67 extracted samples collected from 1998 field trials

**January 00 to March 00:** Optimising test kits to Kodiak samples

**March 00** Submit proposal for phase 2 field studies to EVOS Trustee Council

**April00 to September00:** Select Field sites for sample collection, train collectors, collect 50 samples, test using unextracted and extracted tissue at Jellett Biotek, contract mouse bioassay and HPLC control to Canadian Food Inspection Agency, HPLC profiles to National Research Council or Health Canada. Optimisation of tests. Prepare report for Trustee Council, Due September 30, 00.

## **B. Project Milestones and Endpoints**

The following are milestone dates and deliverables by that date:

<u>Date</u>	<u>Deliverable</u>
<b>31, December 99</b>	Written report on the initial test results of the 67 Kodiak Island samples compared to the 1998 bioassay results.
<b>April 30, 00</b>	a minimum of 200 rapid test prototypes for both PSP and ASP manufactured to test Kodiak samples. Sample sites selected and shellfish sample collectors trained.
<b>April to September 00</b>	Testing of both unextracted and extracted tissue (50 samples) from field sites. Comparison to control mouse bioassay, HPLC. Profiles developed on tests that do not agree. Optimization of antibody mix.
<b>September 30,00</b>	All testing of field samples will be completed and a report delivered to the Trustee Council

## **C. Completion Date**

All project objectives of phase 1 will be complete by September 30,00

### **Publications and Reports**

There will be no manuscripts submitted for publication based on the phase one of this project.

### **Professional Conferences**

We plan to present the initial data collected from the 1998 samples at the Harmful Algal Bloom Conference in Tasmania in February 00.

### **Co-ordination and Integration of Restoration Effort**

We will attempt to co-ordinate the sample collection procedures with other activities occurring in the area. We have asked Hugh Short, Spill Area Wide Community Involvement Co-ordinator, to assist us with this. Both the Ouzinkie and Tatitlek tribal councils have agreed to participate and we hope to work with the Kodiak Youth Area Watch to collect shellfish samples. Discussions have been held with the Kodiak Area Native Association (Frank Peterson) and the Kodiak Island Borough Community Development Department to collaborate on future public information programs.

Jellett Biotek has included substantial in-kind contribution to the project through the provision of our specialised antibodies for test development as well as intellectual property already developed for the immunochromatographic tests. We have prototype tests developed and ready for optimisation to specific toxicity profiles.

In addition, there may be considerable in-kind contribution from the trial sites in obtaining the shellfish samples and conducting the test.

### **Proposed Principal Investigator**

Dr. Joanne F. Jellett, PhD.

President

Jellett Biotek

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# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Revision 28-99  
Approved TC 8-9-99

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$0.0						
Travel		\$0.0						
Contractual		\$52.0						
Commodities		\$0.0						
Equipment		\$0.0						
Subtotal	\$0.0	\$52.0	LONG RANGE FUNDING REQUIREMENTS					
General Administration		\$3.6			Estimated FY 2001	Estimated FY 2002		
Project Total	\$0.0	\$55.6						
Full-time Equivalents (FTE)		0.0						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:								

**FY00**

Project Number: 0048255-BAA  
Project Title: Optimization of Rapid Diagnostic Test Kits for ASP & PSP  
Agency: NOAA

FORM 3A  
TRUSTEE  
AGENCY  
SUMMARY

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$12.5						
Travel		\$10.5						
Contractual		\$9.9						
Commodities		\$8.7						
Equipment		\$0.1	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	\$0.0	\$41.7			Estimated FY 2001	Estimated FY 2002		
Indirect (25%)		\$10.3						
Project Total	\$0.0	\$52.0						
Full-time Equivalents (FTE)		0.3						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:								

**FY00**

Project Number: 00482-BAA

Project Title: Optimization of Rapid Diagnostic Test Kits for PSP and ASP

Agency: Jellett-Biotek

FORM 3A  
TRUSTEE  
AGENCY  
SUMMARY

October 1, 1999 - September 30, 2000

FY00

FORM 3B  
Personnel  
& Travel  
DETAIL

**Prepared:**

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		Proposed
Description		FY 2000
4A Linkage		0.0
Mouse bioassay for PSP control, Canadian Food Inspection Agency (50 samples -- actual cost \$1,950)		2.0
HPLC control for ASP samples, Canadian Food Inspection Agency (50 samples -- actual cost \$1,950)		1.9
HPLC profiles on samples that do not agree (30 samples at \$200)		6.0
When a non-trustee organization is used, the form 4A is required.		
<b>Contractual Total</b>		<b>\$9.9</b>
<b>Commodities Costs:</b>		Proposed
Description		FY 2000
Courier costs for shipping samples (50 at \$50)		2.5
Contingency for shipping samples from field to FedEx		0.5
Ice packs, containers		0.5
Purchase of immunochromatographic tests (Jellett Biotek)		5.0
Communications		0.2
<b>Commodities Total</b>		<b>\$8.7</b>

**FY00**

Prepared:

Project Number: 00482-BAA

Project Title: Optimization of Rapid Diagnostic Test Kits for ASP & PSP

Agency: Jellett-Biotek

FORM 3B  
Contractual &  
Commodities  
DETAIL

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

New Equipment Purchases:		Number of Units	Unit Price	Proposed FY 2000
Description				
	4 homegenizers			0.0
				0.1
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.			<b>New Equipment Total</b>	\$0.1
Existing Equipment Usage:		Number of Units	Inventory Agency	
Description				

**FY00**

Project Number: 00482-BAA  
 Project Title: Optimization of Rapid Diagnostic Test Kits for ASP & PSP  
 Agency: Jellett-Biotek

FORM 3B  
 Equipment  
 DETAIL

Prepared:



## Statistically-Based Sampling Strategies for Gulf of Alaska Ecosystem Trawl Survey Monitoring

Project Number: 00493

Restoration Category: Monitoring

Proposer: P. Anderson/NOAA

Lead Trustee Agency: NOAA

Cooperating Agencies: ADFG

Alaska SeaLife Center: No

New or Continued: New

Duration: 1st yr.  
1 yr. project

Cost FY 00: \$34.5

Cost FY 01: \$0.0

Cost FY 02: \$0.0

Geographic Area: Gulf of Alaska, Kodiak Island, lower Cook Inlet

Injured Resource/Service: All

### ABSTRACT

This project is an integrated study of mechanisms controlling changes in community structure in the Gulf of Alaska ecosystem. The major goal for this fiscal year is to review the existing Gulf of Alaska small-mesh trawl survey database and develop a statistically based and cost-effective strategy for long-term sampling and future monitoring. It is anticipated that any developed sampling scheme or strategy will then be employed in future monitoring survey designs. Proper and consistent sampling should lead to a more comprehensive understanding of biological-physical coupling and dynamics of the Gulf of Alaska ecosystem.

## **INTRODUCTION**

Research results from EVOS sponsored studies have shown the Gulf of Alaska underwent a reorganization in the forage and benthic communities following a climatic change in 1977 (Anderson and Piatt, 1999). The mechanism of how the change occurred is poorly understood although it is clearly related to the increase in temperature observed in the later part of the 1970s. It is important to understand how changes are either related to the mechanism, or are an integral part of the driving force of ecological change. This study proposes to continue trawl survey monitoring of the ecosystem and produce data that will help us understand the mechanisms that lead to changes in the composition of forage and benthic communities. This understanding is the key framework from which to judge the adequacy of recovery for injured species

## **NEED FOR THE PROJECT**

### **A. Statement of Problem**

There is an urgent need to understand the underlying mechanisms for forage species abundance changes in the Gulf of Alaska ecosystem in order to conserve and manage Alaska's fish, seabird, and marine mammal resources. To accomplish this degree of understanding, we must initiate programs that integrate both biological and physical aspects of the ecosystem. The effects of human induced changes from activities such as commercial fishing and oil spills will not be clear until we can establish the magnitude and form of natural response to climate change and its underlying mechanisms.

### **B. Rationale/Link to Restoration**

It is difficult to judge the adequacy of restoration efforts without knowledge of the degree and magnitude of change that has occurred due to climate change or other factors. Understanding these changes and the underlying mechanism, that drive variation in the marine ecosystem is critical in determining higher trophic level response.

### **C. Location**

Gulf of Alaska, Lower Cook Inlet, Kodiak Island Region, South Alaska Peninsula, and surrounding areas.

## **COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE**

Community involvement will play a large initial role in this project. To assist in improving sampling efforts, information on timing of forage fish spawning activity will be collected from fishers who harvested subsistence capelin or commercial fished other species (1970-1995). Such information is critical to determine optimal timing of surveys in order to gather representative samples from subsequent surveys.

## **PROJECT DESIGN**

### **A. Objectives**

1. Develop a statistically based sampling strategy based on analysis of past trawl survey data using changes in abundance and composition as parameters.
2. Provide sampling scenarios based on integrating survey logistics, gear attrition, and other associated survey costs.

### **B. Methods**

1. A list of species, or species groups, will be analyzed using the historical database from both NMFS and ADFG surveys. The selected species could possibly be the 10 taxa that comprised nearly 90% of the biomass reported by Anderson and Piatt (1999). The ability to statistically detect changes in species abundance will be analyzed for the shrimp trawl gear for 1972 - 1975 NMFS data, and 1975 - present for NMFS and ADFG (ADFG data does not include complete taxa sorting until 1975 and later). If seasonal variation exists, it may be necessary to use only the data from the predominant season.
2. Abundance estimates will be obtained using CPUE expanded to the sample grid and expanded to the representative area. The expansion to the representative area will use Dirichlet tessellation, and possibly Delaunay triangulation (Okabe et al 1992.)
3. Each geographic area (a single bay or groups of bays) that has sufficient sampling frequency (years and tows within year) will be tested for statistically significant differences ( $\alpha = 0.05, 0.10$ ) "between years" using the various abundance estimates. The difference "between years" would be adjacent years, but possible would also include combined periods (e.g. 3-year groupings) and non-adjacent years (e.g. 1975 versus 1980). Tests for significant differences will use randomization and permutation tests (Good 1994, Edgington 1987).
4. Sensitivity to reduced or increased sampling intensity will be evaluated (Scott 1992, Silverman 1986).
5. Distance and logistical cost estimates will be integrated into results obtained from 4. by NMFS and ADFG staff in order to arrive at a final cost for each sampling scenario.

### **C. Cooperating Agencies, Contracts, and Other Agency Assistance**

ADFG and NMFS will coordinate the retrospective data analysis.

Alan Johnson (Argile Consulting) will do the statistical analysis under hourly contract to NMFS (NOAA). Mr. Johnson is familiar with the data series and has participated on project data analysis in the past (Anderson et al 1997).

Project data synthesis and report and manuscript preparation would be shared by all of the participating agencies and contractor.

## **SCHEDULE**

### **A. Measurable Project Tasks for FY 00 (October 1, 1999 - September 30, 2000)**

October	Assemble current database
October - December	Statistical analysis of Database
January	Attend annual restoration workshop, present preliminary results.
March - April	Prepare report on Initial Results
March - September	Prepare final report on strategy of sampling/monitoring

### **B. Project Milestones and Endpoints**

Establish various sampling options for extended monitoring and sampling based on the statistical examination of past data.

### **C. Completion Date**

Monitoring ongoing, if successful, at providing data needed by researchers.

## **PUBLICATION AND REPORTS**

Publish report on retrospective statistical analysis from data sources and possible sampling scenarios for possible future monitoring surveys. (FY00)

## **PROFESSIONAL CONFERENCES**

None

## **NORMAL AGENCY MANAGEMENT**

The funds to conduct this project are not available from NMFS or ADFG. Any funds to conduct this project will however be extremely well leveraged since many of the cooperating agencies will be providing equipment and data that is already in hand to conduct the research and monitoring project proposed.

#### **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

This project will take direction from already council funded projects such as APEX and SEA. We will not duplicate their fine past efforts, but rather build on the knowledge from those studies to further the understanding of two highly significant species associated with climate change in the Gulf of Alaska.

#### **EXPLANATION OF CHANGES IN CONTINUING PROJECTS**

None, new project.

#### **PROPOSED PRINCIPAL INVESTIGATORS**

Paul Anderson, trawl sample coordination  
Jim Blackburn, trawl survey and database coordinator

#### **PRINCIPLE INVESTIGATOR**

Paul J. Anderson, NOAA, NMFS Kodiak laboratory

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Revision 7 19  
approved TC 8-9-99

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$2.0						
Travel		\$0.0						
Contractual		\$30.0						
Commodities		\$0.0						
Equipment		\$0.0						
Subtotal	\$0.0	\$32.0	LONG RANGE FUNDING REQUIREMENTS					
General Administration		\$2.5			Estimated FY 2001	Estimated FY 2002		
Project Total	\$0.0	\$34.5						
Full-time Equivalents (FTE)		0.0						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:								

**FY00**

Project Number: 00493  
Project Title: Statistically Based Sampling Strategies for Gulf of  
Alaska Trawl Survey Monitoring  
Agency: NOAA

FORM 3A  
TRUSTEE  
AGENCY  
SUMMARY

Revision 7-30-99

## 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000					
Personnel		\$1.0					
Travel		\$0.0					
Contractual		\$30.0					
Commodities		\$0.0					
Equipment		\$0.0	LONG RANGE FUNDING REQUIREMENTS				
Subtotal	\$0.0	\$31.0			Estimated FY 2001	Estimated FY 2002	
General Administration		\$2.3					
Project Total	\$0.0	\$33.3			\$0.0	\$0.0	
Full-time Equivalents (FTE)		0.0					
Dollar amounts are shown in thousands of dollars.							
Other Resources							
Comments:							

FY00

Project Number: 00493  
 Project Title: Statistically Based Sampling Strategies for Gulf of  
 Alaska Trawl Survey Monitoring  
 Agency: NOAA

FORM 3A  
 TRUSTEE  
 AGENCY  
 SUMMARY

October 1, 1999 - September 30, 2000

**FY00**

**FORM 3B**  
**Personnel**  
**& Travel**  
**DETAIL**

**2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**  
October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		<b>Proposed</b>
<b>Description</b>		<b>FY 2000</b>
Argile Consulting – Statistical Analysis Services		30.0
When a non-trustee organization is used, the form 4A is required.		
<b>Contractual Total</b>		<b>\$30.0</b>
<b>Commodities Costs:</b>		<b>Proposed</b>
<b>Description</b>		<b>FY 2000</b>
none		
<b>Commodities Total</b>		<b>\$0.0</b>

**FY00**

Project Number: 00493  
Project Title: Statistically Based Sampling Strategies for Gulf of Alaska Trawl Survey Monitoring  
Agency: NOAA

**FORM 3B**  
**Contractual & Commodities**  
**DETAIL**

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

New Equipment Purchases:		Number of Units	Unit Price	Proposed FY 2000
Description				
	none			0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		<b>New Equipment Total</b>		\$0.0
Existing Equipment Usage:		Number of Units	Inventory Agency	
Description				
Computer system and network including remote access				

**FY00**

Project Number: 00493  
 Project Title: Statistically Based Sampling Strategies for Gulf of  
 Alaska Trawl Survey Monitoring  
 Agency: ADFG

**FORM 3B  
 Equipment  
 DETAIL**

Prepared:

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$1.0						
Travel		\$0.0						
Contractual		\$0.0						
Commodities		\$0.0						
Equipment		\$0.0						
Subtotal	\$0.0	\$1.0	LONG RANGE FUNDING REQUIREMENTS					
General Administration		\$0.2			Estimated FY 2001	Estimated FY 2002		
Project Total	\$0.0	\$1.2						
Full-time Equivalents (FTE)		0.0						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments: Personel costs reflect time spent in evaluating analysis and compiling sampling strategies.								

**FY00**

red:

Project Number: 00493

Project Title: Statistically Based Sampling Strategies for Gulf of Alaska Trawl Survey Monitoring

Agency: ADFG

FORM 3A  
TRUSTEE  
AGENCY  
SUMMARY

James Blackburn						1.0
						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						\$1.0
Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 2000
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Travel Total						\$0.0

**FY00**

Project Number: 00493  
 Project Title: Statistically Based Sampling Strategies for Gulf of  
 Alaska Trawl Survey Monitoring  
 Agency: ADFG

**FORM 3B**  
**Personnel**  
**& Travel**  
**DETAIL**

Prepared:

**October 1, 1999 - September 30, 2000**

**FY00**

**FORM 3B**  
**Contractual &**  
**Commodities**  
**DETAIL**

**October 1, 1999 - September 30, 2000**

**FY00**

# FORM 3B Equipment DETAIL

9 of 9



# PROTOCOLS FOR LONG-TERM MONITORING OF SEABIRD ECOLOGY IN THE GULF OF ALASKA

Project Number: 00501

Restoration Category: Research, Monitoring

Proposed By: U.S. Geological Survey

Lead Trustee Agency: DOI-BRD

Cooperating Agencies: DOI-FWS

Alaska SeaLife Center No

Duration: 1<sup>st</sup> year, 2-year project

Cost FY 00: \$39,900

Cost FY 01 \$14,000

Cost FY 02 \$0

Geographic Area: Cook Inlet, Gulf of Alaska

Injured Resource: Multiple resources

## ABSTRACT

Some seabird populations damaged by the *Exxon Valdez* oil spill have not recovered, and populations will need to be monitored for many years to assess both recovery and ecological conditions affecting recovery. Detailed studies of individual seabird colonies and marine ecosystems in the Gulf of Alaska (GOA) have been conducted by the USGS and USFWS under the auspices of damage assessment and restoration programs of the EVOSTC. Much has been learned about factors influencing seabird populations and their capacity to recover from the spill in the GOA. As we move towards long-term monitoring of populations, however, we need to develop protocols and long-term monitoring strategies that focus on key parameters of interest and that are inexpensive, practical and applicable over a large geographic area.

## INTRODUCTION

Some seabird populations in the Gulf of Alaska have undergone marked fluctuations during the past few decades, some of which were due to effects of the *Exxon Valdez* oil spill (Byrd et al. 1998, Piatt and Anderson 1996). Results of investigations conducted with funding of the EVOSTC during the period 1989-1999 have included damage assessment studies of populations (e.g., Nyeswander et al. 1993) and restoration studies to evaluate the ecological conditions affecting seabird recovery. The latter studies have focused on how food availability, environmental conditions, and biological constraints on seabirds at colonies affect overall population dynamics (e.g., Piatt et al. 1998, 1999; Zador and Piatt 1999, Robards et al. 1999, Roseneau et al. 1999).

In Cook Inlet, these detailed studies included many research components that required considerable funding and logistic effort. At sea, we have measured forage fish distribution and abundance (with acoustic, trawl and seine surveys) in relation to oceanography (assessed with AVHRR imagery, CTD profiles, and moored thermographs). At colonies, we have measured a range of seabird parameters including adult and chick diets, chick feeding rates, chick growth rates, adult time-budgets (foraging time, nest attendance), breeding phenology, breeding success (laying, hatching, fledging), and population size (plot and whole-colony censuses). In FY1999, the total budget for these studies was 959 K, of which 68% was provided by the EVOSTC and the remainder was provided by the USGS and USFWS. These figures do not include costs of in-kind agency support (vessels, equipment, facilities, etc.).

As the EVOSTC moves from restoration research programs to monitoring programs, a stated goal is to support long-term monitoring of marine ecosystems and species impacted by the spill in Prince William Sound and the Gulf of Alaska. The objectives and scope of a long-term monitoring program are still being evaluated (R. Spies, 1998 EVOSTC Annual Restoration Meeting), but it appears that the level of effort currently under way in the Gulf of Alaska would have to be scaled back under the projected EVOSTC monitoring budget. With the knowledge obtained during the past five years in Cook Inlet, we can develop a monitoring strategy that includes measurement of key parameters that provide statistically rigorous data on seabird population trends, productivity, etc., and on ecological factors influencing seabirds. We would like to design a program that is cost-effective and logistically practical, allowing the EVOSTC to expand seabird monitoring from Cook Inlet to other areas in the Gulf of Alaska for an extended period of time.

## NEED FOR THE PROJECT

### A. Statement of the Problem

For long-term "monitoring" of seabird populations, the level of detailed observations made at any given colony necessarily depends on the objectives of the monitoring program, and the effort (person-days) that can be practically expended given logistic and funding constraints. Over the

years, for example, a variety of methods have been devised to monitor seabird population trends and productivity (e.g., Nettleship 1976, Birkhead and Nettleship 1980, Piatt et al. 1988, 1990; Byrd 1989) and in almost all cases, a balance has been struck between the need for detailed information and time or logistic constraints. In some cases, options may be recommended for obtaining data at differing levels of resolution while retaining acceptable statistical power (e.g., Gaston et al. 1983, Hatch and Hatch 1989).

For a few of the parameters that were measured during the course of EVOSTC-funded seabird and forage fish studies (Table 1), standard protocols and analyses had already been developed for research and monitoring, and some of these methods were employed in Cook Inlet studies. For example, populations of Common Murres and Black-legged Kittiwakes can be monitored annually by counting index plots at least 5 times during the incubation and early chick-rearing period, and this provides enough statistical power to detect changes of 18-20% in populations between years (Hatch and Hatch 1988, 1989). Counting plots 10 times would allow detection of 12-14% changes in populations between years. At the three colonies in Cook Inlet (Barren, Chisik and Gull islands), 6-10 counts of plots were conducted in each year of EVOSTC-funded study (1995-1999), and future monitoring efforts would continue to use this protocol.

However, for most of the parameters measured in lower Cook Inlet under EVOSTC-funded studies (Table 1), standardized monitoring methods have not been established. Furthermore, we do not yet have a clear idea of how much statistical power we might retain under reduced sampling protocols. For example, if the EVOSTC would like to support a monitoring effort that continues to measure oceanographic parameters, plankton and fish abundance, then we need to identify which parameters are most useful to measure and what sample sizes are adequate to measure significant changes among years. We also need to consider options for sampling that can be supported by different levels of funding.

Similarly, if seabirds are to be monitored at colonies, which parameters would be most useful to measure, how would they be measured and how frequently do they need to be measured to detect trends? In general, the Alaska Maritime National Wildlife Refuge (AMNWR) and other seabird researchers in Alaska have fairly well-defined protocols for measuring seabird breeding and population parameters (Table 1), but these are based on 3-4 month-long field seasons (e.g., Byrd 1989). While these two parameters would almost certainly be measured in any long-term monitoring strategy we develop for the EVOSTC, methods could be further refined to reduce costs and effort per colony, or allow for larger geographic coverage of colonies in the Gulf of Alaska. For example, a comprehensive measurement of breeding phenology calls for detailed (every 2-4 days) assessments of nest status (egg, hatch, chick, fledge) throughout the breeding season. Alternatively, one might be able to measure a sample of chicks from a one-time session during chick-rearing, and extrapolate backwards from measurements of body size to estimate mean laying and hatching dates. Similarly, a one-time census during chick-rearing could provide a precise index of kittiwake breeding success that— although less accurate than measures obtained through repeated status-checks of nests— would nonetheless yield adequate data for monitoring long-term trends in productivity (although it would be less useful for assessing

components of productivity). While we have collected data that would allow us to evaluate the reliability of "short-cut" methods for monitoring, we have yet to evaluate their practicality from the point of view of logistics or statistical power. Furthermore, we need to evaluate what is gained or lost by employing "short-cut" rather than comprehensive methods.

Therefore we propose a two-part study. First, we would conduct a 'desk-top exercise' to examine existing parameter datasets for statistical power and utility, and develop a series of protocols designed to meet differing funding and logistic scenarios. We would identify a 'minimum protocol' that includes measurement of the most valuable parameters for selected species in the shortest possible amount of time (e.g., 1-2 weeks), an 'intermediate protocol' which would identify which parameters could be successfully measured (and with what level of detail for which species) in some intermediate amount of time (e.g., 4-6 weeks), and a 'maximum protocol' which would identify work that could be accomplished over a full season (e.g., 12-20 weeks) but with reduced funding and personnel than currently supported under EVOSTC restoration studies. An important part of this process will be to identify what is gained or lost by choosing to use one method over another.

Second, we will compile final monitoring protocols for all aspects of the project and then develop and recommend a long-term monitoring strategy for the EVOSTC to consider for their future monitoring program. We envision applying different protocols to different colonies throughout the Gulf of Alaska depending on overall funding levels, partnerships, and logistic constraints inherent to individual colonies. Consideration will also be given to which colonies are most representative of different oceanographic domains, and to the frequency of sampling needed to detect trends.

## **B. Rationale**

Methodologies for measuring aspects of seabird ecology are constantly evolving as we gain insight into the meaning and utility of routinely collected data, and use new tools and technologies to simplify measures of routine parameters or to measure new parameters. For example, we can now measure sea surface temperatures and surface chlorophyll concentrations over the entire Gulf of Alaska on a daily basis through remote satellite sensors. We can measure temperature, salinity, chlorophyll concentration and turbidity of the entire water column in minutes with a CTD profiler. Seabird attendance, chick feeding rates and foraging trips can be monitored remotely with time lapse videography or real-time video relays. Food limitation and stress in seabirds can be evaluated by taking relatively simple measures of blood hormone levels.

Research conducted during the past five years under auspices of the EVOSTC in Cook Inlet has greatly expanded our knowledge of relationships between seabirds and their local environments. If the EVOSTC wants to continue to monitor seabird recovery in the Gulf of Alaska, then we need to distill what we have learned from our extensive studies and develop a streamlined monitoring program that is cost-effective while retaining the ability to compare results with those collected previously under APEX.

### **C. Location**

The proposed work will be undertaken in offices of the USGS in Anchorage and the AMNWR in Homer. The project's benefits will be realized throughout the EVOS area, in the form of enhanced understanding of seabird ecology, population trends and recovery.

## **COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE**

Gull Island in Kachemak Bay is owned by the Seldovia Native Association (SNA). Limited subsistence use occurs during summer, with occasional eggging and harvesting of juvenile birds. It is also a major tourist attraction for visitors to Homer. Permission to work on and around the island has been obtained under the provision that annual reports of findings be made available to the SNA. In the past we have performed several outreach activities to inform local citizens of our research, including: 1) distribution of flyers and posters describing our work to the SNA, tour boat operators, the AMNWR Visitor's Center, and the Pratt Museum, 2) presentations at public meetings, and 3) cooperation with the Pratt Museum in their video monitoring of seabirds on Gull and the Barren islands. Chisik and the Barren islands are managed by the AMNWR and we employ charter vessels from Homer to support field work there. Chisik Island supports a small, seasonal fishing community and we keep summer residents informed about the nature and purpose of our activities. Whenever possible, equipment and other resources will be acquired locally in the Homer area. Traditional and local ecological knowledge will be sought from fishermen and other residents, particularly on the topic of seabird and forage fish population trends.

## **PROJECT DESIGN**

### **A. Objectives**

1. Using data collected in Cook Inlet during EVOSTC-funded restoration projects, assess the statistical power and utility of measuring biological parameters (Table 1) under different monitoring scenarios and at different frequencies.
2. Based on (1) and in consultation with other investigators, develop and compile written protocols for long-term monitoring of seabirds under different scenarios (minimum, medium, and maximum effort).
3. Based on (2) above, and other experience, develop a long-term monitoring strategy for seabirds in the Gulf of Alaska that also addresses issues of sampling for representative species and oceanographic domains, and frequency of sampling.

## B. Methods

*Objective 1:* First we will have a meeting to discuss and identify parameters that would be most useful for long-term monitoring of seabirds and ecological factors influencing their populations. Questions to be resolved for each parameter include (but are not limited to): 1) would it provide useful, meaningful information for long-term monitoring? 2) how frequently *can* samples be taken each summer in a best case scenario, given appropriate logistic support? 3) how frequently *have* samples been taken in previous work? 4) how frequently should samples be taken *among* years to measure trends, and 5) what would be appropriate methods for evaluating the statistical power of different sampling scenarios?. In addition, we would need to define some working models for sampling scenarios. After considering logistic constraints, seabird breeding schedules, sampling locations (i.e., choosing sampling sites that are representative of specific oceanographic domains or geographic regions), and species of concern, we will need to develop a consensus on what kind of field effort might reasonably be undertaken in 'minimum', 'medium' and 'maximum' scenarios— i.e., how long would a colony be visited (e.g., 1-2, 4-6, 10-16 week windows), how many people would be deployed, what kind of logistic support might be required (boats, planes, camps, etc.).

Following these discussions, data sets for the various parameters under consideration will be evaluated in several ways. First, we will consider whether each parameter *can* be measured under each scenario. For example, measurement of breeding parameters such as laying, hatching, *and* fledging success clearly cannot be accomplished in a 1-2 week visit. In contrast, one could measure fish abundance with beach seines at many temporal scales. Second, we will conduct a power analysis on appropriate parameters (using our historical data) to determine what level of sampling effort would be required to produce statistically useful results. For example, what level of beach seine sampling would be required to detect a 20% difference between years in forage fish CPUE? Similarly, how many days (and/or nests) must be monitored to detect inter-annual differences of 20% in chick-feeding frequency? Also, does sampling need to occur annually, or will multi-year intervals of sampling be adequate and still retain statistical power? This kind of analysis will provide a useful guide for determining which parameters *could* be usefully measured under different scenarios. Finally, some parameters might turn out to be of low value for statistical inference, but useful for ecological characterization. For example, low levels of trawl (or diet collection) effort might preclude detection of trends in fish abundance (or meal size), but may allow us to characterize prey (or diet) composition and/or detect significant changes in composition over time.

*Objective 2.* Following the completion of other objectives, we will solicit input from other investigators (e.g., from APEX projects in Prince William Sound) and compile the results of our work into a monitoring protocol manual. This document will outline which parameters can be measured under different operational scenarios and indicate what levels of statistical certainty may be expected under given sampling regimes. We will also identify what is gained or lost by choosing to conduct one scenario versus the others.

*Objective 3.* Based in part on results of objective (2), but also on other experience and knowledge about seabird colonies and logistics in the Gulf of Alaska, we will develop recommendations for a comprehensive monitoring strategy for seabirds in the Gulf of Alaska for use by the EVOSTC in planning a long-term monitoring program. This will include consideration of issues dealing with sampling frequency and locations.

### **Cooperating Agencies, Contracts, and Other Agency Assistance**

USGS and FWS are cooperating on this project as an extension of their collaboration on EVOSTC (APEX) studies in lower Cook Inlet. Both agencies have collected data on different colonies, and we will both benefit from planning and coordinating future monitoring methods. Personal Services contracts will be used for statistical consultation.

