19.09.04 (4 of 4)

19.09.04

01476

approved TC 8-3-00
Revision 7-7-00

Effects of Oiled Incubation Substrate on Pink Salmon Reproduction

Project Number:	01476
Restoration Category:	Research
Proposer:	R. Heintz/NOAA
Lead Trustee Agency:	NOAA
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	Cont'd
Duration:	3rd yr. 3 yr. project
Cost FY 01:	$94.2
Cost FY 02:	$39.0
Geographic Area:	Little Port Walter
Injured Resource/Service:	Pink salmon

ABSTRACT

Populations are maintained through successful reproduction; this project is designed to determine if exposure to oil impairs pink salmon reproduction. Under Part A, the ability of the parental generation (P1) to produce offspring (F1) will be measured. The P1 was exposed when they incubated in 1998; the F1 will incubate in clean water beginning in FY 01. Part B extends Part A by measuring the ability of the F1 to produce viable offspring (F2) in 2002. A diminished ability to produce the F2 generation represents a genetic effect transmitted to unexposed generations. Corroborating evidence for parental and genetic effects of oil is increasing. This project will demonstrate the extent of these grave and unanticipated effects of oil pollution. [NOTE: This project also requested funds ($36,000) for FY 03.]

INTRODUCTION

This project measures the delayed effects of oil exposure on pink salmon reproduction. Evidence has been accumulating that delayed effects of oil exposure extend to unexposed generations. This possibility was first revealed in 1991, when elevated egg mortalities were observed in the freshwater zone of oiled streams. The direct effects of oil exposure were not possible in this zone because of its location relative to the intertidal. However, adults returning to the oiled streams in 1991 may have been exposed when they incubated (Bue et al. 1996). This observation stimulated a series of field and laboratory studies. In 1998, Bue et al. reported adult fish returning to oil contaminated streams had reduced gamete viability. In that experiment, gametes were collected from adults returning to oil contaminated and uncontaminated streams and incubated in a hatchery before they could be they could be exposed to oil. Despite the identical incubating environments for the eggs, the gametes derived from oil contaminated streams consistently produced fewer viable embryos than gametes derived from uncontaminated streams. As in 1991, this difference was thought to result from the exposures the adults endured when they incubated as eggs, in the oiled streams. However, the exposure histories of the pink salmon used for the study could only be inferred. In addition, the underlying cause for the reduction in gamete viability was not identified.

The field evidence of reproductive impairment has some corroborating experimental evidence. Controlled laboratory exposure tests designed to measure direct and delayed effects of embryonic exposure have identified delayed effects on growth at the part per billion level of PAH exposure. These tests have provided secondary results also suggesting a reproductive effect, but the results were equivocal for the most part. Hence, the present study has been designed to specifically measure reproductive effects from adults with known exposure histories. However, a recent analysis of egg mortalities in earlier experiments by Smoker et al. (2000) indicates that exposure to crude oil can cause heritable damage to female pink salmon, and is consistent with other research on the mutagenicity of crude oil (Roy et al. 1999) and existence of heritable effects of benzo[a]pyrene after exposure during embryonic development (White et al. 1999).

Reproductive impairment described by Bue et al. may result from phenotypic effects on the parents, or genetic effects passed to the offspring. Both result in delayed impacts on the successive generations, and have significant but different implications for the recovery of the damaged populations. A phenotypic effect resulting in the failure to produce high quality gametes would be limited to those individuals that experienced sufficient exposure to oil. Consequently, the effect would diminish along with the exposure levels in the contaminated streams. However, genetic damage passed to offspring could potentially persist for a large number of generations; existing even after oil could no longer be found in contaminated streams. Phenotypic effects on the adults, or genetic effects are not mutually exclusive, and in fact, both may occur at the same time.

Part A of this project is designed to measure the effect of parental exposure on reproductive ability by measuring the viability of gametes taken from exposed and unexposed salmon. These gametes will be collected and crossed to start the F1 generations in Fall 2000. Given the field and earlier laboratory evidence, this result is highly probable. Environmental exposures began in the fall of 1998 by incubating embryos in gravel contaminated with a known amount of oil. Surviving fish representing two exposure levels and a control were marked and released in the spring of 1999. Upon maturity in fall 2000, returning adults representing each of the exposure levels will be recovered and the viability of their gametes compared. We have limited the exposures to two doses, and marked the fish externally so that exposure levels can be readily discerned when the fish return to spawn. These procedures significantly reduced the cost of the study.

Part B further extends this project, by producing an F2 generation to determine if there is a genotypic effect that can be passed on to multiple generations. The F1 generation will have been produced by Part A, and the extension of this project is primarily the continued culturing, tagging, release, and spawning of the F1 adults when they return. No new oil exposures are needed. The costs are reasonable, given the previously funded production of the F1 in Part A. However, the time line is significantly extended by adding a generation, but needed if we are to document multiple generation effects. The final F2 generation would result in fall 2002, and would require incubation for about 90 days to determine effects on that generation. These fish will not be exposed to oil, nor will the F1 parents, thus effects related to the exposure history represent effects with a genetic basis. In part A, effects with F1 are expected, but we will not be able to separate delayed phenotypic effects on the parents from genetic effects. In part B, oil related effects on the F2 can only be from a genetic effects, with longer term implications to multiple generations. The evidence provided by Smoker et al. (2000), and White et al. (1999) strongly suggest the existence of genotypic effects. The final product of this project includes a life-history model with the phenotypic and genotypic impacts of exposure quantified for each life stage. This model represents an important advance in our understanding of the impacts of environmental contaminants on populations.

NEED FOR THE PROJECT

A. Statement of the Problem

Field and laboratory work conducted after the EVOS by Restoration Study 191 demonstrated that pink salmon populations in contaminated streams had reduced fitness when they were exposed to low concentrations of polynuclear aromatic hydrocarbons (PAH). The data clearly demonstrate that reductions in average fitness are the result of decreased survivorship in the exposed populations. This study is designed to verify that fitness is further reduced by the failure to produce viable offspring. This will lead to refinement of our current estimates of the reduction in average fitness. Identification of reduced fertility in the contaminated streams field will greatly strengthen the Trustee conclusions regarding EVOS impacts on pink salmon, and demonstrate the relevance of our model to real-world conditions.

Smoker et al.'s demonstration of a genetic effect suggests that the fitness model we have proposed to construct under Part A will underestimate the impact of embryonic exposure to oil. Fitness reductions resulting from phenotypic impacts will persist only as long as the exposures take place. However, fitness reductions resulting from genotypic impacts may persist for long after the exposures have ended. Elaboration of the fitness model to account for genotypic effects can potentially provide the Trustees with a time line for recovery.

We propose replicating the genetic analysis to verify the claims of Smoker et al. and to provide more information for elaborating the fitness model. Confirmation of the genetic effect is required because such claims are likely to be met with skepticism. The work reported by Smoker et al. was not been corroborated by our evaluations performed the same year. The differences in results are likely due to the high mortality rates we observed in our own studies. Thus, replication of the genotypic effects will provide a firm basis for refuting the criticism we expect from the oil industry. Replicating the genotypic effects also provides opportunity to design experiments that will permit us to evaluate the contribution of dominance effects to the genetic component of variance. Such an evaluation provides a basis for estimating the number of generations required for the genetic load to dissipate.

B. Rationale/Link to Restoration

Identification of a genetic effect of embryonic exposure to crude oil as proposed under Part B provides EVOS Trustees with important evidence of a grave and unanticipated effect of the EVOS. This information is important to managers working to restore salmon populations in PWS. The recovery status of pink salmon in PWS remains controversial, and establishing an identifiable endpoint for recovery remains problematic. Pink salmon escapements to oiled streams were high even in the years when embryo mortality rates were elevated. Recently, embryo mortality has not differed from reference streams, but evidence for oil in stream waters can be found (Rice personal communication). Measurement of the potential genetic load acquired by incubating in oil contaminated streams coupled with the estimated persistence of such a load can provide valuable insight into the recovery status of these populations.

Pink salmon are an ideal species for identifying prolonged population effects resulting from embryonic oil exposure which makes them a premier sentinel species for detecting EVOS impacts. 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. The importance of this work transcends the immediate needs of the Trustees to evaluate recovery and can be generalized for all natal fish habitats. Thus, this work represents an important legacy of the EVOS.

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 began in southeastern Alaska, and maturing fish will return to their natal stream on Baranof Island. We will continue to provide information to interested public (primarily fishermen) who visit the station by displaying at the facility the posters developed for the Restoration Workshop for 97191B and 97076 as interpretative tools. In addition, we have presented our data to the RCAC in the winter of 2000.

PROJECT DESIGN

A. Objectives

Part A of this project is the close-out portion for project 476 which was designed to determine if embryonic exposure to oil produces adults with reduced gamete viability. Part B represents a new component which is designed to determine if reductions in gamete viability are inherited in unexposed generations.

PART A.

1. Determine the average viability of gametes taken from adult fish exposed to uncontaminated and contaminated water during incubation.

2. Determine how incubating in oiled contaminated water influences individual variation in gamete viability.

3. Complete a model of life cycle impacts from incubation in oiled gravel and determine how oil influences average fitness of exposed populations.

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 phenotypic impacts of oil toxicity and allows quantifying the impact of reduced fecundity on the reduction in average fitness for exposed populations. In addition, reduced gamete viability will also provide a demonstration of reduced individual fitness. 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.

PART B.

1. Determine if reductions in gamete viability can be inherited in unexposed generations.

2. Elaborate the fitness model completed under Part A to include the genetic effects identified under Part B.

Objective 1 under Part B represents a validation of the recent report issued by Smoker et al. (2000). This is an extremely important report with far reaching management and policy implications. Objective 2 is an elaboration of the fitness model proposed under Part A, can be further elaborated to include genotypic effects.

B. Methods

Overview of Part A

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 and released. 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). The exposure of each fish will be identified by examining them for the presence of external marks. Similarly exposed fish will be moved to holding pens until they reach sexual maturity. On a given spawning date, 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 by two different methods. The first method replicates the procedure used by Bue et al. (1998) and precisely estimates the average survival of offspring derived from parents exposed to oil or clean gravel during incubation . While this method precisely measures the mean gamete viability in an exposure group, the primary source of variation will be measurement error and no information will be available on individual variation.

Therefore, a second method will be used to estimate how much of the variability in offspring survival is due to individual variation.

Estimation of average offspring survival

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. Estimates will be made on as many days as practical.

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:

$$t_{((p-1)*q*d)df} = \frac{\frac{1}{d}\left[\overline{sv}_{11}+\ldots\overline{sv}_{1d}-\overline{sv}_{21}\ldots-\overline{sv}_{2d}\right]}{\sqrt{\frac{1}{d^2}*\frac{s_c^2}{p*r}*2*d}}$$

where,

$\overline{sv}_{ij}$ = Survival rate for treatment i on day j

s^2_c = Combined Between-Pools Mean Square obtained by ANOVA.

Comparisons will be made between each of the doses and the control with an overall α = 0.05.

Estimation of individual variation in offspring survival

To estimate the components of variation in offspring survival gametes taken from oil-exposed and control fish will be mated using a fully-crossed half-sib design (Falconer 1981). In this design, the 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. This design will be executed using the same individuals used for estimating mean survival. Survival for each cross will be analyzed by ANOVA.

Estimation of fitness reduction

Average fitness for pink salmon that incubate in oiled gravel will be estimated from the fitness function

$$W_i = S_i F_i$$

where W_i is the average fitness of the population incubated at the i^{th} exposure level, with survivorship S from the time of exposure to maturity, and fecundity equal to F. Survivorship will be estimated as the product of survival during incubation and marine survival. Both of these values have been reported in previous reports where embryos were exposed to conditions similar to those used here. Estimates of fecundity will be calculated as the proportion of eggs that survive through eyeing. Thus, W will be expressed as the probability of producing a viable offspring.

Identification of genetic effects under Part B

This component is designed to estimate the genetic component to variation in gamete viability. An oiled and control line of fish will be generated from the fish with known exposure histories returning in September 2000. These lines will represent the F1 generation for each line and they will be incubated in uncontaminated conditions, tagged and released. Fish culture will follow standard practices designed to optimize survival, and tagging will follow procedures employed for the 1998 brood. When the F1 matures and returns in September 2002 they will be spawned and the survival of their offspring evaluated. Their offspring will represent the F2 generation. Evaluation of the F2 will include fertilization rate, survival between fertilization and eyeing and time to mid-hatch. Each of these traits was found to be genetically influenced in the 1997 brood (Smoker 2000).

The spawning design will replicate that reported by Smoker et al. (2000). 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: fertilization rate, mortality rate at eye, hatch, and developmental rate to eye, and hatch.

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). 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).

Elaboration of the life history model

The fitness model developed under Part A accounts for oil effects on phenotypic characters. Assuming a genetic effect is corroborated then a fitness model that accounts for phenotypic and genotypic will be generated. The model will attempt to evaluate how long the genetic load can be expected to be carried in the population, and how the genetic load will influence the risk of extinction in the population over time.

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 University of Alaska has assisted in the design of part B.

SCHEDULE

A. Measurable Tasks for FY 01 (October 1, 2000 - September 30, 2001)

PART A.

Oct. 2000:	Evaluate embryo survival to eyeing.
Dec. 2000:	Evaluate effect of parental exposure to oil on offspring time to mid-hatch
Jan. 2001	Begin analysis of results and development of life history model.
Sep 2001	Final Report due

PART B.

Oct. 2000:	Begin incubation of F1.

Apr. 2001: Mark and release F1.

TASKS for FY02

Sep. 2002: Recover mature adults, spawn.

TASKS for FY03

Oct. 2002: Evaluate embryo survival to eyeing.
Dec. 2002: Evaluate effect of parental exposure to oil on offspring time to mid-hatch
Jan. 2003: Begin analysis of results and development of life history model.
Oct 2003: Final Report due

B. Project Milestones

PART A.

Completed in FY98 and FY99:

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

May 1999: Mark and release 180,000 fry

Underway:

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

Sept. 2001: Complete analysis of gamete viability and fitness model.

PART B.

Underway:

Sept. 2000: Breed F1 oiled and control lines.

FY01 Milestones: .

Apr. 2001: Mark and release F1 lines.

Outlying milestones:

Sep. 2002: Breed F2 generation
Dec. 2002 Complete evaluation of incubation of F2 generation.
Oct . 2003 Submit final report.

C. Completion Date

Final Report for PART A will be submitted on September 15, 2001. Final report for PART B will be submitted on September 15, 2003.

PUBLICATIONS AND REPORTS

FY 00: Annual Report describing the doses, exposure apparatus and effects on early incubation.

PART A.

FY 01: 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.

PART B.

FY02

Annual report describing incubation and release of F1 lines

FY03

Final report

Other reports:

Heintz, R. 2003. Embryonic exposure to oil causes genetic damage in pink salmon. Journal unknown.

PROFESSIONAL CONFERENCES

Initial effects on fertilization rates will be presented at 2000 SETAC conference in Nashville, Tn.

Travel to 2000 EVOS Oil Spill Symposium.

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, or production of. 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 and analyzing the hydrocarbon data.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project will be coordinated with continuation of NOAA research and monitoring efforts regarding pink salmon embryo survival under 01454, and integrates with a new study proposed to evaluate the effects of egg dig timing on mortality estimates. 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.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

PART B has been added and the project extended for an additional 3 years. This component has been added because recent developments suggest the existence of genetic damage resulting from embryonic exposure to oil. Fish returning in FY00 have been exposed to oil and their gamete viability will be evaluated in FY01 in accordance with previous plans. These fish also represent the first step in evaluating genetic effects on gamete viability. The change described in PART B covers marking and releasing fish in the spring of 2001, recovering the adults in 2002 and evaluating their gamete viability in 2003. Detailed descriptions of the factors motivating this change are discussed in the introduction and methods.

PROPOSED PRINCIPAL INVESTIGATOR

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PRINCIPAL INVESTIGATOR

Ron Heintz has been involved in examining the effects of *Exxon Valdez* oil on pink salmon since 1992. He has developed the methods proposed for this project, published 4 peer-reviewed papers and has another in press on this topic. In addition, he has presented results of these studies at 15 professional meetings.

OTHER KEY PERSONNEL

LITERATURE CITED

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Maltby, L., D. M. Forrow, A. B. A. Boxall, P. Calow and C. I. Betton. 1995. The effects of motorway runoff on freshwater ecosystems: 1. Field Study. Env. Tox and Chem. 14:6 1079-1092.