### **SCHEDULE**

#### **Measurable Project Tasks for FY 00**

December 1:	Initial planning meeting and review of data needs
January 14-16:	Attend Annual Restoration Workshop
January-March:	Power analyses, data and protocol evaluation
March 1:	Coordination meeting
April 30:	Draft monitoring protocols completed, distributed for review
August:	Revisions to monitoring protocols based on reviews and field study
September 30:	Revised draft of monitoring protocol

#### **Project Milestones and Endpoints**

By September 30, 2000, we will have a draft manual of monitoring protocols. During the winter of FY01, we will work on development of a monitoring strategy for the Gulf of Alaska (a separate objective from protocols) and send that out for review. Following that, we would make final modifications to the monitoring protocol manual and the monitoring plan for the Gulf of Alaska. A final report will be completed by September 30, 2001.

#### **Completion Date**

All project objectives will be met by September 30, 2001.

### **PUBLICATIONS AND REPORTS**

EVOSTC Annual Report FY00: "Protocols for long-term monitoring of seabird ecology in the Gulf of Alaska"

EVOSTC Final Report FY01: "Protocols and strategies for long-term monitoring of seabird ecology in the Gulf of Alaska"

## **PROFESSIONAL CONFERENCES**

Results of this project will be presented at the EVOSTC Annual Restoration Meeting in January, 2001.

## **NORMAL AGENCY MANAGEMENT**

This research would not be conducted as a normal part of USGS or FWS research on seabirds.

## **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

The proposed research issues are related to management and conservation of seabirds in Alaska as addressed by the U.S. Fish and Wildlife Service (USFWS) 'Seabird Management Plan' (USFWS Region 7, Migratory Bird Management). The proposed work will complement and be coordinated with: i) long-term studies conducted by the Alaska Maritime National Wildlife Refuge (AMNWR, USFWS Region 7), which includes annual monitoring of seabird productivity at 9 major seabird colonies throughout Alaska; ii) related studies (APEX) of seabird-forage fish interactions being supported by EVOSTC in Prince William Sound; and, iii) ongoing studies of seabird populations in areas of oil and gas development conducted by the Minerals Management Service (MMS) in Alaska and the Biological Resources Division of the USGS.

## **PRINCIPAL INVESTIGATORS**

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# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Revision 2-99  
approved 7-8-99

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$31.6						
Travel		\$2.4						
Contractual		\$0.0						
Commodities		\$0.0						
Equipment		\$1.2	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	\$0.0	\$35.2			Estimated FY 2001	Estimated FY 2002		
General Administration		\$4.7						
Project Total	\$0.0	\$39.9			\$14.0	\$0.0		
Full-time Equivalents (FTE)		0.9						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

## Comments:

New Project. Funds in FY01 would be for writing of final monitoring protocols and GOA monitoring strategy (14K).

**FY00**

Project Number: New 00 501

Project Title: Protocols for long-term monitoring of seabird ecology in the Gulf of Alaska

Agency: USGS, USFWS

FORM 3A  
TRUSTEE  
AGENCY  
SUMMARY

Prepared: 4/12/99

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
Name	Position Description					
Drew	USGS Wildlife Biologist	GS-12/2	0.5	5.4		2.7
Abookire	USGS Wildlife Biologist	GS-9/2	0.7	3.9		2.7
Van Pelt	USGS Wildlife Biologist	GS-9/2	1.5	3.9	0.0	5.9
Shultz	USGS Wildlife Biologist	GS-7/2	1.5	3.0	0.0	4.5
Piatt	USGS Wildlife Biologist	GS-14/1	1.0	0.0		0.0
						USGS Tot 15.8
Kettle	FWS Wildlife Biologist	GS-7/2	1.9	3.3		6.3
Roseneau	FWS Wildlife Biologist	GS-11/5	1.0	5.1		5.1
Biotech	FWS Biological Technician	GS-5/1	2.0	2.2		4.4
Byrd	FWS Supervisory Biologist	GS-13/2	1.0	0.0		0.0
						FWS Tota 15.8
Subtotal			11.1	26.8	0.0	
Personnel Total						\$31.6
Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2000
Description						
Coordination meetings in Anchorage (3 x Homer-Anc)		0.2	6	12	0.1	2.4
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Travel Total						\$2.4

**FY00**

Project Number: New

Project Title: Protocols for long-term monitoring of seabird ecology in the Gulf of Alaska

Agency: USGS, USFWS

**FORM 3B**

**Personnel  
& Travel  
DETAIL**

Prep

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		Proposed FY 2000
Description		
		0.0
When a non-trustee organization is used, the form 4A is required.		
<b>Contractual Total</b>		\$0.0
<b>Commodities Costs:</b>		Proposed FY 2000
Description		
<b>Commodities Total</b>		\$0.0

**FY00**

Project Number: New

Project Title: Protocols for long-term monitoring of seabird ecology in the Gulf of Alaska

Agency: USGS, USFWS

FORM 3B  
Contractual &  
Commodities  
DETAIL

Prepared:

October 1, 1999 - September 30, 2000

**FY00**

# FORM 3B Equipment DETAIL



Revision 7/21/99  
Approved TC 8-9-99

## Long-Term Monitoring of Harbor Seal Populations: Development of an Experimental Design

Project Number: 00509

Restoration Category: Monitoring

Proposer: Robert J. Small, ADF&G

Lead Trustee Agency: ADF&G  
Cooperating Agencies: None

Alaska SeaLife Center: No

Duration: 1<sup>st</sup> year, 1-year project

Cost FY 00: \$51.8

Cost FY 01: None

Cost FY 02: None

Geographic Area: EVOS spill area

Injured Resource/Service: Harbor seal

### ABSTRACT

An experimental design for a long-term monitoring program of harbor seal (*Phoca vitulina richardsi*) populations in the EVOS spill area will be developed. Current monitoring programs include aerial population trend and abundance surveys, and land-based counts at a key index site (Tugidak Island). These current monitoring programs will be evaluated based on sampling design, accuracy and precision, and their application to the management and conservation needs of harbor seals. Revisions to the methodology of current programs will be made based on new research results concerning stock structure, population trends, and life history characteristics, and advances in marine mammal survey and abundance assessment.

## INTRODUCTION

This project proposes to evaluate the experimental design currently used to monitor harbor seal (*Phoca vitulina richardsi*) populations in the EVOS spill area, and to subsequently develop a revised experimental design based on new research results on harbor seal biology and advances in marine mammal survey and abundance assessment. This proposal is linked to restoration project 064: Monitoring, Habitat Use, and Trophic Interactions of Harbor Seals in Prince William Sound, Alaska (Frost *et al.* 1998). The results of project 064, and results of similar studies by ADF&G on the Kodiak Archipelago have documented the severe decline of harbor seals in the Gulf of Alaska, and additionally provided insights on population structure based on genetic research and movement and haulout patterns. These new results raise questions concerning the efficacy of the current monitoring program relative to the management and conservation of harbor seals in the spill area. Specifically, are the current monitoring programs designed to collect information that will provide the most robust estimates of population trend and abundance that are representative of harbor seals within the spill area? Such population estimates are critically important as they determine, in part, the status of harbor seals in the Gulf of Alaska under the Marine Mammal Protection Act and the Endangered Species Act.

## NEED FOR THE PROJECT

### A. Statement of Problem

The harbor seal is an injured resource that is not recovering. In the Gulf of Alaska and PWS, harbor seal numbers declined substantially from the late 1970s through the early 1990s (Pitcher 1990, Hoover-Miller 1994, Frost *et al.* 1998). Specifically, the number of seals decreased by approximately 90% between 1976 and 1992 on Tugidak Island (Pitcher 1990, Lewis *et al.* 1996), located southwest of Kodiak Island, and in PWS numbers decreased by 63% between 1984 and 1997 (Frost *et al.* 1998). Recently, population trend surveys indicate the percent change per year in aerial counts has stabilized for the Kodiak Archipelago over the 1993-1997 period (Small *et al.* 1998a), whereas in PWS trend survey results indicate counts decreased 4.6% per year from 1990 through 1997 (Frost *et al.* 1998). Land-based counts on Tugidak Island have increased 8.9% per year from 1992-1997; however, the affect of environmental covariates (e.g., date, time of day) that are known to influence counts has not yet been determined (Small *et al.* 1998a, Frost *et al.* 1999).

The information on harbor seal population status presented above is a result of monitoring programs within the spill area that began over 20 years ago, initially with land-based counts conducted on Tugidak Island by ADF&G. Subsequently, ADF&G established aerial survey routes designed to estimate population trend in PWS (1984) and the Kodiak Archipelago (1993). Additionally, the National Marine Fisheries Service (NMFS) has conducted aerial surveys to estimate the abundance of harbor seals across the seals' statewide range since 1991. The results of these survey efforts have provided invaluable information regarding the population status of harbor seals within the spill area. However, the location of trend survey routes were determined, primarily, on logistical constraints; not, on statistical sampling theory. In addition, knowledge of harbor seal biology and life history characteristics was relatively limited when the current monitoring programs began. Recently, advances have been made in marine mammal survey and assessment methods (Garner *et al.* 1999), and in the understanding of harbor seal stock structure, movement and haulout patterns, and molting phenology within the spill area that is pertinent to

population monitoring (Frost *et al.* 1998, Small *et al.* 1997 & 1998b). This new information raises concerns about whether the current monitoring programs are based on the most appropriate experimental design to provide the best information on harbor seal populations within the spill area.

For example: Are haulout sites within trend survey routes representative of the general trend survey area? Seals are no longer present at some haulout sites within the trend survey routes: should these sites be deleted from the survey and replaced with other sites? Both trend and abundance surveys have been performed in mid to late August, when it was assumed that the peak number of seals hauled out in association with the annual molt. Yet, molting phenology is not well known for most areas: how large is the potential bias in abundance estimates if surveys are not conducted when the majority of seals are hauled out? Similarly, different age and sex cohorts haulout at different periods during the molt (Jemison *et al.* 1998): what cohort should surveys focus on, and when is the peak molt period for that cohort?

#### **B. Rationale/Link to Restoration**

Knowledge of population status (e.g., trend and abundance) is fundamental to assessing recovery. As the harbor seal is a resource that is not recovering, well designed monitoring programs for harbor seals are essential for accurate restoration assessments and management strategies. Recognizing the need to enhance and improve the design of monitoring programs, this project will provide the information necessary to determine when and how monitoring should be conducted. In addition, the new design will determine how the transition from the current monitoring program to a new long-term monitoring program should occur without a loss of information on the present status of the population.

#### **C. Location**

The geographic focus of the majority of research projects on Alaskan harbor seals over the last decade has been in the PWS and Kodiak Archipelago regions, in addition to Southeast Alaska. Fortunately, this project will thus be able to utilize the large and diverse databases generated from harbor seal research within the EVOS spill area. The application of the project will result in benefits within the spill area, and will also be applicable throughout the range of the harbor seal in Alaska. Communities with individuals interested in the cultural and economic value of harbor seals will be affected by the project, as they will be provided with an improved assessment of seal population status and trends.

### **COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE**

The application of the project is to assess harbor seal population status and trends in the most effective and scientifically sound manner. Recognizing that harbor seals represent a valuable cultural and economic resource to many community members, discussions were held with Monica Riedel, executive director of the Alaska Native Harbor Seal Commission (ANHSC), and Dr. Henry Huntington, TEK specialist for the Trustee Council. These discussions generated several potential opportunities for community participation in a long-term monitoring project: (1) provide members of local communities the opportunity to accompany ADF&G and NMFS personnel during population trend and abundance surveys; (2) compile TEK of long-term population abundance and distribution of harbor seals prior to the oil spill; (3) provide members

of local communities the opportunity to assist in the collection of demographic data, such as pupping and molting phenology, at index sites (e.g., Tugidak Island); and (4) seasonal information on the abundance and distribution of harbor seals within the spill area will be collected by members of the local communities. Such information will increase the understanding of population dynamics on a finer temporal and spatial scale, and may assist in the interpretation of larger scale phenomenon.

In addition, a technical representative from the ANHSC will participate in all meetings held in conjunction with this project; i.e., initial discussions on the specific objectives, progress, and final recommendations. Finally, once this project is completed, the development and implementation of the revised monitoring program will be discussed with the ANHSC. Specifically, the opportunities outlined above will be discussed in greater detail such that they can be integrated into the new monitoring program in the most effective manner.

## **PROJECT DESIGN**

### **A. Objectives**

1. Determine which haulout sites best represent all haulouts within a general trend survey area (e.g., PWS), recognizing logistical and technological constraints.
2. Determine the spatial extent, if any, that population trend estimates can be extrapolated from a trend survey area to surrounding areas.
3. Determine if an additional trend route is required to adequately assess population trends within the spill area.
4. Estimate the statistical power associated with population trend estimates.
5. Determine which haulout sites within an existing trend route should be deleted, and which new sites should be included, when the trend route no longer best represents the general survey area.
6. Determine if counts at large glacial haulout sites (e.g., Columbia Bay) should be collected simultaneously with counts at traditional terrestrial sites, recognizing the logistical constraints in obtaining counts at the two different haulout substrates.
7. Determine the influence of environmental covariates (e.g., date, time of day, time of low tide) on population abundance estimates.
8. Estimate the bias resulting from abundance surveys conducted outside of the peak molt period, and determine how to account for this bias in the associated abundance estimate.
9. Determine if trend and abundance surveys should be conducted when the greatest numbers of seals are hauled out during the molt period, or, when the greatest number of yearlings and subadults are hauled out.

10. Determine if counts from either trend or abundance surveys can be used to estimate the maximum net productivity level (MNPL), and thus an assessment of whether stocks are at optimum sustainable population (OSP) size.
11. Determine if an additional index site (e.g., Tugidak Island) is required to adequately assess population trends within the spill area, and the appropriate sampling design for such sites.

## **B. Methods**

This project is designed to determine the most appropriate methods to monitor harbor seal population status within the spill area. The current experimental design to monitor population status will be evaluated based on existing information on the spatial and temporal variation in the abundance and distribution of harbor seals and recent advances in marine mammal survey and assessment methods.

Examples of pertinent hypotheses relative to the objectives presented above, and the methodology that will be used to address them include:

1.  $H_0$ : Haulout sites within existing trend survey routes are stratified within the survey area by haulout substrate and seal abundance.
2.  $H_0$ : The spatial extent of population trend estimates is within the trend survey area, but not in adjacent areas.
3.  $H_0$ : The two existing trend routes adequately assess population trends within the spill area.

The haulout substrate and abundance estimate for all haulout sites within the spill area will be determined. All sites within PWS and the Kodiak Archipelago will then be compared to the existing trend sites within the two areas, respectively. Haulout sites outside these two trend survey areas, but within the distance typically traveled by seals, will also be examined for substrate type and abundance to determine if they are similar to the trend sites. Finally, once hypotheses #1 and #2 have been addressed, the proportion of the harbor seal population within the spill area that is considered to be monitored by the PWS and Kodiak trend routes will be determined. If the remaining proportion that is not monitored is significant, then the creation of an additional trend route will be considered.

Additional methodology:

Trend estimates and their associated confidence intervals will be examined to assess the adequacy of the trend survey program. Specifically, computer simulations will be used to examine the precision (i.e., confidence interval) associated with the trend estimate when additional replicate surveys are conducted within one year, surveys are conducted on a bi- or triennial basis rather than annually, and additional sites within a route are included. Environmental covariate (e.g., time of day, tide height, time of high tide, etc.) relationships for these simulations will be based on existing survey data. This approach will be used due to the difficulties in estimating statistical power with the complex covariate analyses currently used to estimate population trend.

Simulations will also be used to evaluate the effect (i.e., bias and precision) of conducting surveys (both trend and abundance) at times other than the peak haulout period during the molt. Specifically, the duration and amplitude in the distribution of seal numbers during the peak haulout period will vary in the simulations, as will the simulated survey window.

Population modeling of the PWS harbor seal population indicates that population growth is most sensitive to changes in survival of seals aged 0-5 years (Small *et al.*, *in preparation*). Based on age-specific haulout phenology information collected on Tugidak Island (Jemison *et al.* 1998), simulations will be conducted that incorporate trend surveys conducted during different periods within the molt period. These simulations will determine the optimal survey period for monitoring the age cohorts with the greatest influence on population growth.

Based on existing data from NMFS abundance surveys, the proportion of seals not counted during those surveys (i.e., "correction factor") will be modeled from environmental covariates recorded during the surveys. Subsequently, an abundance estimate will be determined using either Poisson regression (Small *et al.* 1998) or Bayesian Hierarchical models (Ver Hoef and Frost 1999) and the estimated correction factor.

### **C. Cooperating Agencies, Contracts, and Other Agency Assistance**

The large majority of this project will be contracted to either a university faculty member or postdoctoral fellow, with necessary supporting information provided by ADF&G and NMFS biologists. A contract is necessary to ensure that an individual recognized as having substantial knowledge in the statistics of population survey and assessment design conducts the research, and that this individual can devote sufficient time to the project. The contract will be established as a cooperative agreement between ADF&G and most likely either the University of Alaska–Fairbanks or the University of Washington.

Once the contractor has been selected and the cooperative agreement established, ADF&G and NMFS biologists will meet with the contractor to clarify the objectives and exchange needed databases. Thereafter, Robert Small will oversee the development of the work to ensure that the milestones are successfully completed on schedule.

## **SCHEDULE**

### **A. Measurable Project Tasks for FY 00 (October 1, 1999 – September 30, 2000)**

October 31:	Selection of contractor and establishment of cooperative agreement completed
November 1-June 30:	Evaluation of existing monitoring programs completed
September 30:	Development of new experimental design completed and integrated into monitoring programs.

### **B. Project Milestones and Endpoints**

November 30:	Acquisition of databases from ADF&G & NMFS completed
December 1-February 28:	Evaluate PWS and Kodiak trend route survey design

April 31:	Recommendations for revisions to PWS and Kodiak trend route survey design completed
May 1-June 30:	Evaluate NMFS abundance survey design
August 31:	Recommendations for revisions to NMFS abundance survey design completed
September 30:	Recommendations for remaining objectives completed, and final report submitted

### **C. Completion Date**

All of the project's objectives will be completed by the end of FY 00.

### **PUBLICATIONS AND REPORTS**

The final report will be completed at the end of FY 00. Once this report is completed, ADF&G and NMFS personnel will determine if a manuscript should be considered for publication, and will provide any additional funding necessary to cover the costs of the publication.

### **PROFESSIONAL CONFERENCES**

Travel funds for conference attendance are not being requested.

### **NORMAL AGENCY MANAGEMENT**

ADF&G is not required to conduct this project by statute or regulation. NMFS funded a workshop on the "Population assessment of harbor seals in Alaska" in November 1995 (Small 1996), which provided a brief overview of the monitoring programs, and a thorough review of the population status of Alaskan harbor seals. In addition, specific recommendations were generated from the workshop, several of which are very similar to some of the objectives listed in this proposed project (e.g., objectives #1-4). ADF&G and NMFS personnel have pursued and completed several of the other workshop recommendations. However, a lack of available statistical expertise has prohibited the completion of the remaining workshop recommendations, as well as the other objectives listed in this proposal. ADF&G and NMFS currently conduct research on harbor seals within the spill area, including population assessment, but do not have sufficient funding or the available technical expertise to pursue all the objectives of this project. Thus, funds are requested from the Trustee Council.

### **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

This project will be coordinated with three harbor seal research programs: (1) Trustee Council restoration project 064: Monitoring, Habitat Use, and Trophic Interactions of Harbor Seals in Prince William Sound, Alaska. Kathy Frost, the principal investigator of project 064, is a co-investigator of the proposed project, and has provided consultation and advice on this DPD. (2) Harbor Seal Investigations in Alaska, the ADF&G statewide harbor seal research program funded through funds allocated by the U. S. Congress, and administered by NMFS. Robert

Small, principal investigator of this ADF&G program, is the other co-investigator of the proposed project. (3) NMFS Polar Ecosystems program, based at the National Marine Mammal Laboratory. John Bengtson is the project leader for this NMFS program, and David Withrow leads the NMFS harbor seal abundance survey effort. John and David are also the principal cooperators for the ADF&G statewide harbor seal program.

All of these personnel will provide databases and knowledge on harbor seal distribution and abundance within the spill area, and advice on issues relative to the evaluation and revision of the monitoring programs. ADF&G and NMFS will be requesting funds through their inter-agency proposal process to supplement the financial support requested from the Trustee Council to provide the selected contractor with a full year of salary and benefits.

## **PRINCIPAL INVESTIGATORS**

Dr. Robert J. Small is a marine mammal biologist and principal investigator of the ADF&G statewide harbor seal research program. He has published numerous articles on the population ecology of vertebrates, and authored the 1996 Alaska Marine Mammal Stock Assessments. He previously conducted statistical analyses of harbor seal population trend data, designed a population model of Alaskan harbor seals, and convened a workshop on the assessment of Alaskan harbor seal populations. He has experience with administration of wildlife research and conservation programs, and supervision. Dr. Small will be responsible for the general oversight and direction of the project, in addition to providing the Kodiak Archipelago trend survey and Tugidak Island index site databases.

Kathy Frost is a marine mammal biologist who has conducted extensive research on marine mammals throughout Alaska since 1975. She is the principal investigator of Trustee Council restoration project 064: Monitoring, Habitat Use, and Trophic Interactions of Harbor Seals in Prince William Sound, Alaska. She has monitored harbor seals in PWS for over a decade, and is very familiar with the distribution and abundance of seals in PWS, and thus the issues relative to the monitoring of those seals. Kathy will be responsible for providing PWS trend survey databases and application of her knowledge towards the development of the revised experimental design.

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# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Revision - 4-99  
Approved 7-9-99

Budget Category:	Authorized FY 1999	Proposed FY 2000					
Personnel		\$5.9					
Travel		\$2.2					
Contractual		\$40.0					
Commodities		\$0.0					
Equipment		\$0.0					
Subtotal	\$0.0	\$48.1	LONG RANGE FUNDING REQUIREMENTS				
General Administration		\$3.7			Estimated FY 2001	Estimated FY 2002	
Project Total	\$0.0	\$51.8					
Full-time Equivalents (FTE)		0.1					
Dollar amounts are shown in thousands of dollars.							
Other Resources		\$24.0					
<p>Comments:</p> <p>This project will develop an experimental design for a long-term monitoring program of harbor seal populations in the EVOS spill area, based on new research results concerning harbor seal stock structure, population trends, and life history characteristics, and advances in marine mammal survey and abundance assessment. This project should be conducted to ensure that populations of the harbor seal, a resource that is not recovering, are monitored in the most effective and scientifically sound manner. The results of this project will have affects on community members that derive cultural and economic value from harbor seals by improved assessment of this resource. In addition, the results of this project will be applied throughout the range of the harbor seal in Alaska. No portion of the project cost is for NEPA compliance, publications, professional conferences, or community involvement. Costs associated with restoration workshop attendance, technical review session attendance, and report writing will be minimal and covered by the ADF&amp;G statewide harbor seal program from Anchorage. The proposed funding listed under "Other Resources" is what the cooperating agencies (ADF&amp;G and NMFS) will request in their upcoming inter-agency proposals to provide the selected contractor with a full year of salary and benefits to complete the project.</p>							

**FY00**

Project Number: 00509  
Project Title: Long-Term Monitoring of Harbor Seal Populations:  
Development of an Experimental Design  
Agency: ADF&G

FORM 3A  
TRUSTEE  
AGENCY  
SUMMARY

Prepared:

14-Apr-99

October 1, 1999 - September 30, 2000

**FY00**

FORM 3B  
Personnel  
& Travel  
DETAIL

14-Apr-99

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		Proposed
Description		FY 2000
<p>Eight months (0.7 FTE) salary and benefits of a University Post-Doc with recognized and substantial knowledge in the statistics of population survey and assessment design, to devote sufficient time and focus on the evaluation and revision of harbor seal population monitoring programs within the spill area.</p> <p>Salary and Benefits: 8 months @ \$4.0/month  University overhead: 8 months @ \$1.0/month</p>		<p>32.0  8.0</p>
When a non-trustee organization is used, the form 4A is required.		
<b>Contractual Total</b>		\$40.0
<b>Commodities Costs:</b>		Proposed
Description		FY 2000
<b>Commodities Total</b>		\$0.0

**FY00**

Project Number: 00509  
Project Title: Long-Term Monitoring of Harbor Seal Populations:  
Development of an Experiment Design  
Agency: ADF&G

**FORM 3B**  
**Contractual &**  
**Commodities**  
**DETAIL**

Prepared:

October 1, 1999 - September 30, 2000

**FY00**

FORM 3B  
Equipment  
DETAIL



*Revision 6-30-99  
Approved TC 8-9-99*

## **Recovery of Intertidal Communities and Recommendations for Future Monitoring**

Project Number: 00510-BAA

Restoration Category: Research

Proposer: T. Dean/CRA, Inc.

Lead Trustee Agency: NOAA

Cooperating Agencies: ADFG

Alaska SeaLife Center: No

New or Continued: New

Duration: 1st yr.  
3 yr. project

Cost FY 00: \$48.8

Cost FY 01: \$0.0

Cost FY 02: \$0.0

Geographic Area: Prince William Sound

Injured Resource/Service: Intertidal communities

### **ABSTRACT**

This project will examine the state of recovery of key habitats and representative injured species within the intertidal zone in Prince William Sound. FY 00 will consist of a statistical comparison of the National Oceanographic and Atmospheric Administration (NOAA) Hazmat and Coastal Habitat (primarily Project CH1A) data and identification of cost effective measures for monitoring intertidal communities. FY 01 will consist of sampling at intertidal sites within the sheltered rocky habitat that were previously sampled as part of the Coastal Habitat Injury Assessment. In addition, sampling will be conducted at representative sites sampled by the NOAA Hazmat team. These data, along with those previously collected during the Coastal Habitat and NOAA Hazmat programs, will be evaluated to assess the status of recovery.

## INTRODUCTION

Intertidal habitats are still considered among the resources that have not fully recovered from injuries resulting from *Exxon Valdez* Oil Spill (EVOS). This evaluation is based largely on the results of Coastal Habitat studies funded by the *Exxon Valdez* Oil Spill Trustee Council (Highsmith *et al.* 1994, 1996) and on studies conducted by the NOAA Hazmat group in evaluating various cleanup methods (Houghton *et al.* 1996, 1997)

The Coastal Habitat study sampled at a relatively large number of randomly selected sites. This allowed inferences concerning injury and recovery from the sampled sites to the larger area of the Sound affected by the spill. These results suggest that many of the dominant invertebrates and plants in the intertidal had not recovered fully as of 1991. The status of recovery of representative taxa, based on the persistence of significant differences between oiled and reference sites, is given in Table 1.

Table 1. Intertidal taxa with significant differences between oiled and reference sites in Prince William Sound in Spring 1991. Habitats are SR = Sheltered rocky, CT = Coarse textured, ES = Estuarine, and ER = Exposed rocky. Tidal heights are H = High, M = Middle, and L = Lower intertidal zone. X = significantly greater at reference sites, O = Significantly greater at oiled. (From Stekoll *et al.* 1995.)

Taxa	Habitat Type and Intertidal Zone											
	SR			CT			ES			ER		
	H	M	L	H	M	L	H	M	L	H	M	L
<i>Fucus gardneri</i>	X	X	X	X	X	X	X	X			X	
<i>Tectura persona</i>	X				X							
<i>Cthamalus dalli</i>	O	O	O							O		
<i>Balanus glandula</i>	X				X	O	X	X		O		
<i>Semibalanus balanoides</i>	X				X	X		X			X	
<i>Mytilus trossulus</i>				X	X	X					X	
<i>Littorina sitkana</i>	X						X					
<i>Littorina scutulata</i>		O		X	X	X		X				

Recovery varied by habitat and tidal height, but all eight numerically dominant taxa (one plant and seven invertebrates) showed signs of incomplete recovery within at least one habitat and tidal zone. Differences between oiled and reference sites were most evident in the upper intertidal zone in sheltered rocky habitats and in the middle intertidal zone on coarse textured beaches. In each of these habitats and tidal heights, patterns of abundance for six of the eight taxa indicated a lack

of complete recovery. Unfortunately, only results on data collected through 1991 have been fully reported (Highsmith *et al.* 1996) and as a result, the status of recovery past 1991 remains uncertain.

The NOAA studies provide some evidence that suggests that the lack of recovery of intertidal resources persisted through 1995 (Table 2).

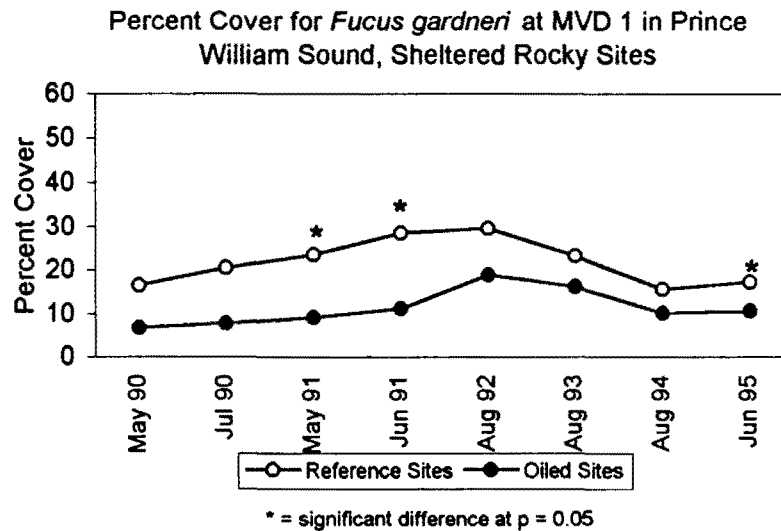
Table 2. Ratios of mean abundance of intertidal taxa at unoiled (N=2) and oiled and cleaned (N = 3) rocky shores in Prince William Sound in 1995. Asterisks indicate significant differences between oiled and control sites ( $P < 0.10$ ). Data are from Houghton *et al.* (1997). H = High intertidal, M = Mid intertidal.