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White P.A., S. Robitaille and J. B. Rasmussen . 1999. Heritable reproductive effects of benzo[a]pyrene on the fathead minnow (*Pimephales promelas*). Environ Toxicol Chem 18(8):1843-1847

Revision 7-7-00
Approved TC 8 3-00

2001 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY2000	Proposed FY2001						
Personnel	$20.7	$35.7						
Travel	$6.5	$11.3						
Contractual	$34.6	$32.1						
Commodities	$7.5	$7.5						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$69.3	$86.6			Estimated FY2002	Estimated FY 2003		
General Administration	$5.5	$7.6						
Project Total	$74.8	$94.2			$39.0	$36.0		
Full-time Equivalents (FTE)		0.4						
	Dollar amounts are shown in thousands of dollars.							
Other Resources		$104.5						

Comments:
PART A
Principle Investigator R. Heintz, 2.0 mo = $15.4
Fishery Research Biologist R. Bradshaw 1.0 mo = $5.9
Additional Operating Costs of Little Port Walter Field Station = $15.0

Elements listed under Part A represent costs assoicated with the the close-out of this project as originally proposed. Costs listed under Part B are those associated with new work. See proposal for details on the new work.

Total NOAA Contribution for Part A = $36.3k

Part B
Principle Investigator R. Heintz, 2.0 mo = $15.7
Co Investigator Adam Moles 2.0 mo = $15.4
Fishery Research Biologist Bradshaw 2 mo. = $12.0
Additional Operating costs of Little Port Walter Field Station = $25.0

TOTAL NOAA contribution for Part B = $68.1

FY01

Prepared: 4/10/00

Project Number: 01476
Project Title: Oil Effects on Pink Salmon Reproduction
Agency: National Oceanic and Atmospheric Administration

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2001 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
PART A						0.0
R. Heintz	Fishery Research Biologist	12/5	1.5	7.7		11.6
						0.0
PART B						0.0
J. Lunasin	Technician	9/7	1.5	5.8		8.7
R. Heintz	Fishery Research Biologist	12/5	2.0	7.7		15.4
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		5.0	21.2	0.0	
					Personnel Total	$35.7

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
PART A:					0.0
Beaver Charters to LPW to examine eggs	1.0	4			4.0
					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
SETAC Meeting	1.0	1	4	0.2	1.8
					0.0
PART B:					0.0
Beaver Charters to LPW to mark fry	1.0	4			4.0
Anchorage EVOS Symposium (Moles)					0.0
					0.0
				Travel Total	$11.3

FY01

Prepared: 4/10/00

Project Number: 01476
Project Title: Oil Effects on Pink Salmon Reproduction
Agency: National Oceanic and Atmospheric Administration

FORM 3B
Personnel
& Travel
DETAIL

2001 EXXON VALDEZ TRUS ϽOUNCIL PROJECT BUDGET
October 1, 200ს - ɔeptember 30, 2001

Contractual Costs:	Proposed
Description	FY 2000
PART A	
contract labor to inucbate eggs $16.00/hr * 320 hr	5.1
PART B	
contract labor to mark fry	
$15.00/hr * 8hr/day*45 days*5 contracts	27.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$32.1

Commodities Costs:	Proposed
Description	FY 2000
Part A	
groceries	1.5
misc	0.5
Part B	
groceries	3.0
miscellaneous buckets, holding nets, feeders, fish food	2.5
Commodities Total	$7.5

FY00

Prepared: 4/10/00

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

FORM 3B
Contractual &
Commodities
DETAIL

2001 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed 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
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency
Part A		
incubation units	4	NOAA
wet lab space	1	NOAA
scales	1	NOAA
Part B		
Microscopes	2	NOAA
Biological Lab	1	NOAA
Nets and frames	21	NOAA
Tag lab space	1	NOAA
Fish feeders	21	NOAA

FY01

Prepared: 4/10/00

Project Number: 01476
Project Title: Oil Effects on Pink Salmon Reproduction
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FORM 3B
Equipment
DETAIL

01478

approved TC 8-3-00

Testing Satellite Tags as a Tool for Identifying Critical Habitat

Project Number: 01478

Restoration Category:

Proposer: J. Nielsen/USGS-BRD

Lead Trustee Agency: DOI

Cooperating Agencies:

Alaska SeaLife Center:

New or Continued: Cont'd

Duration: 2nd yr.
2 yr. project

Cost FY 01: $26.8

Cost FY 02: $0.0

Geographic Area:

Injured Resource/Service:

ABSTRACT

This small amount of funding will allow for completion of this project, which is assessing and testing the application of satellite archive, pop-up tags on marine fishes of the Gulf of Alaska. Software and tag technology will be adapted and developed for geolocation tracking using light, depth, and bathometry data from satellite pop-up tags. Tag application and light-geolocation relationships will be tested on live halibut brought into husbandry at the Alaska SeaLife Center and kept under an accelerated solar-shift regime mimicking standard conditions in the gulf. These data will be compared to light and depth readings taken from tags placed on live fish released into their natural habitat and to an array of tags attached to a stationary buoy in the gulf. The effectiveness of light sensors for geolocation, duration of light measurements, and data sequence design will be determined. These developments will assist in applications of this new tag technology in fisheries-independent habitat assessments for the nearshore and pelagic marine environments in the gulf.

July 2000 update: This project was intended for completion in one year, FY00. Delays in conveyance of funds to the Principle Investigator until late June, in obtaining a fishing boat until August, in the manufacturer's production of the satellite tags until August, and in hiring a Fisheries Project Leader until August have pushed the project at least 1.5 months behind its original schedule. A revised schedule is provided on page 10. Because of the 1.5-month delay, we estimate returning $6.9K to the Trustee Council in lapsed funds at the end of FY00. We are requesting $6.9K from FY01 funds to complete the project as proposed.

INTRODUCTION

The definition of "critical habitat" in the marine environment for anadromous and pelagic fishes is essential to the development of reserves or protected areas (Anonymous, NOAA, 1999). In Alaska, the relationship of aquatic protected areas to subsistence, commercial, or sport fisheries is a critical factor in considerations of design and implementation of reserves. Resource protection and strategic use are not incompatible concepts when a sound foundation of scientific knowledge on the distribution and abundance of key species is incorporated into reserve planning and resource use, and if local community-based natural resource management is included in the analyses of such data (Getz et al. 1999). This proposal tests the application and sets the foundation for deployment of a new technology, satellite pop-up tags, in investigations into the temporal and spatial distribution of key anadromous and marine fish species in the Gulf of Alaska. Many aquatic species that fall under the jurisdiction of the Trustee Council in their efforts to restore the resources and services injured by the spill may benefit from the development and local adaptation of this technology. Fisheries-independent data on real-time position and monitoring of critical habitat use by Gulf of Alaska fish species will allow the organisms to speak directly to the managers of the resource without relying solely on information dependent on harvest recapture that most tagging technologies currently demand.

For many commercially important anadromous and marine fish species ocean-use and critical habitat remain uninvestigated with little or no scientific evidence to support distribution on temporal or spatial scales. The use of radio telemetry and satellite-linked tracking for studying fishes has experienced a recent exponential growth in the development of technologies and applications (Lucas et al. 1993; Eiler 1995; Sibert 2000). For example, the recent study of the effects of commercial halibut fishing on the Glacier Bay marine ecosystem by P.N. Hooge and S. J. Taggart of the USGS/BRD have shown limited but seasonally predictable movements of halibut within Glacier Bay (P. Hooge, USGS/BRD, personal communications). In addition to critical habitat designation, physiological telemetry can now be used to monitor energy expenditure, life history migrations, stage of life cycle, and environmental conditions critical to improving and validating habitat-use models for pelagic fishes (B. Block, Stanford University, personal communications).

Archival satellite technologies offer the fisheries research community a new technology that is required to resolve movement patterns, spatial and temporal habitat use, and stock structure of many migratory marine species found in the Gulf of Alaska. The critical advantage to this new technology is that it allows documentation of habitat use that is independent of any fisheries harvest. Conventional identification tags have been used since the early 1900s, but individuals must be recaptured before information is obtained. Hydroacoustic tags can provide multi-day records of location, depth, temperature and swimming speed in marine fishes, but their temporal and spatial scale is limited by the range of signal recovery and transmission duration in salt water. In 1996 the first generation of archive satellite "pop-up" tags were developed and deployed on pelagic fish.

The range of signal available at depth, sea water conductivity, required recapture of tagged fish, and/or the temporal scale of signal recoveries limit sonic and radio telemetry tags for fish found in the ocean. New technology involving microwave archive tags and satellite-linked telemetry with temperature, light, and pressure sensors can be used to identify critical habitat in near-shore and pelagic fishes that are unavailable with more conventional technologies. There are several versions of satellite pop-up tags currently developed for fish. One (PTT100) can store location data based on solar angle and a set number of average or instantaneous temperature points (up to 60). This tag is commercially available from Microwave Telemetry, Inc. A second, the pop-up archival transmitting (PAT) tag, collects and stores data on depth, temperature, and light levels at user set intervals and transmits these data at a preselected time via Argos satellites. The PAT tags are available from Wildlife Computers. In studies of pelagic movements of Atlantic blue fin tuna, pop-up tags developed by both manufacturers gave very similar results following applications by two independent research groups. Recovery rates for PTT pop-up tags deployed by one European research group were low in 1999. It is unclear, however, if these poor recoveries are due to differences in survivorship of the fish, differences in attachment technique, or failure of the tags.

A more technical tag is in development which measures and records light intensity, hourly temperatures, and/or pressure for up to one year and downloads these data remotely to a satellite link from any location. These tags have limited commercial availability at this time, have been field tested on a limited number of deep-sea pelagic fishes (tuna and marlin), but can be made available in limited quantities for this study (P. Howey, Microwave Telemetry, Inc., personal communications). Size restrictions are a problem with the first series of satellite pop-up tags. These tags require large animals (around 70 lbs) for successful attachment. Smaller, more hydrodynamic tags are currently in development by several vendors and may be available for research in the near future.

Data archived by satellite tags include records of ambient and internal body temperature, pressure, and light. It is possible to estimate latitude (geoposition) for tag location at any given time from light intensity, temperature, and accurate temporal measurements of dawn and dusk (Hill 1994). The longitude determination is equally accurate throughout the year and at all locations except those where no dawn and dusk events are recorded. Latitude determinations are most accurate at the solstices and useless at the equinoxes. This is clearly a problem in Alaska waters where long crepuscular periods (winter) are followed by intense solar periods (summer). The accuracy of light-level measurements, duration of crepuscular events, atmospheric aberrations, and individual fish behavior can all impact the accuracy of geoposition estimates. A current error rate of 50-60 miles is not uncommon in the analyses of these data from temperate waters. We should expect a much wider error rate in Alaskan waters unless data collection and processing are adapted to local light conditions. Wildlife Computers is working on new analytical algorithms using time-series analyses of light sensor data for increased accuracy of geoposition estimates from pop-up tags. This approach seems very promising for areas, such as Alaska, where crepuscular light conditions alternate with long solar exposures.

Light sequence data from pop-up tags are downloaded to satellite relays in predetermined data sequences. These sequences can be set as individual records of light/temperature/pressure at set intervals, means of individual sequence data, or as data series sets (such as sets based on time series analyses). Data sequence, architecture, and analyses can be developed for local conditions at different times of the year increasing the effectiveness of geoposition estimates. *In situ* temperature records can be integrated with sea surface temperature (SST) to add rigor to geoposition estimates taken from tags recording near the surface. However, any correlation between SST and actual temperatures at various depths in the Gulf of Alaska remains unclear. A combination of temperature and pressure data can be used to evaluate fish behavior (time at surface, length of dive, time at depth, etc.), but a clear association between ocean bathometry and currents for the Gulf of Alaska and temperature/pressure at depths needs to be evaluated.

Satellite tags are attached externally to fish released back into their natural habitat. Tags release at a preprogrammed time, float to the surface, and transmit their data continuously to available satellites. The data are then available via satellite links to the individual researcher. These data can be made available in real time to any user group after developed algorithms translate the satellite transmissions into temperature, pressure, and light data. Successful integration of satellite tag data into the EVOS Trustee Council's Gulf Ecosystem Monitoring (GEM) program will allow the development of a unique and continuous information base on natural use of critical marine habitat by migratory fishes due to the fact that tags can be programmed to detach at predetermined intervals and transmit location and other pertinent data over both short and long time intervals. This flexibility in data recovery from natural distributions of organisms will allow research scientists and managers to develop and test hypotheses concerning critical habitat use over temporal and spatial scales unavailable with any other tool.

One additional advantage to satellite tagging technology is the ease of application and data transfer to multiple user groups beyond the research scientist, making these data a potentially important link between fisheries, conservation, and management groups. This proposal suggests that data collected from archive tags deployed in the Gulf of Alaska be made available to local communities and interest groups in real-time through internet web links with a USGS/BRD web site dedicated to this study.

This proposal is intended to test the accuracy and efficiency of archive satellite tags for estimates of geoposition in the Gulf of Alaska. If successful these data can provide an effective database for analyses of critical habitat use in Alaska waters. This technology is clearly universal in its application and testing. A recent 5-day symposium was held in Hawaii on "Tagging and Tracking Marine Fish with Electronic Devices." This symposium had registered participants from 13 countries (Australia, Canada, France, Germany, Iceland, Iran, Italy, Japan, Mexico, New Zealand, Norway, Sweden, United Kingdom, and United States). There were 21 satellite-tracking presentations at the symposium covering case studies on four species of tuna, swordfish, marlin, Atlantic salmon, brown trout, Arctic char, and five species of sharks. Also included were six talks on new hardware and software application developments in satellite tagging technology. The PI for this project is currently editing the proceedings of this symposium. Clearly there are numerous data sets in development that will facilitate the application of satellite tags in Alaska waters. One research project scheduled for funding by EVOS (Alaska Shark Assessment Project #00396) has agreed to cooperate on the analyses of light and temperature data from pop-up tags deployed on sharks (Lee Hulbert, pers. comm.)

There are several developmental issues based on conditions endemic to Alaska that have not yet been addressed to date in the use of satellite tags. Primary is the issue of geolocation estimated from ambient light levels. Studies of satellite tags in the lower 48 states and Europe primarily rely on records of sunrise and sunset recorded by changes in light intensity on the tag data to establish approximate longitude and latitude locations for individual tags (fish). With the long duration of crepuscular light sequences in Alaska waters new light interpretative algorithms need to be developed for the Gulf of Alaska to provide an efficient tool for geolocation using satellite tags. This is critical to studies where we end up tracking animals over time in very shallow or very deep waters where variation in depth and temperature data will not provide collaborative evidence of fish locations. For best results these algorithms need to be developed and tested in conjunction with laboratory experiments of light conditions and sensor data and compared to data collected from an array of tags submerged at different depths on a stationary mooring line in the Gulf of Alaska.

Additional research needs to be undertaken on cost-effective tagging regimes for this area. These analyses would investigate species-specific tagging protocols, size and anchor location of tags as they affect survival rates (for both fish and tags), effects of coastal geology on tag recovery, release mechanisms appropriate for depth and scale of movement by different species, and the effects of fish mortality and tag mortality on the interpretation of results. We also need to develop some platform for data exchange, crossover studies, and data archive capacity for ecosystem scale marine habitat analyses in the Gulf of Alaska. The latter objectives will require integration of satellite tag data with other significant geological, oceanographic, and climatic databases for this area.

The approach of this study is directed at multiple species, not individuals of any one species. Halibut were selected as the test organism at the Sea Life Center because of their general size in the Gulf of Alaska, their ease of capture and adaptation to captivity that will allow experiments of light intensity, tag sensitivity, and handling (tagging) stress under different natural and artificial conditions available at the Center. This proposal requests funding to initiate satellite telemetry studies incorporating three elements: 1) initiate and monitor satellite telemetry data from tags on captive fish under artificial light regimes that mimic crepuscular conditions in the Gulf of Alaska, on a few tagged fish released into their natural environment, and on a tag array placed *in situ* on a stationary buoy in the Gulf of Alaska; 2) develop data architecture (i.e. duration and sequence of data points) and analytical approaches (sequence mean or time series analysis) for estimates of geoposition from satellite pop-up tags in the Gulf of Alaska; 3) initial studies in captivity of tagging effects, efficiency, and physiological response in individual fish at Alaska Sea Life Center.

NEED FOR THE PROJECT

A. Statement of Problem

The development of marine reserves or protected areas in geographic localities with subsistence, commercial, and sport fisheries depend on sound scientific knowledge of "critical habitat" and ecosystem use at several temporal and spatial scales. Our knowledge of marine habitat use over time for different life stages and fish species in the Gulf of Alaska are currently limited to information from harvest statistics and antidotal information from resource users and managers (Int. Pac. Halibut Comm. 1987; Pelletier and Parma 1994), with the notable exception of recent work done on halibut in Glacier Bay (Chilton et al in press; Hooge and Taggart unpublished data). Knowledge of the distribution of individual fish over time within the Gulf of Alaska ecosystem is needed to make sound management decisions at the inception of reserves or protected areas. Without sound scientific support, initial development of marine reserves can create significant conflict among diverse user groups. Including local community based information in the deployment and recovery of these scientific data will be an effective tool in resource management. Documentation of individual fish behavior in economically and ecologically important species within the reserve will aid in the development of a common-ground database on fish distributions over time and space during the development of reserve boundaries and temporal management units within the reserve where frequent conflict-of-interest problems are expected to arise.

The marine environment imposes severe constraints on the type of electronic tags that can be used to monitor the behavior of fish in their natural environment. Seawater is highly conductive and radio waves do not propagate well in this medium. Recently marine biologists have developed new technologies in an effort to address this problem. Pop-up devices are externally attached to fish and are programmed to detach from the animal at a specific date, surface to the ocean, and transmit data to available satellites. The newest pop-up tags incorporate archive technology and transmit a full suite of data arrays to the satellite. To date this technology has been applied to large pelagic fish spending at least part of their time in temperate waters. The developmental approach used in the acquisition and analyses of pop-up tag data need to be adapted to local climatic and solar conditions if this technology is to be effectively implemented in the Gulf of Alaska.

There are numerous data sets in development that will facilitate the application of satellite tags in Alaska waters. But there are several developmental issues based on conditions endemic to Alaska that have not yet been addressed. Primary is the issue of geolocation by light levels. Studies of satellite tags in the lower 48 states and Europe primarily rely on records of sunrise and sunset recorded by changes in light intensity on the tag data to establish approximate longitude and latitude locations for individual tags (fish). With the long duration of crepuscular light sequences in Alaska waters new light interpretative algorithms need to be developed for the Gulf of Alaska to provide an efficient tool for geolocation using satellite tags. This is critical to studies where we end up tracking animals over time in very shallow or very deep waters where variation in depth and temperature data will not provide collaborative evidence of fish locations.

Additional research needs to be undertaken on cost-effective tagging regimes for this area. This study would facilitate investigations of species-specific tagging protocols, size and anchor location of tags as they affect survival rates (for both fish and tags), effects of coastal geology on tag recovery, release mechanisms appropriate for depth and scale of movement by different species, and the effects of fish mortality and tag mortality on the interpretation of results. We also need to develop some platform for data exchange, crossover studies, and data archive capacity for ecosystem scale marine habitat analyses in the Gulf of Alaska. I anticipate that this latter objective will require integration of satellite tag data with other significant geological, oceanographic, and climatic databases for this area.

The approach of this study has always been one directed at multiple species found in their natural marine habitats. Halibut were selected as the test organism simply because of their ease of capture and adaptation to captivity that would allow experiments of light intensity, tag sensitivity, and handling (tagging) stress under different natural and artificial conditions we can manipulate at the Sea Life Center. Potential future applications directed at discovery and monitoring of ocean habitat use by critical Trustee fish species are broad. A clear understanding of marine salmonid life history and ocean forage migrations will only be possible with the development of this technology. Understanding temporal and spatial use of marine habitats by species, such as sharks, lingcod, rockfish, halibut, trout, and salmon will contribute significant information to fisheries resource management decisions in the Gulf of Alaska.

B. Rationale/Link to Restoration

Information collected during this study will contribute to our ability to use new technology to assess recovery and impediments to recovery (critical habitat) for economically and ecologically important fish species found in Prince William Sound and the Gulf of Alaska. The proposed work represents a sound initial scientific approach to increase our technological capacity to investigate the factors that affect population dynamics on multiple temporal and spatial scales and if successful, this technology will help in the definition of critical habitat for proposed marine reserves in the Gulf of Alaska. Without an understanding of the general underlying patterns of habitat use that dictate population change and species interaction within marine units or areas, we can not prescribe or limit specific activities within the reserve based on species distribution. Analysis of critical habitat use for different life history stages of key species will allow integration of sustainable use or limited harvest in the conservation and management of these species within the marine reserve. The development of satellite tag technology offers a promising window on this type of information.

Archival satellite technologies offer the fisheries research community a new technology that is required to resolve movement patterns, spatial and temporal habitat use, and stock structure of many migratory marine species found in the Gulf of Alaska. The critical advantage to this new technology is that it allows documentation of habitat use that is independent of any fisheries harvest. Conventional identification tags have been used since the early 1900s, but individuals must be recaptured before information is obtained. Hydroacoustic tags can provide multi-day records of location, depth, temperature and swimming speed in marine fishes, but their temporal and spatial scale is limited by the range of signal recovery and transmission duration. In 1996 the first generation of archive satellite "pop-up" tags were developed and deployed on pelagic fish. The data archived by satellite tags include records of ambient and internal body temperature, pressure, and light. It is possible to estimate latitude and longitude for tag location at any given time from changes in light intensity. Only after crepuscular 24hr light sequence data are developed for local conditions and integrated with the satellite data will the true potential of these tags be available to species in the Gulf of Alaska.

Satellite tags are attached externally to fish, release at a preprogrammed time, float to the surface, and then transmit their data continuously to ARGOS satellites. The data are then available via satellite links to the individual researcher. These data can be made available in real time to any user group after developed algorithms translate the satellite transmissions into temperature, pressure, and light data. Successful integration of satellite tag data into GEM's goals will allow the development of a unique and continuous information base on natural use of critical marine habitat by migratory fishes due to the fact that tags can be programmed to detach at predetermined intervals and transmit location and other pertinent data over both short and long time intervals. This flexibility in data recovery from natural distributions of organisms allows research scientists to develop and test hypotheses concerning critical habitat use over temporal and spatial scales unavailable with any other tool.

One additional advantage to satellite tagging technology is the ease of application and data transfer to multiple user groups beyond the research scientist, making these data a potentially important link between fisheries, conservation, and management groups. This proposal suggests that data collected from archive tags deployed in the Gulf of Alaska be made available to local communities and interest groups in real-time through internet web links with a USGS/BRD web site dedicated to this study.

C. Location

Data to be compiled will come from tags deployed in the Gulf of Alaska and tags in controlled light condition at the Sea Life Center. Initial physiological data concerning tagging effects and efficiencies of light intensity data will be assessed using a limited number of fish (6) in captivity at the Alaska Sea Life Center in Seward, AK. Tagging of four wild fish with satellite pop-up tags will take place in collaboration with the local sport and commercial fishing community. Tag array disposition on a stationary buoy in the Gulf of Alaska will be done in collaboration with the National Weather Service, National Marine Fisheries, and the US Coast Guard. Satellite data recovery, data architecture, data array analysis, and the development of a web-site for real-time data access to tag data will be done by the staff of the USGS/BRD Alaska Biological Science Center, in conjunction with tag vendors.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

All efforts will be made throughout the project to incorporate participation in and provide local involvement in the implementation and development of this project in relation to target populations and tagging localities. Project staff will be available to present information to local communities, internet access to real-time data from satellite tags will be made available at the local level as it becomes available to the PI. All articles, video, or photographs of the tagging study will be made available to the Trustee Council. The nature of the tagging study and the charismatic character of the fish subjects make this a potentially high profile public relations project for the recovery and Trustee Council.

PROJECT DESIGN

A. Objectives

1. Develop critical criteria for satellite telemetry data dedicated to geolocation of organisms in marine habitats within the Gulf of Alaska:

    a. Monitor satellite telemetry data derived from artificial light conditions simulating long crepuscular and intense solar periods on fish maintained in short-term captivity studies at the Alaska Sea Life Center

    b. Deploy pop-up tag array from a stationary buoy in the Gulf of Alaska and develop data sets on light, temperature, and pressure from direct *in situ* studies of tag efficiency and data architecture.

    c. Monitor and plot individual movement and geolocation estimates based on data derived from four tagged fish releases in the Gulf of Alaska

    d. Integrate all available light data bases taken from pop-up tags in the Gulf of Alaska, including NMFS's data on tagged sharks into analyses of geolocation on fish in the Gulf of Alaska

2. Study captivity effects, metabolic compensation, and fish physiology based on tagging efficiency (attachment methods, tag stability, fish response) for Pacific halibut brought into captivity at the Sea life Center

3. Summarize data available for different tag configuration and data architecture accessible via satellite links. Test efficiency of geolocation estimates based on tag studies and publish results in peer-reviewed scientific journals

4. Create a public access internet site for the display and development of study results with real-time deposition of tag recovery data throughout the duration of the project.

B. Methods

A total of 14 pop-up tags will be deployed under various conditions to gather and analyze data on estimates of geolocation in the Gulf of Alaska. Six fish will be collected in FY00 from the halibut sport fishery and transported live to the Alaska Sea Life Center for analyses of tag attachment, tagging efficiencies under different light conditions, and photo sensor precision. Fish in captivity will be fitted with pop-up tags (3.5 g). Each tag is housed in a composite, positively buoyant, low-drag housing that is towed by the fish via a short "leader" attached to a tagging dart. The PI will monitor tag attachment effects with at least two veterinary scientists with a background in fish, and a representative from the satellite tag vendor. Tests will include attachment location effects, physiological stress during and after tagging, and stability of implantation over time.

Several features of the satellite tags will be tested from an array of tags deployed from a stationary buoy located in the Gulf of Alaska. This tag array will be used to test efficiency of light sensors at latitudes within the Gulf of Alaska, temperature cycles at depth, stability of pressure sensors at depth, and effective deployment of timed-release mechanisms in pop-up tags. The data downloaded from this artificial *in situ* array of tags will be compared to results we obtained from our artificial light experiments for halibut held in captivity under controlled conditions. The relative efficiencies of different data arrays, download capacity, and photo sensors for estimates of geoposition in conditions common to the Gulf of Alaska will be analyzed in these comparisons artificial and natural light conditions.

Estimates of actual fish location will be obtained from data collected from four live fish released with pop-up tags into the Gulf of Alaska and from coordination and data sharing with other research groups working with pop-up tags in the same area (i.e. NMFS's shark project). These data will then be compared and analyzed for rigor of geoposition estimates based of our findings from captivity light studies and the stationary tag array.

Conversion of satellite data to position and movement cycles for individual fish will be made using adaptations of existing conversion algorithms available from the vendor and our initial field trials of tags in the Gulf of Alaska. New approaches to estimating geoposition from light data using time series analyses will be tested in this study (R. Hill, Wildlife Computers, pers. comm.) Data for location and position for individual tags collected in the wild will be plotted by species on digitized maps of the Gulf of Alaska (two dimensional) incorporating any bathymetric data (three dimensional) available for this area using standard telemetry and GIS mapping methods (Swilhard and Slade 1985; Baltz 1990; Cressie 1991; Thompson et al. 1992).

The development of the internet link to tagging studies and results will run parallel to the ongoing field studies and tagging data development. The initial web site will be posted on the USGS/BRD Alaska Biological Science Center's home page.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

This proposal relies on data collected by a number of research collaborators as yet unnamed (i.e. commercial or sport boat captains, fishing volunteers, and community internet links). Known collaborators include: Dan Mulcahy, DVM, USGS/BRD fish and wildlife veterinarian; Riley Wilson, DVM Anchorage Zoo; Roger Hill, Wildlife Computers; Dr. Paul

Howey, Microwave Telemetry, Inc.; Philip Hooge and Spencer Taggart, USGS/BRD Glacier Bay; Dr. Barbara Block, Hopkins Marine Station, Stanford University; Dr. Heidi Dewar, the Pfleger Institute of Environmental Research; Dr. Steve McCormick, fish physiologist, NMFS, Conte Anadromous Fish Laboratory; and the staff of the Alaska Sea Life Center. Lee Hulbert of the National Marine Fisheries has volunteered collaboration on the analysis of light data collected from their shark pop-up tag study. All technical and clerical staff will be current employees of USDGS/BRD Alaska Biological Science Center or qualified individuals contracted directly for this project.

SCHEDULE

A. Measurable Project Tasks for FY 00 - 01

Aug. 1 – Sept. 15:	Purchase satellite-linked tags, establish download links, develop field collection protocols, and prepare live tanks (3) for halibut at Alaska Sea Life Center. Consult with resource managers and local users on best populations to target for captivity and tagging studies. Letters with study plan have been sent to ADFG and IPHC.
Aug. 16 – Sept 15:	Collect six Pacific halibut and transport to Alaska Sea Life Center. Time depends on availability of vessel (boat still in negotiation and under permit constraints from ADFG and IPHC).
Aug. 15 – Nov. 15:	Captivity test on light data arrays using UV tank covers. Do analyses of halibut physiology, tagging effects and efficiency, and survival trials in captivity at Sea Life Center.
Dec. 2000:	Field trials of environmental sensors in satellite tags in Gulf of Alaska. Deploy pop-up tag array on stationary buoy. Service date for UAF buoy is 12/00. We intend to leave in place 1 yr. to capture spring and fall crepuscular light cycles
Nov.– Mar. 01:	Release 4 halibut in Gulf of Alaska. Surviving fish from Sea Life Center will be used for live releases. Deploy tags to pop-up in 2-3 months.
Apr. - May 01:	Collect and analyze first data sets (two tags from Sea Life Center and returns from live releases). Develop Web Page for study results and plot initial data. Consult on tagging applications and data interpretation. Develop oceanic temperature and bathymetry database for Gulf of Alaska.
Feb. – Apr. 01:	Analyze final data from tagging recoveries in captivity and in the wild.
Postponed:	Prepare data presentation and attend restoration meeting
July – Aug. 01:	Compile data and write annual report. Integrate analyses from parallel studies of pop-up tags in Gulf of Alaska.
Sept. 2001:	Submit final report to EVOS on study results.

B. Project Milestones and Endpoints

EVOS costs for this project will be billed in FY00 and FY01.

Due to late implementation of study plan and funding, USGS/BRD data analyses will continue into FY2001.

Project will be completed upon submission of the final report prior to Sept. 30, 2001.

C. Completion Date

All project objectives will be met during FY2000-2001.

PUBLICATIONS AND REPORTS

A final report of activities will be submitted to the Restoration Office on or before 30 September 2001.

Manuscript containing final results and recommendations will be submitted to a peer-reviewed scientific journal for publication in FY01-FY02.

Website development and maintenance of our tagging database will be available FY01. At the end of the project we will transfer the internet site to a webmaster designated by the Trustee Council.

PROFESSIONAL CONFERENCES

International Marine Biotechnology Conference (IMBC) 2000
American Society of Ichthyologists and Herpetologists FY01
American Fisheries Society FY02

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

This research provides fundamental information needed for the implementation and development a new technology dedicated to the identification of critical marine reserve areas in Prince William Sound and the Gulf of Alaska. The definition of critical marine habitat for economically and ecologically important fish species will serve as a cornerstone for future Trustee sponsored conservation and use management proposals under the GEM program. The major objectives of this work require interaction with several other investigators and integration of all available data that are relevant to the question of critical marine habitat in the Gulf of Alaska.

PROPOSED PRINCIPAL INVESTIGATOR

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PERSONNEL QUALIFICATIONS

Jennifer Nielsen is Fisheries Supervisor and Research Biologist (GS14) with the Alaska Biological Science Center, USGS Biological Resources Division. She has conducted salmonid and fisheries research throughout the western Pacific for the past 20 years. Dr. Nielsen is a Associate Professor at the University of Alaska, Fairbanks in the School of Fisheries and Ocean Sciences. From 1995 - 1999 she was a visiting scientist at Hopkins Marine Station, Stanford University, where the first experiments on satellite pop-up tags were conducted on blue fin tuna. From 1995 - 1999, she was an Adjunct Professor in Ichthyology and Fisheries at the University of California, Berkeley and Moss Landing Marine Laboratory, and served on the Scientific Review Board for the Monterey Bay Aquarium. Dr. Nielsen has published over 30 peer-reviewed journal publications and book chapters, numerous technical reports, and gives frequent national and international presentations at scientific meetings addressing research issues in fish conservation, behavior, evolution, and genetics. Her work on salmonid fishes is recognized internationally for its contribution and focus in fisheries conservation and management.

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Prepared 7/--/00
Approved TC 8-3-00

2000 EXXON VALDEZ TRUSTE)UNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Budget Category:	Actual FY 2000	Proposed FY 2000
Personnel	$15.5	$6.0
Travel	$1.0	$0.0
Contractual	$5.5	$0.0
Commodities	$0.9	$0.0
Equipment	$51.4	$0.0
Subtotal	$74.3	$6.0
General Administration	$2.7	$0.9
Project Total	$77.0	$6.9
Full-time Equivalents (FTE)	0.8	0.3
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

		Estimated FY2002	Estimated FY 2003		
		$0.0	$0.0		

Dollar amounts are shown in thousands of dollars.

USGS/BRD will contribute travel from Anchorage to the SeaLife Center, salaries for the PI and a project veternarian

NOTE: We were unable to complete this project during FY00 as scheduled due to overseen delays. Our currently revised schedule for the work during FY00 projects $6K in unspent FY00 salary costs plus $0.9 GA which will be returned to the Trustee Council in lapsed funds at the end of FY00. A total of $6K in salary costs plus $0.9 GA are being requested for FY01 to complete the project.