<u>Taxa</u>	<u>H</u>	<u>M</u>
<i>Fucus gardneri</i>	3	1.7
Lottidae (limpets)	6*	0.6
<i>Cthamalus dalli</i>	12	0.3
<i>Balanus glandula</i>	8	0.7
<i>Semibalanus balanoides</i>	250*	1.5
<i>Mytilus trossulus</i>	1.5	1.5
<i>Littorina sitkana</i>	2	3.2
<i>Littornia scutulata</i>	4	0.8

For example, limpet populations in the upper intertidal zone were significantly reduced at oiled and cleaned sites after the spill, and remained about six times higher at reference sites than at oiled and cleaned sites in 1995 (Houghton *et al.* 1997). In the upper intertidal zone, eight taxa had higher mean densities at oiled sites. However, due to small sample sizes (two reference and three oiled and cleaned sites) and associated low power to detect differences, means differed significantly for only two taxa. While the NOAA study provides a lengthy time series of observations, it is difficult to make strong statements about recovery status based on these data because, in addition to the low power, the sites were chosen in order to examine the efficacy of various cleanup methods. The potential biases in site selection make it difficult to make strong inferences from observations made at these selected sites to the Sound as a whole.

Some of the Coastal Habitat sites have been revisited by M. Stekoll, R. Jenne, M. Lindeberg, and S. Saupe since 1991, but only the data on percentage cover by *Fucus gardneri* that were collected through 1994 have been fully analyzed and reported (Stekoll and Deysher 1998, 1999). In the upper intertidal region in Prince William Sound in 1994, percentage cover by *Fucus* remained slightly higher at reference sites, but did not differ significantly. However, unpublished data from

1995 (M. Lindeberg and S. Saupe) indicate that there was significantly higher *Fucus* cover at reference sites, suggesting that populations of *Fucus* in the upper intertidal zone may not have fully recovered (See figure below).



The differences in mean percentage cover changed only slightly between 1994 and 1995, but the data were less variable in 1995 providing more power to detect a significant difference. These analyses are clearly preliminary, but point out that all existing data need to be evaluated, and a more current survey needs to be conducted, in order to assess the status of recovery within the intertidal community.

## NEED FOR THE PROJECT

### A. Statement of Problem

The status of recovery of critical intertidal resources remains largely unknown. Understanding the recovery process, and evaluating methods for determination of injury and recovery are critical to developing future monitoring plans.

### B. Rationale/Link to Restoration

The data concerning the status of recovery of intertidal and nearshore subtidal resources is important in determining whether future restoration efforts are required. Also, these data are extremely valuable in that they can be used to design effective monitoring of these critical habitats.

### C. Location

Studies will be conducted in Prince William Sound. However, data from the Kenai/Cook Inlet and Kodiak/Alaska Peninsula regions will also be evaluated in assessing monitoring methods.

## COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

The projects are based on data gathered throughout the damage assessment and restoration phases of the *Exxon Valdez* Oil Spill studies funded by the Trustees. Past work has been presented at various public meetings sponsored by the council. It is anticipated that manuscripts produced will be the basis of future presentations at Trustee sponsored restoration workshops.

## PROJECT DESIGN

### A. Objectives

The objectives of the proposed study are to 1) statistically compare data previously collected by NOAA Hazmat and Coastal Habitat studies to evaluate the status of recovery of injured resources in the intertidal zone in Prince William Sound, and 2) to provide guidance for future monitoring within these habitats. In FY2001, we will conduct additional sampling to further assess recovery, if a full recovery is not suggested by prior analyses.

### B. Methods

#### Data analysis - Assessment of recovery

The recovery of the intertidal community will be assessed by comparing the density or percent cover of each taxa at oiled and control sites used in CHIA studies. Statistical tests will be conducted on matched pairs of sites to evaluate if differences (injuries) detected in 1990-91 are still present. Evaluation of the magnitude of differences will be conducted for each matched pair of sites using confidence intervals on the ratios of means. These confidence intervals will allow us to place the burden of proof of "no difference" on the data. That is, do the data prove that differences have disappeared, that the differences are still present, or that the data lack sufficient precision to assess the issue of continuing differences?

Unfortunately, with the incomplete time series of data on the CHIA sites, assessment of "recovery" over the broad area of PWS is difficult. Analysis will be conducted that compare the results of sampling at NOAA and CHIA sites. If both sets of sites show similar patterns with respect to recovery, then inferences made from the longer time series of sampling at NOAA sites may be used to infer the state of recovery over broader areas within the Sound.

#### Recommendations for future monitoring

Recommendations will be made regarding the type of sampling that is advised in future intertidal and shallow subtidal monitoring. Indicator species will be selected based on 1) their function within the system, 2) their relative importance, either trophically or structurally, their susceptibility to injury, and the expected level of power to detect change of a reasonable magnitude with reasonable sampling effort. This will require a combination of power analyses and judgment based on knowledge of the system and the role of species within the system.

Metrics used to assess the effects of disturbance to the system will be based on the above analyses plus data from other programs (e.g., NVP analyses of mussel growth by O'Clair and sea urchin growth by Dean) in order to recommend efficient means of monitoring.

It is anticipated that a recommendation will be made that will incorporate limited sampling of key metrics for representative species at fixed sites, plus continued studies that develop efficient long term monitoring tools (e.g., remote sensing), or explore processes important to the evaluation of monitoring data.

#### Sampling in FY2001

Sampling will be conducted at five pairs of oiled and unoiled sites within the sheltered rocky habitat that were previously sampled as part of the Coastal Habitat program (Highsmith *et al.* 1996, Stekoll *et al.* 1996). In addition, we will sample at six sites (three oiled and cleaned and three unoiled) used by NOAA to assess effects of various cleanup methods within this habitat. Sampling will be conducted in June 2001.

The percent cover of bare substrate, *Fucus gardneri*, and other algae will be estimated as described in Stekoll *et al.* (1996). Seven dominant epifaunal invertebrates, including the mussels (*Mytilus trossulus*), three barnacles (*Balanus glandula*, *Cthamalus dalli*, and *Semibalanus balanoides*), two periwinkle snails (*Littorina sitkana* and *Littorina scutulata*) and one limpet (*Tectura persona*) will be counted. Sampling will only be conducted in the upper (MVD 1) and middle (MVD 2) intertidal zones because of restrictions in sampling time, and because most of the observed injuries that persisted through 1991 occurred in these upper and middle zones. We will not sample at coarse textured, exposed rocky, or estuarine sites primarily because of cost considerations. Exposed and estuarine sites were eliminated because these habitats are relatively rare in the Sound and injuries appeared less prevalent there. Injuries to a large number of taxa were observed on coarse textured beaches, but we elected to sample at the sheltered rocky sites instead because: 1) injuries were somewhat similar in the two habitats, 2) there were considerable unpublished data gathered from sheltered rocky sites between 1991 and 1998, and 3) NOAA Hazmat sites were more comparable to CHIA sheltered rocky sites than to coarse textured beaches.

At each tidal level at each site, the percent cover of algae and counts of invertebrates will be made within six quadrats measuring 40 by 50 cm. Methods used for determining percent cover and estimating density will be the same as used in 1991 Coastal Habitat Injury Assessment (CHIA) surveys, except that only non-destructive sampling (without scraping rocks surfaces) will be employed.

#### Personnel and project management

The project will be conducted by a team of scientists who have been directly involved in the coastal habitat studies funded by the Trustees. The work will be coordinated by Coastal Resources Associates, Inc. (CRA). Dr. Thomas Dean, President of CRA will serve as project leader. Key individuals in the Coastal Habitat Injury Assessment program who will serve as co-principal investigators are: Drs. Steve Jewett and Mike Stekoll of the University of Alaska, Dr. Chuck O'Clair of NOAA, and Dr. Lyman McDonald of WEST, Inc. Other key members of the technical staff include Mandy Lindeberg, Susan Saupe, and Michelle Bourassa who have been

instrumental in the collection and analysis of intertidal and subtidal data since the inception of the Coastal Habitat program.

Responsibilities for each of the contractors is as follows:

Coastal Resources Associates, Inc. (P.I. Dean)

- Manage the project

- Serve as coordinator and lead author for a report (and possible manuscript) that examines recovery based on statistical analysis of NOAA Hazmat and Coastal Habitat data

- Provide analytical support for the above analysis

- Provide for all logistical support for field sampling efforts in FY2001

- Assist in sampling and data analysis in FY2001

University of Alaska, Fairbanks (P.I. Jewett)

- Assist in sampling in 2001

NOAA Auke Bay Laboratory (P.I. O'Clair)

- Assist in manuscript preparation

- Assist in sampling in FY2001

University of Alaska, JCSFOS (P.I. Stekoll)

- Assist in manuscript preparation

- Assist in sampling in FY2001

Western Ecosystem Technologies, Inc. (P.I. McDonald)

- Prepare databases of existing data

- Conduct preliminary analyses to assess key habitats and species for monitoring

- Analyze data to assess the status of recovery

- Serve as lead on a manuscript describing methods for assessing recovery and recommendations for future monitoring

- Merge existing data with new data obtained in FY2001

### **C. Cooperating Agencies, Contracts, and Other Agency Assistance**

This proposal is being submitted under BAA by Coastal Resources Associates, Inc. However, it is anticipated that a portion of the funding will be directed to the University of Alaska (with contract administration for that portion of the contract conducted by Alaska Department of Fish and Game), NOAA, and WEST (under a BAA with NOAA). Separate budgets are submitted for each of these organizations.

This proposal also will, in part, be a collaborative effort with the NOAA Hazmat group (See attached letter from G. Shigenaka, NOAA Hazmat). They have sampled intertidal sites in Prince William Sound on a more or less continuous basis since 1990, and have agreed to work collaboratively. We will share data and cross reference sampling methods by sampling a subset of six sites using both CHIA and NOAA methods in 2001. As part of this collaborative effort, a meeting will be held in Seattle in 2000 with both NOAA Hazmat personnel and two of this project's PIs (Dean and McDonald) in attendance. It is anticipated that more integrated products (e.g., A joint publication on methods of assessing recovery) may result from this meeting.

## SCHEDULE

### A. Measurable Project Tasks for FY00 (October 1, 1999 - September 30, 2000)

### B. Project Milestones and Endpoints (FY00)

Drafts of reports and manuscripts will be completed by April <sup>2000</sup>~~2001~~. It is anticipated that the manuscript will be reviewed, revised and submitted for final acceptance by September <sup>2000</sup>~~2001~~. correction  
per e-mail  
on file at  
R.O.  
L

Responsibilities for specific products are as follows:

Coastal Resources Associates, Inc. (P.I. Dean)

Progress report at the end of the first contract year

A report or (if warranted by the analysis) manuscript describing the results of statistical comparisons of NOAA and Coastal habitat data

University of Alaska, Fairbanks (P.I. Jewett), University of Alaska, JCSFOS (P.I. Stekoll), and NOAA Auke Bay Laboratory (P.I.)

None

Western Ecosystem Technologies, Inc. (P.I. McDonald)

A manuscript describing methods for assessing recovery and recommendations for future monitoring

### C. Completion Date

It is anticipated that reports for this project will be completed by April <sup>2000</sup>~~2001~~. Sampling slated for FY2001 will be completed by September 2001. Some funding will likely be required in FY02 for publication preparation.

## PUBLICATIONS AND REPORTS

Two products will be prepared and will serve as the final report for the project. The first will be a report, or if the analyses warrant, a publication describing the results of statistical comparisons between NOAA Hazmat and Coastal Habitat data. The second will be a publication describing possible methods for assessing recovery. Anticipated titles, authorship, and journals for submission are as follows:

Status of recovery of intertidal communities ten years after the *Exxon Valdez* Oil Spill. TA Dean, L McDonald, M Bourassa, M Lindeberg, C O'Clair, S Saupe, G Shigenaka, M Stekoll, R. Highsmith (anticipated submission to Marine Pollution Bulletin).

Methods of assessing recovery following disturbance and implications for monitoring: Examples from the intertidal following the Exxon Valdez Oil Spill. L McDonald, TA Dean, SC Jewett, C O'Clair, M Stekoll. (anticipated submission to Biometrics).

A progress report will be submitted to the Trustee Council in September 2000 summarizing findings from a joint meeting with NOAA Hazmat contractors and project administrators to discuss methods of assessing recovery and recommendations for future monitoring.

## **PROFESSIONAL CONFERENCES**

No funding is being requested for attendance at professional conferences in FY00. However, funding is requested for attendance of a monitoring workshop to be held jointly with the NOAA Hazmat contractors in Seattle.

## **NORMAL AGENCY MANAGEMENT**

This project has been developed through collaboration of private sector, NOAA, and University of Alaska scientists. None of the proposers have management responsibility. However, it is anticipated that publications produced will be widely utilized in future management decisions.

## **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

The scientists involved in the preparation of manuscripts have worked collaboratively in previous Trustee funded investigations of injury and recovery in coastal habitats.

Several of the authors are also participants in other large ecosystem studies funded by the Trustees. Thomas Dean, Stephen Jewett, and Charles O'Clair are principal investigators for the Nearshore Vertebrate Predator Project and Lyman McDonald serves as consulting statistician for both the Nearshore Vertebrate Predator and APEX projects. The APEX and especially the Nearshore Vertebrate Predator Project have large components that deal with coastal habitats, and new findings produced by these studies will be considered when preparing manuscripts. It is also anticipated that information presented in the manuscripts, along with the information gained in ongoing research and monitoring efforts, will be integrated and utilized in developing future monitoring plans for coastal habitats.

## **EXPLANATION OF CHANGES IN CONTINUING PROJECTS**

None

## **PROPOSED PRINCIPAL INVESTIGATORS**

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**2000 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET**  
 October 1, 1999 - September 30, 2000

*Revision 6-30-99*  
*Approved 8-9-99*

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel								
Travel		\$0.0						
Contractual		\$45.6						
Commodities		\$0.0						
Equipment		\$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	\$0.0	\$45.6			Estimated FY 2001	Estimated FY 2002		
General Administration		\$3.2						
Project Total	\$0.0	\$48.8						
Full-time Equivalents (FTE)		0.0						
			Dollar amounts are shown in thousands of dollars.					
Other Resources								
Comments:								
NOTE:								
NOAA will administer BAA's with Coastal Resources Associates, Inc. (\$18.5) and Western Ecosystems Technologies, Inc. (\$18.6) – GA \$2.6								
ADFG will administer RSA with University of Alaska Fairbanks (\$8.5) – GA \$0.6								

**FY00**

Project Number: 00510-BAA  
 Project Title: Intertidal Recovery and Monitoring Recommendations  
 Agency: NOAA & ADFG

**FORM 3A  
 TRUSTEE  
 AGENCY  
 SUMMARY**

**2000 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET**  
October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000					
Personnel	\$0.0	\$8.8					
Travel	\$0.0	\$0.9					
Contractual	\$0.0	\$0.7					
Commodities	\$0.0	\$0.0					
Equipment	\$0.0	\$0.0					
Subtotal	\$0.0	\$10.4	LONG RANGE FUNDING REQUIREMENTS				
Indirect		\$8.1			Estimated FY 2001	Estimated FY 2002	
Project Total	\$0.0	\$18.5			\$25.0	\$0.0	
Full-time Equivalents (FTE)	0.0	1.9					
Dollar amounts are shown in thousands of dollars.							
Other Resources							
<b>Comments:</b>  Indirect costs calculated as follows: Indirect costs = Overhead + General and Administrative costs + Fee Overhead = 59.5% of personnel costs G&A = 12.85% of personnel + overhead + other direct (excluding contractual) Fee = 4% of Total Direct + Indirect (excluding contractual)  No overhead or fees are charged on contractual costs							

FY00

Prepared: 6/25/99

Project Number: 00510  
 Project Title: Recovery of Intertidal Communities and  
 Recommendations for Future Monitoring - Submitted Under BAA  
 Name: Thomas A. Dean - Coastal Resources Associates, Inc.

FORM 4A  
 Non-Trustee  
 SUMMARY

**2000 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET**  
 October 1, 1999 - September 30, 2000

Personnel Costs:				Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
	Name	Position Description					
	T.A. Dean	Senior Scientist, P.I.		1.1	8.0	0.0	8.8
							0.0
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**FY00**

Prepared: 6/25/99

Project Number: 00510  
 Project Title: Recovery of Intertidal Communities and  
 Recommendations for Future Monitoring - Submitted Under BAA  
 Name: Thomas A. Dean - Coastal Resources Associates, Inc.

**FORM 4B  
 Personnel  
 & Travel  
 DETAIL**

**2000 EXXON VALDEZ TRUS      COUNCIL PROJECT BUDGET**  
October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		Proposed
Description		FY 2000
Consultant fees - Sue Saupe		0.7
<b>Contractual Total</b>		<b>\$0.7</b>
<b>Commodities Costs:</b>		Proposed
Description		FY 2000
		0.0
<b>Commodities Total</b>		<b>\$0.0</b>

**FY00**

Prepared: 6/25/99

Project Number: 00510  
Project Title: Recovery of Intertidal Communities and  
Recommendations for Future Monitoring - Submitted Under BAA  
Name: Thomas A. Dean - Coastal Resources Associates, Inc.

**FORM 4B**  
**Contractual &**  
**Commodities**  
**DETAIL**

**2000 EXXON VALDEZ TRUST COUNCIL PROJECT BUDGET**  
**October 1, 1999 - September 30, 2000**

[illegible]

FY00

**Project Number: 00510**  
**Project Title: Recovery of Intertidal Communities and**  
**Recommendations for Future Monitoring - Submitted Under BAA**  
**Name: Thomas A. Dean - Coastal Resources Associates, Inc.**

**FORM 4B**  
**Equipment**  
**DETAIL**

**Prepared: 6/25/99**

**2000 EXXON VALDEZ TRU : COUNCIL PROJECT BUDGET**  
 October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel	\$0.0	\$8.3						
Travel	\$0.0	\$1.0						
Contractual	\$0.0	\$0.0						
Commodities	\$0.0	\$0.0						
Equipment	\$0.0	\$0.0						
Subtotal	\$0.0	\$9.3	LONG RANGE FUNDING REQUIREMENTS					
Indirect		\$9.3			Estimated FY 2001	Estimated FY 2002		
Project Total	\$0.0	\$18.6			\$26.9	\$0.0		
Full-time Equivalents (FTE)	0.0	1.0						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:								

**FY00**

Prepared: 4/8/99

Project Number: 00510  
 Project Title: Recovery of Intertidal Communities and  
 Recommendations for Future Monitoring - Submitted Under BAA  
 Name: Lyman McDonald - Western Ecosystems Technologies, Inc.

**FORM 4A  
 Non-Trustee  
 SUMMARY**

**2000 EXXON VALDEZ TRU: COUNCIL PROJECT BUDGET**  
 October 1, 1999 - September 30, 2000

Personnel Costs:				Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000	
	Name	Position Description						
	L. McDonald	Senior Scientist, P.I.		0.5	7.9	0.0	4.0	
	M. Bourassa	Biometrician I		1.0	4.3	0.0	4.3	
							0.0	
							0.0	
							0.0	
							0.0	
							0.0	
							0.0	
							0.0	
							0.0	
							0.0	
							0.0	
Subtotal				1.5	12.2	0.0		
Personnel Total							\$8.3	
Travel Costs:				Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2000
	Description							
	RT Denver to Seattle			0.5	1	3	0.15	1.0
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
Travel Total							\$1.0	

**FY00**

Prepared: 4/8/99

Project Number: 00510  
 Project Title: Recovery of Intertidal Communities and  
 Recommendations for Future Monitoring - Submitted Under BAA  
 Name: Lyman McDonald - Western Ecosystems Technologies, Inc.

**FORM 4B  
 Personnel  
 & Travel  
 DETAIL**

**2000 EXXON VALDEZ TRU      COUNCIL PROJECT BUDGET**  
October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		<b>Proposed FY 2000</b>
<b>Description</b>		
None		
<b>Contractual Total</b>		<b>\$0.0</b>
<b>Commodities Costs:</b>		<b>Proposed FY 2000</b>
<b>Description</b>		
None		
<b>Commodities Total</b>		<b>\$0.0</b>

**FY00**

Prepared: 4/8/99

Project Number: 00510  
Project Title: Recovery of Intertidal Communities and  
Recommendations for Future Monitoring - Submitted Under BAA  
Name: Lyman McDonald - Western Ecosystems Technologies, Inc.

**FORM 4B  
Contractual &  
Commodities  
DETAIL**

**2000 EXXON VALDEZ TRU : COUNCIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

New Equipment Purchases:		Number of Units	Unit Price	Proposed FY 2000
Description				
	None			0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		<b>New Equipment Total</b>		<b>\$0.0</b>
Existing Equipment Usage:		Number of Units		
Description				
	None			

**FY00**

Prepared: 4/8/99

Project Number: 00510  
 Project Title: Recovery of Intertidal Communities and  
 Recommendations for Future Monitoring - Submitted Under BAA  
 Name: Lyman McDonald - Western Ecosystems Technologies, Inc.

**FORM 4B  
 Equipment  
 DETAIL**

## 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel	\$0.0	\$6.8						
Travel	\$0.0	\$0.0						
Contractual	\$0.0	\$0.0						
Commodities	\$0.0	\$0.0						
Equipment	\$0.0	\$0.0						
Subtotal	\$0.0	\$6.8	LONG RANGE FUNDING REQUIREMENTS					
Indirect	\$0.0	\$1.7			Estimated FY 2001	Estimated FY 2002		
Project Total	\$0.0	\$8.5			\$6.3	\$0.0		
Full-time Equivalents (FTE)	0.0	1.0						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:								
The indirect rate is 25% TDC as negotiated by the <i>Exxon Valdez</i> Oil Spill Trustee Council with the University of Alaska.								

FY00

Project Number: 00510  
 Project Title: Recovery of Intertidal Communities and  
 Recommendations for Future Monitoring - Submitted Under BAA  
 Name: Michael Stekoll - UAF - JCSFOS

FORM 4A  
 Non-Trustee  
 SUMMARY

**2000 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

<b>Personnel Costs:</b>				Months	Monthly		Proposed
	Name	Position Description		Budgeted	Costs	Overtime	FY 2000
	M. Stekoll	Professor of Chemistry and Biochemistry		0.7	9.7		6.8
Subtotal				0.7	9.7	0.0	
				<b>Personnel Total</b>			<b>\$6.8</b>
<b>Travel Costs:</b>			Ticket	Round	Total	Daily	Proposed
	Description		Price	Trips	Days	Per Diem	FY 2000
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
Travel Total							\$0.0

**FY00**

Project Number: 00510  
 Project Title: Recovery of Intertidal Communities and  
 Recommendations for Future Monitoring - Submitted Under BAA  
 Name: Michael Stekoll - UAF - JCSFOS

**FORM 4B  
 Personnel  
 & Travel  
 DETAIL**

Prepared: 6/25/99

**2000 EXXON VALDEZ TRU: COUNCIL PROJECT BUDGET**  
 October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		Proposed
Description		FY 2000
None		
<b>Contractual Total</b>		<b>\$0.0</b>
<b>Commodities Costs:</b>		Proposed
Description		FY 2000
<b>Commodities Total</b>		<b>\$0.0</b>

**FY00**

Prepared: 6/25/99

Project Number: 00510  
 Project Title: Recovery of Intertidal Communities and  
 Recommendations for Future Monitoring - Submitted Under BAA  
 Name: Michael Stekoll - UAF - JCSFOS

**FORM 4B**  
**Contractual &**  
**Commodities**  
**DETAIL**

October 1, 1999 - September 30, 2000

**FY00**

**FORM 4B**  
**Equipment**  
**DETAIL**



**Publication: Comparative Habitat Use by Kittlitz's and Marbled Murrelets**

Project Number: 00516-BAA  
Restoration Category: Research  
Proposer: R. Day/ABR, Inc.  
Lead Trustee Agency: NOAA  
Cooperating Agencies: None  
Alaska SeaLife Center: No  
New or Continued: New  
Duration: 1st yr.  
1 yr. project  
Cost FY 00: \$21.0  
Cost FY 01: \$0.0  
Cost FY 02: \$0.0  
Geographic Area: Prince William Sound  
Injured Resource/Service: Kittlitz's murrelet, marbled murrelet

**ABSTRACT**

This project will analyze an existing data set and publish a paper on the comparative at-sea habitat use by Kittlitz's and marbled murrelets. Both species were classified as injured by the oil spill. At this time, nothing is known about at-sea ecological segregation and overlap in habitat use. An existing data set for both species will be ideal for examining these issues.

## INTRODUCTION

This study will use an existing data set to describe at-sea habitat use in two species of *Brachyramphus* murrelets in the glaciated fjords of Prince William Sound. Kittlitz's and marbled murrelets both were impacted by the *Exxon Valdez* oil spill (*Exxon Valdez* Oil Spill Trustee Council 1999). At this time, nothing has ever been published on comparative habitat use and ecological segregation and overlap in habitat use between the two species. The data set collected by Day and Nigro (1998; Final Report in prep.) is the only one of its kind and provides a unique opportunity to evaluate these issues.

## NEED FOR THE PROJECT

### A. Statement of Problem

Virtually nothing has ever been quantified on the at-sea habitat use by Kittlitz's and marbled murrelets. In general, Kittlitz's murrelets are more tied to glaciated fjords than are marbled murrelets (Day et al., in press). Other than that generality, however, no one has ever quantified what that difference is and how much overlap in habitat use occurs in these two species. This study would use an existing data set to quantify these at-sea habitat characteristics.

### B. Rationale/Link to Restoration

There are three reasons why this study is important. First, this study will provide quantitative information on at-sea habitat use by two seabird species that the *Exxon Valdez* Oil Spill Trustee Council concluded were injured by the spill (*Exxon Valdez* Oil Spill Trustee Council 1999). Second, this information previously has not been available. Third, an evaluation of ecological overlap and segregation will provide insights into the potential for competition between the two species.

### C. Location

The data to be used in this study were collected in northwestern Prince William Sound in 1996–1998. No further field work is anticipated.

## COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

My understanding is that Kittlitz's and marbled murrelets play no role in subsistence use by local Natives in Prince William Sound (M. Vlasoff, pers. comm.). I would, however, draw on any local information that is available on these species on the open shelf and, especially, to be able to collect samples from any seabirds that are killed there for subsistence use.

## PROJECT DESIGN

### A. Objectives

The overall goal of this study is to quantify and describe comparative at-sea habitat use in Kittlitz's and marbled murrelets. This information then can be used to evaluate ecological overlap and segregation in at-sea habitat use of the two species. The specific objectives of the proposed research program are:

1. To quantify and describe the at-sea habitat use by Kittlitz's and marbled murrelets in Prince William Sound.
2. To calculate the degree of ecological overlap in at-sea habitat use in these two species.

## **B. Methods**

This study will use an existing data set to quantify and describe at-sea habitat use in Kittlitz's and marbled murrelets in northwestern Prince William Sound. These data were collected in 1996–1998 during a study of the ecology of Kittlitz's murrelet in those bays (Day and Nigro 1998, in prep.). Because so many marbled murrelets occurred in these bays, and because it took a substantial effort to identify and separate the two species, Day and Nigro (unpubl. data) simply recorded and keypunched the data on both species. These data sets have been proofed and corrected and are ready for analysis.

There are three data sets available for examination: nearshore surveys within bays, offshore surveys within bays and pelagic surveys outside of bays (Day and Nigro 1998, in prep.). The amount of habitat data that are available for analysis vary with the data set. The following habitat variables (following Day and Nigro 1998, in prep.) are available for examination:

- survey type (nearshore, offshore, pelagic)
- standardized habitat type (glacial-affected, glacial-stream-affected, marine-sill-affected, glacial-unaffected; all offshore and pelagic data are glacial-unaffected)
- ice cover (%)
- secchi depth (m) as a measure of water clarity (nearshore and offshore data only)
- sea-surface temperature (°C)
- sea-surface salinity (‰)
- depth (nearshore data only)
- distance from shore (nearshore data only)
- distance to nearest freshwater input (nearshore data only)
- shoreline substrate (ice, fine alluvium, large alluvium, bedrock; nearshore data only).

I will evaluate one primary hypothesis:

*H<sub>0</sub>: There is no difference in at-sea habitat use between Kittlitz's and marbled murrelets.*

I will calculate and plot mean habitat use by each species with the above list of habitat variables. I will test whether the two species use significantly different habitat characteristics, probably with a MANOVA. I also will explore whether some sort of multivariate analysis will do a better job of comparing overall habitat use in each species.

I also will use the above habitat variables to calculate the degree of ecological overlap in at-sea habitat use. The degree of ecological overlap will be calculated following Hespdenheide (1975).

### **C. Cooperating Agencies, Contracts, and Other Agency Assistance**

All field work already has been completed; all office work will be conducted by ABR, Inc. The Trustees Council will need to pay an outside agency for a Program Manager and for general administration. (These management costs will be funded directly from the Trustee Council to the agency, which is how my other Trustee-funded contracts were set up. Hence, that management money is not listed on the enclosed budget.)

## **SCHEDULE**

### **A. Measurable Project Tasks for FY00 (October 1, 1999-September 30, 2000)**

Dec-Jan 2000:	Data analysis
Jan-Apr 2000:	Write manuscript and submit as Final Report

### **B. Project Milestones and Endpoints**

1. "To quantify and describe the at-sea habitat use by Kittlitz's and marbled murrelets in Prince William Sound." Data will be analyzed and summarized in FY00.
2. "To calculate the degree of ecological overlap in at-sea habitat use in these two species." Measures of ecological overlap will be calculated in FY00.

### **C. Completion Date**

Sampling for the project already is done. Analysis of the data will be completed in FY00. Preparation of the manuscript/Final Report will be completed in FY00.

## **PUBLICATIONS AND REPORTS**

I will submit a manuscript/Final Report to the Chief Scientist no later than 15 April 2001. This Final Report will synthesize results from the data analyses and will be presented in the form of a manuscript.

## **PROFESSIONAL CONFERENCES**

To save money, I do not plan to attend a scientific conference.

## **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

This study will integrate data collected in Study 98142 ("Status and ecology of Kittlitz's murrelet in Prince William Sound), conducted by the Principal Investigator here. Some results of that research suggested the possibility of significant ecological overlap and, hence, competition for food between the two species (Day, unpubl. data). This study will take that work a step further and evaluate just how much ecological overlap the two species exhibit. Significant overlap would suggest that there might be enough competition between the two species that they may be hindering each other's recovery.

## **EXPLANATION OF CHANGES IN CONTINUING PROJECTS**

This is a proposed 1-year project. Hence, there are no proposed changes in this year.