Plus ASLC bench fees $19,900
PROJECT TOTAL $26,800

FY01

Prepared: 7/20/00

Project Number: 01478
Project Title:Testing satellite tags as a tool for idenifying critical habitat
Agency: DOI-BRD

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2000 EXXON VALDEZ TRUSTE UNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Personnel Costs*:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
J. Nielsen*	Fisheries Supervisor	GS14/01	1.0	7.2		0.0
TBA	Fisheries Project Leader	GS9/01	1.5	4.0		6.0
D. Mulcahy*	Fish/Wild. Veterinarian	GS13/05	0.3	6.8		0.0
D.Douglas*	Fish/Wild Scientists	GS12/05	0.3	6.0		0.0
TBA**	Aquaculture Technician (ASLC)	ASC grade	168 hrs.	$20/hr		0.0
TBA**	ASC Veterinarian (ASLC)	ASC grade	7 hrs.	$40/hr		0.0
						0.0
						0.0
*all personnel costs will be covered by USGS/BRD						0.0
** presonnel costs covered by Sea Life Center						0.0
						0.0
	Subtotal		3.1	24.0	0.0	
					Personnel Total	$6.0
Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 2000
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
						0.00
					Travel Total	0.00

FY01

Prepared: 7/20/00

Project Number: 01478
Project Title: Testing satellite tags as a tool for identifying critical habitat
Agency: DOI-BRD

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed
Description	FY 2000
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed
Description	FY 2000
Commodities Total	$0.0

FY01

Prepared: 7/20/00

Project Number: 01478
Project Title: Testing satellite tags as a tool for idenifying critical habitat
Agency: DOI-BRD

FORM 3B
Contractual &
Commodities
DETAIL

2000 EXXON VALDEZ TRUSTE UNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			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: Description	Number of Units	Inventory Agency

FY 01 EXXON VALDEZ TRUSTE)UNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FFY 2000	Proposed FFY 2001						
Personnel		$0.0						
Travel		$0.0						
Contractual		$18.6						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal		$18.6		Estimated FFY 2002				
General Administration		$1.3						
Project Total		$19.9		$0.0				
Full-time Equivalents (FTE)								
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

2001

Project Number: 01478
Project Title: Alaska SeaLife Center Bench Fees
Agency: ADF&G

FORM 3A
SUMMARY

approved TC 8-3-00

Effects of food stress on survival and reproductive performance of seabirds

Project Number:	01479
Restoration Category:	Research
Proposed By:	USGS, University of Washington
Lead Trustee Agency:	DOI--USGS
Cooperating Agencies:	University of Washington
Duration:	3d year, 4-year project
Cost FY 01:	$129,600
Cost FY 02:	$75,000
Geographic area:	Cook Inlet, Gulf of Alaska
Injured resource:	Common Murre, Black-Legged Kittiwake

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.

RECEIVED
APR 14 2000
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

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., 1999*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 debilitative 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 captive seabirds provide a way to examine the mechanisms by which increased mortality and decreased reproduction are expressed.

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. We also propose to investigate the effects of 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 our pilot and EVOS-funded (Project 00479) studies show clearly (see below) 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.

Results of pilot work in 1997 showed that adult Black-legged Kittiwakes and Common Murres had higher average baseline levels of corticosterone on Chisik (food-poor colony) and seasonal increase in corticosterone occurred earlier as body condition declines (Kitaysky et al. 1999a, and in prep.). Baseline levels of corticosterone were also measured in 1998. However, sample sizes and seasonal coverage were limited in 1997 and 1998, and planned measures of baseline corticosterone were carried out in 1999 only. These studies show, for example, that seasonal baseline stress levels in murres at Chisik and Gull were different in 1998 than in 1997; showing little seasonal variation at Chisik (very high throughout season with complete reproductive failure) and Gull (no seasonal increase in stress) and relatively high reproductive success. Summer of 1999 was different again, with very cold waters delayed breeding and lowered reproductive success of Common Murres at Gull I., but did not delay breeding of Common Murres at Chisik I. Baseline levels of corticosterone were also elevated in birds nesting at Gull I. at the pre-laying and early incubation stages, but then declined to normal at early chick-rearing. We did not find an elevation of baseline levels of corticosterone at early stages (pre-laying and early incubation) in murres at Chisik I. However, the dynamics of baseline corticosterone later in the season was similar between the colonies. Planned measures of baseline corticosterone need to be collected over at least two more years (2000-2001) to evaluate the annual variability in baseline stress before these methods can be used elsewhere with confidence.

The "acute stress response" to capture and restraint reveals, in a way that baseline measures cannot, how birds are likely to respond to future stress, and indicates whether birds are "chronically" stressed. During the pilot study of 1997, kittiwakes breeding at the food-poor colony had suppressed acute stress-responses compared to those at the food-rich colony, even early in the season when baseline hormone levels were similar. We measured the acute stress-response of small samples of kittiwakes and murres in the wild (Kitaysky et al. 1999a) and under experimental chick feeding regimes (Kitaysky et al. 1999b) in 1997. However, no acute stress-responses were measured in 1998 and only limited samples were collected on Chisik I. in 1999 owing to breeding failure and difficulties in capturing birds. Like baselines (above), acute stress-responses should be measured over two more years (2000-2001) to examine inter-annual variability.

One of the most important objectives of our study is to determine the relationship between circulating levels of corticosterone and post-breeding survival of parents and chicks at Gull and Chisik islands. Specifically, we propose to link stress with demographics; i.e., does food stress have an impact on populations? For example, even if murres on Chisik Island can fledge chicks (which they do most years), does the added physiological stress (compared to Gull Island) of doing this have some 'hidden' survival costs? This objective has three components:
1. Adult stress and subsequent survival. This study is linked with the survival study (Project 01338). The question is simple: Are physiological stress levels observed in one year correlated with levels of over-winter mortality observed in the subsequent year? Statistical power to answer this question depends on sample size and number of years of survival data. We estimated that it will take a minimum of four years (1998-2001) to address this objective.

An additional question here is whether stress and survival are linked to sex, especially if the sexes differentially allocate effort into reproduction. Other studies have shown that survival is sex-dependent in some species. Sex determination is relatively simple, and is being done at minimal cost as part of the survival study, so these data will also be used here to look for sex-dependent differences in physiological stress and body condition. Addressing this question is a matter of more thorough statistical analyses of data collected and collection of data during one more (2001) reproductive season at the both colonies, at no additional cost to the existing budget.
2. Adult stress and reproductive success. Experimental work in 1997 has already established a link between corticosteroid hormone levels, foraging effort, and feeding of chicks, which in turn must influence reproductive success in wild birds (in prep.). Pilot work in 1998 established a link between stress hormone levels and current breeding success (e.g., high baseline corticosterone levels found early in murres on Chisik with complete breeding failure later in summer). Additionally, high stress levels may cause abandonment of breeding and regression of reproductive systems. Both these questions can not be fully addressed with the data collected in 1998 and 1999 only. The relationship between current stress and reproductive success needs three years of study to establish predictive power in the relationship. It is possible that stress in one year may be correlated with reproductive failure (or skipping of breeding) in the subsequent year. Thus, it will take a minimum of two years (2000-2001) to address this question, especially as birds may skip years of breeding.
3. Juvenile stress and survival. With regard to juveniles, a critical question is: Does high stress levels prior to fledging (owing to food deprivation or poor quality food) have any impact on subsequent survival? Measuring survival of juveniles to breeding age was ruled out in APEX because of the long study times needed to address the question. In our project we address the question of whether juveniles are at risk of mortality immediately after fledging. Chronic elevation of corticosterone is known to cause neuronal cell death, suppress memory and immune systems, and promote wasting of muscle tissue. The results of pioneering EVOS-funded work in 1999 justified this prediction for Black-legged Kittiwake chicks. Chronic elevation of corticosterone in food-stressed Black-legged Kittiwake chicks causes impaired learning and memory, and consequently might decrease their chances of survival after fledging (Kitaysky et al. in prep). If Common Murre chicks respond to food stress in similar fashion to Black-legged Kittiwake chicks, which will be examined in summer of FY 2000, testing of learning and memory of Common Murre chicks exposed to a chronic elevation of corticosterone during their development will be conducted in summer of 2001.

All field work and experiments for this study will be completed by the end of FY 2001. Completion of laboratory analyses, summarizing results, preparation of the final manuscripts for publication in peer-review journals, preparation of the final report for EVOS, and developing a protocol for monitoring of seabird populations will be accomplished in 2002.

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 survival of seabirds in Lower Cook Inlet will be provided by on-going project that is designed specifically for these purposes (Restoration Project #01338). 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. 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. Determine the relationship between circulating levels of corticosterone and post-breeding survival of parents and chicks 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 μL) 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 μL) 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 μL).

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. 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. 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 #01338) 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 #01338), would allow us to make a conclusive statement about the relationships between stress and survival in parent Black-legged Kittiwakes and Common Murres in Lower Cook Inlet.

The proposed examination of the effects of chronic elevation of corticosterone on learning and memory of Common Murre chicks is contingent on the results of captive experiments, which will be carried out in summer FY 2000. If Common Murre chicks respond to food stress in similar fashion to Black-legged Kittiwake chicks, testing of learning and memory of Common Murre chicks exposed to a chronic elevation of corticosterone during their development will be conducted according to the established protocol (Kitaysky et al. in prep).

3. 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°C. All plasma samples will be transported to the laboratory at the University of Washington and processed according to the radio-immuno assay techniques.

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 01 (October 1, 2000 - September 30, 2001)

January-April:	preparation for field work, hiring personnel
February:	Annual Report on FY 00 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
FY02:	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.

PUBLICATIONS AND REPORTS

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

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2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Approved TC 8-3-00

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel	$12.4	$13.2						
Travel	$2.4	$2.4						
Contractual	$90.0	$93.2						
Commodities	$5.2	$5.3						
Equipment	$7.0	$7.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$117.0	$121.1			Estimated FY2002	Estimated FY2003		
General Administration	$8.2	$8.5						
Project Total	$125.2	$129.6			$75.0	$0.0		
Full-time Equivalents (FTE)		0.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY01

Prepared: 04/13/00

Project Number: 01479
Project Title: Effects of food stress on survival and reproductive performance of seabirds
Agency: U.S. Geological Survey

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
Vacant	Biotech	GS-7	4.0	3.3		13.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		4.0	3.3	0.0	
					Personnel Total	$13.2

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
Seattle-Anc	0.8	2			1.6
Anc-Homer	0.2	4			0.8
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.4

FY01

Prepared: 04/13/00

Project Number: 01479
Project Title: Effects of food stress on survival and reproductive performance of seabirds
Agency: U.S. Geological Survey

FORM 3B
Personnel
& Travel
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Contractual Costs:	Proposed
Description	FY 2000
University of Washington Research Work Order	93.2
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$93.2

Commodities Costs:	Proposed
Description	FY 2000
Food	1.5
Fuel	1.5
Misc. field supplies	1.0
Fish for seabird growth expts	1.3
Commodities Total	$5.3

FY01

Prepared: 04/13/00

Project Number: 01479
Project Title: Effects of food stress on survival and reproductive performance of seabirds
Agency: U.S. Geological Survey

FORM 3B
Contractual & Commodities
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
Misc Scientific field supplies			1.0
Laboratory supplies for Radio-immunoassay			6.0
			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.		**New Equipment Total**	$7.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency
All boat, lodging, field laboratory, and logistic support provided by APEX project 98163M (Cook Inlet Seabirds). Equivalent value of about 25K.		
University of Washington, research laboratory of Dr. John Wingfield. Equivalent value of complete laboratory support including supplies for radio-immunoassy (above) is about 40K		

FY01

Project Number: 01479
Project Title: Effects of food stress on survival and reproductive performance of seabirds
Agency: U.S. Geological Survey

FORM 3B
Equipment
DETAIL

Prepared: 04/13/00

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$93.2						
Travel		$0.0						
Contractual		$0.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$93.2			Estimated FY 2002	Estimated FY 2003		
Indirect								
Project Total	$0.0	$93.2			$75.0			
Full-time Equivalents (FTE)		1.7						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY01	Project Number: 01479 Project Title: Effects of food stress on survival and reproductive performance of seabirds Agency: U.S. Geological Survey

Prepared: 04/13/00

FORM 4A
Non-Trustee
SUMMARY

Personnel Costs:						
Name	Position Description		Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
University of Washington Research Work Order						
Post-doc Salary + Benefits + GA= 65K			12.0	5.5		66.0
Lab Assistant			8.0	3.4		27.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		20.0	8.9	0.0	
					Personnel Total	$93.2

Travel Costs:					
Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed 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

FY01

Project Number: 01479
Project Title: Effects of food stress on survival and reproductive performance of seabirds
Agency: U.S. Geological Survey

FORM 4B
Personnel
& Travel
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed 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
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	

FY01	Project Number: 01479 Project Title: Effects of food stress on survival and reproductive performance of seabirds Agency: U.S. Geological Survey	FORM 4B Equipment DETAIL

Prepared: 04/13/00

Contractual Costs:	Proposed
Description	FY 2000
Contractual Total	$0.0

Commodities Costs:	Proposed
Description	FY 2000
Commodities Total	$0.0

FY01

Prepared: 04/13/00

Project Number: 01479
Project Title: Effects of food stress on survival and reproductive performance of seabirds
Agency: U.S. Geological Survey

FORM 4B
Contractual &
Commodities
DETAIL

Approved TC 8-3-00

PROPOSAL FOR A DOCUMENTARY FILM COMPARING AND CONTRASTING *EXXON VALDEZ* OIL SPILL IMPACTS ON THE SUBSISTENCE USE OF INTERTIDAL RESOURCES, INCLUDING MUSSELS, CLAMS, CHITONS, AND OCTOPUS, IN THE COMMUNITIES OF CHENEGA BAY IN PRINCE WILLIAM SOUND, AND OUZINKIE ON KODIAK ISLAND

Project Number:	01481
Restoration Category:	Subsistence Restoration
Proposers:	Ouzinkie Tribal Council and Chenega Bay Village IRA Council
Lead Trustee Agency:	Alaska Department of Fish and Game
Alaska SeaLife Center:	
Duration:	second year of 2 year project
Cost FY 00:	$8.6
Cost FY 01:	$111.8
Cost FY 02:	00
Geographic Area:	Prince William Sound, Kodiak Island, Spruce Island
Injured Resource/Service:	Clams, intertidal communities, and subsistence

ABSTRACT

The purpose of this project is to produce a roughly 28 minute long documentary film on *Exxon Valdez* oil spill impacts on the subsistence use of intertidal resources, including mussels, clams, chitons, and octopus, by residents of two predominantly Alaska Native communities; Chenega Bay in Prince William Sound, and Ouzinkie in the Kodiak area. The proposed documentary would build on two previous subsistence documentaries funded by the Trustee Council (Restoration Projects 96214, and 98274) and will focus on the use of the resources in the intertidal, the area hardest hit by oil, and broaden the discussion by bring in the perspective of the residents of Chenega Bay, the first community directly in the path of the spilled oil, and Ouzinkie, the first Kodiak area community to see the oil arrive. The documentary will compare and contrast the impact the *Exxon Valdez* oil spill has had on the use of intertidal resources in each community, as well as on the on-going EVOS restoration efforts to help residents mitigate these impacts. Funding in FY 00 supported development of an RFP and awarding of a contract to produce the video. Funding for the second year supports actual video production.

INTRODUCTION

Subsistence uses of natural resources are essential to the economies and cultures of the communities in the *Exxon Valdez* oil spill region, especially in the smaller predominantly Alaska Native communities. Many of the resource species on which these communities rely, were injured by the spilled oil.

Residents of the affected communities found that it was sometimes difficult for them to communicate the importance of these resources to their way of life to decision makers involved in the EVOS restoration process. Part of the problem was that the decision makers, including the Trustees, resource managers, and government attorneys are predominantly non-Native urban-dwellers. While decision makers did make the effort to visit communities in the spill area, these visits were necessarily infrequent and brief. Community residents saw the need for a more effective means of educating decision makers about their way of life and the spill impacts to their communities.

In answer to this need, the Tatitlek Village Council proposed the production of a series of films that would cover each species effected by the *Exxon Valdez* oil spill. Since 1996, two Tatitlek documentaries have been produced, in cooperation with the Department of Fish and Game, Division of Subsistence, and funding from the EVOS Trustee Council. The first documentary was on harbor seals (restoration project 96214), the second on herring and nearshore resources (restoration project 98274). These documentaries have proven popular in the spill area communities, and have also served as an effective tool for educating outsiders about the way of life and values of the residents of Tatitlek. This has created a better understanding among decision makers of the *Exxon Valdez* oil spill impacts to Tatitlek.

While the small predominantly Alaska Native communities in the spill region do have a lot of things in common, each community is unique. By the same token, the spill impacts to each community, and the local response to those impacts varied from community to community. The Tatitlek documentaries show a community that was significantly challenged by the *Exxon Valdez* oil spill, which has substantially triumphed over those challenges and is well on its way to recovery. The communities of Ouzinkie and Chenega Bay provide a contrast to the Tatitlek story. The beaches around Chenega Bay were much more heavily oiled than those around Tatitlek, and the oiling persists in many places. Chenega Bay residents remain concerned about using resources from the intertidal in their harvest areas. Even if they chose to harvest these resources, despite their concern, the intertidal species around Chenega Bay have declined to the point where they are not available to harvest. For Chenega Bay, recovery is not yet in sight.

For the communities of the Kodiak Island area, including Ouzinkie, the aftermath of the *Exxon Valdez* oil spill has coincided with an increase in paralytic shellfish poison (PSP), a toxin found in shellfish, which can be fatal to humans when consumed. There is, at present, no easy way for subsistence users to detect the presence of PSP in their shellfish harvesting areas. Until there is, Ouzinkie residents cannot use their intertidal resources with any confidence in their safety.

The Tatitlek documentaries are valuable educational tools. However, they only show part of the picture. The proposed Chenega Bay/Ouzinkie documentary, in combination with the Tatitlek documentaries, will provide a more balanced view of the range of *Exxon Valdez* oil spill impacts to the small predominantly Alaska Native communities in the spill impact area, as well as the range of local responses to these impacts. The stories of Ouzinkie and Chenega Bay must also be told.

The current proposal has been submitted by the villages of Ouzinkie and Chenega Bay to obtain funding to produce a film on the subsistence uses of intertidal resources in the Kodiak area and Prince William Sound.

NEED FOR THE PROJECT

A. Statement of Problem

The injured service this project addresses is subsistence. The injured resources are intertidal communities, including mussels, clams, chitons, and octopus. Prior to the *Exxon Valdez* oil spill, the intertidal in Prince William Sound, and Kodiak and Spruce Islands provided fresh, easily accessible sea food all year round. A favorite saying among residents of Chenega was, "When the tide is out, the table is set."

The intertidal zone was the hardest hit by the oil, especially in the shellfish harvesting areas around Chenega Bay. In the southwestern part of Prince William Sound the oil penetrated sandy beaches, to depths of as much as four feet in some areas. On rocky beaches, the oil formed pools and oozed into pockets and crevices. Intertidal resources on some of the beaches with heaviest oiling were smothered. The more aggressive attempts to remove the oil, such as high-pressure, hot water washing, also killed animals in the intertidal. The effects of the use of chemicals, such as Inipol, in the intertidal raised questions for subsistence users that have never been answered to their satisfaction.

These impacts to the intertidal zone disrupted harvest activities and created concerns about the safety of the resources. These concerns led people to look at the resources much more carefully. The residents of the Prince William Sound and Kodiak Island area villages were the first to note changes in the composition of the intertidal communities in the wake of the spill, and the first to note the slowed growth of intertidal bivalves. The observation of small white lesions on chitons in 1991 by residents of Chenega Bay increased their concerns about using intertidal resources.

Ouzinkie was the first Kodiak area community to see the oil arrive, mostly in the form of mousse and tar balls, and saw it in denser, fresher concentration than other communities in the region. A large proportion of Ouzinkie residents (61% of all adults) were employed on the *Exxon Valdez* oil spill clean up, and saw first hand the devastating effects of the spill on bird and marine life. It is for these reasons understandable that of the Kodiak area communities, Ouzinkie was the community in which subsistence harvests were curtailed the most severely. The harvesting of butterclams, a favorite wild food resource, came almost to a standstill. The aftermath of the *Exxon Valdez* oil spill coincided with an increase of red tides and paralytic shellfish poison (PSP) on Kodiak area beaches. This has compounded resident's concern about the safety of consuming shellfish from beaches where tar balls still wash up a decade after the *Exxon Valdez* oil spill, and has been an inhibiting factor in the recovery of subsistence uses of intertidal resources by residents of Ouzinkie.

This project will provide the residents of Chenega Bay and Ouzinkie an opportunity to be a part of the effort to help in the recovery of intertidal resources, and in so doing, put them in contact with researchers and information about these critical resources. It is the hope of the communities that their knowledge of these resources, and their views about the importance of subsistence, will be communicated through the film to the Trustee Council, to scientists, and to the general public.

B. Rationale/Link to Restoration

The EVOS Restoration Plan: Update on Injured Resources and Services, March 1999, lists intertidal communities and clams as injured and recovering, but not recovered.

The restoration objective for subsistence states that recovery will have occurred when "the cultural values provided by gathering, preparing, and sharing foods are integrated into community life" (p.82). One strategy to meet this objective is to "facilitate the participation of and communication with subsistence users in the restoration process" (p.86). Continuing concern about the safety of intertidal resources from beaches near Chenega Bay, where oil contamination has persisted, has greatly affected subsistence harvesting, resulting in lost opportunities to teach subsistence skills and traditional knowledge associated with these resources. One means of preserving these skills and knowledge, and ensuring they are transmitted to the next generation is to document them on film. This is also a good strategy for integrating local and traditional knowledge into on-going restoration efforts.

The intent of this project is to contribute to the restoration of intertidal resources and subsistence uses by providing a medium for harvesters to transmit their knowledge and observations, gained from years of experience, to the scientific community. Currently no other medium exists that presents harvesters' knowledge within its own contextual framework. Producing this video will help fill this void and enhance the restoration of clams and other intertidal species by providing a harvester's perspective on intertidal communities and *Exxon Valdez* oil spill impacts. As such, this project will contribute to various restoration strategies including: Sound Ecosystem Assessment; the Enhancement of Subsistence Resources; and Increase Involvement of Subsistence Users in the Restoration Process.

C. Location

Filming will take place in Chenega Bay and Ouzinkie, as well as other locations in Prince William Sound, on Kodiak Island and Spruce Island.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

This project is being jointly proposed by the Ouzinkie Tribal Council and the Chenega Bay Village IRA Council. Subcontracts will ensure each community's involvement in the production of the film. The councils and Council Presidents, Gail Evanoff and Paul Panamarioff, will be involved in selecting a contractor for the film, as well as in decisions concerning the content of the film.

PROJECT DESIGN

A. Objectives

The overall objective of this project is to promote the recovery of injured intertidal communities and their subsistence use through the production of a documentary on the subsistence uses of these resources in the Kodiak area and in Prince William Sound. This includes harvesting techniques, methods of processing, the distribution of resources and the traditional knowledge employed in the harvest of intertidal resources. The documentary will also highlight the difficulties each community has faced in returning to the harvest and use of these resources, as well as the on-going efforts to mitigate these difficulties being undertaken as part of the EVOS restoration program, including beach treatment, the clam restoration project, and the PSP testing program.

B. Methods

A twenty-eight (28) minute documentary film will be produced through a professional services contract. The film will document the subsistence harvest of intertidal resources in Prince William Sound (focusing primarily on Chenega Bay), and the Kodiak area (focusing primarily on Ouzinkie). A film crew will visit each community for two weeks in April and May of 2001 to document the harvest and distribution intertidal resources. Interviews will be conducted with residents of each community to gather traditional knowledge and views about the importance of these resources and subsistence to the community. A subcontract within the contract will support community involvement.

In February 2002, the documentary will be presented in public screenings in Chenega Bay, Ouzinkie, and Anchorage, and distributed to *Exxon Valdez* oil spill affected communities, libraries, Alaska Native organizations, and state and federal agencies.

The proposers cannot guarantee that the documentary will be broadcast on television. However, programming staff at KAKM (the Public Broadcasting Television Station in Anchorage) have been contacted to learn what criteria they use in deciding what programs to air. KAKM is most interested in airing programs that are produced not-for-profit, that are educational and aimed at adults, and which convey a positive message about Alaska. KAKM sets their broadcast schedule 6 to 8 weeks ahead, and would require at least that amount of notice prior to the desired air-date. For broadcast on KAKM, the actual length of a "half hour" program should be 26 minutes and 46 seconds, to allow for station identification and promotions. the proposers will work with the contractor to design and produce a documentary that will fit these criteria, will be attractive to broadcast programmers, and therefore more likely to be aired.

Story Outline

Each community's story will be told in interviews with residents and visits to local harvest areas. The stories of the two communities will be compared and contrasted.

<u>Chenega Bay</u>
Interviews will be done with active harvesters, some of whom are also elders, including: John M. Totemoff, Don Kompkoff, Sr., Pete Kompkoff, Jr., Larry Evanoff, Diane Selanoff, and Peter Selanoff.

Topics to be discussed include: experiences at the time of the *Exxon Valdez* oil spill, the persistence of oiling, continuing impacts on resource species, and subsistence harvests, and restoration efforts, including beach treatment efforts and the clam restoration project.

Three harvest areas will be visited during filming:

1) <u>Bishop Rocks, Evans Island</u>—This beach was previously used by Chenega Bay residents for seining salmon, harvesting chitons and octopus, as well as for recreation. The beach here was heavily oiled, and was subjected to mechanical clean-up techniques and application of Inipol. Subsurface oil remains here, and the beach is naked of life.
2) <u>Sleepy Bay, LaTouche Island</u>—Prior to the *Exxon Valdez* oil spill Chenega residents harvested sea weed for food here, and the area was also important to marine mammal hunters, because it was a pinniped haulout area. This was one of the most heavily oiled beaches in Prince William Sound, with a thick layer of crude oil covering the beach, and subsurface oiling in excess of 4 feet in depth in the sandy areas of the beach. The beach was treated with both hot and cold mechanical washing, and bulldozing. Today the beach is barren of life.
3) <u>Fox Farm, Elrington Island</u>—Hunters from Chenega Bay used to be able to count on there being seals on this beach, and sea lions nearby. This was also an important place to hunt deer. This beach was not as heavily hit as some others in Prince William Sound. However, it was impacted by tar balls, and there are still tar mats on the beach. Deer were found dead on this beach following the spill. The abundance of life has been reduced on this beach.

<u>Ouzinkie</u>
A round table group interview will be done with Kenneth Anderson, the Natural Resource Specialist for Ouzinkie, and four or five elders from the community including Zach Chichenoff, Floyd Anderson and Fred Squartsoff.

The group will discuss the status of intertidal resources and harvests before the spill and since the spill. The elders will draw on their lifetime experience, and traditional knowledge, to talk about the changes in the intertidal resources through time. They will also talk about PSP, and about the efforts, in coordination with the EVOS Trustee Council, to develop a fast and simple PSP test for use by harvesters.

The following harvest areas will be visited during filming:

1) Camels Rock
2) Spruce Island clamming beach

—these are both important clam harvest areas in close proximity to the community of Ouzinkie. These beaches were impacted by tar balls following the *Exxon Valdez* oil spill. PSP has been a problem on these beaches in the years since the spill.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

The production and post production work on the film will be contracted out, through a request-for-proposals (RFP) process, to an experienced film maker who has the expertise to make a quality film. In contracting out for this production, the proposers will seek a contractor who will create and produce the product, rather than sub-contracting for creative talent. By hiring a video production company, the proposers will maintain control over all aspects of the process.

Each bidder will be required to submit two samples of their work, consisting of a 20 to 30 minute long film, along with their proposal. Bids will be evaluated by a panel, including the Village Council Presidents of Ouzinkie and Chenega Bay, the Spill Area Wide Community Involvement Coordinator, and staff of the Division of Subsistence , Alaska Department of Fish and Game. Evaluation criteria will include understanding of the project (as demonstrated in the proposal), quality of work, appropriateness of the methodology suggested in the proposal, and price. A preference will be given for Alaska businesses.

In consultation with the communities and ADF&G staff, the video production company will create a more detailed story line before shooting the film. All footage will be shot on location and include interviews with members of the community and footage of harvesters. Once the film is completed, the production company will edit the footage using digital state of the art editing equipment.

SCHEDULE

A. Measurable Project Tasks (February 1 2000-December 15 2001)

This project will be completed over two fiscal years and the budget will be divided accordingly. In the first year (2000) ADF&G personnel will develop an RFP and award a contract. Because of previous commitments, ADF&G personnel will not be able to develop the RFP until July of 2000. During the second year (2001) all phases of video production will be completed and the contractor will provide a completed film by December 15, 2001.

Pertinent Dates:

February 1, 2000:	Project Approval
July 1- September 30, 2000:	Develop contract guidelines, evaluate bids, and award contract.
October 1 - March 30, 2001:	Pre-Production Phase, develop story-line for film.
April-June 2001:	Production Phase, contractor to travel to Chenega Bay and Ouzinkie, as well as locations in Prince William Sound and

	on Kodiak and Spruce Islands, to film interviews and harvesting footage.
July 1-November 30, 2001:	Post Production Work.
December 15, 2001:	Contractor will provide completed film and deliver 100 copies.
February 2002	Public screenings of documentary in Ouzinkie, Chenega Bay, and Anchorage.

PUBLICATION AND REPORTS

The film will be widely distributed to federal and state agencies, non-governmental agencies, and interested parties. Showings will take place in Chenega Bay, Ouzinkie, and Anchorage.

PROFESSIONAL CONFERENCES

The film may be shown at professional conferences.

NORMAL AGENCY MANAGEMENT

This project does not fall under existing statute or regulation governing the activities of the Alaska Department of Fish and Game, Division of Subsistence.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project will contribute to various restoration strategies including: Sound Ecosystem Assessment; the Enhancement of Subsistence Resources; and Increase Involvement of Subsistence Users in the Restoration Process.

PROPOSED PRINCIPAL INVESTIGATORS

Gail Evanoff, President
Chenega Bay Village IRA Council
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Phone: (907) 573-5132
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Paul Panamarioff, President
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Alaska Department of Fish and Game
Division of Subsistence
333 Raspberry Road
Anchorage, Alaska 99518

Phone: (907) 267-2309
Fax: (907) 267-2450

PROJECT PERSONNEL

Kenneth Anderson
Mr. Anderson, a life-long resident of Ouzinkie, is the Natural Resource Specialist for Ouzinkie. In that capacity, he has been digging clams at designated beaches, and sending samples to the ADEC laboratory in Palmer for PSP testing for two years.

Gail Evanoff
Mrs. Evanoff was involved in the effort to get the community of Chenega reestablished and Chenega Bay has been her primary home since 1983. She was the primary spokesperson for the community during the initial response to the *Exxon Valdez* oil spill, she coordinated the local beach treatment efforts, represented her community on the Oil Spill Health Task Force, and has served as the EVOS community facilitator for Chenega Bay. She is currently president of the Chenega Bay Village IRA Council.

Paul Panamarioff
Mr. Panamarioff was born in Ouzinkie, and is a life-long harvester of subsistence foods. He is currently president of the Ouzinkie Tribal Council.

William E. Simeone
Dr. Simeone has worked in oil spill and subsistence related projects in Prince William Sound for the last ten years. Five of those years have been with the Alaska Department of Fish and Game, Division of Subsistence. During that time Dr. Simeone administered, coordinated, and consulted on two documentary films funded by the Exxon Valdez Trustee Council, restoration projects 96214, and 98274.

approved TC 8-3-00

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$10.0						
Travel		$3.8						
Contractual		$90.2						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$104.0				Estimated FY 2002		
General Administration		$7.8						
Project Total	$0.0	$111.8				$0.0		
Full-time Equivalents (FTE)		0.2						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY01

Prepared: 4/14/00

Project Number: 01481
Project Title: Intertidal Documentary
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2001 EXXON VALDEZ TRUS' OUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2001
William E Simeone	SRS II	16C	2.0	5.0		10.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.0	5.0	0.0	
					Personnel Total	$10.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2001
Two round trips to Chenega Bay and Prince William Sound	0.4	2	10	0.1	1.8
Two round trips to Ouzinkie and Spruce Island	0.5	2	10	0.1	2.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$3.8

FY01

Prepared: 4/14/00

Project Number: 01481
Project Title: Intertidal Documentary
Agency: Alaska Department of Fish and Game

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs: Description	Proposed FY 2001
Ouzinkie Village Council (for logistical support, boats, fuel))	7.5
Chenega Bay Village IRA Council (for logistical support, boats, fuel)	7.5
The Alaska Department of Fish and Game will develop a request for proposals for a documentary film maker. (described under Methods on page 4 of detailed project description)	75.0
Postage to distribute copies of video	0.2
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$90.2

Commodities Costs: Description	Proposed FY 2001
Commodities Total	$0.0

FY01

Prepared: 4/14/00

Project Number: 01481
Project Title: Intertidal Documentary
Agency: Alaska Department of Fish and Game

FORM 3B
Contractual &
Commodities
DETAIL

2001 EXXON VALDEZ TRU... COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2001
			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.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY01

Prepared: 4/14/00

Project Number: 01481
Project Title: Intertidal Documentary
Agency: Alaska Department of Fish and Game

FORM 3B
Equipment
DETAIL

01492

Revision 7-6-00
approved TC 8-3-00

Project Title: Were pink salmon embryo studies in PWS biased?