## **PRINCIPAL INVESTIGATOR**

Robert H. Day, Ph.D.  
ABR, Inc.  
P.O. Box 80410  
Fairbanks, AK 99708-0410  
PH: 907-455-6777  
FAX: 907-455-6781  
E-mail: bday@abrinc.com

## PRINCIPAL INVESTIGATOR AND KEY PERSONNEL

Dr. Robert H. Day will be the Principal Investigator for the project. Bob has conducted research on seabirds, marine ecology, impacts of marine pollution, and marine conservation topics in Alaska and the North Pacific since 1975. His research topics have included the biology of poorly known seabirds in Alaska; the ecology of seabirds at sea in relation to oceanography (the topic of his Ph.D. dissertation); the ingestion of plastic pollutants by seabirds in Alaska; the mortality of seabirds in the high-seas drift-gillnet fishery of the North Pacific; and the distribution, abundance, and decomposition of plastic pollution and other marine debris in the North Pacific. Recently, he conducted several years of research on impacts of the *Exxon Valdez* oil spill on habitat use by marine-oriented birds and on bird communities (sponsored by Exxon Company, USA) and on the ecology of Kittlitz's Murrelet (sponsored by the *Exxon Valdez* Oil Spill Trustee Council). Dr. Day also has provided expert consultation to the USFWS as a member of the Spectacled Eider Endangered Species recovery Team, as an author of the Draft Steller's Eider Recovery Plan, and as a reviewer of the Short-tailed Albatross listing proposal.

Dr. Day is employed by ABR, Inc., Environmental Research and Services (formerly Alaska Biological Research, Inc.). ABR is an Alaskan-owned small business—headquartered in Fairbanks since its formation in 1976—that specializes in environmental research and services. During more than two decades of operation in Alaska, ABR has served a variety of clients, including private industry, state and federal government agencies, and the University of Alaska. During this time, ABR has developed a reputation for conducting objective research that provides the basis for sound management decisions. ABR remains committed to the goals of providing timely, accurate, and cost-effective information to those who manage or develop our natural resources.

## LITERATURE CITED

- Day, R. H., and D. A. Nigro. 1998. Status and ecology of Kittlitz's Murrelet in Prince William Sound: results of 1996 and 1997 studies. Unpublished *Exxon Valdez* Oil Spill Restoration Project Annual Report (Restoration Project 97142), prepared by ABR, Inc., Fairbanks, AK. 143 pp.
- Exxon Valdez* Oil Spill Trustee Council. 1999. Invitation to submit restoration proposals for federal fiscal year 2000. Unpublished notice prepared by *Exxon Valdez* Oil Spill Trustee Council, Anchorage, AK. 68 pp. + appendices.
- Hespenheide, H. A. 1975. Prey characteristics and predator niche width. Pp. 158–180 in M. L. Cody and J. M. Diamond, eds. *Ecology and evolution of communities*. Belknap Press of Harvard University Press, Cambridge, MA.

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Approved TR -9-99

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$0.0						
Travel		\$0.0						
Contractual		\$19.6						
Commodities		\$0.0						
Equipment		\$0.0						
Subtotal	\$0.0	\$19.6	LONG RANGE FUNDING REQUIREMENTS					
General Administration		\$1.4			Estimated FY 2001	Estimated FY 2002		
Project Total	\$0.0	\$21.0						
Full-time Equivalents (FTE)		0.0						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:								

**FY00**

Project Number: 00516-BAA

Project Title: Publication: Comparative Habitat Use by Kittlitz's and  
Marbled Murrelets

Agency: NOAA

FORM 3A  
TRUSTEE  
AGENCY  
SUMMARY

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

Budget Category:	Authorized FFY 1999	Proposed FFY 2000							
Personnel	\$0.0	\$18.4							
Travel	\$0.0	\$0.0							
Contractual	\$0.0	\$1.2							
Commodities	\$0.0	\$0.0							
Equipment	\$0.0	\$0.0							
Subtotal	\$0.0	\$19.6	LONG RANGE FUNDING REQUIREMENTS						
Indirect	\$0.0	\$0.0	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005	
Project Total	\$0.0	\$19.6	N/A	N/A	N/A	N/A	N/A	N/A	
Total Personnel Hours *	0	259							
Dollar amounts are shown in thousands of dollars.									
Other Resources									
<p>Comments:</p> <p>ABR, Inc. has used <b>Hourly Rates</b> instead of <b>Monthly Costs</b>. The hourly rate shown is an all inclusive rate. ABR, Inc. requested permission from EVOS Trustee Council and received verbal permission from <b>Sandra Schubert</b> on April 12, 1999 to substitute fully burdened hourly rates for monthly costs and indirect costs.</p> <p>Full-Time Equivalents (FTE's) have been changed to fully burdened Total Personnel Hours.</p>									

00

Project Number: 00516  
 Project Title: PUBLICATION OF PAPER ON COMPARATIVE HABITAT USE BY  
 KITTLITZ'S AND MARBLED MURRELETS  
 Name: ABR, Inc.

FORM 4A  
 Non-Trustee  
 DETAIL

Prepared: 4/12/1999

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

Personnel Costs:				* Hours	* Hourly		Proposed
	Name	Position Description		Budgeted	Costs	Overtime	FFY 2000
	Ritchie R	Principal		1.0	\$100.00	\$0	0.1
	Murphy S	Research Coordinator		6.0	\$94.00	\$0	0.6
	DeLong T	Office/Contracts Manager		4.0	\$69.00	\$0	0.3
	Day R	Senior Scientist I		184.0	\$75.00	\$0	13.8
	Smith M	GIS Specialist		60.0	\$57.00	\$0	3.4
	Harshburger D	Word Processor/Administrative Assistant		4.0	\$39.00	\$0	0.2

00

Project Number:

Project Title: PUBLICATION OF PAPER ON COMPARATIVE HABITAT USE BY  
KITTLITZ'S AND MARBLED MURRELETS

Name: ABR, Inc.

FORM 4B  
Personnel  
& Travel  
DETAIL

dated: 4/12/1999

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

Contractual Costs:		Proposed
Description		FFY 2000
1 Phone/Fax/Modem		0.1
2 Printing/Off-Site Photocopying		0.1
3 Publication Costs ( 1 paper @\$1,000)		1.0
Contractual Total		\$1.2
Commodities Costs:		Proposed
Description		FFY 2000
		0.0
		0.0
Commodities Total		\$0.0

00

Project Number:  
 Project Title: **PUBLICATION OF PAPER ON COMPARATIVE HABITAT USE BY  
 KITTLITZ'S AND MARBLED MURRELETS**  
 Name: **ABR, Inc.**

FORM 4B  
 Contractual &  
 Commodities  
 DETAIL

Prepared: 4/12/1999

## 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

New Equipment Purchases:		Number of Units	Unit Price	Proposed FFY2000
Description				
Those purchases associated with replacement equipment should be indicated by placement of an R.		New Equipment Total		\$0.0
Existing Equipment Usage:		Number of Units		
Description				
1 Library reference books				
2 Computer Resources				

00

Project Number:  
Project Title: **PUBLICATION OF PAPER ON COMPARATIVE HABITAT USE BY  
KITTLITZ'S AND MARBLED MURRELETS**  
Name: **ABR, Inc**

FORM 4B  
Equipment  
DETAIL



## **Lessons Learned: Evaluating Scientific Sampling of Oil Spill Effects**

Project Number:	00530
Restoration Category:	General Restoration
Proposer:	M. See/ADEC
Lead Trustee Agency:	ADEC
Cooperating Agencies:	ALL
Alaska SeaLife Center:	No
New or Continued:	New
Duration:	1st yr. 1 yr. project
Cost FY 00:	\$78.4
Cost FY 01:	\$0.0
Cost FY 02:	\$0.0
Geographic Area:	All
Injured Resource/Service:	All

### **ABSTRACT**

In the ten years following the oil spill, a substantial amount of scientific research has been conducted on the impacts of the spill. Despite this wealth of information, there has been no comprehensive evaluation and compilation to determine which sampling methods and studies were or were not effective. This project will review selected studies and methods to assess which ones provided effective means of documenting environmental impacts. To ensure that the proposed approach will be effective, this project will be structured as a pilot.

## **INTRODUCTION**

This project is a cooperative effort to review existing oil spill information and determine the effectiveness of sampling methods and studies for assessing impacts to natural resources and services. The review findings will interpret “lessons learned” from the scientific research conducted since the Exxon Valdez oil spill. The resulting evaluation will contribute to an understanding of quantifiable effects of spills on sensitive resources and services. The goal is to ensure that resource managers, scientists, and the public at large can gain an understanding of the complete program. In addition, the assessment from this project can help provide support for restoration decisions. To ensure useful results, this project is proposed as pilot and will test the approach with a limited number of topics. Upon successful evaluation of this pilot, the methodology could be used to conduct additional evaluations.

## **NEED FOR THE PROJECT**

### **A. Statement of Problem**

A substantial amount of information on the effects on natural resources from the Exxon Valdez Oil Spill has been generated in the past ten years. The agencies cooperating on this project recognize the need to review the “lessons learned” to further our knowledge of ecosystem response and recovery.

Depending on the nature of the effect, some impacts are clearly evident and can be easily quantified; for example, oiled beaches, and dead or injured wildlife that have been recovered. Other oil spill impacts are difficult to quantify because they are subtler or are not evident in short-term assessments. At present there is no consensus-based approach on the most effective methods of assessing impacts. With as much as ten years of study results to evaluate, the assessment of effectiveness of sampling methods and studies will be based on substantial data.

An associated benefit of the project is the potential to use the findings to guide procedures in the future. This would be especially valuable if another spill occurs in an area where resources are not yet fully restored. The tanker corridor in Prince William Sound is a unique industrial usage area associated with risks from accidental discharge of oil or other hazardous substances. Although industry has made significant progress after 1989 in preventing and limiting the extent of such problems, oil spills continue to be documented.

### **B. Rationale/Link to Restoration**

This project will help resource managers and the public understand how effects were measured, where they occurred, and whether the methods or data were adequate or appropriately timed. The review and analysis of research and monitoring methodologies from Trustee-sponsored projects will provide a key linkage between scientific inquiry, oil spill management and impact

assessment. This project will summarize how well the spill effects were assessed, as well as what did not work. The resulting analysis will help show whether the data provided a useful foundation for the subsequent phases of damage assessment and restoration. Of particular concern is ensuring timely detection of potential impacts to the most vulnerable natural resources and services, as well as those with the longest recovery periods.

As an associated benefit, this project will recommend methods and strategies for assessing effects and monitoring that needs to be agreed upon in advance of an oil spill. A more effective ability to assess injury during an oil spill could also aid restoration of EVOS injured species.

This project relates to the Trustee Council's increased emphasis to "transfer study results to resource managers and stakeholders so that they can take full advantage of what has been learned through the EVOS program. "(Exxon Valdez Oil Spill Trustee Council, 1999). The Council also notes that "results of these studies and the approaches underlying them can provide valuable guidance for the ongoing restoration program as well as for natural resource managers and other stakeholders who may make decisions or take actions that bear on the long-term recovery of injured resources or lost or reduced services."

### **C. Location**

Project work will be carried out by specialists, resource managers and reviewers who are located within and outside of Alaska. The project does not involve direct fieldwork. The synthesis developed by this research project will focus on the spill affected area including Prince William Sound, Cook Inlet, Kodiak Archipelago, and the Gulf of Alaska.

## **COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE**

Existing traditional ecological knowledge will be used to the extent that it is available and pertinent to this evaluation. The results of this project will be available for the public and communities within the spill area. The public needs to know that we have scrutinized what has been learned from the Exxon Valdez oil spill, and applied these lessons to improve capability to assess effects of oil spills.

## **PROJECT DESIGN**

### **A. Objectives**

1. To develop the scope and questions addressing what was learned from studying effects of the oil spill; how well approaches worked or not, data gaps, and recommendations.
2. To meaningfully involve researchers, scientists, and trustee agencies to answer these questions.

3. To help ensure stakeholder access to this information by distributing the final report.
4. To implement this project with a pilot to ensure an effective approach to assessment.

## **B. Methods**

This pilot project will be a sequence of phased work to ensure technically rigorous focus, and full involvement of trustee agencies with resource management responsibilities.

1. Trustee agencies and the EVOS Scientist through consensus, develop questions for experts to address in white papers and identify workshop participants.
2. Scientific and research experts, through contractual support, evaluate the effectiveness of sampling and other research and studies that were conducted after the oil spill, by reviewing relevant information, and preparing a white paper addressing questions identified in 1 above. Question areas may include: what useful knowledge was gained from studies? Where were the data gaps – what was not collected or studied, or was collected too late? What should have been collected or studied within the first few hours, days, weeks and months of a spill? How long did it take to assess effects? Related issues may include: effects on trophic levels and food webs, population levels, sentinel species, statistically valid designs, matrix combinations (air, water, soil, sediment, tissues), bioassays, and others. Each expert evaluates a specific resource or service especially vulnerable to marine spills, and for which initial post-spill data are available. Priority topics are: pink salmon, herring, harlequin duck, murre, blue mussels, sea otter, archeology, and recreation.
3. The “white papers” will serve as a basis of a workshop of specialists, resource managers, the EVOS Chief Scientist and designated peer reviewers to collaboratively review, and discuss the information contained in each white paper.
4. Results of the workshop will be compiled into an overall summary to capture the areas of consensus and any alternative approaches. The project manager, assisted by the workshop facilitator, will oversee production of the report. Document preparation, review, and publication will follow EVOS procedures and requirements. The project manager will use a consensus model with the Chief Scientist and Trustees Agencies on the format and content of the final workshop report.
5. The Chief Scientist and Trustee Agencies will evaluate the pilot project to identify necessary adjustments and propose evaluation methods for future use.

The Alaska Department of Environmental Conservation (ADEC) representative will manage this project to promote effective coordination among the species experts, resource agency specialists,

EVOS staff, the EVOS Chief Scientist, and workshop facilitators to ensure product completion.

### **C. Cooperating Agencies, Contracts, and Other Agency Assistance**

Cooperating agencies will coordinate intra-agency development and preparation of key questions for specialists to address, coordinate intra-agency reviews of draft work products, raise agency-specific concerns, and help ensure resolution of issues for the final project document.

The contracts and credentials for this project will be developed by the project manager with assistance from the EVOS Chief Scientist, trustee agency representatives, and assistance from EVOS staff. All trustee agencies will participate in this project.

The estimate of funding needed for this project includes the costs of the resource experts estimated at 0.4 workmonth each, and a contract for professional services to facilitate the workshop and help compile the workshop report. Workshop participation is supported by travel funds for authors of white papers and other recognized resource experts. An essential part of this project is the modest allocation of time from agency specialists to actively participate.

## **SCHEDULE**

### **A. Measurable Project Tasks for FY00**

October 1-31:	Develop scope of questions for white papers, and prepare contract documents.
November 1:	EVOS experts conduct necessary reviews, address resource agency questions, and prepare “white papers”.
January 10:	White papers due; distributed to workshop participants.
February 11:	Reviewer comments due; distributed to workshop participants.
March (date TBA):	Facilitated workshop for trustee agencies and scientists to review white papers, address concerns, and discuss information in and related to white papers, striving to reach consensus where possible.
May 15:	Draft workshop report submitted to workshop participants for review.
June 16:	Comments due on draft workshop report.
July 17:	Final workshop report due to the EVOS Chief Scientist and trustees agencies for review and approval.
September 30:	Project is completed.

## **B. Project Milestones and Endpoints**

November 1: EVOS experts start white papers.

January 11: Review drafts of white papers available.

February 14: Reviewer comments available.

March (date TBA): Workshop

May 15: Workshop summary under review.

June 16: Comments due on draft workshop summary.

July 17: Final workshop summary submitted to EVOS.

## **C. Completion Date**

The documents will be completed in August and the project will be completed by the end of September 2000.

## **PUBLICATIONS AND REPORTS**

The final workshop report will be produced as noted above, and publications are likely for the evaluation of each major topic.

## **PROFESSIONAL CONFERENCES**

The presentation of the scope of this project will be presented at the annual EVOS conference. The results may also be written up for presentation at other conferences or workshops in Alaska.

## **NORMAL AGENCY MANAGEMENT**

This project is proposed to the Trustees Council because it is largely outside the scope of normal agency work. Specifically, the evaluation of the many studies and sampling efforts goes well beyond the functions and expertise of any one agency or academic organization, and thus may not be funded by those organizations under normal agency management. Funding the core commitment of specialists' time and travel costs for the workshop participants is therefore essential to the success of the project.

## **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

The synthesis of "lessons learned" from studies funded by the Trustee Council helps support goals and priorities of the damage assessment and restoration phases of the EVOS program. The evaluation represented by this pilot project helps ensure a complete understanding of the program.

As an added benefit, should a subsequent oil spill affect an area not fully restored, the findings of this project may help focus the appropriate response and sampling.

## **PROPOSED PRINCIPAL INVESTIGATOR**

Name: Marianne G. See

Affiliation: Department of Environmental Conservation, Office of the Commissioner

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Phone number: (907) 269-7635

Fax number: (907) 269-7508

E-mail address: msee@envircon.state.ak.us

Marianne See has more than 25 years of northern environmental science and resource management experience, and has worked in Alaska since 1980 in federal (U.S. Department of Interior), business (environmental consulting) and state service (Alaska Departments of Fish and Game, and Environmental Conservation).

**2000 EXXON VALDEZ TRU     COUNCIL PROJECT BUDGET**  
October 1, 1999 - September 30, 2000

*Revision - 30-99*  
*Approved - 1-9-99*

Budget Category:	Authorized FY 1999	Proposed FY 2000	PROPOSED FY 2000 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
			\$31.0	\$11.8	\$8.3	\$0.0	\$8.2	\$19.1
Personnel	\$0.0	\$39.5						
Travel	\$0.0	\$5.8						
Contractual	\$0.0	\$25.3						
Commodities	\$0.0	\$0.0						
Equipment	\$0.0	\$0.0						
Subtotal	\$0.0	\$70.6	LONG RANGE FUNDING REQUIREMENTS					
General Administration	\$0.0	\$7.8			Estimated FY 2001	Estimated FY 2002		
Project Total	\$0.0	\$78.4			\$0.0	\$0.0		
Full-time Equivalents (FTE)	0.0	0.5						
Dollar amounts are shown in thousands of dollars.								
Other Resources	\$0.0	\$0.0			\$0.0	\$0.0		
Comments:  Interagency project: requires participation by Trustee Agencies.  Contractor for workshop facilitation and summary to be selected through RFP process (see 3B for ADEC).  Participation costs are estimates for specialist's time to review EVOS studies and data, prepare "white papers," participate in project workshop and help finalize workshop report. Two of the specialists will be contracted, others are agency staff.  Agency costs in specified cases include participation with trustee agency representatives and Chief Scientist to carry out required project tasks.								

**FY00**

Project Number: 00530  
Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
Lead Agency: ADEC

**FORM 2A  
MULTI-TRUSTEE  
AGENCY  
SUMMARY**

Prepared:

**2000 EXXON VALDEZ TRU     COUNCIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

<b>Budget Category:</b>	<b>Authorized FY 1999</b>	<b>Proposed FY 2000</b>						
Personnel		\$8.1						
Travel		\$0.0						
Contractual		\$20.3						
Commodities		\$0.0						
Equipment		\$0.0	<b>LONG RANGE FUNDING REQUIREMENTS</b>					
Subtotal	\$0.0	\$28.4			Estimated FY 2001	Estimated FY 2002		
General Administration		\$2.6						
Project Total	\$0.0	\$31.0			\$0.0	\$0.0		
Full-time Equivalents (FTE)		0.1						
			Dollar amounts are shown in thousands of dollars.					
Other Resources								
Comments:  Estimated cost of ADEC Principal Investigator to lead project, manage contracts, review of the report drafts, organize the project workshop, co-write workshop summary, oversee report review, revisions, and final document.								

**FY00**

Project Number: 00530  
Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
Agency: ADEC

**FORM 3A  
TRUSTEE  
AGENCY**

Prepared:

**2000 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

<b>Personnel Costs:</b>		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
Name	Position Description					
M. See	Restoration Specialist (Principal Investigator)		1.0	8.1		8.1
						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			1.0	8.1	0.0	
<b>Personnel Total</b>						<b>\$8.1</b>
<b>Travel Costs:</b>		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2000
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
						0.0
<b>Travel Total</b>						<b>\$0.0</b>

**FY00**

Project Number: 00530  
 Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
 Agency: ADEC

**FORM 3B  
 Personnel  
 & Travel  
 DETAIL**

Prepared:

**2000 EXXON VALDEZ TRU : COUNCIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		Proposed
Description		FY 2000
Contract for two (2) day workshop facilitation, recording, and co-write workshop summary with PI. Produce final report per EVOS procedures. Contractor to be selected through RFP process (thus 4A not included at this time).		12.3
Contracted with the University of Alaska for speicies expert on herring (Evelyn Brown; proposed but not confirmed). Alternates would be Mark Willette (ADF&G) or A.J. Paul (U. of A.). Reviews EVOS studies and data and prepare a "white paper," participates in a project workshop and help finalize workshop report. Includes salary 2.9 (0.4 month) plus travel from Fairbanks for workshop (ticket .3 and .6 per diem).		3.8
Contract with Archeology expert (Don Dumond, University of Oregon, Emeritus) to review EVOS studies and data and prepare a "white paper," participate in project workshop, and help finalize workshop report. Includes salary of 3.2 (0.4 month), plus travel from Portland, Oregon for workshop (ticket .4 plus .6 per diem).		4.2
When a non-trustee organization is used, the form 4A is required.		
<b>Contractual Total</b>		<b>\$20.3</b>
<b>Commodities Costs:</b>		Proposed
Description		FY 2000
<b>Commodities Total</b>		<b>\$0.0</b>

**FY00**

Project Number: 00530  
Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
Agency: ADEC

**FORM 3B  
Contractual &  
Commodities  
DETAIL**

Prepared:

## COUNCIL PROJECT BUDGET

**October 1, 1999 - September 30, 2000**

[illegible]

FY00

Project Number: 00530  
Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
Agency: ADEC

**FORM 3B**  
**Equipment**  
**DETAIL**

**Prepared:**

**2000 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET**  
October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$9.1						
Travel		\$1.3						
Contractual		\$0.0						
Commodities		\$0.0						
Equipment		\$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	\$0.0	\$10.4			Estimated FY 2001	Estimated FY 2002		
General Administration		\$1.4						
Project Total	\$0.0	\$11.8			\$0.0	\$0.0		
Full-time Equivalents (FTE)		0.1						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:  1. Estimated cost of ADF&G biologist's participation with trustee agency representatives and the Chief Scientist to: (a) develop questions for resource experts to address in "white papers;" (b) identify workshop participants; (c) coordinate agency review and comment (from at least Cordova, Anchorage, and Kodiak offices) on draft 'white papers' specific to ADF&G trust resources; (d) participate in workshop; (e) coordinate agency review and comment on workshop report drafts; (f) finalize workshop report; and (g) evaluate the pilot project.  2. Estimated cost of ADF&G wildlife biologist to review EVOS studies and data and prepare a "white paper," participate in a project workshop, and review and comment on workshop report drafts.								

**FY00**

Project Number: 00530  
Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
Agency: ADF&G

FORM 3A  
TRUSTEE  
AGENCY  
SUMMARY

6 of 25

Prepared:

**2000 EXXON VALDEZ TRU     COUNCIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

<b>Personnel Costs:</b>		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
C. Slater	Habitat Biologist	20J	1.0	6.7	0.0	6.7
D. Rosenberg	Wildlife Biologist	18J	0.4	5.9	0.0	2.4
	(species expert for harlequin ducks)					0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Subtotal			1.4	12.6	0.0	
<b>Personnel Total</b>						<b>\$9.1</b>
<b>Travel Costs:</b>		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 2000
Participation in Workshop						0.0
Cordova Staff		0.3	1	2	0.2	0.7
Fairbanks Staff		0.2	1	2	0.2	0.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
<b>Travel Total</b>						<b>\$1.3</b>

**FY00**

Project Number: 00530  
 Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
 Agency: ADF&G

**FORM 3B  
 Personnel & Travel  
 DETAIL**

Prepared:

**2000 EXXON VALDEZ TRU     COUNCIL PROJECT BUDGET**  
October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		<b>Proposed FY 2000</b>
Description		
When a non-trustee organization is used, the form 4A is required.		<b>Contractual Total</b>
		\$0.0
<b>Commodities Costs:</b>		<b>Proposed FY 2000</b>
Description		
		<b>Commodities Total</b>
		\$0.0

**FY00**

Project Number: 00530  
Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
Agency: ADF&G

**FORM 3B  
Contractual &  
Commodities  
DETAIL**

Prepared:

## COUNCIL PROJECT BUDGET

**October 1, 1999 - September 30, 2000**

<b>New Equipment Purchases:</b>		<b>Number of Units</b>	<b>Unit Price</b>	<b>Proposed</b>
<b>Description</b>				<b>FY 2000</b>
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		<b>New Equipment Total</b>		<b>\$0.0</b>
<b>Existing Equipment Usage:</b>			<b>Number of Units</b>	<b>Inventory Agency</b>
<b>Description</b>				

**FY00**

Project Number: 00530  
Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
Agency: ADF&G

**FORM 3B**  
**Equipment**  
**DETAIL**

Prepared:

**2000 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$7.2						
Travel		\$0.0						
Contractual		\$0.0						
Commodities		\$0.0						
Equipment		\$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	\$0.0	\$7.2			Estimated FY 2001	Estimated FY 2002		
General Administration		\$1.1						
Project Total	\$0.0	\$8.3			\$0.0	\$0.0		
Full-time Equivalents (FTE)		0.1						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:  Funding is requested to support ADNR participation with trustee agency representatives, trustee agency resource managers, the Chief Scientist and resource experts to:  1. Develep questions for resource experts to address in "white paper" including coordination within the agency; 2. Identify workshop participants; 3. Coordinate agency review and comment on draft "white papers" relevant to ADNR areas of trust responsibilities; 4. Participate in workshop; 5. Coordinate agency review and comment on workshop report draft; 6. Participate in finalization of workshop summary; and 7. Evaluation of pilot project.								

**FY00**

Project Number: 00530  
Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
Agency: ADNR

**FORM 3A  
TRUSTEE AGENCY  
SUMMARY**

Prepared:

**2000 EXXON VALDEZ TRU : COUNCIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

<b>Personnel Costs:</b>		<b>GS/Range/ Step</b>	<b>Months Budgeted</b>	<b>Monthly Costs</b>	<b>Overtime</b>	<b>Proposed FY 2000</b>
<b>Name</b>	<b>Position Description</b>					
C. Fries	Natural Resource Manager	20	1.0	7.2		7.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
<b>Subtotal</b>			1.0	7.2	0.0	
<b>Personnel Total</b>						<b>\$7.2</b>
<b>Travel Costs:</b>		<b>Ticket Price</b>	<b>Round Trips</b>	<b>Total Days</b>	<b>Daily Per Diem</b>	<b>Proposed FY 2000</b>
<b>Description</b>						
						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
<b>Travel Total</b>						<b>\$0.0</b>

**FY00**

Project Number: 00530  
 Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
 Agency: ADNR

**FORM 3B  
 Personnel & Travel  
 DETAIL**

Prepared:

**2000 EXXON VALDEZ TRUST COUNCIL PROJECT BUDGET**  
 October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		<b>Proposed FY 2000</b>
Description		
When a non-trustee organization is used, the form 4A is required.		<b>Contractual Total</b>
		\$0.0
<b>Commodities Costs:</b>		<b>Proposed FY 2000</b>
Description		
		<b>Commodities Total</b>
		\$0.0

**FY00**

Project Number: 00530  
 Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
 Agency: ADNR

**FORM 3B  
 Contractual &  
 Commodities  
 DETAIL**

Prepared:

## COUNCIL PROJECT BUDGET

**October 1, 1999 - September 30, 2000**

<b>New Equipment Purchases:</b>		<b>Number of Units</b>	<b>Unit Price</b>	<b>Proposed</b>
<b>Description</b>				<b>FY 2000</b>
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		<b>New Equipment Total</b>		\$0.0
<b>Existing Equipment Usage:</b>			<b>Number of Units</b>	<b>Inventory</b>
<b>Description</b>				<b>Agency</b>

**FY00**

Project Number: 00530  
Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
Agency: ADNR

**FORM 3B**  
**Equipment**  
**DETAIL**

**Prepared:**

**2000 EXXON VALDEZ TRUST COUNCIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$0.0						
Travel		\$0.0						
Contractual		\$0.0						
Commodities		\$0.0						
Equipment		\$0.0						
Subtotal	\$0.0	\$0.0	LONG RANGE FUNDING REQUIREMENTS					
General Administration		\$0.0			Estimated FY 2001	Estimated FY 2002		
Project Total	\$0.0	\$0.0			\$0.0	\$0.0		
Full-time Equivalents (FTE)		0.0						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:								
Estimated cost of USFS specialist's time to participate in project to be provided by USFS.								

**FY00**

Project Number: 00530  
 Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
 Agency: USFS

FORM 3A  
 TRUSTEE  
 AGENCY  
 SUMMARY

Prepared:

**2000 EXXON VALDEZ TRU      COUNCIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

<b>Personnel Costs:</b>		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
Name	Position 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	
<b>Personnel Total</b>						<b>\$0.0</b>

<b>Travel Costs:</b>		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2000
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
						0.0
<b>Travel Total</b>						<b>\$0.0</b>

**FY00**

Project Number: 00530  
 Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
 Agency: USFS

FORM 3B  
 Personnel & Travel  
 DETAIL

Prepared:

**2000 EXXON VALDEZ TRU      COUNCIL PROJECT BUDGET**  
October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		<b>Proposed FY 2000</b>
Description		
When a non-trustee organization is used, the form 4A is required.		<b>Contractual Total</b>
		\$0.0
<b>Commodities Costs:</b>		<b>Proposed FY 2000</b>
Description		
		<b>Commodities Total</b>
		\$0.0

**FY00**

Project Number: 00530  
Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
Agency: USFS

**FORM 3B  
Contractual &  
Commodities  
DETAIL**

Prepared:

## 2000 EXXON VALDEZ TRU

## COUNCIL PROJECT BUDGET

**October 1, 1999 - September 30, 2000**

[illegible]**FY00**

**Project Number: 00530**

**Project Title: Evaluating Scientific Sampling of Oil Spill Effects**

**Agency: USFS**

**FORM 3B**  
**Equipment**  
**DETAIL**

**Prepared:**

**2000 EXXON VALDEZ TRU      COUNCIL PROJECT BUDGET**  
October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$5.3						
Travel		\$2.1						
Contractual		\$0.0						
Commodities		\$0.0						
Equipment		\$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	\$0.0	\$7.4			Estimated FY 2001	Estimated FY 2002		
General Administration		\$0.8						
Project Total	\$0.0	\$8.2			\$0.0	\$0.0		
Full-time Equivalents (FTE)		0.1						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:  Costs include salary for two agency specialists to review NRDA studies and data and each prepare a "white paper," participate in a workshop, and help finalize the workshop project. Travel to attend workshop is also included.								