Project Number:	00492
Restoration Category:	Research
Proposer:	John Thedinga, Mark Carls, Ron Heintz, NMFS, Auke Bay Laboratory ABL Program Manager: Dr. Stanley Rice NOAA Program Manager: Bruce Wright
NMFS Auke Bay Laboratory	
Lead Trustee Agency:	NOAA
Alaska SeaLife Center:	No
Cooperating Agencies:	
Duration:	2 years
Cost FY01:	$62,100
Cost FY02:	$48,900
Geographic Area:	Field studies: Little Port Walter on Baranof Island, Auke Creek Hatchery (Southeast Alaska) Laboratory studies: Retrospective analysis-PWS samples
Injured Resource/Service:	Pink salmon

ABSTRACT

Effects of the *Exxon Valdez* oil spill on wild pink salmon embryo survival in Prince William Sound are disputed among government- and industry-sponsored researchers. Exxon contends the government's conclusions that reduced embryo viability in oiled streams was caused by persistent oil contamination were biased because sampling times were earlier in oiled streams than in reference streams. We propose a combination of retrospective and experimental studies to determine if estimates of pink salmon embryo survival were accurate or biased by conducting a historical review of past sampling procedures and experimentally determining the ability to discriminate eggs killed by sampling (shock mortality) and previously dead eggs.

INTRODUCTION

The Trustee Council view of damage to pink salmon in Prince William Sound (PWS) is different than that of Exxon (Rice et al. 1999; Brannon and Maki 1996; Brannon et al. 1999). One controversial issue has been embryo mortality in oiled vs. non-oiled streams. Bue (1998) found that oiled streams had significantly higher pink salmon embryo mortality than non-oiled streams and Heintz et al. (1999) confirmed that incubation in oiled substrate can cause damage to embryos. Brannon (1996), however claimed that increased mortality in oiled streams was an artifact of sample design due to shocking and bias from sampling timing. Collins et al. (2000) showed that hydraulic sampling of embryos can cause mortality that can bias mortality estimates upward if not accounted for.

After 11 years, the questions remain- -was there bias in the sampling because of run timing differences between oiled and non-oiled streams? Were egg counters able to separate new mortalities caused by shocking during the sampling, and did they account for the sampling mortalities? Is it possible to account for the mortalities? These questions are basic to the assessment of damage to pink salmon from the spill, and to restoration strategies that should result. This multi-year project examines this continuing controversy with a combination of retrospective and experimental studies.

In the first year, experimental studies will focus on the ability to separate live eggs and dead eggs from newly shocked eggs. This will be done first in a controlled laboratory situation (hatchery) with a series on known life stages. A field test will also be conducted to test the relationship between run timing and susceptibility of eggs to pumping damage. For the field test, we will need a uniform stream that can be re-sampled periodically during the run; the spawning channel at Lovers Cove Creek near Little Port Walter (LPW) will be used for the field study. A proportion of the eggs in these experiments will be repeatedly viewed by several observers to test discrimination of recent and past mortality as a function of time.

In the second year, several different retrospective efforts will be conducted in this study. The analyses of the run timing issue by both ADFG (Craig et al. 1999) and Brannon et al. (1999) will be examined statistically in detail. Key to the issue is whether shock induced mortalities were caused, how they were counted, and if they were accounted for. The quality of the mortality data will be evaluated by interviewing supervising and technician personnel to determine what the sampling protocols were, if they were used, and if they were adequate. Sampling error by mis-identification of live/dead eggs can also be independently assessed by re-examination of the preserved live and dead eggs collected in 1990 and 1991. Auke Bay laboratory has received the preserved egg samples from all four zones sampled from 15 control and 10 oiled streams in 1990 and 1991 (several thousand eggs). The potential for error can be assessed by measuring the degree of necrosis in the preserved specimens, and also by identification of the life stage at the time of collection.

Ultimately, a model will be developed to examine the possibility that ADFG data collected from 1989-1993 in oiled and reference streams had uni-directional biases in spawn timing, processing time, and recognition of shock mortality. Data from both the retrospective and field studies and from ADFG's egg pumping studies will be synthesized to determine if results were biased.

Spawning for pink salmon begins in August and September; Auke Bay Laboratory will provide in kind funds to facilitate initiation of this project in late FY 2000 so that it can be fully functional for FY 2001.

NEED FOR PROJECT

A. Statement of problem

There is an ongoing dispute between government and industry researchers concerning the impact of the Exxon Valdez oil spill on pink salmon in PWS. Government researchers concluded that pink salmon embryo survival was lower in oiled streams than in non-oiled streams from 1989-1993. Industry researchers allege that government sampling in oiled streams was earlier than in reference streams relative to run timing, thus biasing estimates of egg survival, because early egg stages are more susceptible to mechanical damage caused by hydraulic pump sampling than later stages. Industry researchers further contend that government observers failed to discriminate between previously dead eggs and those killed by sampling, thereby compounding the problem. The controversy continues after 11 years; this study attempts to clarify the controversy if possible and will use several lines of investigation. The controversy continues to cloud estimates of damage, restoration strategies, the impact of long term damage, and the definition of full recovery for this species.

B. Rationale/Link to Restoration

Pink salmon are listed as a recovering species, but before they can be added to the list of recovered species we need to know if persistent oil caused increased mortality of pink salmon embryos in PWS streams. Controversy over how sampling techniques and run timing affected the results of past embryo mortality studies needs to be resolved in order to determine the extent of possible damage from EVOS. Recent studies have shown that oil still exists near natal habitats and that pink salmon embryos are significantly more sensitive to oil exposure than previously believed (Heintz, et al. 1999a, b). If embryos are continuing to be exposed to oil in streams then the extent of damage needs to be understood. Understanding the damage that oil can cause to pink salmon embryos is also important in realizing potential risks associated with future oil spills.

C. Location

The field portion of the project will take place at Lovers Cove Creek near the Little Port Walter field station (LPW) in Southeast Alaska and at Auke Creek Hatchery in Juneau. Lovers Cove Creek provides a uniform spawning channel and an intertidal spawning population of pink salmon that allows repeated sampling. This location is appropriate because the streams physical characteristics are conducive to this type of project and it close to LPW which provides the necessary logistical and infrastructure support. The retrospective portion of this project will use pink salmon eggs pumped from PWS streams from 1990-1991. ADFG personnel that participated in the egg pumping studies in PWS will be interviewed.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

Scientists involved in this study will regularly present progress reports and results in scientific and public forums, including the annual workshop. They will be available to talk with interested public and will provide information for Trustee Council newsletters and annual reports as appropriate.

PROJECT DESIGN

A. Objectives

The primary objective is to determine if time-series estimates of pink salmon embryo survival in streams oiled by the Exxon Valdez oil spill were accurate or biased. Several steps are required to achieve this objective:

Experimental study (Year 1)

1. Develop models to relate previous field work to known life stages, run timing, and observer accuracy.
   a. At a hatchery, experimentally determine the period of time observers are able to discriminate between eggs of known age killed by shocking and previously dead eggs. This test will be repeated at different egg developmental stages by up to 10 observers.
   b. In the field, collect a time series of egg shock data by pumping samples from a pink salmon stream over time to determine sensitivity of eggs to stress. Relate mortality to run timing.

Retrospective study (Year 2)

1. Determine if there was potential for bias:
   Did sampling times differ in oiled and non-oiled streams relative to mean spawning time?

a. Evaluate ADFG's (Bue 1998; Craig et al. 1999) results of PWS pink salmon embryo mortality data and Brannon et al.s (1999) interpretation of ADFG's results.

2. Determine if observers accounted for mortality induced by sampling procedures.
   a. Document standard operating procedures. Specifically, determine if instructions were given to egg counters to discriminate eggs killed by pumping from previously dead eggs.
   b. Document what data were actually collected by field crews. Determine if observers followed protocol.

3. Determine if standard operating procedures were adequate.
   a. Determine if egg observers kept up with egg pumpers or fell behind: determine the average and range of times between egg collection and egg observation.
   b. Determine if there were differences between oiled and reference streams in lag times between egg pumpers and observers. Were the number of eggs to count different between oiled and un-oiled streams?

4. Determine the developmental stage of preserved eggs that were sampled by ADFG in 1990-1991 from oiled and non-oiled streams.
   a. Determine if there is evidence of errors in the identification of live and dead eggs.
   b. Visually examine live and dead eggs to determine if there is a difference in the life stage at mortality between oiled and non-oiled streams.

Synthesis (Year 2)

1. Develop a model to examine the possibility that ADFG data collected from 1989-1993 in oiled and reference streams had uni-directional biases in processing time, recognition of shock mortality, and spawn timing.

2. Discuss and compare results and conclusions to those reached by Brannon and Maki (1996).

B. Methods

Experimental study (year 1)

Hatchery: To determine the period of time observers are able to discriminate between shock mortality and previously dead eggs, eggs will be incubated in the Auke Creek hatchery and assessed for shock mortality at three times after fertilization. Eggs from two adult pink salmon from Auke Creek from three portions of the run will be fertilized and incubated. Eggs from each group will be assessed 1, 10, 20, 30, 40, and 50 days after fertilization. For assessment, 50 eggs from each sampling period will be shocked at three shock intensities; eggs will be shocked by dropping them into water from a distance of 1/4, 1, and 2 meters. Eggs will be assessed 5, 15, 30, 60, and 90 minutes after shocking independently by up to 10 observers. A subset of eggs will be preserved in 5% acetic formalin immediately after pumping for verification of live and dead eggs.

Field: Eggs will be pumped at Lovers Cove Creek where repeated sampling over a spawning run is feasible. Lovers Cove Creek was modified into an experimental spawning channel in the 1970's (Martin 1973), and today it is an intertidal stream channel with uniform width and spawning gravel and consistent stream flow. The 50 m channel will be partitioned into 25 transects 2 m apart. Care will be taken to avoid walking in other areas of the stream outside the sampled transects to avoid damaging embryos. Eggs will be pumped using standard egg pumping procedures in randomly selected transects to identify live and dead eggs and those killed by pumping. Pumping will begin the end of September and end the first week of November. Approximate sampling dates are Sept. 30, Oct. 5, 10, 20, and Nov. 2. To ensure adequate sample size, five transects will be sampled each day, and five plots will be sampled at each transect for a total of 25 samples each sample date.

Eggs collected from each plot will be placed in separate plastic trays and assessed 10 minutes after pumping. Eggs will be classified into four groups: translucent, translucent eyed, dense opaque, and partially opaque. Translucent eggs will be considered live. Translucent eyed eggs that show eye pigmentation through the chorion will be considered live. Opaque eggs are those that contain coagulated yolk and appear white and will be considered to have died prior to sampling. Eggs that are partially opaque or are in the process of turning opaque will be considered fatalities or shock mortalities because the viteline membrane has ruptured and the yolk has begun coagulating. Samples of eggs that were assessed as shock mortalities will be preserved in 5% acetic formalin for later microscopic examination of embryo development.

To test the effect of time after collection on identifying shock mortality, eggs will be classified at several times following collection. At one of the transect each sample date, live and dead eggs will be assessed independently by two samplers after collecting the eggs. Handling of eggs will be minimized to reduce the chance of further inducing egg shock mortality. Eggs will be assessed 10, 30, and 60 minutes after pumping.

Run timing at Lovers Cove Creek will be monitored prior to and during egg pumping to determine run timing. Beginning in mid-August, the spawning channel at Lovers Cove Creek will viewed every other day to determine the onset and number of spawners. Egg pumping will begin when most fish have spawned.

Retrospective study (year 2)

ADFG personnel (supervisors, technicians) that supervised hydraulic egg sampling in PWS following EVOS will be interviewed to determine what egg sampling protocols existed and what protocol were given to field samplers. Personnel that sampled eggs will be interviewed to determine what data they actually collected and what sampling protocols were followed. We will determine if the number of eggs counted differed between oiled and nonoiled streams which could affect the time between egg collection and egg observation. A statistician will analyze pink salmon embryo and sampling timing data reported by Bue (1998) and Craig et al (1999) and challenged by Brannon et al. (1999). The findings in each report will be evaluated and if additional data exists it will be made available by ADFG and incorporated into the analysis. Results will be synthesized and a conclusion to whether the results are biased or not will be made.

The developmental stage of the eggs at the time of death will be assessed by visual estimating egg condition of preserved eggs sampled from PWS streams in 1990-1991. Visual estimates will confirm the amount of necrosis in both live and dead eggs. Live eggs that were killed by sampling will appear partially necrotic. All dead eggs with visible chorion will be of an earlier stage of development than eggs in the live samples. The collection of eggs is from each of the four zones sampled from 15 control and 10 oiled streams in 1990 and 1991(Tables 1, 2).

Synthesis (year 2)

We will develop a model to examine the possibility that ADFG data collected from 1989-1993 in oiled and reference streams had uni-directional biases in processing time, recognition of shock mortality, and spawn timing. We will use data from both the retrospective and the field studies for the model.

In order to determine what level of misinterpretation of egg condition (live or dead) would bias the results of the embryo mortality study we model the PWS embryo data from 1989 - 1993. Based on Bue's (1996) data, we modeled the number of eggs counted in the oiled and control streams in PWS to account for the misidentification of eggs shocked and killed by the egg pumping procedure. We used a GLM two factor model based on the height above intertidal where the eggs were collected and compared the oiled vs. non-oiled streams. The difference in egg mortality between the oiled and non-oiled streams became non significant ($P = 0.05$) when 9.5% of eggs in all of the oiled streams were incorrectly counted as dead, but were actually killed by egg pumping and should have been counted as live. Whereas in the non-oiled streams, 11.3% of dead eggs would have to be incorrectly counted as live before mortality between oiled and non-oiled streams was no longer significantly different.

C. Cooperating agencies, contracts and other agency assistance

ADFG will provide historic egg sampling data, eggs, and run timing information. Contracts will be awarded to analyze preserved eggs from PWS and to evaluate Bue's (1998) pink salmon embryo mortality results and Brannon et al.'s (1999) rebuttal of the results. NMFS will pump eggs in the field, test egg shock mortality recognition in the hatchery, and conduct the retrospective analysis. In order to sample eggs from this years pink salmon run, this project will need to be started in FY 2000. NMFS will facilitate the start of the experimental portion of this project by making preparations this summer for sampling in September 2000.

SCHEDULE

A. Measurable tasks for FY00 (October 1, 1999 - September 30, 2000)

September:	Field: Begin pumping eggs at Lovers Cove Creek Hatchery: Begin incubating eggs at Auke Creek Hatchery

A. Measurable tasks for FY01 (October 1, 2000 - September 30, 2001)

Oct. - Nov.:	Field: Pump and assess eggs at Lovers Cove Creek Hatchery: Assess shocked eggs at Auke Creek Hatchery
Winter:	Begin analysis of egg pumping and egg shocking data from FY 01 field season
Spring:	Complete data analysis
Summer:	Complete two manuscripts

A. Measurable tasks for FY02 (October 1, 2001 - September 30, 2002)

Fall:	Conduct retrospective study Analyze preserved eggs
Winter:	Analyze preserved eggs and retrospective data
Spring :	Begin synthesis
Summer:	Complete synthesis

B. Project Milestones and Endpoints

Fall	2000:	Initiate and complete field and laboratory studies
Winter	2001:	Analyze egg pumping and egg shocking data
Spring	2001:	Complete data analysis
Summer	2001:	Complete two manuscripts

Fall	2002:	Initiate retrospective study
Spring	2002:	Initiate synthesis manuscript
Summer	2002:	Complete synthesis manuscript

C. Completion Date

Two manuscripts on egg shocking will be submitted Sept 30, 2001.

Synthesis manuscript will be submitted Sept 30, 2002.

PUBLICATIONS AND REPORTS

Final report

peer-reviewed manuscripts:

Thedinga, J. T. et al. Detection of pink salmon eggs killed by hydraulic sampling. Journal unknown.

Carls, M. G. et al. Ability of observers to discriminate shock mortality in pink salmon eggs as a function of time after shock. Journal unknown.

Thedinga, J. T. et al. Pink salmon embryo studies in Prince William Sound: Did oil affect mortality or were sampling techniques biased?

PROFESSIONAL CONFERENCES

Travel to 2001 oil spill symposium is included.