**FY00**

Project Number: 00530  
Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
Agency: USDOl

**FORM 3A  
TRUSTEE  
AGENCY**

Prepared:

**2000 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

<b>Personnel Costs:</b>		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
Name	Position Description					
(D. Roseneau)	Species Expert - Murres	GS-11	0.4	6.4		2.6
(J. Bodkin)	Species Expert - Sea Otter		0.4	6.8		2.7
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
<b>Subtotal</b>			0.8	13.2	0.0	
<b>Personnel Total</b>						<b>\$5.3</b>
<b>Travel Costs:</b>		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2000
Description						
Travel to Anchorage for workshop - species experts		0.2	1	3	0.2	0.8
Travel to Anchorage for workshop - recreation expert (B. Peacock)		0.7	1	3	0.2	1.3
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
<b>Travel Total</b>						<b>\$2.1</b>

**FY00**

Project Number: 00530  
 Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
 Agency: USDOl

**FORM 3B  
 Personnel & Travel  
 DETAIL**

Prepared:

**2000 EXXON VALDEZ TRU: COUNCIL PROJECT BUDGET**  
 October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		<b>Proposed FY 2000</b>
Description		
When a non-trustee organization is used, the form 4A is required.		<b>Contractual Total</b>
		<b>\$0.0</b>
<b>Commodities Costs:</b>		<b>Proposed FY 2000</b>
Description		
		<b>Commodities Total</b>
		<b>\$0.0</b>

**FY00**

Project Number: 00530  
 Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
 Agency: USDOl

**FORM 3B**  
**Contractual &**  
**Commodities**  
**DETAIL**

Prepared:

## COUNCIL PROJECT BUDGET

**October 1, 1999 - September 30, 2000**

<b>New Equipment Purchases:</b>		<b>Number of Units</b>	<b>Unit Price</b>	<b>Proposed</b>
<b>Description</b>				<b>FY 2000</b>
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		<b>New Equipment Total</b>		\$0.0
<b>Existing Equipment Usage:</b>			<b>Number of Units</b>	<b>Inventory Agency</b>
<b>Description</b>				

**FY00**

Project Number: 00530  
Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
Agency: USDOI

**FORM 3B**  
**Equipment**  
**DETAIL**

**Prepared:**

**2000 EXXON VALDEZ TRU      COUNCIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

<b>Budget Category:</b>	<b>Authorized FY 1999</b>	<b>Proposed FY 2000</b>						
Personnel		\$9.8						
Travel		\$2.4						
Contractual		\$5.0						
Commodities		\$0.0						
Equipment		\$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	\$0.0	\$17.2			Estimated FY 2001	Estimated FY 2002		
General Administration		\$1.9						
Project Total	\$0.0	\$19.1			\$0.0	\$0.0		
Full-time Equivalents (FTE)		0.8						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:  Estimated cost of NOAA specialist's time to review EVOS studies and data and prepare a "white paper," participate in a project workshop, and help finalize workshop report.  Includes travel to participate in workshop.								

**FY00**

Project Number: 00530  
Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
Agency: NOAA

**FORM 2A  
MULTI-TRUSTEE  
AGENCY SUMMARY**

Prepared:

**2000 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

<b>Personnel Costs:</b>		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
Name	Position Description					
S. Rice	Resource Specialist		0.8	12.2		9.8
	Species Expert:					0.0
	Blue Mussels (.4 wm)					0.0
	Pink Salmon (.4 wm)					0.0
						0.0
N. Meade	Resource Economist	<b>SALARY PAID BY NOAA</b>				0.0
	(PI: Recreation)					0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Subtotal			0.8	12.2	0.0	
<b>Personnel Total</b>						<b>\$9.8</b>
<b>Travel Costs:</b>		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2000
Description						
Travel to Anchorage for Workshop	(S. Rice)	0.5	1	3	0.2	1.1
	(N. Meade)	0.7	1	3	0.2	1.3
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
<b>Travel Total</b>						<b>\$2.4</b>

**FY00**

Project Number: 00530  
 Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
 Agency: NOAA

FORM 3B  
 Contractual &  
 Commodities  
 DETAIL

Prepared:

**2000 EXXON VALDEZ TRU: COUNCIL PROJECT BUDGET**  
 October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		Proposed
Description		FY 2000
Contract for collaboration assistance on recreation value for "white paper," (Norman Meade: Principal Investigator and Contract Manager for recreation portion).		5.0
When a non-trustee organization is used, the form 4A is required.		\$5.0
<b>Contractual Total</b>		<b>\$5.0</b>
<b>Commodities Costs:</b>		Proposed
Description		FY 2000
<b>Commodities Total</b>		<b>\$0.0</b>

**FY00**

Project Number: 00530  
 Project Title: Evaluating Scientific Sampling of Oil Spill Effects  
 Agency: NOAA

FORM 3B  
 Contractual &  
 Commodities  
 DETAIL

Prepared:

**October 1, 1999 - September 30, 2000**

25 of 25

**Prepared:**



*Revision 7-9-99*  
*Approved TC 8-9-99*

**Publication: Prince William Sound Isotope Ecology**

Project Number: 00541-BAA  
Restoration Category: Research  
Proposer: T. Kline/PWSSC  
Lead Trustee Agency: NOAA  
Cooperating Agencies: None  
Alaska SeaLife Center: No  
New or Continued: New  
Duration: 1st yr.  
1 yr. project  
Cost FY 00: \$15.0  
Cost FY 01: \$0.0  
Cost FY 02: \$0.0  
Geographic Area: Prince William Sound  
Injured Resource/Service: Pink salmon

**ABSTRACT**

A crucial part of the scientific research process is dissemination of the results to the scientific community. This project will prepare and submit a paper on salmon for publication in FY 00.

## INTRODUCTION

A crucial part of the scientific research process is dissemination of the results to the scientific community. This comes in the form of papers given at meetings and through publication in the open literature. The process of dissemination generally requires a protracted schedule. This occurs for several reasons. One being that the process of reviewing, revising, and publication of a paper can take several years. Secondly, publication of one article may need to follow the publication of another. This has been the case for the P.I.'s restoration research. The keystone paper, number 4 in the list below, presently in press (accepted by the CJFAS in September 1998, Appendix I) needs to be published before other papers that rely on concepts established there can be used. Given that the P.I.'s paper establishing isotopic applications for Prince William Sound will soon be out (#4 below, accepted by the CJFAS in September 1998), the P. I. is ready to submit a paper on salmon in 2000. If this paper can be submitted within the year, they could be published sometime in 2001 depending on the queue at the journal.

### Results from prior work

The following contributions to the scientific literature were made by the P.I. based on EVOSresearch:

1. Kline, Thomas C. Jr. 1997. Confirming forage fish food web dependencies in the Prince William Sound ecosystem using natural stable isotope tracers. Proceedings of the International Symposium on the Role of Forage Fishes in Marine Ecosystems. Alaska Sea Grant College Program Report No. 9701. University of Alaska Fairbanks. P. 257 - 269.
2. Kline, Thomas C. Jr. 1998. Salmon Fry. In: T. A. Okey and D. Pauly (eds), A Trophic Mass-Balance Model of Alaska's Prince William Sound Ecosystem, for the Post-Spill Period 1994-1996. Fisheries Centre Research Reports 1998 Volume 6 Number 4. Fisheries Centre, University of British Columbia, Vancouver, Canada. p. 26-31.
3. Kline, Thomas C. Jr.. and Daniel Pauly. 1998. Cross-validation of trophic level estimates from a mass-balance model of Prince William Sound using  $^{15}\text{N}/^{14}\text{N}$  data. In: Funk, F., T.J. Quinn II, J. Heifetz, J.N. Ianelli, J.E. Powers, J.F. Schweigert, P.J. Sullivan, and C.-I. Zhang (eds.), Fishery Stock Assessment Models. Alaska Sea Grant College Program Report No. AK-SG-98-01. University of Alaska Fairbanks, pp. 693-702.
4. Kline, Thomas C. Jr. 1998. Temporal and Spatial Variability of  $^{13}\text{C}/^{12}\text{C}$  and  $^{15}\text{N}/^{14}\text{N}$  in Pelagic Biota of Prince William Sound, Alaska. Canadian Journal of Fisheries and Aquatic Sciences. 55 (Suppl. 2): IN PRESS

5. Kline, Thomas C. Jr. 1999. Carbon and Nitrogen Isotopic Composition of Prince William Sound Pelagic Biota Shift on Annual Time Scales: A Tool for Monitoring Changes in Oceanographic Forcing. In: Ecosystem Consideration in Fisheries Management. Proceedings of the International Symposium on Ecosystem Consideration in Fisheries Management. Alaska Sea Grant College program Report No. 99-01. University of Alaska Fairbanks. IN PRESS:

## **NEED FOR THE PROJECT**

### **A. Statement of Problem**

The Problem: There is need to disseminate results in the scientific community. The publication process facilitates this communication while the review process provides the credibility. The Trustee Council also gains credibility for its science through these publications.

### **B. Rationale/Link to Restoration**

The restoration process should be based on valid science. Validation of a research project comes about through the anonymous peer review process that occurs with publication. The paper is examined critically by specialists in the field of the paper. Dubious results are rejected.

### **C. Location**

Prince William Sound

## **COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE**

## **PROJECT DESIGN**

### **A. Objectives**

1. A paper dealing with the experimental release of salmon from PWS hatcheries. Ascertain whether differences in feeding may explain the differences in survival rate while exploiting the PWS isotope gradient described in paper #4 listed above:

*proposed paper title*  
**Pacific salmon early marine life-history trophic shifts based on  $^{15}\text{N}/^{14}\text{N}$  and  $^{13}\text{C}/^{12}\text{C}$   
of hatchery-released fry implanted with coded wire tags in Prince William Sound,  
Alaska.**

*authors* Thomas C. Kline, Jr. and T. Mark Willette  
*target journals* CJFAS, MEPS, or JEMBE

**B. Methods**

Draft paper will be sent to the journal for review. Reviews expected back in six months from date of submission. Revision expected to take one month. Revised paper will be reviewed within three months. Publication, about 6-12 months, depending on journal, from date of acceptance.

**C. Cooperating Agencies, Contracts, and Other Agency Assistance**

N/A

**SCHEDULE**

**A. MEASURABLE PROJECT TASKS for FYI (October 1, 1999 - September 30, 2000)**

Oct. 99 - Jun. 00: Prepare draft and submit to journal

Oct. 00 - Dec. 00: Revise paper

Jun. 01 - Dec. 01: Papers published

**B. Project Milestones and Endpoints**

Jun. 2000:	Paper submitted to journal
Dec. 2000:	Revised paper sent to journal
Mar 2001:	Paper accepted by journal
Jan. 2000, 2001:	Attend Annual Restoration Workshop
Oct., 1999 - Sept. 2000:	Preparation for and dissemination of results at EVOS and other Symposia
Jan-April 2000:	Preparation of Annual Reports (to consist solely of a manuscript)
Jan-April 2000:	Draft Final Report preparation (to consist solely of a manuscript)
September 2000:	Final Report revisions (to consist of galley proofs or reprints)

**C. Completion Date**

September 2000 (Final Report)

**PUBLICATIONS AND REPORTS**

See objectives

**PROFESSIONAL CONFERENCES****NORMAL AGENCY MANAGEMENT**

N/A

**COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

Collaboration with other EVOS investigators will continue, workshops and meetings will facilitate the exchange.

**PROPOSED PRINCIPAL INVESTIGATOR**

Thomas C. Kline Jr., Ph.D.  
Prince William Sound Science Center  
P. O. Box 705  
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907-424-5800 (t)  
907-424-5820 (f)  
tkline@grizzly.pwssc.gen.ak.us

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Revision 7 79  
Approved TC 8-9-99

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$0.0						
Travel		\$0.0						
Contractual		\$14.0						
Commodities		\$0.0						
Equipment		\$0.0						
Subtotal	\$0.0	\$14.0	LONG RANGE FUNDING REQUIREMENTS					
General Administration		\$1.0			Estimated FY 2001	Estimated FY 2002		
Project Total	\$0.0	\$15.0						
Full-time Equivalents (FTE)		0.0						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:								

**FY00**

Project Number: 00541-BAA  
Project Title: Publication: PWS Isotope Ecology  
Agency: NOAA

FORM 3A  
TRUSTEE  
AGENCY  
SUMMARY

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000							
Personnel		\$9,727.4							
Travel		\$0.0							
Contractual		\$1,369.0							
Commodities		\$100.0							
Equipment		\$0.0							
Subtotal	\$0.0	\$11,196.4	LONG RANGE FUNDING REQUIREMENTS						
Indirect		\$2,799.1			Estimated FY 2001	Estimated FY 2002			
Project Total	\$0.0	\$13,995.5			\$0.0	\$0.0			
Full-time Equivalents (FTE)		0.1							
Dollar amounts are shown in thousands of dollars.									
Other Resources									
Comments:									

**FY00**

Prepared:

Project Number: 00541  
 Project Title: Prince William Sound Isotope Ecology Dissemination,  
 Submitted Under the BAA  
 Name: Prince William Sound Science Center

**FORM 4A  
 Non-Trustee  
 SUMMARY**

October 1, 1999 - September 30, 2000

**FY00**

Project Number: 00541 Project Title: Prince William Sound Isotope Ecology Dissemination, Submitted Under the BAA Name: Prince William Sound Science Center
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**FORM 4B**  
**Personnel**  
**& Travel**  
**DETAIL**

Prepared:

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>			Proposed
Description			FY 2000
PWSSC network charge by computer-months	computer months: 1.19	monthly cost: \$100	119.0
photocopying			100.0
shipping			50.0
communications (fax and phone)			100.0
page charges			1,000.0
<b>Contractual Total</b>			<b>\$1,369.0</b>
<b>Commodities Costs:</b>			Proposed
Description			FY 2000
Office supplies misc			100.0
Computer supplies and upgrades			
Dyesub, photog. (presentation materials)			
<b>Commodities Total</b>			<b>\$100.0</b>

**FY00**

Prepared:

Project Number: 00541  
 Project Title: Prince William Sound Isotope Ecology Dissemination,  
 Submitted Under the BAA  
 Name: Prince William Sound Science Center

**FORM 4B**  
**Contractual &**  
**Commodities**  
**DETAIL**

October 1, 1999 - September 30, 2000

FORM 4B  
Equipment  
DETAIL



## Exchange Between Prince William Sound and the Gulf of Alaska

*Revision 7-9-99  
Approved TC 8-9-99*

Project Number: 00552-BAA

Restoration Category: Research

Proposer: S. Vaughn/PWSSC

Lead Trustee Agency: NOAA

Cooperating Agencies: None

Alaska SeaLife Center: No

New or Continued: New

Duration: 1st yr.  
3 yr. project

Cost FY 00: \$114.4

Cost FY 01: \$107.6

Cost FY 02: \$95.9

Geographic Area: Prince William Sound

Injured Resource/Service: Pink salmon, Pacific herring

### ABSTRACT

One of the least understood physical processes that influence the biological components of Prince William Sound is the exchange between the northern Gulf of Alaska and Prince William Sound. This project will document the interannual variability in water mass exchange between Prince William Sound and the adjacent northern Gulf of Alaska at Hinchinbrook Entrance, and identify mechanisms governing this exchange. The project will deploy an upward looking ADCP mooring in Hinchinbrook Entrance to create time series of velocities over the next three years. The mooring will be equipped with a CTD to create a time series of deep temperature and salinity. To identify the dominant factors that govern Prince William Sound/Gulf of Alaska exchange, the mooring velocity and deep temperature/salinity time series will be combined with additional data types collected under other research programs already in progress.

## INTRODUCTION

The Sound Ecosystem Assessment (SEA), funded by the EVOS Trustee Council from 1994 to 1999, was aimed at understanding physical and biological factors affecting pink salmon and Pacific herring survival on an ecosystem level. The physical oceanographic component of SEA (320-M) identified three physical processes that most influence the biological components of PWS, particularly phytoplankton, zooplankton and juvenile fish: surface stratification and frontal formation; upper layer circulation; and exchange between the northern GOA, PWS and the PWS nearshore regions (Vaughan et al, 1999).

Phytoplankton blooms followed initial stratification formation in northern PWS in April (McRoy et al, 1998). A horizontal density front separating the northern and southern Sound was observed in spring and summer, which could prolong the northern Sound phytoplankton and zooplankton blooms by entraining deeper nutrient-rich water into the adjacent stratified layer. The PWS basin scale circulation might promote the transport of larval and juvenile fish from one nearshore region to another. Exchange between PWS and the GOA could potentially seed the Sound with Gulf zooplankton or flush zooplankton from PWS out into the Gulf. The focus of this proposal is on the mechanisms that drive exchange between PWS and the GOA, and the impact of the exchange on PWS water mass properties and circulation patterns.

As part of the SEA study, an upward-looking acoustic Doppler current profiler (ADCP) mooring was deployed in Hinchinbrook Entrance from June through September 1995, and from September 1996 through May 1997. Time series of horizontal and vertical velocities were created for these two periods. The data were low-pass filtered (40 hour) to remove the tidal component. In addition to the mooring velocities, measurements were also collected on transects made with a downward-looking ADCP towed from a ship at both Hinchinbrook Entrance and Montague Strait. The transects were repeated on opposite stages of the tide and averaged to produce a coarse approximation of the flow without the tidal contribution. Satellite tracked drifting buoys drogued at a mean depth of 15m documented circulation patterns in 1997 and 1998. The following is a summary of some of the findings from the SEA program (Vaughan et al, 1999).

The spring and summer circulation in the central Sound could be either cyclonic or anticyclonic. The mechanisms responsible for this variability have not yet been identified. Wind forcing, exchange with the GOA, and horizontal density gradients may all have an impact. Hinchinbrook Entrance flow patterns could either force the central Sound circulation, or respond to it. A robust feature of the central

Sound circulation is the closed cyclonic gyre in September, which was accompanied by isopycnal doming.

Easterly offshore winds can cause surface Ekman layer inflow at both Hinchinbrook Entrance and Montague Strait. Deeper outflow accompanied the inflow at both locations, and it is not known how far the inflow penetrated northward. The density front in the central Sound may isolate the northern Sound from GOA influence in the upper layer. In the absence of the easterly wind forcing, the upper layer summer and early fall pattern seems to be outflow at Hinchinbrook Entrance and inflow at Montague Strait, as shown by several drifting buoy tracks in 1997 and 1998.

At Hinchinbrook Entrance the summer and early fall months of 1995 (June through September) were characterized by outflow above about 150m and inflow below. Except for the Ekman inflow, which reached speeds greater than 80 cm/sec, the magnitude of the flow seldom exceeded 20 cm/sec. In late September, at the very end of the 1995 time series, the pattern seemed to reverse to one of inflow above about 150m and outflow below.

The fall and early winter months (September 1996 through January 1997) at Hinchinbrook Entrance were characterized by inflow above 150m and weak outflow below. The magnitude of the inflow often exceeded 60cm/sec. The change to the opposite baroclinic structure in September could be a regular seasonal event, or indicate different conditions in 1995 and 1996. Late winter and spring months (January through May 1997) were characterized by more barotropic inflows and outflows (Vaughan et al, 1998). Speeds during this time were the weakest observed, typically less than 20cm/sec. The mechanisms responsible for the observed variability have not been identified. Offshore wind forcing or flows through the deep trench southeast of Montague Island may influence the vertical structure at Hinchinbrook Entrance.

Along channel transports through Hinchinbrook Entrance were calculated from the 1995 and 1996-1997 time series for layers above and below 150m, and compared to transports from 1978 (Niebauer et al, 1994). Trends in the monthly mean transports were similar above and below 150m for both time periods. In the upper layer, maximum inflows occurred in October and December, although the magnitudes in 1978 (0.3 Sv) were slightly greater than in 1996 (0.2 Sv). Above 150m, weaker outflows occurred in summer 1995 and in summer 1978. Below 150m, weak inflow occurred in summer 1995 and in summer 1978.

SEA activities in FY94 through FY96 consisted mainly of data collection and processing. Efforts in FY97 and FY98 were focused more

on data analysis and manuscript preparation. Efforts in FY99 were dedicated almost entirely to the SEA synthesis, which is nearing completion. This proposal is for a new project that will build upon what was learned in SEA, and also interface with two new research programs underway in this region.

GLOBEC Northeast Pacific (NEP) monitoring surveys in the northern GOA were completed in FY99 (Dr. T. Weingartner, P.I.), and are scheduled to continue in FY00 through FY04. Process studies in the northern GOA are scheduled for FY01 and FY03. A GLOBEC survey line of particular interest is the trench on the southeastern side of Montague Island, which runs from the western side of Middleton Island to Hinchinbrook Entrance and is almost certainly the conduit of any dense water entering PWS. Both Dr. Weingartner and Dr. D. Musgrave from the University of Alaska have expressed interest in collaborating and sharing data sets.

Another project underway in PWS is the development of a near real-time nowcast/forecast (N/F) system partially sponsored by the Oil Spill Recovery Institute (OSRI). The main objective of this project is to develop a prototype N/F circulation model that will be capable of calculating current velocity vector fields, particle trajectories, and the evolution of passive drifter concentrations. Funding has been secured for collecting current data using a downward looking ADCP towed from one of the Alyeska SERVS vessels, and for deployment of satellite-tracked drifting buoys. The drifting buoys are co-sponsored by the PWS Region Citizens Advisory Council (PWS RCAC).

## **NEED FOR THE PROJECT**

### **A. Statement of the Problem**

Of the three physical processes listed above, the exchange between the northern GOA and PWS is perhaps the least understood. It is not clear quantitatively what controls the amount of throughflow at Hinchinbrook Entrance, or how the throughflow affects the circulation in PWS. In particular, it is not known what causes the baroclinic structure in summer and early fall, the apparent reversal of this structure in September, and the transition to a barotropic structure in winter. The Hinchinbrook Entrance velocity data collected during the SEA program revealed significant spatial (horizontal and vertical) and seasonal variability of the throughflow. Documenting the interannual variability of the currents at Hinchinbrook Entrance and identifying the mechanisms that govern the exchange will require a time series of velocity at all depths that spans several years.

## **B. Rationale/Link to Restoration**

Juvenile fish in PWS rely on zooplankton as their food source. Exchange at Hinchinbrook Entrance could either seed PWS with zooplankton or flush zooplankton out, thereby regulating the amount of available food and possibly the number of copepods diapausing in PWS in winter. Exchange at Hinchinbrook Entrance may influence the central Sound circulation, and possibly the transport of juvenile fish from one nearshore region to another.

## **C. Location**

This project has been designed for Prince William Sound. All communities that utilized the marine resources of Prince William Sound will benefit from this research.

## **COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE**

Bids will be solicited from the private sector for oceanographic charters in FY00. This project will contribute information to local news letters and newspaper articles. Scientific results will be posted on the SEA web page, and will be accessible to the public.

## **PROJECT DESIGN**

### **A. Objectives**

The main objective of this proposal is to document the interannual variability in water mass exchange between PWS and the northern GOA at Hinchinbrook Entrance, and to identify mechanisms governing this exchange. Funding is requested to deploy an upward looking ADCP mooring in Hinchinbrook Entrance in fall through spring of the next three years. In addition to the ADCP velocity time series, time series of deep temperature (T) and salinity (S) will be collected by a CTD mounted on the mooring. Finally, support is requested to provide physical oceanographic data collected in FY00 and in previous years (under SEA) to new projects proposed by EVOS researchers, to exchange data with GLOBEC researchers, and to prepare collaborative manuscripts.

### **B. Methods**

An upward-looking ADCP mooring (RDI 150 kHz broadband) will be deployed in Hinchinbrook Entrance in October 1999 and retrieved in May

2000. The approximate mooring location will be latitude 60 17.0', longitude 146 51.0', which is south of the SEA mooring location and in deeper water (about 340m). The new position is in the deepest part of Hinchinbrook Entrance at the northern end of the Montague Island trench. As configured, this ADCP will measure horizontal and vertical velocities from a few meters above the transducer faces to within roughly 45m of the surface in 8m bin depths. Velocities are stored every two hours.

The data will be processed using standard RDI software and analyzed using software developed under SEA. The horizontal velocities will be translated into along-channel and cross-channel components, and 40 hour low-pass filtered to remove the tidal components. Transports will be calculated from the along-channel low-pass filtered velocities above and below 150m (as well as other depth intervals) and compared to previous years' values. Power spectra for each component will also be calculated at several depths and compared to previous years.

In addition to the velocity data, T/S data will be collected by a SeaBird 16 CTD mounted on the mooring. The instrument has been equipped with a new pressure housing enabling it to function at the mooring depth. The data will be processed using standard SeaBird software. Density will be calculated from T and S.

With a two hour collection interval, data storage on the 150 kHz ADCP is limited to roughly nine months because of battery power. The September to May time period was chosen because maximum transports were found to occur in October through December. Weather conditions in September and May are generally mild enough to permit mooring operations. September may be a transition month from the summer baroclinic structure (outflow overlying inflow) to the late fall baroclinic structure (inflow overlying outflow). The spring phytoplankton and zooplankton blooms occur in April and May.

While early September is preferable for mooring deployment, the first deployment in FY00 will have to be in October because of availability of funds. Subsequent deployments will be in September, which will mean FY00 will include three mooring cruises (October 1999, May 2000, and September 2000). Deployment dates would be, for example:

October 1999 - May 2000  
September 2000 - May 2001  
September 2001 - May 2002

FY01 will include two mooring cruises (May 2001 and September 2001). FY02 will include one mooring cruise (May 2002) unless

continued funding makes additional deployments possible. A vessel with a crane, A-frame, or other equipment suitable for mooring deployments will be required.

To identify the dominant factors that govern PWS/GOA exchange, the mooring velocity and deep T/S time series will be combined with additional data types collected under other programs. Meteorological data are available from the NOAA C-Man stations, particularly the Seal Rocks and Mid-Sound buoys, and from the station located on Middleton Island. Towed downward looking ADCP measurements funded by SERVS and OSRI will capture the Hinchinbrook Entrance flow patterns during the summer months when the mooring is not in place. Satellite tracked drifting buoys funded by RCAC and OSRI will document the basin scale circulation patterns throughout each year. Conditions in the GOA, particularly in the trench southeast of Montague Island, will be documented by the GLOBEC group at IMS/UAF.

The mooring velocity time series coupled with the repeated ADCP transects over multiple years will show whether the baroclinic inflow/outflow structure that dominated the flow in summer 1995 and in fall through early winter 1996 (including the apparent September reversal and the 150m separation depth), as well as the transition from a baroclinic to barotropic structure in January 1997, is typical or anomalous. The correlation between easterly wind bursts and surface Ekman layer inflow was well documented from the mooring time series in 1995 and 1996. The downward-looking towed ADCP has an upper limit of 20m depth as opposed to about 45m for the mooring. During periods of strong easterly winds (as measured by the C-Man buoy at Seal Rocks), more the Ekman inflow will be captured using the towed instrument.

The T/S time series will signal the movement of any new deep water mass into or out of PWS. T/S observations from the GLOBEC cruises should reveal the source of deep water flowing into PWS, or the southern extent of deep water flowing out of PWS. Time series of GOA wind speed and direction (from the Middleton Island station) should indicate if large scale atmospheric forcing in the Gulf is responsible for the inflow/outflow patterns and transitions at Hinchinbrook Entrance, and for the variability in transports above and below 150m. Seasonal and interannual changes in the inflow/outflow patterns and magnitudes can be related to the central Sound circulation as documented by the satellite tracked drifting buoys.

Considerable shared data analysis and co-authored manuscript preparation was completed under SEA. Still, new findings have suggested further collaboration. In addition to the GLOBEC

activities, the following EVOS investigators have expressed interest in including past and future physical oceanographic data in their analysis, and in preparing co-authored manuscripts:

Dr. B. Norcross - comparing within-bay herring distributions and physical characteristics, using methods developed for Atlantic herring (e.g., Graham, 1972).

Dr. P. McRoy - correlation between phytoplankton distribution and water mass properties surrounding decadal scale regime shifts.

Ms. E. Brown - synthesis of data collected in the SEA Herring project (320-T), including aerial surveys, acoustic data, zooplankton data, and physical oceanographic data from 1995 to 1997.

In addition, investigators from EVOS sponsored APEX projects have expressed interest in utilizing physical oceanographic data from the nearshore bays and fjords. For example, since zooplankton and some forage fish form dense layers around the pycnocline, the depth of the mixed layer may determine how efficiently diving birds can feed.

### **C. Cooperating Agencies, Contracts and Other Agency Assistance**

Cooperating agencies will be OSRI, PWS RCAC, and Alyeska SERVS.

## **SCHEDULE**

### **A. Measurable Project Tasks**

#### **FY00:**

October 1999: Mooring deployment and PWS cruise  
January 2000: EVOS Workshop - Anchorage  
April 15, 2000: FY99 Annual Report due  
May 2000: Mooring retrieval and PWS cruise  
September 2000: Mooring deployment and PWS cruise

#### **FY01:**

January 2001: EVOS Workshop - Anchorage  
April 15, 2001: FY00 Annual Report due  
May 2001: Mooring retrieval and PWS cruise  
September 2001: Mooring deployment and PWS cruise

**FY02:**

January 2002: EVOS Workshop - Anchorage  
April 15, 2002: FY01 Annual Report due  
May 2002: Mooring retrieval and PWS cruise

**FY03:**

April 15, 2003: FY02 Final Report due

**B. Project Milestones and Endpoints**

Processing of the mooring data obtained in May of each year will be completed before the following September. Data exchange with other SEA investigators will be completed by September 2000. The endpoint of each fiscal year will be marked by the Annual Report due date (April 15 of 2001, 2002 and 2003).

**D. Completion Date**

All project objectives will be completed in FY02 except for submission of the final report. The completion date of this project is September 30, 2003.