NORMAL AGENCY MANAGEMENT

This project seeks to address the hypothesis that the effects of oil in streams on pink salmon embryo mortality was confounded by time of sampling through a cooperative relation ship between NMFS and the Trustees. NMFS would not be conducting this project if the oil spill had not occurred. NMFS proposes to make a significant contribution to the operation of this project, making it a cooperative venture with the Trustee Council.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The design of this project has been coordinated with work performed in the past by ADFG. NMFS will coordinate with the Trustees by providing labor requirements and laboratory overhead.

PROPOSED PRINCIPAL INVESTIGATOR

Name	John Thedinga
Affiliation	NMFS
Address	Auke Bay Laboratory 11305 Glacier Hwy Juneau, AK 99801
Phone	907-789-6025
Fax	907-789-6094
E-mail	john.thedinga@noaa.gov

PRINCIPAL INVESTIGATOR

GS-12 Fisheries Research Biologist - John F. Thedinga. BS Fisheries and Wildlife Management, University of North Dakota (1975); MS Fisheries Science, University of Alaska (1986). He has been employed by the National Marine Fisheries Service, Auke Bay Laboratory since 1978 specializing in research on the effects of logging on salmon and freshwater habitat. He has been principle investigator and co-investigator on several projects. Recently he was co-investigator of Trustee project 98076 and principal investigator of Trustee project 00163A. He has published over 20 scientific papers.

CO INVESTIGATORS

GS-12 Fisheries Research Biologist - Mark G. Carls Received BA (1975) in Biology from Gustavus Adolphus College, St. Peter, MN, and MS (1978) in Biological Oceanography from Dalhousie University, Halifax, Nova Scotia. Mark has been employed at the Auke Bay Fisheries Laboratory since 1979. His principal involvement has been in research of petroleum hydrocarbon toxicology to marine fish and invertebrates, including egg, larval, and adult life stages. Mark has published 17 papers, and has 5 Exxon Valdez damage assessment papers in preparation or pending publication. Since 1989, he has been involved as a principal investigator and co-investigator on several studies resulting from the Exxon Valdez oil spill involving Pacific herring, pink, and chum salmon, and mussels.

GS-12 Fisheries Research Biologist - Ron A. Heintz Education: BS Ecology, University of

Illinois (1979); MS Fisheries Science, University of Alaska (1986). Ron has been involved in examining the effects of Exxon Valdez oil on pink salmon since 1992. He has published 4 peer-reviewed papers and has another in press on this topic. To date his work has identified the sensitivity of pink salmon embryos to low concentrations of oil, demonstrated the existence of delayed effect on marine survival and the persistence of oil in stream deltas in Prince William Sound. He is currently working on two other EVOS projects related to this same topic.

OTHER KEY PERSONNEL

GS-12 Fisheries Research Biologist - Adam Moles will assist with the analysis of the preserved egg samples.

GS-9 Fisheries Research Biologist - Jacek M. Maselko will assist in setting up the experiments, collecting data, and analyzing data.

LITERATURE CITED

Brannon, E. L. and A. W. Maki. 1996. The Exxon Valdez oil spill: Analysis of impacts on the Prince William Sound pink salmon. Reviews in Fisheries Science 4(4): 289-337.

Brannon , E. L., L. Moulton, K. Parker, M. Cronin, and K. Collins. 1999. Resolution of oil spill affects on incubation pink salmon Prince William Sound. Center for salmonid and freshwater species at risk, University of Idaho, Moscow, ID. Research Bulletin 99-1.

Bue, B. G., Sharr, S. D. Moffitt, and A. Craig. 1996. Injury to salmon eggs and preemergent fry due to the T/V Exxon Valdez oil spill. In S D. Rice, R. B. Spies, D. A. Wolfe, and B. A. Wright (eds.). Exxon Valdez Oil Spill Symposium Proceedings. American Fisheries Society Symposium Number 18.

Bue, B. G., S. Sharr, and J. E. Seeb. 1998. Evidence of damage to pink salmon populations inhabiting Prince William Sound, Alaska, two generations after the Exxon Valdez oil spill. Trans. Am. Fish. Soc. 127:35-43.

Craig, A. K., M. Willette, D. G. Evans, and B. G. Bue. 1999. Injury to pink salmon embryos in Prince William Sound -field monitoring. Exxon Valdez Oil Spill Restoration Project Final Report. Restoration Project 8191A-1.

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Heintz, R. A., S. D. Rice, A. C. Wertheimer, R. Bradshaw, F. P. Thrower, J. E. Joyce, and J. W. Short. 1999a. Delayed effects on growth and marine survival of pink salmon after exposure to crude oil during embryonic development. P. 5.1-5.19 in A. C. Wertheimer, A. C., R. A. Heintz, J. F. Thedinga, J. M. Maselko, A. G. Celewycz, R. Bradshaw, and S. D. Rice. Effects of oiled incubation substrate on straying and survival of wild pink salmon. Exxon Valdez Trustee Council Restoration Project 98076 Final Report.

Heintz, R. A., J. W. Short, and S. D. Rice. 1999b. Sensitivity of fish embryos to weathered crude oil: part II. Increased mortality of pink salmon (Oncorhynchus gorbuscha) embryos incubating downstream from weathered Exxon Valdez crude oil. Environ. Toxicol. Chem. 18(3):494-503.

Martin, R. M. 1973. Hydraulic modification of intragravel streambed flow as a means of improving egg-to-fry survival. Masters thesis, California State University, Humboldt.

Rice, S. D., R. E. Thomas, R. A. Heintz, A. Moles, M. Carls, M. Murphy, J. W. Short, A. Wertheimer. 1999. Synthesis of long term impacts to Pink Salmon following the Exxon Valdez oil spill: persistence, toxicity, sensitivity, and controversy. Final Report: project 99329, Exxon Valdez Trustee Council.

Table 1. Location, date, and number of jars of preserved live and dead eggs sampled in 1990 in oiled and non-oiled (control) streams in Prince William Sound by ADFG.

		Number of jars of eggs at each intertidal zone and upstream							
Creek	Date	6- 8' Live	8-10' Live	10-12' Live	Upstream Live	6-8' Dead	8-10' Dead	10-12' Dead	Upstream Dead
					Non-oiled				
Koppen Creek	24-Sep	2	0	2	2	1	0	1	1
McClure Creek	25-Sep	2	1	2	2	1	1	1	1
Mink Creek	25-Sep	2	1	2	2	1	1	1	1
West Finger Creek	26-Sep	2	2	2	2	1	1	1	1
Totemoff Creek	28-Sep	2	2	2	2	1	1	1	1
Port Audrey	29-Sep	2	2	2	2	1	1	1	1
Cathead Bay	1-Oct	2	2	2	2	1	1	1	1
Brizgaloff Creek	2-Oct	2	2	2	2	1	1	1	1
Erb Creek	2-Oct	2	2	2	2	1	1	1	1
Bernard Creek	8-Oct	1	2	2	2	1	1	1	1
Cabin Creek	9-Oct	2	1	2	2	1	1	1	1
Wilby Creek	9-Oct	2	1	2	2	1	1	1	0
Kelez Creek	10-Oct	2	2	2	2	1	1	1	1
O'Brien Creek	11-Oct	2	2	2	2	1	1	1	1
Falls Creek	12-Oct	2	1	2	2	1	1	1	1
Bainbridge Creek	14-Oct	0	2	2	2	1	1	1	1
Claw Creek	14-Oct	2	2	2	0	1	1	1	0
Hogg Creek	15-Oct	2	1	2	2	1	0	1	1
Cook Creek	18-Oct	2	2	2	2	0	1	1	1
Halverson Creek	18-Oct	2	1	2	2	1	1	1	1
					Oiled				
Junction	28-Sep	2	1	2	2	1	1	1	1
Herring Bay	30-Sep	2	1	2	2	1	1	1	1
Loomis Creek	30-Sep	2	1	2	2	1	1	1	1
Point Countess	3-Oct	2	1	2	2	1	1	1	1
Bjorne Creek	4-Oct	2	2	2	2	1	1	1	1
Hayden Creek	12-Oct	2	1	2	2	1	1	1	1
Hogan Bay	13-Oct	1	0	2	2	1	0	1	1
Shelter Bay	13-Oct	2	1	2	2	1	1	1	1
Snug Harbor	16-Oct	2	1	2	2	1	1	1	1
Sleepy Bay	30-Oct	2	1	2	2	1	1	1	1
Chenega	1-Oct	2	1	2	2	1	1	1	1
Canoe Pass	1-Oct	2	2	2	2	1	1	1	1

Table 1. Location, date, and number of jars of preserved live and dead eggs sampled in 1991 in oiled and non-oiled (control) streams in Prince William Sound by ADFG.

		Number of jars of eggs at each intertidal zone and upstream							
Creek	Date	6-8' Live	8-10' Live	10-12' Live	Upstream Live	6-8' Dead	8-10' Dead	10-12' Dead	Upstream Dead
					Non-oiled				
Moffitoffskiloff	1-Oct	1	1	1	1	1	1	1	1
Bernard Creek	23-Sep	0	1	1	1	0	1	1	1
Koppen Creek	23-Sep	0	1	1	1	0	1	1	1
Cabin Creek	24-Sep	1	1	1	1	0	1	1	1
Cook Creek	24-Sep	0	1	1	1	0	1	1	1
Kelez Creek	25-Sep	1	1	1	1	3	1	1	1
Wilby Creek	25-Sep	1	1	1	1	0	1	1	1
Falls Creek	28-Sep	1	1	1	1	1	1	1	1
Hogg Creek	28-Sep	1	1	1	1	1	1	1	1
O'Brien Creek	28-Sep	1	1	1	1	1	1	1	1
Halverson Creek	29-Sep	1	1	1	1	1	1	1	1
Claw Creek	31-Sept	1	1	1	1	1	1	1	0
Port Audrey	2-Oct	1	1	1	1	1	1	1	1
McClure Creek	8-Oct	1	1	1	1	0	1	1	1
West Finger Creek	8-Oct	1	1	1	1	0	1	1	1
Mink Creek	9-Oct	1	1	1	1	1	1	1	1
Erb Creek	10-Oct	1	1	1	1	1	1	1	1
Totemoff Creek	10-Oct	1	1	1	1	1	1	1	1
Bainbridge Creek	11-Oct	1	1	1	1	1	1	1	1
Brizgaloff Creek	11-Oct	1	1	1	1	1	1	1	1
Cathead Bay	10/1,10/2	1	1	1	1	1	1	1	1
					Oiled				
Sleepy Bay	25-Sep	1	1	1	1	1	1	1	1
Snug Harbor	26-Sep	1	2	2	2	1	2	2	2
Bjorne Creek	27-Sep	1	1	1	1	1	1	1	1
Hogan Bay	27-Sep	1	0	0	0	1	0	0	0
Shelter Bay	27-Sep	0	1	1	1	0	1	1	1
Point Countess	9/29-9/30	1	1	1	1	1	1	1	1
Junction	1-Oct	0	1	1	1	0	1	1	1
Herring Bay	7-Oct	1	1	1	1	1	1	1	1
Loomis Creek	9-Oct	1	1	1	1	1	1	1	1
Hayden Creek	12-Oct	1	2	1	1	1	1	0	1

Revision 7-5-00
approved TC 0 3-00

2001 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$22,460.0						
Travel		$8,094.0						
Contractual		$16,800.0						
Commodities		$9,000.0						
Equipment		$2,000.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$58,354.0				Estimated FY 2002		
General Administration		$3,717.5						
Project Total	$0.0	$62,071.5				49K		
Full-time Equivalents (FTE)		0.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:
This project addresses the controversy between government and industry -sponsored researchers over the effect of oil on pink salmon embryo mortality in Prince William Sound streams.

NOAA Contribution FY00: Principal Investigator - John Thedinga 2 mo. @ $16K
Co-PI - Mark Carls1 mo. @ $8.2K
Jacek Maselko 2 mo. @ $10.5K

NOAA Contribution: Habitat Investigation Program Manager, S. Rice,1 mo @ $12.1K
Principal Investigator - John Thedinga 4 mo. @ $32K
Co-PI - Mark Carls 3 mo. @ $24.6K
Co-PI - Ron Heintz 1 mo. @ $7.7K
Little Port Walter Research Facility, Auke Creek Hatchery

FY01

Prepared: 7/5/00

Project Number: 00 442
Project Title: Pink salmon embryo shocking study
Agency: National Oceanic & Atmospheric Administration

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2001 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2001
John Thedinga	PI	GS12/4	1.5	8000.0		12,000.0
Jacek Maselko	Fishery Research Biologist	GS9/3	2.0	5230.0		10,460.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		3.5	13230.0	0.0	
					Personnel Total	$22,460.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2001
Juneau to Anchorage (Restoration Workshop/Thedinga)	444.0	1	3	150.0	894.0
Juneau - LPW roundtrip	1800.0	4		0.0	7,200.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$8,094.0

FY01

Prepared: 7/5/00

Project Number: 00
Project Title: Pink salmon embryo shocking study
Agency: National Oceanic & Atmospheric Administration

FORM 3B
Personnel
& Travel
DETAIL

2001 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Contractual Costs:	Proposed
Description	FY 2001
NOAA Contract labor (Experimental hatchery and field studies)	
1 x $4.2k/month - @ 1 months(Hatchery shocking experiment)	4,200.0
2 x $4.2k/month - ea 1.5 months (Field shocking experiment)	12,600.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$16,800.0

Commodities Costs:	Proposed
Description	FY 2001
Egg shocking supplies for hatchery study	1,000.0
Gas, oil for outboards and LPW maintenace	4,000.0
Egg pumping equipment	2,000.0
Tent, tarps, pink salmon observation platform	2,000.0
Commodities Total	$9,000.0

FY01

Prepared:7/5/00

Project Number: 00
Project Title: Pink salmon embryo shocking study
Agency: National Oceanic & Atmospheric Administration

FORM 3B
Contractual &
Commodities
DETAIL

2001 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 2001
Hydraulic egg pump	1	2000.0	2,000.0
			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		**New Equipment Total**	$2,000.0

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency
Auke Creek hatchery equipment (heath trays, water heaters, hatchery facility)		
Boats and outboard motors	2	
Little Port Walter Research Station		

FY01

Prepared: 7/5/00

Project Number: 00
Project Title: Pink salmon embryo shocking study
Agency: National Oceanic & Atmospheric Administration

FORM 3B
Equipment
DETAIL

Approved TC 8-3-00

Exxon Valdez Oil Spill Exhibit: The Continuing Legacy

Project Number:	01513
Restoration Category:	General Restoration
Proposer:	J. Pfeiffenberger/Alaska SeaLife Center
Lead Trustee Agency:	ADFG
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	New
Duration:	1st yr. 1 yr. project
Cost FY 01:	$50.3
Cost FY 02:	$0.0
Geographic Area:	All
Injured Resource/Service:	All

ABSTRACT

This project will develop an interactive exhibit "*Exxon Valdez* Oil Spill: The Continuing Legacy" to inform the public about the current status of wildlife species injured by the spill. It will combine pieces of the existing exhibit "Legacy of an Oil Spill, 10 Years After" with new audio and visual components that will allow easy updating of information as the status of injured species changes over time. This exhibit will be a permanent installation at the Alaska SeaLife Center and will serve as a source of public dissemination to hundreds of thousands of visitors.

INTRODUCTION

The restoration being proposed is the effective dissemination of information to the public about the current status of species injured by the Exxon Valdez Oil Spill. We will use at least two of the existing text panels and the 16x8 foot mural from the "Legacy of an Oil Spill, 10 Years After," and combine them with new components to create an interactive experience that is engaging and easy to update. The existing text panel on the Exxon Vadez Oil Spill Trustee Council will be retained to explain what the Council is and how the settlement money was divided. The panel describing the Restoration Plan will also be retained. A new panel will be developed which describes how the Alaska SeaLife Center (ASLC) was funded and how it fits into the Restoration Plan. The centerpiece of the exhibit will be the combination of the 16x8 foot mural depicting the wildlife of Prince William Sound with audio wands that explain the status of the wildlife. A new graphical key to the mural will be developed that identifies selected species by number. Visitors will be able to pick up an audio wand and type in the number of the species in which they are interested. They will then hold the wand to their ear and hear a brief message describing the injury to that species and the its current status, including descriptions of any research taking place on that species. Visitors will have at least fourteen different messages to choose from. We will also build three acrylic cases that will be filled with rocks to represent beach sediment profiles from three different locations in the spill zone. We will incorporate actual oiled rocks into these profiles to give visitors a clear picture of the location and condition of the oil today. A new graphic panel will also be developed to interpret these beach profile displays. The rocks will be removable and can be rearranged as new data becomes available on the status of the oil. The work for FY 00 will be to design, fabricate, and install the entire exhibit. The work for FY 01 will be to update the audio component with new messages to reflect the latest knowledge about the injured species and the research that is focused on them.