**PUBLICATIONS AND REPORTS**

Physical Processes Influencing the Pelagic Ecosystem of Prince William Sound, Fisheries Oceanography, October 1999.

**PROFESSIONAL CONFERENCES**

Travel is requested to present results at the EVOS Workshops in January of each year in Anchorage.

**COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

This project will be coordinated with the efforts Dr. T. Weingartner and Dr. D. Musgrave (GLOBEC). There will also be continued collaboration with SEA investigators, particularly Dr. B. Norcross, Dr. P. McRoy, and Ms. E. Brown. This project will cooperate with APEX and other EVOS-sponsored programs to provide the most efficient means for investigating biological and environmental factors common to all projects.

## **PROPOSED PRINCIPAL INVESTIGATOR**

Shari L. Vaughan, Ph.D.  
Prince William Sound Science Center  
P. O. Box 705  
Cordova, Alaska 99574  
(907) 424-5800 Office  
(907) 424-5820 Fax  
vaughan@pwssc.gen.ak.us

## **PRINCIPAL INVESTIGATOR**

Shari L. Vaughan, Ph.D.  
Physical Oceanographer, Prince William Sound Science Center  
(P.I. of SEA Physical Oceanography project 320-M)

### **Education:**

B.S., University of Miami, May 1981, Physics (major)/Mathematics (minor)  
M.S., University of Miami, May 1986, Physics  
Ph.D., University of Miami, Rosenstiel School of Marine and Atmospheric  
Science (RSMAS), May 1993, Meteorology and Physical Oceanography  
(MPO), Kevin D. Leaman, advisor

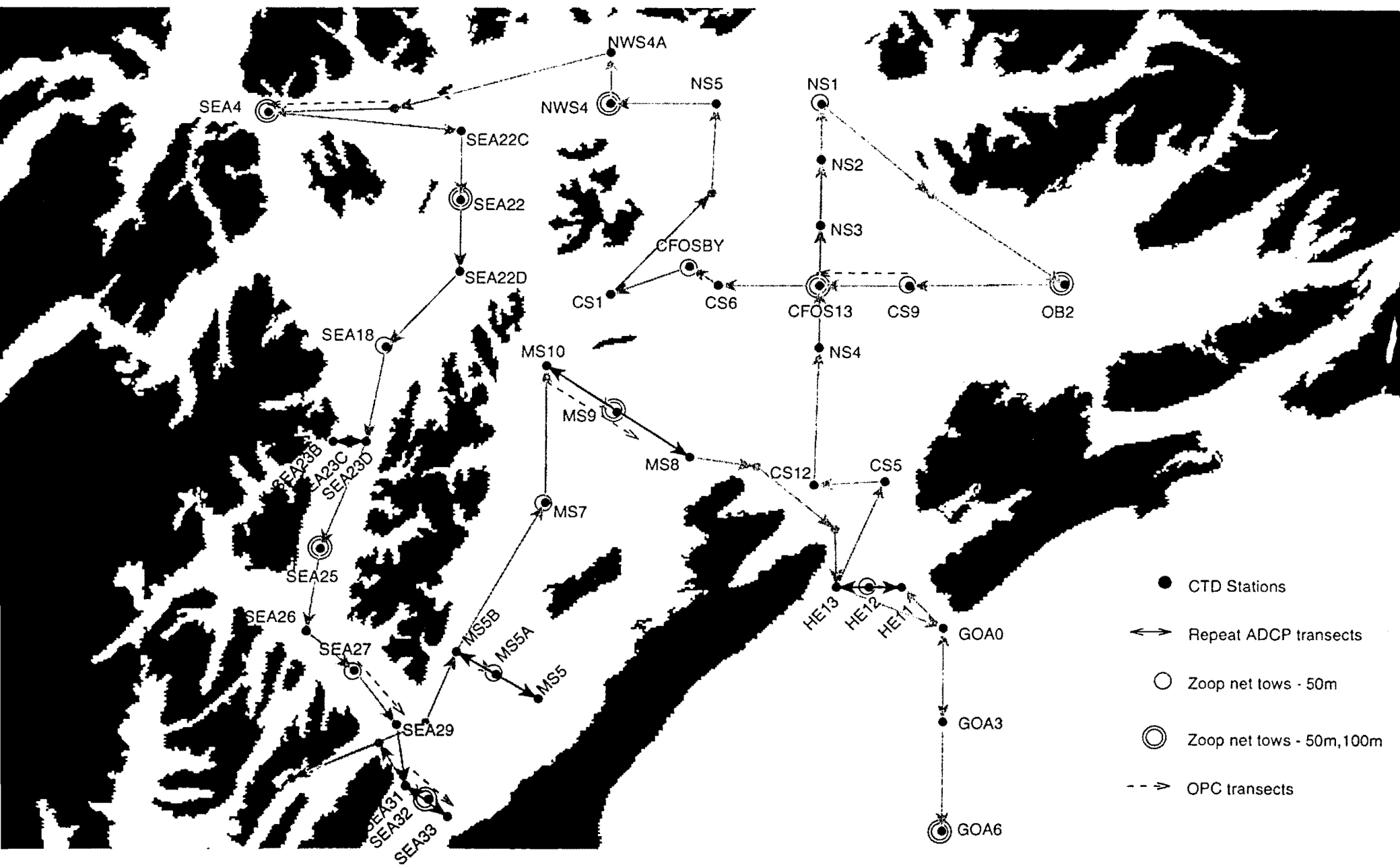
### **Professional Experience (since 1986):**

1986 - 1993: Research Assistant, University of Miami, RSMAS, MPO,  
Miami, Florida  
1993 - 1995: Postdoctoral Associate, University of Miami, Cooperative  
Institute for Marine and Atmospheric Studies, a  
cooperative institute between RSMAS and NOAA's Atlantic  
Oceanographic and Meteorological Laboratory (AOML), Miami,  
Florida, Robert L. Molinari, supervisor  
Sept. 1995 - present: Physical Oceanographer, Prince William Sound  
Science Center, Cordova, Alaska

### **Recent Refereed Journals:**

Vaughan, S. L. and K. D. Leaman, 1995: The Role of Small-Scale Cells  
in the Mediterranean Convection Process. J. Phys. Oceanogr., 25 (10),  
2423-2436.

Vaughan, S. L. and R. L. Molinari, 1997: Temperature and Salinity  
Variability in the Deep Western Boundary Current. J. Phys. Oceanogr.,  
27 (5), 749-761.



# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Revision '22/99  
Approved TC 8-9-99

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$0.0						
Travel		\$0.0						
Contractual		\$106.9						
Commodities		\$0.0						
Equipment		\$0.0						
Subtotal	\$0.0	\$106.9	LONG RANGE FUNDING REQUIREMENTS					
General Administration		\$7.5						
Project Total	\$0.0	\$114.4						
Full-time Equivalents (FTE)		0.6						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:								

**FY00**

Project Number: 60552  
Project Title: Exchange between PWS and the Gulf of Alaska  
Agency: NOAA

FORM 3A  
TRUSTEE  
AGENCY  
SUMMARY

Prepared:

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$45.9						
Travel		\$7.0						
Contractual		\$28.6						
Commodities		\$4.0						
Equipment		\$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	\$0.0	\$85.5			Estimated FY 2001	Estimated FY 2002		
Indirect (25%)		\$21.4						
Project Total	\$0.0	\$106.9			\$107.6	\$95.9		
Full-time Equivalents (FTE)		0.6						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:								

**FY00**

Project Number:  
Project Title: Exchange between PWS and the Gulf of Alaska  
Name: Prince William Sound Science Center

FORM 4A  
Non-Trustee  
SUMMARY

Prepared:

October 1, 1999 - September 30, 2000

**FY00**

Project Title: Exchange between PWS and the Gulf of Alaska  
Name: Prince William Sound Science Center

FORM 4B  
Personnel  
& Travel  
DETAIL

3 of 5

**2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		Proposed
Description		FY 2000
Vessel Charter (3 cruises, 2 days each @ \$3000 per day)		18,000.0
Equipment calibration/repair		1,000.0
Network costs and maintenance (\$100/computer-month)		2,000.0
Professional servies - mooring technician (\$2000 per cruise)		6,000.0
Phone, fax, copying		800.0
Mail, freight, shipping		800.0
<b>Contractual Total</b>		<b>\$28.6</b>
<b>Commodities Costs:</b>		Proposed
Description		FY 2000
Office supplies		500.0
Computer supplies		500.0
Marine supplies		3,000.0
<b>Commodities Total</b>		<b>\$4.0</b>

**FY00**

Project Number:

Project Title: Exchange between PWS and the Gulf of Alaska

Name: Prince William Sound Science Center

FORM 4B  
Contractual &  
Commodities  
DETAIL

Prepared:

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

New Equipment Purchases:		Number of Units	Unit Price	Proposed FY 2000
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
Those purchases associated with replacement equipment should be indicated by placement of an R.			<b>New Equipment Total</b>	<b>\$0.0</b>
Existing Equipment Usage:		Number of Units		
Description				
150 kHz RDI ADCP and mooring components (floatation, releases, hardware)		1		
150 kHz RDI ADCP and towbody		1		
SBE 911 CTD and rosette		1		

**FY00**

Project Number:  
Project Title: Exchange between PWS and the Gulf of Alaska  
Name: Prince William Sound Science Center

FORM 4B  
Equipment  
DETAIL

Prepared:



**Manuscript: Resolution of Mixtures Containing Exxon Valdez Oil and Regional Background Hydrocarbons in Subtidal Sediments of Prince William Sound.**

Project Number: 00 598

Restoration Category: Publication

Proposer: Jeffrey W. Short  
NMFS, Auke Bay Laboratory  
ABL Program Manager: Dr. Stan Rice  
NOAA Program Manager: Bruce Wright

Lead Trustee Agency: National Marine Fisheries Service

Cooperating Agencies: None

Alaska Sea Life Center: No

Duration: One year

Cost, FY00: \$13,500

Cost, FY01: \$0

Geographic Area: Prince William Sound (field work completed)

Injured Resource/Service: Pink Salmon

RECEIVED

APR 15 1999

EXXON VALDEZ OIL SPILL  
TRUSTEE COUNCIL

**ABSTRACT**

Using existing hydrocarbon data, this paper will report application of multivariate statistical methods to the problem of resolving a hydrocarbon mixture from two different sources in subtidal sediments of Prince William Sound, viz., *Exxon Valdez* oil (EVO) and the regional background hydrocarbon pattern. Multivariate logistic and Dirichlet error distributions will be compared as bases for maximum likelihood mixture compositions, under the assumption that one source (EVO) is time-varying in composition, and the other (regional background from coal) is not. The large hydrocarbon database produced for the *Exxon Valdez* oil spill will be used to evaluate the performance of these approaches. Results will be used to evaluate biases inherent in a previous bivariate approach to resolution of these mixtures, which had erroneously assumed that both hydrocarbon sources were time-varying, and had concluded that EVO contributed a small increment on a large background in shallow subtidal sediments. The actual extent of initial and present pollution of these subtidal sediments bears directly on biotic exposure to bioavailable PAH associated with the epibenthos in this region.

## INTRODUCTION

The extent to which shallow, subtidal sediments were polluted by Exxon Valdez oil (EVO) remains unsettled, largely because resolution of the polluting oil from natural background hydrocarbons is so difficult. Previous studies sponsored by the Trustees have demonstrated considerable fluxes of EVO to shallow subtidal sediments, which in some cases appeared to have caused substantial increases in the sediment hydrocarbon burden based on mass-balance arguments. Studies sponsored by Exxon corporation have concluded that these increases were negligible in most cases, based on a bivariate mixing model involving a major assumption that was later invalidated. Exploration of this issue using more sophisticated multivariate methods has not been attempted, although such methods make far more efficient use of the available data than either of the previous approaches, with the attendant promise of far more rigor. Resolution of this issue is important because it addresses a fundamental question regarding the extent of initial and continuing exposure of biota to toxic hydrocarbons: How much EVO polluted the seafloor in the spill area?

The work proposed will examine benthic sediment hydrocarbon data already in hand from the spill region, using multivariate statistical methods that realistically incorporate the time-varying aspects of one of the sources (EVO), the time-invariant aspect of the other (coal), and make efficient use of the large number of independent analytes available.

## NEED FOR THE PROJECT

### A. Statement of Problem

The Exxon-sponsored conclusion of negligible pollution of subtidal sediments by EVO (Page *et al.*, 1996) rest on two inherent biases. First, these studies assume that the natural background source is another crude oil, and therefore weathers the same way that EVO does. Recent work (Short *et al.*, 1999) invalidates this assumption, and showed that the background almost certainly derives from coal. The hydrocarbon pattern of coal does not weather. The Exxon method for allocating hydrocarbon sources systematically overestimates contributions from a source that weathers less rapidly than assumed. Since coal does not weather at all, contributions from coal become progressively more over-estimated as the oil in a sediment mixture weathers. Second, the Exxon approach is based on only two of dozens of hydrocarbon analytes measures, and underestimates analytical variability. These problems may exacerbate the biases that result from source mis-identification.

More extensive and persistent pollution of shallow subtidal sediments by EVO than has been recognized by *e.g.* Page *et al.* (1996) may corroborate other indications of oil exposure in biota associated with these sediments. The proposed project will allow more precise and definitive estimates of the extent that biota in the shallow subtidal were exposed to oil pollution from the T/V Exxon Valdez.

### **B. Rationale/Link to Restoration**

The proposed manuscript will add to the growing body of peer-reviewed literature supported by Trustee research, will support previous EVOS literature, and will refute no-effect claims by industry.

### **C. Location**

Prince William Sound is the geographic focus, but this manuscript project does not require additional field or laboratory work.

## **COMMUNITY INVOLVEMENT**

Because all field work has been completed, opportunity for community involvement is very limited.

## **PROJECT DESIGN**

### **A. Objectives**

Goal: Write a manuscript comparing results of multivariate statistical resolution of EVO and coal in subtidal sediment with bivariate results reported by Page et al. (1996).

### **B. Methods.**

Multivariate resolution of hydrocarbon mixtures from two sources will follow the general methods presented by Bandeen-Roche (1994). This involves derivation of maximum likelihood estimates for source contributions based on assumptions about the underlying multivariate error distributions. Two error distributions will be compared, the logistic and the Dirichlet. Substantial agreement between these two approaches will be taken as validation of the overall approach. Results on source contribution estimates derived from the multivariate approach will be compared with results derived from the Page et al (1996) approach to evaluate systematic bias in the latter as EVO weathering proceeds.

### **C. Cooperating Agencies, Contracts, and Other Agency Assistance**

None

## **SCHEDULE**

### **A. Measurable Project Tasks for FY98 (October 1, 1999 - September 30, 2000)**

October 1999	Begin final analysis and start first draft
February 2000	Complete first draft, start author review
June 2000	Review of manuscript by non-authors
August 2000	Submit manuscript to journal (target journal has not been determined)

#### **B. Project Milestones and Endpoints**

October 1999	Begin final analysis and start first draft
February 2000	Complete first draft, start author review
June 2000	Review of manuscript by non-authors
August 2000	Submit manuscript to journal (target journal has not been determined)

#### **C. Completion Date**

This project would be completed in Fiscal Year 2001.

#### **PUBLICATIONS AND REPORTS**

Peer-reviewed manuscript and final report.

#### **PROFESSIONAL CONFERENCES**

One presentation is anticipated

#### **NORMAL AGENCY MANAGEMENT**

NOAA/NMFS has statutory stewardship for all living marine resources; however, if the oil spill had not occurred NOAA would not be conducting this project. NOAA/NMFS proposes to contribute any writing time that extends beyond the 1 month salary request.

#### **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

This project will complete work funded under Trustee project 290 in previous years to identify and interpret hydrocarbon signals in the oil spill region.

#### **PROPOSED PRINCIPAL INVESTIGATOR, IF KNOWN**

Jeffrey W. Short  
NOAA/NMFS  
Auke Bay Laboratory  
11305 Glacier Hwy

**2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

*Approved TC 8-9-99*

Budget Category:	Authorized FY 1999	Proposed FY 2000							
Personnel		\$10.2							
Travel		\$1.2							
Contractual		\$0.0							
Commodities		\$0.6							
Equipment		\$0.0							
Subtotal		\$12.0	LONG RANGE FUNDING REQUIREMENTS						
General Administration		\$1.5			Estimated FY 2001	Estimated FY 2002			
Project Total		\$13.5							
Full-time Equivalents (FTE)		0.1							
Dollar amounts are shown in thousands of dollars.									
Other Resources		\$27.0							
<p>NOAA Contribution:</p> <p>Habitat Senior Research Chemist, J Short 1.0 mo.@ 9.4 K, Senior Statistician Jerry Pella 1.0 mo @ 11.0 K, Program Manager, Stan Rice .5 mo @ 6.6K for a total NOAA contribution of: 27K</p>									

**FY00**

Prepared:4/12/99

Project Number: 00 598  
 Project Title: Resolution of Mixtures Containing EV Oil and Regional  
 Background Hydroground and Subtital Sediments of PWS  
 Agency: National Oceanic and Atmospheric Administration

**FORM 3A  
 TRUSTEE  
 AGENCY  
 SUMMARY**

Juneau, AK 99801  
Phone: (907) 789-6065; Fax: (907) 789-6094  
email: jeff.short@noaa.gov

## PRINCIPAL INVESTIGATOR

Jeffrey W. Short

Education: M.S. (Physical Chemistry)

### Relevant Experience:

1989- Present: Established and managed the hydrocarbon analysis facility at ABL to analyze hydrocarbon samples generated by the *Exxon Valdez* NRDA effort (about 20% of these samples were analyzed at ABL).

1989 - 1992: Principal Investigator, Exxon Valdez project Air/Water #3: Determination of petroleum hydrocarbons in seawater by direct chemical analysis and through the use of caged mussels deployed along the path of the oil spill.

1991 - 1996: Principal Investigator, Exxon Valdez project Subtidal #8: Development of computer-based statistical methods for global examination of sediment and mussel hydrocarbon data produced for the Exxon Valdez NRDA effort for systematic bias, and for identification of probable sources of hydrocarbons.

1996 - present: Principal Investigator, Restoration Project 290, Database Management: Discovered particulate coal on beaches near Katalla is a major source of background PAH in marine sediments of the spill area.

## OTHER KEY PERSONNEL

Dr. Jerome Pella, Statistician (ABL)

## LITERATURE CITED

- Bandeen-Roche, K. 1994. Resolution of Additive Mixtures into Source components and Contributions: A Compositional Approach. *J. Am. Stat. Assn.* **89**:1450-1458
- Page, D. S., P. D. Boehm, G. S. Douglas, A. E. Bence, W. A. Burns, and P. J. Mankiewicz. 1996. The Natural Petroleum Hydrocarbon Background in Subtidal Sediments of Prince William Sound, Alaska, USA. *Environ. Toxicol. & Chem.* **15**:1266-1281
- Short, J. W., K. A. Kvenvolden, P. R. Carlson, F. D. Hostettler, R. J. Rosenbauer, and B. A. Wright. 1999. Natural Hydrocarbon Background in Benthic Sediments of Prince William Sound, Alaska: Oil vs. Coal. *Environ. Sci. Technol.* **33**:34-42

**2000 EXXON VALDEZ TRUSTEES OIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

<b>Personnel Costs:</b>		<b>GS/Range/ Step</b>	<b>Months Budgeted</b>	<b>Monthly Costs</b>	<b>Overtime</b>	<b>Proposed FY 2000</b>
<b>Name</b>	<b>Position Description</b>					
Jerry Pella	Senior Statistician	13/7	0.5	11.0		5.5
						0.0
Jeff Short	Senior Research Chemist	13/4	0.5	9.4		4.7
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
<b>Subtotal</b>			1.0	20.4	0.0	
<b>Personnel Total</b>						<b>\$10.2</b>
<b>Travel Costs:</b>		<b>Ticket Price</b>	<b>Round Trips</b>	<b>Total Days</b>	<b>Daily Per Diem</b>	<b>Proposed FY 2000</b>
<b>Description</b>						
Juneau - San Francisco- American Chemical Society Meeting		0.8	1	2	0.2	1.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
<b>Travel Total</b>						<b>\$1.2</b>

**FY00**

Prepared:4/12/99

Project Number: 00 \_\_\_\_\_  
 Project Title: Resolution of Mixtures Containing EV Oil and Regional  
 Background Hydroground and Subtital Sediments of PWS  
 Agency: National Oceanic and Atmospheric Administration

**FORM 3B  
 Personnel  
 & Travel  
 DETAIL**

**2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		<b>Proposed FY 2000</b>
Description		
<p>When a non-trustee organization is used, the form 4A is required.</p>		<b>Contractual Total</b>
		\$0.0
<b>Commodities Costs:</b>		<b>Proposed FY 2000</b>
Description		
Page Charges		0.6
<b>Commodities Total</b>		\$0.6

**FY00**

Prepared:4/12/99

Project Number: 00 \_\_\_\_  
 Project Title: Resolution of Mixtures Containing EV Oil and Regional  
 Background Hydroground and Subtital Sediments of PWS  
 Agency: National Oceanic and Atmospheric Administration

**FORM 3B  
 Contractual &  
 Commodities  
 DETAIL**

**2000 EXXON VALDEZ TRUST. NCIL PROJECT BUDGET**  
**October 1, 1999 - September 30, 2000**

<b>New Equipment Purchases:</b>		<b>Number of Units</b>	<b>Unit Price</b>	<b>Proposed</b>
<b>Description</b>				<b>FY 2000</b>
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
Those purchases associated with replacement equipment should be indicated by placement of an <b>New Equipment Total</b>				\$0.0
<b>Existing Equipment Usage:</b>			<b>Number of Units</b>	<b>Inventory</b>
<b>Description</b>				<b>Agency</b>

FY00

Prepared:4/12/99

Project Number: 00\_\_\_\_  
Project Title: Resolution of Mixtures Containing EV Oil and Regional  
Background Hydroground and Subtital Sediments of PWS  
Agency: National Oceanic and Atmospheric Administration

**FORM 3B**  
**Equipment**  
**DETAIL**



*Approved TC 8-9-99*

## **Evaluation of Yakataga Oil Seeps as Regional Background Hydrocarbon Sources in Benthic Sediments of the Spill Area**

Project Number: 00599

Restoration Category: Research

Proposer: J. Short/NOAA

Lead Trustee Agency: NOAA

Cooperating Agencies: None

Alaska SeaLife Center: No

New or Continued: New

Duration: 1st yr.  
2 yr. project

Cost FY 00: \$75.6

Cost FY 01: \$10.0

Cost FY 02: \$0.0

Geographic Area: Gulf of Alaska

Injured Resource/Service: Benthic sediments

### **ABSTRACT**

This project will evaluate fluxes of crude oil from terrestrial oil seeps and of particulate coal near Yakataga into the northern Gulf of Alaska to delineate the extent of "natural oil pollution" in the area affected by the oil spill.

## INTRODUCTION

Scientists contracted by Exxon corporation have claimed that benthic coastal sediments of the northern Gulf of Alaska (GOA), including Prince William Sound (PWS), receive crude oil produced naturally by terrestrial oil seeps at Katalla and Yakataga. If true, this suggests that the marine biota of the EVOS spill area are adapted to oil pollution, thus promoting recovery of species exposed to toxic components of oil spilled from the T/V *Exxon Valdez*. Thus, fauna that show induction of cytochrome-P450 in the spill area may be responding to natural oil pollution and not to the spilled oil. A recent study by Trustee scientists casts considerable doubt on oil from Katalla as a candidate source of hydrocarbons in these sediments, hence sources near Cape Yakataga have been emphasized by the Exxon team. The study proposed here will compare hydrocarbon transport from oil seeps with coal deposits in drainages where oil seeps or particulate coal particles have been located in the Cape Yakataga area, to resolve the relative contributions from these two alternatives to benthic sediments offshore of these drainages in the GOA. Resolution of coal and sediment-bound oil will be achieved by physical separation, with less dense coal particles floated off from the more-dense inorganic fraction of sediments in an aqueous brine solution of intermediate density.

## NEED FOR THE PROJECT

### A. Statement of Problem

Long-term toxic effects of the oil spilled by the T/V *Exxon Valdez* may be confounded by the presence of other sources of crude oil affecting the spill area. Oil seeps near Cape Yakataga continue to be promoted as significant alternative sources of crude oil in PWS. Coal from terrestrial source beds has also been verified as a hydrocarbon source. However, toxic hydrocarbons in coal are sequestered and not available biologically, consequently they are incapable of inducing molecular indicators of PAH exposure (i.e. cytochrome P450). If the terrestrial oil seeps near Cape Yakataga are shown to be negligible compared to coal beds there, then cytochrome P450 induction that continues to be observed in some non-recovered species within the spill area are more likely the result of exposure to residual oil spilled from the T/V *Exxon Valdez*.

### B. Rationale

The criteria used to evaluate recovery of sediments and of biota that continue to show increased cytochrome P450 depends on the extent of background oil contamination in the affected area from sources other than the T/V *Exxon Valdez*. This project will provide much more precise criteria for these assessments. Oil from terrestrial seeps at Katalla and near Cape Yakataga was claimed to have associated with fine-grained sediments, flushed into the norther GOA, and then transported by the ACC into PWS where the sediments deposited in the calmer waters there. However, these studies ignored the possibility that terrestrial coal deposits could be a more dominant source in these areas. Although such coal deposits have been verified as dominant

sources at Katalla, coal sources have not as yet been documented in the Cape Yakataga area. The oil seeps at Cape Yakataga are the last remaining plausible alternative oil sources for the regional background hydrocarbon signature found inside PWS. If the contribution of hydrocarbons from these seeps is shown to be negligible in comparison with coal sources, then definitive criteria for recovery of benthic sediments inside PWS follows immediately, and the link between cytochrome P450 induction and exposure to residual *ExxonValdez* oil is made much stronger.

### **C. Location**

The samples collected for this project will be taken from the coastal and terrestrial margin of the northern GOA between the Duktoth River drainage in the west to Icy Bay in the east. Several short coastal streams bisect the Sullivan syncline in this area and receive oil from seeps associated with the syncline. These samples will be analyzed in Juneau, AK, and in Menlo Park, CA. The benefits of the project will apply most directly to communities and to other Trustee projects in the spill area. The communities that may be directly affected include Cordova, Valdez, and Whittier.

## **COMMUNITY INVOLVEMENT**

Communities will become informed about this project through radio and newspaper interviews responding to agency press releases, which will include communicate significant findings in non-technical language. The necessary vessel and aircraft charters will be advertized in Cordova and in Yakutat, the two communities closest to the study area, but cost will be the primary factor determining selection. Neither traditional nor local knowledge is expected to play a significant part in this project now.

## **PROJECT DESIGN**

### **A. Objectives**

This project has 1 objective:

1. Measure contributions of hydrocarbons from oil seeps and from terrestrial coal deposits to benthic marine sediments adjacent to the northern GOA margin from Icy Bay to the Duktoth River.

### **B. Methods**

Sampling will focus on 6 streams in the Cape Yakataga area, 3 of which receive oil from seeps and 3 of which do not. At each stream, a riparian sediment sample will be collected upstream of any oil seeps ( or upstream of the Sullivan syncline an equivalent distance where oil seeps are absent), and just above tidal influence near the stream mouth on the GOA. A marine epibenthic sediment sample will also be collected in front of each stream at a seawater depth of 50 m to characterize the composite sediment discharge of the area.

Each sediment sample will be subjected to a high-density brine solution (CsCl<sub>2</sub>) to separate coal particles from the remainder of the sediment. Coals in this region have a density of about 1.2, compared with densities above 1.8 for the remaining inorganic fraction of these sediments, and these can be easily separated with brines of intermediate density. Each fraction will be analyzed for alkane and polycyclic aromatic hydrocarbons (PAH; analysis at ABL), and for hydrocarbon biomarkers (analysis at USGS). These analytes will also be determined in the benthic sediment sample without brine separation to compare the hydrocarbon concentrations found in the separated samples with the original samples.

Water samples will also be collected from each of the study streams to evaluate the flux of hydrocarbons from oil seeps into the GOA. A 4 L water sample will be collected 100 m downstream of the oil seep entry point into a stream (or an equivalent distance upstream when oil seeps are absent), and another 4L water sample will be collected just above tidal influence near the stream mouth on the GOA. Each water sample will be partitioned into a dissolved and particulate fraction as describe by Payne et al. (International Oil Spill Conference, 1999). The dissolved and particulate water sample fractions will also be analyzed for alkane, PAH and biomarker hydrocarbons as described above for sediments.

Analysis of sediment samples for PAH will follow methods described by Short et al. (American Fisheries Society Symposium 18, pp.140-148, 1996). Biomarker analysis is summarized by Carlson et al. (U.S. Geological Survey Open File Report 97-518, 1997).

By physically separating the coal particles from these sediments, the contribution estimate from this source will be quite unambiguous. Comparison of dissolved and particle-bound hydrocarbons in the water samples together with stream discharge estimates will further constrain contributions from oil seeps. Hydrocarbon pattern recognition will follow methods summarized by Short et al. ( Environmental Science & Technology, Vol 33, pp. 34-42, 1999).

### **C. Contracts and Other Agency Assistance**

The U.S. Geological Survey will cooperate with this project. Their participation is necessary because they have the expertise required to perform the brine density separations of the sediment samples, and the analysis of the samples for hydrocarbon biomarkers.

Collection and partitioning of the water samples will be contracted to Payne Environmental Consultants, who have developed the sample fractionation methodology to be used.

## **SCHEDULE**

### **A. Measurable Project Tasks for FY00**

FY00:

Apr 15 - June 30: Collect sediment and water samples.

Prepared 4/12/99

Project 00\_\_

Jun 1 - Sep 30: Analyze samples for hydrocarbons

**B. Project Milestones and Endpoints**

Finish sample collection by June 30, 2000 (this is weather-dependent).

Finish sample processing and hydrocarbon analysis by Sept. 30, 2000

Complete final report and submit manuscript for publication in peer-reviewed journal by Apr 15, 2001.

**C. Completion Date**

April 15, 2001

**PUBLICATIONS AND REPORTS**

A final report will be produced by April 15, 2001. A manuscript will be submitted for publication in peer-reviewed journal by Apr 15, 2001.

**NORMAL AGENCY MANAGEMENT**

If the oil spill had not occurred, neither NOAA nor USGS would be conducting this project.

**COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

This project will complete work funded under Trustee project 290 in previous years to identify and interpret hydrocarbon signals in the oil spill region.

**EXPLANATION OF CHANGES IN CONTINUING PROJECTS**

None

**PROPOSED PRINCIPAL INVESTIGATOR**

Jeffrey W. Short  
Auke Bay Laboratory, Alaska Fisheries Science Center  
National Marine Fisheries Service, NOAA  
11305 Glacier Highway, Juneau, Alaska 99801-8626  
Phone: (907) 789-6065  
FAX: (907) 789-6094  
e-mail: jeff.short@noaa.gov

## PRINCIPAL INVESTIGATORS

### 1. Jeffrey W. Short (Sediment sample collection; PAH analysis and interpretation)

Education: M.S. (Physical Chemistry)

Relevant Experience:

1989- Present: Established and managed the hydrocarbon analysis facility at ABL to analyze hydrocarbon samples generated by the *Exxon Valdez* NRDA effort (about 20% of these samples were analyzed at ABL).

1989 - 1992: Principal Investigator, Exxon Valdez project Air/Water #3: Determination of petroleum hydrocarbons in seawater by direct chemical analysis and through the use of caged mussels deployed along the path of the oil spill.

1991 - 1996: Principal Investigator, Exxon Valdez project Subtidal #8: Development of computer-based statistical methods for global examination of sediment and mussel hydrocarbon data produced for the Exxon Valdez NRDA effort for systematic bias, and for identification of probable sources of hydrocarbons.

1996 - present: Principal Investigator, Restoration Project 290, Database Management: Discovered particulate coal on beaches near Katalla is a major source of background PAH in marine sediments of the spill area.

### 2. Keith A. Kvenvolden (Sediment sample collection and partitioning; hydrocarbon biomarker analysis; biomarker and geochemistry interpretation)

Education : Ph. D. (Geology)

Relevant Experience:

Group Leader, Organic Geochemistry  
Branch of Pacific Marine Geology  
U. S. Geological Survey  
Menlo Park, CA

Over 250 peer-reviewed scientific publications on hydrocarbons in the marine environment

### 3. James R. Payne (Water sample collection and partitioning, interpretation of aqueous hydrocarbon results)

Education: Ph. D (Chemistry)

Relevant Experience:

Author of 4 books and 27 peer-reviewed scientific publications on effects of water-borne hydrocarbon pollutants.

Jun 1 - Sep 30: Analyze samples for hydrocarbons

**B. Project Milestones and Endpoints**

Finish sample collection by June 30, 2000 (this is weather-dependent).

Finish sample processing and hydrocarbon analysis by Sept. 30, 2000

Complete final report and submit manuscript for publication in peer-reviewed journal by Apr 15, 2001.

**C. Completion Date**

April 15, 2001

**PUBLICATIONS AND REPORTS**

A final report will be produced by April 15, 2001. A manuscript will be submitted for publication in peer-reviewed journal by Apr 15, 2001.

**NORMAL AGENCY MANAGEMENT**

If the oil spill had not occurred, neither NOAA nor USGS would be conducting this project.

**COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

This project will complete work funded under Trustee project 290 in previous years to identify and interpret hydrocarbon signals in the oil spill region.

**EXPLANATION OF CHANGES IN CONTINUING PROJECTS**

None

**PROPOSED PRINCIPAL INVESTIGATOR**

Jeffrey W. Short  
Auke Bay Laboratory, Alaska Fisheries Science Center  
National Marine Fisheries Service, NOAA  
11305 Glacier Highway, Juneau, Alaska 99801-8626  
Phone: (907) 789-6065  
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e-mail: jeff.short@noaa.gov

## PRINCIPAL INVESTIGATORS

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1989- Present: Established and managed the hydrocarbon analysis facility at ABL to analyze hydrocarbon samples generated by the *Exxon Valdez* NRDA effort (about 20% of these samples were analyzed at ABL).

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Education : Ph. D. (Geology)

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### 3. James R. Payne (Water sample collection and partitioning, interpretation of aqueous hydrocarbon results)

Education: Ph. D (Chemistry)

#### Relevant Experience:

Author of 4 books and 27 peer-reviewed scientific publications on effects of water-borne hydrocarbon pollutants.

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Revised 7-2-99  
Approved 7-8-9-99

Budget Category:	Authorized FY 1999	Proposed FY 2000	PROPOSED FY 2000 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
							\$30.8	\$66.0
Personnel	\$0.0	\$38.1						
Travel	\$0.0	\$8.5						
Contractual	\$0.0	\$20.5						
Commodities	\$0.0	\$1.3						
Equipment	\$0.0	\$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	\$0.0	\$68.4			Estimated FY 2001	Estimated FY 2002		
General Administration	\$0.0	\$7.2						
Project Total	\$0.0	\$75.6			\$10.0			
Full-time Equivalents (FTE)	0.0	0.4						
			Dollar amounts are shown in thousands of dollars.					
Other Resources	\$0.0	\$46.2			\$0.0	\$0.0		

## Comments:

Total NOAA Contribution: 33K

Total USGS Contribution: 13.2K for a total contribution of 42,6K

**FY00**

## Project Number:

Project Title: Evaluation of Yakataga Oil Seeps as Regional Back  
ground Hydrocarbon Sources in Benthic Sediments of EVOS Area  
Lead Agency: National Oceanic & Atmospheric Administration

FORM 2A  
MULTI-TRUSTEE  
AGENCY SUMMARY

Prepared: 7/2/99

## 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$24.9						
Travel		\$5.1						
Contractual		\$17.5						
Commodities		\$1.3						
Equipment		\$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	\$0.0	\$48.8			Estimated FY 2001	Estimated FY 2002		
General Administration		\$5.0						
Project Total	\$0.0	\$53.8			\$10.0			
Full-time Equivalents (FTE)		0.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources		\$33.0						
 <b>Comments:</b>  								
 <b>NOAA Contribution:</b> Senior Research Chemist, P-I Jeff Short 1.5 mo.@ 14.1K, Senior Analytical Chemist Marie Larsen 1 mo @ 6.7K , Program Manager, Stan Rice 1 mo @ 12.2K for a total NOAA contribution of:33K.								

**FY00**

Project Number:

**Project Title: Evaluation of Yakataga Oil Seeps as Regional Background Hydrocarbon Sources in Benthic Sediments of EVOS Area**  
**Lead Agency: National Oceanic & Atmospheric Administration**

# FORM 3A TRUSTEE AGENCY SUMMARY

## October 1, 1999 - September 30, 2000

October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
Name	Position Description					
Jeff Short	Senior Research Chemist	13/4	0.5	9.3		4.7
Marie Larsen	Research Chemist	11/6	0.5	6.7		3.4
Chemistry Lab Analyses Preparation						0.0
Josie Lunasin	Chemist	9/6	3.0	5.6		16.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Subtotal			4.0	21.6	0.0	
Personnel Total						\$24.9
Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2000
Description						
						0.0
						0.0
						0.0
						0.0
Juneau- Yakutat-Juneau		0.6	1	10	0.2	2.6
						0.0
Helicopter charter for 1 day		2.5	1	1		2.5
						0.0
						0.0
Travel Total						\$5.1

**FY00**

Project Number:

**Project Title:** Evaluation of Yakataga Oil Seeps as Regional Background Hydrocarbon Sources in Benthic Sediments of EVOS Area  
**Lead Agency:** National Oceanic & Atmospheric Administration

**FORM 3B**  
**Personnel**  
**& Travel**  
**DETAIL**

**2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		Proposed
Description		FY 2000
Boat Charter - 1 seiner for 5 days at 1.5K/day		7.5
Payne Environmental Consultants- collection and partition of water samples		10.0
When a non-trustee organization is used, the form 4A is required.		
<b>Contractual Total</b>		<b>\$17.5</b>
<b>Commodities Costs:</b>		Proposed
Description		FY 2000
Chemistry lab supplies for analyses (chemicals and glassware)		1.0
Page charges		0.3
<b>Commodities Total</b>		<b>\$1.3</b>

**FY00**

Project Number:

Project Title: Evaluation of Yakataga Oil Seeps as Regional Back-ground Hydrocarbon Sources in Benthic Sediments of EVOS Area

Lead Agency: National Oceanic &amp; Atmospheric Administration

FORM 3B  
Contractual &  
Commodities  
DETAIL

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

New Equipment Purchases:		Number of Units	Unit Price	Proposed FY 2000
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
Those purchases associated with replacement equipment should be indicated by placement of an R.			<b>New Equipment Total</b>	\$0.0
Existing Equipment Usage:		Number of Units	Inventory Agency	
Description				
	GC/MS		NOAA	
	HPLC		NOAA	

**FY00**

Project Number:

Project Title: Evaluation of Yakataga Oil Seeps as Regional Back-ground Hydrocarbon Sources in Benthic Sediments of EVOS Area

Lead Agency: National Oceanic & Atmospheric Administration

**FORM 3B  
Equipment  
DETAIL**

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000					
Personnel		\$13.2					
Travel		\$3.4					
Contractual		\$3.0					
Commodities		\$0.0					
Equipment		\$0.0					
Subtotal	\$0.0	\$19.6	LONG RANGE FUNDING REQUIREMENTS				
General Administration		\$2.2			Estimated FY 2001	Estimated FY 2002	
Project Total	\$0.0	\$21.8					
Full-time Equivalents (FTE)		0.1					
			Dollar amounts are shown in thousands of dollars.				
Other Resources		\$13.2					
<b>Comments:</b> USGS Contribution: K.Kenvolden, Group Leader Chemist, 1.0 mo @ 13.2K for a total USGS contribution of 13.2K							

**FY00**

Prepared 7/2/99

**Project Number:**

**Project Title:** Evaluation of Yakataga Oil Seeps as Regional Back-ground Hydrocarbon Sources in Benthic Sediments of EVOS Area

**Agency:** DOI- USGS

**FORM 3A  
TRUSTEE  
AGENCY  
SUMMARY**

## 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
Name	Position Description					
Keith Kenvolden	Group Leader, Organic Geochemistry	GS-14	1.0	13.2		13.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Subtotal			1.0	13.2	0.0	
Personnel Total						\$13.2
Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2000
Description						
Menlo Park - Yakutat for sampling for USGS personnel		0.7	2	10	0.2	3.4
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Travel Total						\$3.4

**FY00**

Project Number:

**Project Title: Evaluation of Yakataga Oil Seeps as Regional Background Hydrocarbon Sources in Benthic Sediments of EVOS Area**

**Agency:** DOI- USGS

**FORM 3B**  
**Personnel**  
**& Travel**  
**DETAIL**

## 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		Proposed
Description		FY 2000
Chemistry Lab supplies		3.0
When a non-trustee organization is used, the form 4A is required.		<b>Contractual Total</b>
		\$3.0
<b>Commodities Costs:</b>		Proposed
Description		FY 2000
<b>Commodities Total</b>		\$0.0

**FY00**

Project Number:

**Project Title: Evaluation of Yakataga Oil Seeps as Regional Background Hydrocarbon Sources in Benthic Sediments of EVOS Area**

**Lead Agency:** National Oceanic & Atmospheric Administration

**FORM 3B**  
**Contractual &**  
**Commodities**  
**DETAIL**

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

New Equipment Purchases:		Number of Units	Unit Price	Proposed FY 2000
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
Those purchases associated with replacement equipment should be indicated by placement of an R.			<b>New Equipment Total</b>	\$0.0
Existing Equipment Usage:		Number of Units	Inventory Agency	
Description				
Chemistry Laboratory				

**FY00**

Prepared: 7/2/99

Project Number:  
 Project Title: Evaluation of Yakataga Oil Seeps as Regional Back-ground Hydrocarbon Sources in Benthic Sediments of EVOS Area  
 Agency: DOI- USGS

**FORM 3B  
 Equipment  
 DETAIL**

00605

00568

## Information Transfer to Resource Managers, Stakeholders, and General Public

Project Number: 00605

Restoration Category: Public Information

Proposer: Restoration Office, *Exxon Valdez* Oil Spill Trustee Council

Lead Trustee Agency: Restoration Office (ADFG)

Cooperating Agencies: DOI

Alaska SeaLife Center: No

Duration: 1st year of a 1-year project

Cost FY 00: \$19,800

Cost FY 01: \$0

Cost FY 02: \$0

Geographic Area:

Injured Resource/Service: All injured resources and services

### ABSTRACT

Public information is an integral part of Trustee Council activities. This project increases public awareness and understanding of EVOS restoration activities through improvements to the EVOS web site, improves the ability of researchers to locate and order pertinent publications, and educates managers of fish, wildlife, land, and habitat about new data and new tools available to them through EVOS-funded projects.

## **INTRODUCTION**

This project is part of a multi-faceted approach to update and revise the EVOS web site and promote data and tools developed from EVOS research that are directly relevant to resource management. It has two main objectives.

First, it establishes a mechanism to make the bibliography of peer-reviewed publications and EVOS final reports available on the web and searchable by key words, authors, species, and resource cluster. Researchers will then have a direct link to ARLIS to receive a copy of the publication through library loan.

Second, it identifies EVOS projects that have resulted in pertinent data and practical tools for managers of fish, wildlife, land and habitat. Those applicable projects and results will be flagged as part of the web site revisions mentioned above. In addition, a publication will be designed, printed and distributed that highlights tools and data sets available for managers. The publication, web site, and other tools such as Environmentally Sensitive Index (ESI) maps (Project 99368) will be introduced at an open house designed to bring managers together with PIs for presentations and discussions on useful results of EVOS-funded projects.

This project also complements Project 00414 as well as an in-house revision of the web site to make it easier for the general public to review and understand restoration activities.

## **NEED FOR THE PROJECT**

### **A. Statement of the Problem**

Through FY 99, the Trustee Council has funded \$109 million in research and monitoring efforts, resulting in a better general understanding about the Gulf of Alaska ecosystem, 288 peer-reviewed publications, and 133 final reports (as of August 1, 1999). This information is currently available to scientific researchers and to the general public in various ways, but is not easily researched through the EVOS web site. The general public, including residents and stakeholders of the spill region, want to know what we have gained from 10 years of research. Scientific researchers want easy access to the new data and results of EVOS projects. Managers of fish, wildlife, and land/habitat want to know what new tools might assist them in their permitting and resource planning efforts. Currently, the web site does not offer this information in ways that is easy to understand and easy to use. Resource managers also need this information provided in a printed format that is accessible off the shelf and would benefit from presentations on EVOS results directly from the principal investigators.

### **B. Rationale/Link to Restoration**

This effort is a vital step in information management of the EVOS Restoration program; it provides an important means of information transfer of research findings to user groups.

### **C. Location**

No field work is planned for this project.

## **COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE**

Remote communities in the oil spill region with Internet access, like other user groups, will be able to find sources of reports and publications more readily.

## **PROJECT DESIGN**

### **A. Objectives**

- (1) For researchers and resource managers: convert the bibliography of peer reviewed publications and all available final reports so that they are searchable by species, resource cluster, names of all authors, and key words; add abstracts; identify and flag reports and manuscripts useful to resource managers; post it all on the web; and add a mechanism for ordering documents from ARLIS.
- (2) For resource managers: create visually pleasing and readable booklet(s) of EVOS-funded management tools, containing a descriptive paragraph of each item, plus graphics or photos, and a list of sources (web sites, publications, people) where they can learn more.
- (3) For resource managers: host an open house for fish, wildlife, and land/habitat managers where they can receive the booklet mentioned above, get a tour of the revised web site, introduce and review Environmentally Sensitive Index (ESI) maps, and listen to presentations by PIs on management tools and resources.

### **B. Methods**

The methods described below are organized by project objective:

- (1)
  - a. Working with ARLIS, obtain copies of 83 articles that are not yet on file at the library.
  - b. Scan abstracts of all articles and convert them into format searchable on the web.
  - c. Identify keywords, as necessary
  - d. Convert existing final report information on web to a searchable format
  - e. Add search mechanism to the web site.
  - f. Identify which articles provide useful tools and information for resource managers and flag them.
  - g. Update throughout the year as articles and final reports become available
- (2)
  - a. Identify data and tools most useful for resource managers.
  - b. Organize them (possibly by resource) to allow a logical presentation of facts and materials.
  - c. Create and print a booklet that provides a concise synopsis of each tool, provides helpful graphics and photographs, and provides information on how to obtain more detailed information, either through web sites, publications, or contacting principal investigators.

- (3)
  - a. Identify list of data and tools most useful for resource managers.
  - b. Determine an appropriate time for an open house (possibly in late March)
  - c. Invite principal investigators to attend and make presentations.
  - d. Invite resource managers from federal and state agencies to attend
  - e. Host an open house at the Restoration Office to introduce tools and data to managers.

### **C. Cooperating Agencies, Contracts, and Other Agency Assistance**

The U.S.G.S. will provide technical assistance and expertise in development of a searchable web site, led by U.S.G.S. webmaster Mary Whalen. This project is being coordinated with Projects 00414 and 99368 as well as with the in-house Restoration Office effort. It will also be coordinated with principal investigators, agency liaisons, and resource managers from state and federal agencies.

## **SCHEDULE**

### **A. Measurable Project Tasks for FY 00**

December 1, 1999

- a. Obtain 83 articles not currently at ARLIS
- b. Scan and convert abstracts of all articles into word processing format
- c. Convert bibliographies of articles and final reports to ProCite; add key words and abstracts
- d. Flag articles that will have data useful to resource managers

January 15, 2000

- a. Convert Project Data Base so it's searchable by key words
- b. Update data base with newly available final reports
- c. Install software for searching data and ordering reports from ARLIS
- d. Post bibliographies of articles and final reports onto web using new format

March 15, 2000

ESI maps to be posted onto the web site

SPRING (date to be determined)

Publication for resource managers to be completed

Copies of ESI maps to be made

Host open house for resource managers

### **B. Project Milestones and Endpoints**

The first publically available posting on the Internet of the new searchable system is scheduled for January 15, 2000 so that it can be introduced at the 2000 Annual Workshop. The system will be updated regularly so that latest articles and final reports will be posted.

**C. Completion Date**

September 30, 2000

**PUBLICATIONS AND REPORTS**

One or more booklets will be created and distributed to resource managers to explain what tools and data are available, how to access that information, and who to contact.

**PROFESSIONAL CONFERENCES**

Participation in professional conferences is not anticipated.

**NORMAL AGENCY MANAGEMENT**

As this is an effort to promote EVOS-funded data and results, it would not fall under normal agency management.

**COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

This project is being coordinated with Projects 00414 and 99368 as well as with the in-house Restoration Office effort to revise and improve the web site. It will also be coordinated with principal investigators, agency liaisons, and resource managers from state and federal agencies.

**PROPOSED PRINCIPAL INVESTIGATOR**

Joe Hunt, Communications Coordinator  
*Exxon Valdez* Oil Spill Trustee Council  
645 G Street, Suite 401  
Anchorage, Alaska 99501  
907-278-8012  
907-276-7178 (fax)  
<joe\_hunt@oilspill.state.ak.us>

**PRINCIPAL INVESTIGATOR**

Joe Hunt has 16 years of experience in Alaska in communications, journalism, public relations, publications, and advertising. He has been communications coordinator of the Trustee Council since 1996. Joe's role will be to oversee the overall development of the website, create publications, and coordinate the open house with resource managers.

**OTHER KEY PERSONNEL**

Mary Whalen  
U.S. Geological Survey  
Alaska Biological Science Center  
1011 E. Tudor Road  
Anchorage, AK 99503

**2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**  
October 1, 1999 - September 30, 2000

Revised -2-99  
Approved TC 8-9-99

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$6.0						
Travel		\$0.0						
Contractual		\$0.0						
Commodities		\$0.0						
Equipment		\$0.0						
Subtotal	\$0.0	\$6.0	LONG RANGE FUNDING REQUIREMENTS					
General Administration		\$0.9			Estimated FY 2001	Estimated FY 2002		
Project Total	\$0.0	\$6.9			\$0.0	\$0.0		
Full-time Equivalents (FTE)		0.1						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:								
<div style="text-align: right; margin-right: 50px;">           ADFG      12.9            DOI        6.9  <hr style="width: 100px; margin: 0 auto;"/>           PROJECT TOTAL      \$ 19.8         </div>								

**FY00**

Project Number: 00605  
Project Title: Information Transfer to Resource Managers, Stakeholders,  
and General Public  
Agency: DOI - U.S. Geological Survey

**FORM 3A  
TRUSTEE  
AGENCY  
SUMMARY**

Prepared:

October 1, 1999 - September 30, 2000

<p><b>FY00</b></p>	<p>Project Number: 00605          Project Title: Information Transfer to Resource Managers, Stakeholders,          and General Public          Agency: DOI - U.S. Geological Survey</p>	<p><b>FORM 3B          Personnel          &amp; Travel          DETAIL</b></p>
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# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		Proposed FY 2000
Description		
When a non-trustee organization is used, the form 4A is required.		
<b>Contractual Total</b>		\$0.0
<b>Commodities Costs:</b>		Proposed FY 2000
Description		
<b>Commodities Total</b>		\$0.0

**FY00**

Project Number: 00605  
 Project Title: Information Transfer to Resource Managers, Stakeholders,  
 and General Public  
 Agency: DOI - U.S. Geological Survey

FORM 3B  
 Contractual &  
 Commodities  
 DETAIL

Prepared:

October 1, 1999 - September 30, 2000

**FY00**

Project Number: 00605 Project Title: Information Transfer to Resource Managers, Stakeholders, and General Public Agency: EVOS Restoration Office
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### FORM 3B Equipment DETAIL

Prepared:

## 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000							
Personnel		\$0.0							
Travel		\$5.5							
Contractual		\$6.0							
Commodities		\$1.0							
Equipment		\$0.0							
Subtotal	\$0.0	\$12.5	LONG RANGE FUNDING REQUIREMENTS						
General Administration		\$0.4			Estimated FY 2001	Estimated FY 2002			
Project Total	\$0.0	\$12.9			\$0.0	\$0.0			
Full-time Equivalents (FTE)		0.0							
Dollar amounts are shown in thousands of dollars.									
Other Resources									
Comments:									

FY00

Prepared:

Project Number: 00605  
 Project Title: Information Transfer to Resource Managers, Stakeholders,  
 and General Public  
 Agency: Dept. of Fish & Game, EVOS Restoration Office

FORM 3A  
 TRUSTEE  
 AGENCY  
 SUMMARY

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
<b>In-house</b> Restoration Office staff time will be provided by Joe Hunt, Cherri Womac, and Paula Banks						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	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 2000
Resource managers & principal investigators attending the open house  Travel from: Juneau Cordova Kodiak Fairbanks Kenai Homer						0.0
						0.0
						0.0
		250.0	6	1	270.0	1,770.0
		210.0	3	1	435.0	1,065.0
		230.0	3	1	435.0	1,125.0
		195.0	3	1	135.0	720.0
		100.0	3	1	135.0	435.0
		130.0	2	1	90.0	350.0
						0.0
						0.0
Travel Total						\$5,465.0

**FY00**

Prepared:

Project Number: 00605  
Project Title: Information Transfer to Resource Managers, Stakeholders,  
and General Public  
Agency: Dept. of Fish & Game, EVOS Restoration Office

FORM 3B  
Personnel  
& Travel  
DETAIL

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

<b>Contractual Costs:</b>		Proposed
Description		FY 2000
Printing -- Booklet(s), 24 pages, 2 color, for resource managers and public		6.0
When a non-trustee organization is used, the form 4A is required.		
<b>Contractual Total</b>		<b>\$6.0</b>
<b>Commodities Costs:</b>		Proposed
Description		FY 2000
Open House expenses, including posters, slides, refreshments, audio-video rentals, scans, printing		1.0
<b>Commodities Total</b>		<b>\$1.0</b>

**FY00**

Prepared:

Project Number: 00605  
 Project Title: Information Transfer to Resource Managers, Stakeholders,  
 and General Public  
 Agency: Dept. of Fish & Game, EVOS Restoration Office

FORM 3B  
 Contractual &  
 Commodities  
 DETAIL

October 1, 1999 - September 30, 2000

FY00	Project Number: 00605 Project Title: Information Transfer to Resource Managers, Stakeholders, and General Public Agency: Dept. of Fish & Game, EVOS Restoration Office	FORM 3B Equipment DETAIL
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*Revision 7-16-99  
Approved TC 8-9-99*

## **Kodiak Island Youth Area Watch**

Project Number: 00610

Restoration Category: General Restoration

Proposer: P. Brown-Schwalenberg/CRRC

Lead Trustee Agency: ADFG

Cooperating Agencies: None

Alaska SeaLife Center: No

New or Continued: New

Duration: 1st yr.  
3 yr. project

Cost FY 00: \$61.8

Cost FY 01: \$61.8

Cost FY 02: \$61.8

Geographic Area: Kodiak Island

Injured Resource/Service: All

### **ABSTRACT**

In FY 99, Chugach Regional Resources Commission collaborated with the Kodiak Island Borough School District to institute an internship program within the Community Involvement Project (/052A), involving one student from each of the following communities: Akhiok, Larsen Bay, Old Harbor, Port Lions, Kodiak and Karluk. This project will expand the involvement and objectives of the internship program by collaborating with four research projects on Kodiak Island: ongoing Project 00245/Harbor Seal Biosampling, proposed Project 00482/PSP Field Test Kit, a yet-to-be identified project with the Fisheries Industrial Technical Center, and an algae testing project with Dr. Gerry Plumley, University of Alaska Fairbanks, to find the origin of PSP funded by the Alaska Science and Technology Foundation.

## **INTRODUCTION**

The Youth Area Watch program instituted in the Prince William Sound and lower Cook Inlet has been one of the most popular and supported projects that the Trustee Council has implemented. The spill area does not strictly include only those areas though, but instead encompasses Kodiak Island and the Alaska Peninsula. The villages on Kodiak Island have all seen results from this Youth Area Watch and seen the interest expressed by Kodiak Island youth in the Community Involvement Project Internship Program. It is because of this that the Kodiak Island Borough School District and Chugach Regional Resources Commission have submitted this proposal.

Children in high school will be selected to participate depending on their scholastic skills, interest in science, and ability to commit to the project. This project will encourage youth, primarily Alaska Natives, to participate in the sciences and possibly go on to pursue careers in the science field. It will be a coordinated effort between the school district, CRRC, and tribal councils throughout the Island.

Four core research projects, two of which are funded by the Trustee Council, will be the heart of the program. These project include 00482, Field-Testing of PSP Test Kits for Subsistence Use. This proposal was submitted to the Trustees and if funded will heavily rely on the youth in this project to carry out field tests. Secondly, 00245, Harbor Seal Biosampling, will train and involve Kodiak Island Youth Area Watch participants in the program. They will be trained in how to conduct a biosample, where to ship the sample, and what the uses of the seal are. Third, Dr. Gerry Plumley, University of Alaska-Fairbanks, has received funding from the Alaska Science and Technology Foundation to test algae for a possible connection to the infection of PSP to shellfish. He has indicated that Youth Area Watch participants would play a large role in the formation, implementation, and success of that project. Finally, Dr. Scott Smiley of the Kodiak Fisheries Technology Center has indicated an interest in involving youth in some of the commercial fisheries studies that take place around Kodiak Island.

In addition, students will select a local project to conduct. Possible connections to traditional knowledge, and integrating TEK data into a format traditionally used in western science are an option. Teri Schneider, Cultural Coordinator at the Kodiak Island School District, is very interested in pursuing this integration. It is an option to implement their own small-scale research. It is a hope that this would be presentable at the January 2000 Restoration Workshop.

## **NEED FOR PROJECT**

### **A. Statement of Problem**

Kodiak Island Youth Area Watch would share much of the same values and objectives of that as the original Youth Area Watch. The commitment would be to assist in the restoration of the spill area through the collection and requisite samples and data for principal investigators of research projects. Research dollars are often scarce – the

assistance of labor through this project to the four core projects would be an invaluable asset to the overall restoration effort.

The public aspect of this would also be invaluable to the Trustee Council. Youth involved in science, especially Alaska Natives, has been difficult to achieve in many cases. This project give students hands-on experience and an avenue to achieve goals that may before have seemed impossible. Youth Area Watch has received tremendous support throughout the spill area and beyond and the benefits of this project are felt in many different arenas. The Trustee Council would be supporting a win-win situation by funding this project.

#### **B. Rationale/Link to Restoration**

The Kodiak Island Youth Area Watch will work in primarily three areas. First, harbor seals disastrously affected by the oil spill are being studied under 00245. YAW participants would assist in this recovery effort of the Alaska Native Harbor Seal Commission and Trustee Council. Secondly, the enhancement of safe shellfish to eat would benefit the use of subsistence greatly; consequently, assisting in the recovery of the subsistence service by providing a replacement subsistence resource for harvesters. The field test and algae project both will assist in making shellfish safer for everyone. Finally, the Fisheries Technology Center in Kodiak has multiple research projects on commercial fishing in the Kodiak Island region. The willingness of the Center to integrate YAW in one of their projects will assist in the recovery of the commercial fishing service injured by the oil spill.

The public/youth involvement through this project in the restoration process will assist the Trustee Council in their mission to inform and involve the public regarding the restoration program.

#### **C. Location**

Kodiak Island Youth Area Watch will take place in the Kodiak Island communities of Akhiok, Old Harbor, Karluk, Larsen Bay, Port Lions, Ouzinkie, and Kodiak. Site teachers will be recruited through the school district and Teri Schneider will serve as the coordinator for the program for the school district. Hugh Short and Elmer Moonin will work with the school district and provide outreach to tribal councils throughout Kodiak Island, utilizing the Community Involvement/Traditional Ecological Knowledge Project. Additionally, TEK will be integrated into the program with the assistance of TEK Specialist, Dr. Henry Huntington.

### **COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE**

In addition to assisting in research, community involvement and the utilization of traditional ecological knowledge are at the heart of this program. Tribal councils, schools, communities, regional organizations, and researchers will all be collaborating to ensure that this project is a success. CRRC will work closely to ensure that each of the

tribal councils where there is YAW participants will have a voice in the research and curriculum of the program. Traditional ecological knowledge will be integrated into the projects that student's design and collaborating researchers will be encouraged to utilize TEK on their particular projects.

## **PROJECT DESIGN**

### **A. Objectives**

Selected students in the identified communities will participate in the project to accomplish the following objectives:

1. Research project personnel interact with students, communities, and staff.
2. Identify all research and data collection activities.
3. Orient researchers on working with students.
4. Conduct research with the four projects.
5. Update MOA between CRRC and KIBSD.
6. Complete site teacher training.
7. Conduct school orientations for student in YAW.
8. Complete student project training with tribal council and site teacher.
9. Facilitate project follow-up training with site teachers.

## **METHODS**

CRRC will update the current sub-contract with the Kodiak Island Borough School District to reflect the expansion of project from the previous years Internship program. Agreements will be made with tribal councils throughout the island to ensure their meaningful involvement in the project. Researchers involved will sign contracts to ensure their follow-through of involving the youth in their projects.

Teri Schneider, Cultural Coordinator with the Kodiak Island Borough School District, and Elmer Moonin with CRRC, will work cooperatively to plan the involvement and logistics of youth and researchers field work. Additionally, training will take place with all involved parties to ensure that this project will work for everyone.

We will utilize the Chugach School Districts developed tool for selecting applicants for the program. Up to 13 students will be selected in the first year of the project. While distribution may vary according to interest and ability of students that apply, it is expected that the distribution will be as follows: two from Kodiak, two from Old Harbor, two from Larsen Bay, one from Karluk, two from Port Lions, two from Ouzinkie and two from Akhiok.

Prior to the school year in the fall, participating YAW teachers will congregate in Kodiak to conduct a two-day training on what the program will encompass. We will ask that those researchers who are available to attend as well. Since funding will not yet be available, CRRC will front the cost of this training. Protocols from principal

investigators and program details will be discussed. In addition to the site teachers, we will invite tribal council representatives.

Three of the coordinating projects, field test PSP kit, algae testing, and biosampling, will take place geographically close to the participant's communities. It will be the responsibility of the site teacher and participants to determine field schedules. Harbor seal biosampling will require two training sessions and coordination with local seal harvesters. The commercial fishing project will require coordinated efforts on contracted vessels and such. This will be negotiated between the Fish Tech Center and CRRC. Schedules will be determined when appropriate. Quarterly, students and support staff will congregate in Kodiak for a day to discuss progress and evaluate the program. Training will be on going and project objectives will be met.

Ongoing projects will include:

- 1) PSP Field Testing, 00482 – Jellet Biotech – Dr. Jellet and Dr. Roberts are selecting sites throughout the spill area to field test their PSP testing kit to be used in place of the existing mouse bioassay. Students in this program will test shellfish harvests from their community and coordinate with Jellet Biotech to ensure that the project has the data it needs.
- 2) Harbor Seal Biosampling, 00245 – Alaska Native Harbor Seal Commission – YAW will work with local harvesters involved in the program to biosample harbor seals caught for subsistence purposes. Mitch Simeonoff, Akhiok, will work with CRRC and the school district to train and involve students.
- 3) Algal PSP Testing – Dr. Gerry Plumley – University of Alaska Fairbanks – Dr. Plumley will train students in how to test algae in their area for algal PSP infection. This project will provide data to Dr. Plumley regarding where PSP originates.
- 4) Dr. Scott Smiley – Fisheries Technical Center - This project will involve the commercial fisheries. The exact project has yet to be identified, but a commitment from Dr. Smiley has been received.

In addition to these four core projects, students will work with their tribal council or local site teacher to identify a local research project to implement that is achievable. We will encourage the tribal councils to identify an area of TEK that may be of interest and possibly try to integrate that with western science methods. TEK Specialist Henry Huntington will be called upon to assist in this effort.

School credit for the youths involvement in this project will be strongly sought after. We anticipate allowing credit to those who participate for the whole length of the project. This will encourage more participation and give credibility to the project among site teachers and students who are thinking about apply to the project. It is anticipated that this project will be strongly popular and receive island-wide attention for the tremendous efforts it will accomplish.

## COOPERATING AGENCIES

The Chugach Regional Resources Commission will serve as the administering agency for this project and work closely with the Kodiak Island Borough School District to implement the project. CRRC has a positive history with the Alaska Department of Fish and Game and expects to continue that partnership through this project. We will update our current contract with the school district to reflect the new changes to the program and work to coordinate and collaborate on the successful implementation of the project.

CRRC has a history working with tribal councils on Kodiak Island additionally. We implemented and completed the Subsistence Service Assessment with tribal councils on Kodiak Island, hiring many employees directly. We have a strong partnership with the Community Involvement Project and have demonstrated a commitment to involving all Alaska Native organizations in the restoration process.

A partnership would be created with the University of Alaska system at the Fisheries Technical Center and Dr. Smiley will work to integrate his YAW project with the on-going tasks that need to be completed.

## SCHEDULE

### A. Measurable Project Tasks for FY 00

July 1, 1999 – August 1, 1999	Confirm research and data collection activities
August 15-16, 1999	Site teacher, tribal, and researcher orientation
September 1 – 18, 1999	School site orientations
September 15 – 30, 1999	Students selected
October 15 – 31, 1999	Student orientation and training
November 1, 1999 – July 30, 2000	Students participate in research activities
March 1, 2000	Site teachers send data to project PI
March 1 – 15, 2000	Site teacher follow-up training
June 2000	Project Coordinator sends data to PI
June 2000	Students complete FY 00 projects

#### On-going activities

October 1999 to July 2000	Students collect shellfish samples for field test
October 1999 to July 2000	Students analyze algae
October 1999 to July 2000	Students conduct harbor seal biosamples
October 1999 to June 2000	Students conduct their local research project
October 199 to October 2000	PI interact and share information with students

### B. Project Milestones and Endpoints

October 17, 1999	Students selected
October 30, 1999	Protocol training complete

November 1, 1999	Students conduct project activities
March 1, 2000	Data/samples to PI
June 1, 2000	Data/samples to PI and reports complete

#### **D. Completion Date**

Objective identified in the project design will serve as guidelines for community involvement within the civil settlement throughout the life of the restoration effort. It is expected that the YAW will be completed upon termination of the restoration effort.

#### **PUBLICATIONS AND REPORTS**

No specific publications are planned at this point.

#### **PROFESSIONAL CONFERENCES**

Youth will participate in the Restoration Workshop in January 2000.

#### **NORMAL AGENCY MANAGEMENT**

Not applicable.

#### **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

This project will work closely with the Community Involvement/Traditional Ecological Knowledge Project (00052) and the Harbor Seal Biosampling Project (00245). If funded, this project will work closely with PSP Field Testing (00482).

#### **PROPOSED PRINCIPAL INVESTIGATOR**

Patty Brown-Schwalenberg  
Executive Director  
Chugach Regional Resources Commission  
4201 Tudor Centre Dr., Ste. 300  
Anchorage, AK 99508  
(907) 562-6647  
fax: 562-4939  
[crrcomm@alaska.net](mailto:crrcomm@alaska.net)

#### **PRINCIPAL INVESTIGATOR**

Patty Brown-Schwalenberg is the Executive Director of Chugach Regional Resources Commission. She maintains all administrative authority over CRRC programs and projects. She has extensive experience in project administration, tribal relations, and managing budgets. Ms. Schwalenberg will be responsible for all expenditures, contracts, and project management.

**2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**  
October 1, 1999 - September 30, 2000

*Revision 14-99*  
*Approved 72 8-9-99*

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$0.0						
Travel		\$0.0						
Contractual		\$57.8						
Commodities		\$0.0						
Equipment		\$0.0						
Subtotal	\$0.0	\$57.8	LONG RANGE FUNDING REQUIREMENTS					
General Administration		\$4.0			Estimated FY 2001	Estimated FY 2002		
Project Total	\$0.0	\$61.8			\$67.7	\$67.7		
Full-time Equivalents (FTE)		0.0						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:								

**FY00**

Project Number: 00610  
Project Title: Kodiak Island Youth Area Watch  
Agency: Alaska Department of Fish and Game

**FORM 3A  
TRUSTEE  
AGENCY  
SUMMARY**

**2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**  
October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
Name	Position Description					
						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	
Personnel Total						\$0.0

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2000
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
Travel Total						\$0.0

**FY00**

Prepared: 7-14-99

Project Number: 00610  
Project Title: Kodiak Island Youth Area Watch  
Agency: Alaska Department of Fish and Game

**FORM 3B**  
**Personnel**  
**& Travel**  
**DETAIL**

**October 1, 1999 - September 30, 2000**

**FY00**

**Project Number: 00610**  
**Project Title: Kodiak Island Youth Area Watch**  
**Agency: Alaska Department of Fish and Game**

**FORM 3B**  
**Contractual &**  
**Commodities**  
**DETAIL**

**2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**  
**October 1, 1999 - September 30, 2000**

New Equipment Purchases:		Number of Units	Unit Price	Proposed FY 2000
Description				
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		New Equipment Total		\$0.0
Existing Equipment Usage:		Number of Units	Inventory Agency	
Description				

**FY00**

**Project Number: 00610**  
**Project Title: Kodiak Island Youth Area Watch**  
**Agency: Alaska Department of Fish and Game**

**FORM 3B**  
**Equipment**  
**DETAIL**

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$0.0						
Travel		\$13.3						
Contractual		\$38.8						
Commodities		\$0.0						
Equipment		\$0.0						
Subtotal	\$0.0	\$52.1	LONG RANGE FUNDING REQUIREMENTS					
Indirect		\$5.7			Estimated FY 2001	Estimated FY 2002		
Project Total	\$0.0	\$57.8			\$60.0	\$60.0		
Full-time Equivalents (FTE)		1.0						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:								

**FY00**

Prepared: 7-14-99

Project Number: 00610  
 Project Title: Kodiak Island Youth Area Watch  
 Name: Chugach Regional Resources Commission

**FORM 4A  
 Non-Trustee  
 SUMMARY**

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:				Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000	
Name	Position Description							
							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	Proposed FY 2000
Description								
Village - Kodiak - Anchorage ( Restoration Workshop) 6 communities			0.5	16	45	0.0	8.0	
Kodiak - Akhiok			0.1	3	3	0.1	0.6	
Kodiak - Old Harbor			0.1	3	3	0.1	0.6	
Kodiak - Ouzinkie			0.1	3	3	0.1	0.6	
Kodiak - Larsen Bay			0.1	3	3	0.1	0.6	
Kodiak - Port Lions			0.1	3	3	0.1	0.6	
Kodiak - Karluk			0.1	3	3	0.1	0.6	
Anchorage - Kodiak			0.3	3	8	0.1	1.7	
							0.0	
							0.0	
							0.0	
							0.0	
Travel Total							\$13.3	

**FY00**

Prepared: 7-14-99

Project Number: 00052  
 Project Title: Community Involvement/Traditional Ecological Knowledge  
 Name: Chugach Regional Resources Commission

FORM 4B  
 Personnel  
 & Travel  
 DETAIL

**October 1, 1999 - September 30, 2000**

**FY00**

Project Number: 00610  
Project Title: Kodiak Island Youth Area Watch  
Name: Chugach Regional Resources Commission

7 of 8

**October 1, 1999 - September 30, 2000**

[illegible]

**FY00**

Project Number: 00610  
Project Title: Kodiak Island Youth Area Watch  
Name: Chugach Regional Resources Commission

**FORM 4B**  
**Equipment**  
**DETAIL**





## Planning for Long-Term Research and Monitoring Program

Project Number: 00630

Restoration Category: Research/Monitoring

Proposer: Restoration Office, *Exxon Valdez* Oil Spill Trustee Council

Lead Trustee Agency: Restoration Office (ADFG)

Cooperating Agencies: ADNR

Alaska SeaLife Center: No

Duration: 1st year of a 3-year project

Cost FY 00: \$84,700

Cost FY 01: \$50,000

Cost FY 02: \$25,000

Geographic Area: Entire oil-spill region

Injured Resource/Service: All injured resources and services

### ABSTRACT

In March 1999 the Trustee Council agreed to dedicate \$115 million of Restoration Reserve funds in support of long-term monitoring and research in the spill area and adjacent northern Gulf of Alaska. Development of a draft plan for what is tentatively named the Gulf Ecosystem Monitoring (GEM) program was initiated in FY 99 and will continue through FY 02. In FY 00, the main steps will be to present a draft plan for comment by the general public and spill-area stakeholders, coordinate and refine the plan in association with such other large-scale programs as the U.S. Global Ocean Ecosystem Dynamics (GLOBEC) and the North Pacific Marine Science Organization (PICES), provide a revised draft plan for review by the National Research Council (see Project 00360), and contribute to development of the *FY 01 Invitation* which will request proposals for projects needed to accomplish the transition to the long-term program. This project will be accomplished through the combined efforts of the Restoration Office and Chief Scientist.

## INTRODUCTION

In March 1999, the *Exxon Valdez* Oil Spill Trustee Council allocated at least \$115 million from the Restoration Reserve account in support of long-term research and monitoring in the northern Gulf of Alaska. Accordingly, the Restoration Office staff and representatives of Trustee agencies have begun to develop a plan for what is to be called the Gulf Ecosystem Monitoring (GEM) program, which will be designed to operate on a permanent basis. The mission of the GEM program is to foster a productive, healthy, and biologically diverse marine ecosystem in the northern Gulf of Alaska through greater understanding of how its marine productivity is influenced by natural changes and human activities. The goals of GEM are to: track lingering oil-spill injury, distinguish natural variability from human influences in the marine ecosystem, develop new fish and wildlife management tools, provide information on the status, trends, and health of fisheries and other marine resources, identify important marine habitats, foster efficiency through interagency coordination of monitoring and research activities, and promote local stewardship by and involvement of stakeholders.

It is anticipated that a first conceptual draft of the GEM plan will be available for public review and comment by September 30, 1999. During the years FY 00 through FY 02, this plan will be refined and become increasingly detailed, leading to the implementation of GEM in the field starting in FY 03 (October 0002). This Detailed Project Description describes the first of three years of planning activities leading toward implementation of GEM.

## NEED FOR THE PROJECT

### A. Statement of the Problem

Development of a successful GEM program is a complex undertaking, which has a number of aspects and requirements and which will go through several iterations. First, it is essential that the plan be based on input from biologists, oceanographers, and other scientists and from natural resource managers who are familiar with marine ecosystems, with the mechanics, problems, and applications of long-term ecological monitoring and research programs, and with existing agency and university monitoring and research programs and databases. Second, it is essential that stakeholders and the general public participate in designing the program and that they have confidence that implementation of GEM will lead to the sustained use and conservation of the northern Gulf of Alaska marine ecosystem. Finally, the GEM program must receive thorough independent peer review sufficiently in advance of implementation that it can be modified and improved in response to review comments and recommendations. In order to meet the goal of implementation in FY 03, it is necessary that progress be made toward satisfying these requirements in FY 00.

### B. Rationale/Link to Restoration

In deciding to allocate a significant portion of the Restoration Reserve for long-term monitoring and research, the Trustee Council explicitly recognized that complete recovery from the oil spill will not occur for decades and that through long-term observation and, as needed, restoration actions, injured resources and services could be fully restored. The Trustee Council further recognized that conservation and improved management of these resources and services will require a substantial ongoing investment to improve understanding of the biology and marine and coastal ecosystems that support the services as well as the people of the spill region. Hence, the Trustee Council made a commitment to development of a long-term research and monitoring program for the spill region that will inform and promote the full recovery and restoration, conservation, and improved management of spill-area resources.

### **C. Location**

Monitoring and research carried out under the GEM program will take place mostly in the coastal and marine environment within the oil-spill area, and, to the extent necessary, in adjacent parts of the northern Gulf of Alaska. Most of the planning activities described in this proposal will take place in Anchorage and in spill-area communities.

## **COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE**

The decision by the Trustee Council to use a significant portion of funds in the Restoration Reserve for long-term research and monitoring was made after extensive public review and comment, including meetings in most spill-area communities, in FY 98 and 99. The Trustee Council's Community Involvement Coordinator (Project 1052) and an expert in traditional ecological knowledge have participated in early discussions which will lead to a first draft of the GEM plan. In FY 00, a series of visits to spill-area communities, public meetings, and meetings with stakeholders will further involve the public in development of GEM. In addition, one of the purposes of GEM is to involve communities in gathering data and other information, including local and traditional knowledge, that contribute to understanding of the spill-area ecosystem.

## **PROJECT DESIGN**

### **A. Objectives**

The mission of the GEM program is to foster a productive, healthy, and biologically diverse marine ecosystem in the northern Gulf of Alaska through greater understanding of how its marine productivity is influenced by natural changes and human activities. Accordingly, the goal of this project is to design a common-sense, scientifically rigorous, cost-effective program ready for implementation in FY 03. Specific objectives are to:

- (1) present a conceptual draft GEM plan to the public and various stakeholders for review,

discussion, and comment;

(2) consult and coordinate with biologists, oceanographers, and other scientists, especially those involved with prior or ongoing agency and university research and monitoring programs, plans, projects, and databases in the Gulf of Alaska and north Pacific Ocean;

(3) obtain independent peer review of one or more versions of the draft GEM plan;

(4) through FY 01 and 02 *Invitations to Submit Proposals* and other means (e.g., contracts), conduct projects to obtain information and advice needed to plan for and accomplish the transition to the long-term program; and

(5) prepare a final GEM plan and contribute to development of the *FY 03 Invitation to Submit Proposals* to invite proposals to implement the plan starting in FY 03.

## **B. Methods**

The methods described below are organized by project objective and only pertain to activities proposed to be carried out in FY 00:

(1) Present plan to the public. A conceptual draft of the GEM plan should be ready for public review, discussion, and comment by September 30, 1999. When that draft is available, the Restoration Office staff will schedule a series of briefings for the general public and for various stakeholders (e.g., fishing and environmental organizations, regional citizen advisory councils, local communities). The purpose of the briefings will be to increase awareness of the GEM plan and to obtain feedback on the plan and how to improve it. These meetings, which will be carried out primarily during October and November 1999, will draw on various combinations of Restoration Office and agency staff under the leadership of the Trustee Council's executive director and chief scientist. In addition to printing the draft GEM plan, fulfilling this objective may require development of additional materials (e.g., audio-visuals, brochures or booklets) to aid in public review of the plan.

(2) Consult with scientists. Once a conceptual draft of the GEM plan is complete, it will be necessary to gather additional information that will enable more detailed versions of the plan to be developed. For example, the final version of the plan will need to include specific information on samples and measurements to be obtained and the locations and timing of field work. It also will be necessary to have detailed information about ongoing data gathering efforts so that GEM can be tailored to complement and take advantage of ongoing work, thus achieving greater scientific integration, applicability to management needs, cost savings, and efficiency. The needed background information will be obtained primarily through a series of consultations between the Trustee Council's chief scientist or science coordinator and individual scientists, especially those involved in or experienced with prior or ongoing large-scale monitoring and research programs and projects in the northern Gulf of Alaska or the north Pacific ocean (e.g.,

GLOBEC, PICES, FOCI). These consultations, which will mostly take place during October through December, will include meetings with agency natural resource managers to help ensure that results from GEM will help address managers' needs for marine ecological information.

(3) Independent peer review. It is essential that appropriate versions of the GEM plan are subjected to independent peer review. Such reviews will be used to improve the scope and content of the plan, plus enhance its profile and credibility nationally. The needed reviews will be accomplished in two ways. First, the Trustee Council's team of "core" peer reviewers will review the draft plan or specific aspects of the draft plan as requested by the chief scientist. Second, it is anticipated that the National Research Council's (NRC) Polar Research Board and Board on Environmental Science and Technology will be invited to review a draft of GEM starting in January 2000 (see Project 00360). This January 2000 draft would be revised from the September 1999 draft to take into account feedback from the public, stakeholders, the scientific community, and natural resource management agencies. If the NRC review is funded, a special review panel will be convened in FY 00 and a published report and recommendations will be produced in FY 01. Throughout this process, the Trustee Council's executive director and science coordinator will serve as the primary liaisons to the NRC staff and review panel. The chief scientist will assist in this process as needed.

(4) Transition Projects. The *FY 00 Invitation to Submit Proposals* invited proposals that would assist in the transition to a long-term research and monitoring program. Several such proposals were submitted and some of them may be funded in FY 00. Examples of the types of work needed are development of efficient monitoring protocols for seabird productivity, harbor seal population trends, and data management. The *FY 01 Invitation*, which is scheduled to be printed in February 2000, will need to include a similar--but probably more detailed--request. Development of the appropriate request will require considerable effort and will specifically require additional consultation by Restoration Office staff with the chief scientist and core peer-review team. This probably will be accomplished in conjunction with the FY 00 Restoration Workshop, which is scheduled for late January 2000.

There may be need for additional time-sensitive small projects outside of the annual work plan cycle. An example of such a project would be a preliminary consultation with a statistician in regard to the overall sampling design of the monitoring component of GEM. Information of this type may be accomplished through contracts from the Restoration Office.

(5) Final Plan Development. This objective will be addressed in FY 02.

### **C. Cooperating Agencies, Contracts, and Other Agency Assistance**

Representatives of all Trustee agencies have been or will be involved in some way in developing the draft GEM plan, in presenting it to the public, or in refining future versions of it. In addition to a direct role in developing the GEM plan, agency representatives will be involved in the continuing process of identifying and describing prior and existing monitoring and research

programs, plans, projects, and databases relevant to the northern Gulf of Alaska. There may be need for one or more small personal services contracts to obtain timely information needed in the further development of the GEM plan (e.g., with a statistician in regard to the overall sampling design of GEM monitoring).

Beyond the participation of Trustee agencies, there will be consultations with other institutions and programs involved in monitoring and research in the north Pacific Ocean. These include, for example, the North Pacific Marine Science Organization (PICES) and the Global Oceans Ecosystems Dynamics (GLOBEC) Northeast Pacific project, which is sponsored jointly by the National Science Foundation and National Oceanic and Atmospheric Administration.

## **SCHEDULE**

### **A. Measurable Project Tasks for FY 00**

October 1999	<ul style="list-style-type: none"><li>-Print and release conceptual draft of GEM to public</li><li>-Produce any supplementary materials needed for public presentations</li><li>-Begin series of stakeholder and public meetings in spill-area communities</li><li>-Continue technical consultations with agency and academic contacts</li><li>-Interact with National Research Council (NRC) staff to facilitate implementation of Project 00360, if funded</li><li>-Formal presentation of the GEM plan to the Public Advisory Group and Trustee Council</li></ul>
November	<ul style="list-style-type: none"><li>-Conclude first round of stakeholder and public meetings</li></ul>
December	<ul style="list-style-type: none"><li>-Conclude preliminary technical consultations with agency and academic contacts</li><li>-As needed, enter into small contracts for personal services to address key, time-sensitive information gaps</li></ul>
January	<ul style="list-style-type: none"><li>-Prepare revised draft of GEM plan and circulate to core peer reviewers</li><li>-Address peer review comments and revise draft plan as needed</li><li>-Present revised draft conceptual plan to NRC and facilitate their review by providing other background materials, briefings, etc.</li><li>-Meet with core peer reviewers at Restoration Workshop to discuss transition projects to be requested in the <i>FY 01 Invitation to Submit Proposals</i></li></ul>
February	<ul style="list-style-type: none"><li>-Print and distribute <i>FY 01 Invitation to Submit Proposals</i></li></ul>
March-September	<ul style="list-style-type: none"><li>-Continue interactions with NRC staff and review panel as needed</li><li>-Continue consultations with stakeholders and scientific and agency contacts as needed to further develop content of GEM plan</li></ul>

### **B. Project Milestones and Endpoints**

Progress toward project objectives in FY 00 will be completed according to the schedule above. The following overall milestones are key:

February 01	-Print and distribute <i>FY 02 Invitation to Submit Proposals</i> , which will request a final series of transition projects prior to GEM implementation
Spring	-Publication of NRC report and recommendations (if Project 00360 is funded)
	-Review and consideration of NRC report and recommendations
Summer	-Prepare revised draft GEM plan, incorporating NRC comments and additional technical detail as deemed appropriate and necessary
February 02	-Print and distribute <i>FY 03 Invitation to Submit Proposals</i> , which will request projects for implementation of GEM plan in FY 03
March-September	-Prepare, print, and distribute final version of GEM plan

## **PUBLICATIONS AND REPORTS**

There will be no annual report on FY 00 activities. The primary product in FY 00 will be the revised draft conceptual GEM plan presented to the NRC in January 2000.

## **PROFESSIONAL CONFERENCES**

There is need for travel support for meetings and consultations in spill-area communities and at other localities as needed for scientific and agency contacts. No presentations are anticipated at professional conferences, although opportunities may arise to create awareness about the GEM program at key scientific gatherings.

## **NORMAL AGENCY MANAGEMENT**

The Trustee Council directed the executive director and chief scientist to develop a plan for long-term monitoring and research (i.e., GEM) in a resolution adopted on March 1, 1999, in regard to the expenditure of Restoration Reserve funds. In addition, public information and participation is an explicit requirement of the October 1991 settlement. Thus, this project is something that is appropriately carried out by the Restoration Office.

## **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

This project will be fully coordinated with and among Trustee agencies, scientific peer reviewers, the Public Advisory Group, and others. Part of the January 2000 Restoration Workshop will be devoted to briefing principal investigators and others on the status of the GEM plan.

Development of the GEM program represents the streamlining and integration of the current restoration program into a form that can be sustained on a multi-decadal time scale.

## **PROPOSED PRINCIPAL INVESTIGATOR**

Molly McCammon, Executive Director  
*Exxon Valdez* Oil Spill Trustee Council  
645 G Street, Suite 401  
Anchorage, Alaska 99501  
907-278-8012  
907-276-7178 (fax)  
<mollym@oilspill.state.ak.us>

Dr. Robert Spies, Chief Scientist  
*Exxon Valdez* Oil Spill Trustee Council  
Applied Marine Sciences  
4749 Bennett Drive, Suite L  
Livermore, California 94550  
925-373-7142  
925-373-7834 (fax)  
<spies@amarine.com>

## **PRINCIPAL INVESTIGATOR**

Ms. McCammon has 25 years of experience in Alaska in recreation and tourism, journalism, communications, and public policy, emphasizing natural resource issues. She has been executive director of the Trustee Council since 1994.

Dr. Spies has 35 years of experience as a scientist in marine pollution and toxicology, the effects of petroleum on marine organisms, and benthic ecology. He is president of Applied Marine Sciences, Inc. and has been the Trustee Council's chief scientist since 1991.

## **OTHER KEY PERSONNEL**

Science Coordinator (to be named)  
*Exxon Valdez* Oil Spill Trustee Council  
645 G Street, Suite 401  
Anchorage, Alaska 99501  
907-278-8012  
907-276-7178 (fax)

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

*Approved TC 99*

Budget Category:	Authorized FY 1999	Proposed FY 2000	PROPOSED FY 2000 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
				\$20.5	\$64.2			
Personnel	\$0.0	\$0.0						
Travel	\$0.0	\$15.0						
Contractual	\$0.0	\$60.0						
Commodities	\$0.0	\$5.5						
Equipment	\$0.0	\$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	\$0.0	\$80.5			Estimated FY 2001	Estimated FY 2002		
General Administration	\$0.0	\$4.2						
Project Total	\$0.0	\$84.7			\$50.0	\$25.0		
Full-time Equivalents (FTE)								
			Dollar amounts are shown in thousands of dollars.					
Other Resources								

Comments:

**FY00**

Prepared: 7/7/99

Project Number: 00630

Project Title: Planning for Long-Term Research & Monitoring Program

Lead Agency: ADFG/Restoration Office

FORM 2A  
MULTI-TRUSTEE  
AGENCY  
SUMMARY

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$0.0						
Travel		\$15.0						
Contractual		\$0.0						
Commodities		\$5.5						
Equipment		\$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	\$0.0	\$20.5			Estimated FY 2001	Estimated FY 2002		
General Administration		\$0.0						
Project Total	\$0.0	\$20.5						
Full-time Equivalents (FTE)		0.0						
Dollar amounts are shown in thousands of dollars.								
Other Resources								

Comments:

**FY00**

Prepared: 7/7/99

Project Number: 00630

Project Title: Planning for Long-Term Research & Monitoring  
Program

Agency: ADFG / Restoration Office

FORM 3A  
TRUSTEE  
AGENCY  
SUMMARY

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
Name	Position 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	Proposed FY 2000
Description						
Travel for Restoration Office staff and other personnel as needed for National Research Council review sessions and public/ stakeholder presentation meetings.						15.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Travel Total						\$15.0

**FY00**

Prepared: 7/7/99

Project Number: 00630  
 Project Title: Planning for Long-Term Research & Monitoring Program  
 Agency: ADFG / Restoration Office

**FORM 3B  
 Personnel  
 & Travel  
 DETAIL**

October 1, 1999 - September 30, 2000

<p><b>FY00</b></p>	<p>Project Number:00630          Project Title: Planning for Long-Term Research &amp; Monitoring Program          Agency: ADFG</p>	<p><b>FORM 3B</b>  <b>Contractual &amp; Commodities</b>  <b>DETAIL</b></p>
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October 1, 1999 - September 30, 2000

**FY00**

**FORM 3B**  
**Equipment**  
**DETAIL**

5 of 9

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		\$0.0						
Travel		\$0.0						
Contractual		\$60.0						
Commodities		\$0.0						
Equipment		\$0.0						
Subtotal	\$0.0	\$60.0	LONG RANGE FUNDING REQUIREMENTS					
General Administration		\$4.2			Estimated FY 2001	Estimated FY 2002		
Project Total	\$0.0	\$64.2						
Full-time Equivalents (FTE)		0.0						
Dollar amounts are shown in thousands of dollars.								
Other Resources								
Comments:								

**FY00**

Prepared: 7/7/99

Project Number: 00630  
 Project Title: Planning for Long-Term Research & Monitoring  
 Program  
 Agency: ADNR

**FORM 3A  
 TRUSTEE  
 AGENCY  
 SUMMARY**

# 2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
Name	Position Description					
						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	Proposed FY 2000
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
Travel Total						\$0.0

**FY00**

Prepared: 7/7/99

Project Number: 00630  
 Project Title: Planning for Long-Term Research & Monitoring Program  
 Agency: ADNR

FORM 3B  
 Personnel  
 & Travel  
 DETAIL

October 1, 1999 - September 30, 2000

When a non-trustee organization is used, the form 4A is required.	<b>Contractual Total</b>	<b>\$60.0</b>
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Project Number: 00630  
Project Title: Planning for Long-Term Research & Monitoring  
Program  
Agency: ADNR

Prepared: 7/7/99

October 1, 1999 - September 30, 2000

**FY00**

# FORM 3B Equipment DETAIL