NEED FOR THE PROJECT

A. Statement of Problem

The problem that this project addresses is reaching large numbers of the public with up-to-date information on diverse projects. The study of species injured by the Exxon Valdez Oil Spill is undertaken by many different agencies and institutions. Gathering the information gained from these studies at one central location is important to disseminating an accurate picture of the overall effects and recovery progress from the Exxon Valdez Oil Spill. While the Oil Spill Public Information Office does a wonderful job of gathering information on these diverse projects and producing regular publications, they do not provide a public exhibit setting as attractive as the Alaska Sealife Center. The Alaska Sealife Center has had nearly 350,000 visitors during its first two years of operation. This includes thousands of school students from both Alaska's urban centers and bush villages like Shaktoolik and Razdolna. The Alaska Sealife Center's exhibit hall provides an ideal opportunity to reach large numbers of the visiting public with Exxon Valdez Oil Spill information. The impact of this information is heightened by the presence of live examples of many of the species on exhibit at the Sealife Center. The species which are included in the mural and will be interpreted with audio messages are:

1. Bald Eagle
2. Black Oystercatcher
3. Clams
4. Common Murre
5. Marbled Murrelet
6. Mussels
7. Pacific Herring
8. Pink Salmon
9. Sea Otter
10. Sockeye Salmon
11. Harbor Seal
12. Harlequin Duck
13. Killer Whale
14. Pigeon Guillemot

B. Rationale

This work should be done because of its potential to reach large numbers of people with up-to-date information about the Exxon Valdez Oil Spill. The public needs access to such information in order to dispel popular misconceptions and to help create an informed constituency that can participate in discussion and policy-making on oil spill related issues.

C. Location

This project will be undertaken at the Alaska SeaLife Center. Some of the exhibit design and fabrication may be contracted with a company in Anchorage or elsewhere.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

During the research for the audio components, community facilitators will be contacted for information on the local perspective regarding the species in question. Where appropriate, local anecdotal information will be included along with scientific data in the final audio messages that are prepared for the public. In any case where such information is used, community facilitators and the Traditional Ecological Knowledge Specialist will be consulted for review of the final audio messages.

Community outreach will also include providing complimentary tickets to the Alaska SeaLife Center to local Native Alaskan families, especially those that can not visit without admission assistance. The ASLC will donate 100 adult tickets and 200 tickets for children ages 7-12, and requests matching support from the Trustee Council. Community outreach personnel from local tribal groups and Native corporations will distribute the tickets to families. This will encourage participation and interaction with the exhibit, and we find that Native visitors often provide interesting, relevant information to ASLC interpreters and other visitors.

PROJECT DESIGN

A. Objectives

1. To provide up-to-date information to the public on species injured by the Exxon Valdez Oil Spill in a location that will reach a large number of people.

2. To provide a concrete visual display of where oil lies today at selected beaches.

3. To explain the makeup and role of the Exxon Valdez Oil Spill Trustee Council.

4. To explain how and why the construction of the Alaska Sealife Center was funded.

3. To create an interactive audio experience that is both engaging and informative.

4. To create an exhibit that is easy to update.

5. To create a visually attractive exhibit that grabs attention.

B. Methods

We chose to use a combination of methods to disseminate information to the public. These methods will be visual in the form of text, pictures, artwork, and a full scale display of beach sediment and audio in the form of recorded messages about selected species. This combination of methods will accomodate diverse learning styles and increase the effectives of the exhibit. One of the best things about using programmable audio wands for the audio messages is that it allows the public to actively choose the information they want to hear. One visitor may only care about sea otters, while another may want to listen to every message. This kind of visitor control increases the appeal of the exhibit. The audio component also provides a nice alternative to much of the other information at the Alaska Sealife Center, which is mostly presented in a non-audio format. Additionally, the exhibit design uses existing elements from another exhibit, which helps control cost and extend the useful life of a previous Trustee Council funded project.

Cooperating Agencies, Contracts, and Other Agency Assistance

We anticipate a need for cooperation from principal investigators of many different projects in providing information on their projects and helping to review final audio messages.

We anticipate the need for cooperation from whomever it is that conducts periodic surveys of beach sediment and oil condition in the field. We do not plan to travel to the beaches and collect oiled rocks ourselves, nor have we requested a budget for such activity. We will request collection or rocks and other beach profile information through the Exxon Valdez Oil Spill Public Information Office or other appropriate agencies.

We plan to contract out the production of the new poster graphics to the private sector, most likely to the same company, Art Services North, that produced "Legacy of an Oil Spill, 10 Years After." This will ensure consistency in the look and feel of new components with the existing components we plan to use.

We will also pay a private company to provide sound recording services, since this is an area involving specialized knowledge and equipment not available at the Alaska Sealife Center.

SCHEDULE

A. Measurable Project Tasks for FY 01

February 1:	Complete design of new exhibit panels and components.
March 1:	Complete research and writing of audio messages.
March 15:	Complete recording of audio messages.
April 1:	Complete fabrication of new exhibit panels and components.
April 15:	Complete installation of exhibit.

B. Project Milestones and Endpoints

March 15: Create an interactive audio experience that is both engaging and informative.

April 1: Create an exhibit that is easy to update. Create a visually attractive exhibit that grabs attention.

April 15: Provide up-to-date information to the public on species injured by the Exxon Valdez Oil Spill in a location that will reach a large number of people. Provide a concrete visual display of where oil lies today at selected beaches. Explain the makeup and role of the Exxon Valdez Oil Spill Trustee Council. Explain how and why the construction of the Alaska Sealife Center was funded.

April 15, FY02: Provide updated audio information on species injured by the Exxon Valdez Oil Spill.

C. Completion Date

This project will be completed by April 15, 2002.

PUBLICATIONS AND REPORTS

We do not plan to submit any manuscripts for publication in relation to this project, though we certainly will provide press releases and marketing support to advertise the opening of the new exhibit.

PROFESSIONAL CONFERENCES

We do not plan to attend any professional conferences in relation to this project.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project will require close coordination with many Trustee Council funded projects. We will be seeking the latest status and descriptions of the latest research taking place on the injured species that are depicted in the mural. Some of this information will be available from the Oil Spill Public Information Office, but much of it will have to be gathered directly from Principal Investigators and community facilitators. Some of the projects are housed at the Alaska SeaLife Center, so the information is readily at hand. Others will require coordination with state and federal agencies. Part of the beauty of this project is the gathering of all of this diverse information into one exhibit that will reach thousands of people. As far as public education goes, this project really embodies coordination and integration of the entire restoration effort.

PROPOSED PRINCIPAL INVESTIGATOR

Jim Pfeiffenberger
Exhibits Manager, Alaska SeaLife Center
P.O. Box 1329
(907) 224 6337
(907) 224 6320
jimp@alaskasealife.org

Revision 7-5-00
Approved -3-00

FY 01 EXXON VALDEZ TRUS' COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FFY 2000	Proposed FFY 2001						
Personnel		$0.0						
Travel		$0.0						
Contractual		$47.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal		$47.0		Estimated FFY 2002				
General Administration		$3.3						
Project Total		$50.3		$0.0				
Full-time Equivalents (FTE)								
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

2001

Project Number: 01513
Project Title: ASLC Exhibit: The Continuing Legacy
Agency: ADF&G

FORM 3A
SUMMARY

2001 EXXON VALDEZ TRUST OUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$7.1						
Travel		$0.4						
Contractual		$19.3						
Commodities		$0.0						
Equipment		$14.1	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$40.9				Estimated FY 2002		
Indirect 15%		$6.1						
Project Total	$0.0	$47.0				$15.0		
Full-time Equivalents (FTE)		0.2						
	Dollar amounts are shown in thousands of dollars.							
Other Resources		$2.6						

Comments:

The conservative indirect rate of 15% accounts for overhead costs of operating the public education/exhibits component of the Alaska SeaLife Center, including maintenance and operation of exhibit space, marketing to increase attendance , ticketing, interpretive services, clerical and accounting support, and administrative supervision.

Approximately $400 is budgeted for the P.I. to attend the Trustee Council's Annual Restoration workshop in Anchorage.

NOTE: In a revision from the budget originally submitted, the SeaLife Center will provide admission assistance of $2,600 for Native Alaskan families to enhance community involvement and participation (noted in "Other Resources"). Tickets purchased at full price by the 150,000 to 200,000 annual visitors to the ASLC who will interact with the exhibit can also be considered as other resources.

FY01

Prepared: 12-Apr-00

Project Number:
Project Title: "Exxon Valdez Oil Spill: The Continuing Legacy"
Name: The Alaska SeaLife Center

FORM 4A
Non-Trustee
SUMMARY

2001 EXXON VALDEZ TRUS OUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Personnel Costs:				Months	Monthly		Proposed
	Name	Position Description		Budgeted	Costs	Overtime	FY 2001
[redacted]	Jim Pfeiffenberger (P.I.)	Exhibits Manager	[redacted]	1.5	3690.00		5.5
		Responsible for research and writing of					
		exhibit text and administering project	[redacted]				0.0
	Cliff Menzel	Maintenance Supervisor		0.5	3290.00		1.6
		Responsible for installation of exhibit					0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		2.0	6980.00	0.0	[redacted]
						Personnel Total	$7.1

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2001
[redacted]	Travel for Jim Pfeiffenberger (P.I.) to attend Trustee Council					0.0
	Annual Restoration Workshop in January, 2001	77.00	1	2	125.00	0.4
	(No ticket needed-- R/T 250 miles by car @ $0.31/mile)					0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$0.4

FY01

Prepared: 12-Apr-00

Project Number:
Project Title: "Exxon Valdez Oil Spill: The Continuing Legacy"
Name: The Alaska SeaLife Center

FORM 4B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed
Description	FY 2001
Audio mastering (recording and editing) information for audio sticks @ 10 studio hours x $100/hour	1.0
Contractual services with Art Services North to produce the following exhibit components:	17.0
Title panel, panel describing the EVOS funding that built the SeaLife Center,	
and graphic panels with numbered indentification keys for each species on the mural	
Railing and deck on which identification keys and racks for the audio wands are mounted	
Printing and mailing costs for flyer publicizing new exhibit to ASLC members, public schools, and others	
5,000 2-color pieces, including graphic layout, printing, and postage	1.3
Contractual Total	$19.3

Commodities Costs:	Proposed
Description	FY 2001
Commodities Total	$0.0

Project Number:
Project Title: "Exxon Valdez Oil Spill: The Continuing Legacy"
Name: The Alaska SeaLife Center

FORM 4B
Contractual &
Commodities
DETAIL

FY01

12-Apr-00

Prepared:

	Number of Units	Unit Price	Proposed FY 2001
Ten-wand audio sound stick system	1	7.5	7.5

2001 EXXON VALDEZ TRUS.__ _JUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

New Desc	Software for audio updating capability	1	5.0	5.0
	Lighting fixtures to highlight exhibit	10	$80.00	0.8
	Acrylic cases to display beach profiles	3	$250.00	0.8
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
			New Equipment Total	$14.1

Existing Equipment (Original cost $4,058) Description	Number of Units	
Thos Wall mural (4 panels each 4' x 8') from the current EVOS exhibit at ASLC, showing species injured in spill	1	
EVOS information panels from current exhibit (Original cost $2,560)	2	

Project Number:
Project Title: "Exxon Valdez Oil Spill: The Continuing Legacy"
Name: The Alaska SeaLife Center

FORM 4B
Equipment
DETAIL

FY01

12-Apr-00

Prepared:

Approved TC 8-3-00

Project Title: Comparison of Cytochrome P450 1A Induction in Blood and Liver Cells of Sea Otters

Project Number:	01534
Restoration Category:	Research and Monitoring
Proposer:	Brenda E. Ballachey and Paul W. Snyder
Lead Trustee Agency:	DOI: U.S. Geological Survey
Cooperating Agencies:	
Alaska SeaLife Center:	No
Project Duration:	1st year, 1-year project
Cost FY 01:	$19,900.
Geographic Area:	WPWS
Injured Resource/Service:	Sea otter

RECEIVED
APR 14 2000
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

ABSTRACT

Sea otters in oiled areas of western PWS had elevated levels of cytochrome P450 1A (CYP1A), a biomarker of hydrocarbon exposure, measured in blood samples collected from otters in 1996-98. In summer 2001, as part of project 01423, we have proposed to resample CYP1A in blood from sea otters in oiled and unoiled areas of PWS. Herein we describe a complementary effort to project 01423. We propose also to sample liver from the captured sea otters, for assays of CYP1A, and for examination of histopathological changes. Liver CYP1A levels will be compared to those measured in blood from the same individuals. We will also assay for CYP1A in archived frozen liver samples from sea otters that were oiled and died in 1989, to enable comparison of current levels of CYP1A induction with levels in sea otters that had a known high degree of oil exposure. The results of this study will provide a basis for comparison of cytochrome P4501A induction in sea otters in 1989, in 1996-98, and in 2001, and will help determine if there is a decline in CYP1A levels over time.

INTRODUCTION

In the NVP project (/025), sea otters were evaluated for increased levels of cytochrome P450 1A (CYP1A) in blood (peripheral blood mononuclear cells), as a biomarker of exposure to environmental hydrocarbons. Data from 1996-98 show elevations of CYP1A in otters from oiled areas, compared to those from unoiled areas.

We do not have archived blood samples from previous years that are suitable for assays of CYP1A, and so cannot compare CYP1A levels currently observed to levels that would have been present in sea otters exposed to oil in the months immediately after the 1989 oil spill. We do, however, have archived liver samples from 1989, which are suitable for the assay of CYP1A; most of those samples also have data on tissue hydrocarbon concentrations, collected as part of NRDA studies. During 1999, we have verified that RNA can be isolated from the archived liver samples (see below).

Further monitoring of CYP1A in sea otters in WPWS, in the summer of 2001, is currently proposed as part of Project 01423. Our goal herein is to supplement measurement of CYP1A in blood from those otters with assays on liver biopsies from the same individuals, to establish the relation between CYP1A in the two tissue types. We further propose to assay archived liver samples collected from sea otters that died in the summer of 1989. The comparison of liver levels from 1989 and 2001 would give an indication of the relative levels of exposure, 12 years after the spill.

NEED FOR THE PROJECT

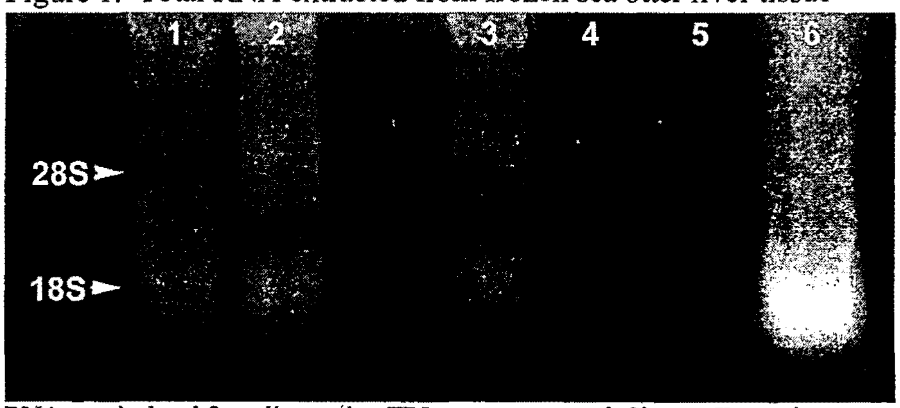
A. Statement of Problem

Sea otters in the most heavily oiled areas of western Prince William Sound (WPWS) have not yet recovered from the *Exxon Valdez* oil spill, based on several lines of evidence from studies conducted as part of the NVP project (/025) and the continuing sea otter work as part of project /423. Significant results on sea otters include lack of population growth in the oiled study area (Bodkin et al. 1999, Dean et al. 2000, USGS unpub. data), evidence of relatively poor survival rates of sea otters from the oiled area (Bodkin et al. 1999, Monson et al. 2000), and increased induction of CYP1A in the oiled area (Ballachey et al. 1999). Elevations in CYP1A do not appear to be due to background or natural hydrocarbon sources, as these were found to be negligible in intertidal areas of PWS (Short and Babcock 1996), nor to differential contamination of areas by PCBs (Trust et al. 2000; USGS unpub. data). Continued exposure to residual *Exxon Valdez* oil is the most plausible explanation of elevated CYP1A. Residual oil is still stranded in intertidal areas of PWS (Babcock et al. 1996, Harris et al. 2000, Hayes and Michel 1999), providing a continuing potential source of contamination. However, the extent to which continuing exposure to residual oil may be constraining sea otter population recovery is not known (Project 01423 contains objectives designed to address this question).

The NVP CYP1A data cover the period from 1996-98. At this time, comparable data on CYP1A induction in sea otters are not available from earlier post-spill years (1989-95). However, such data would be valuable as they would provide a benchmark for evaluation of degree of exposure seen in samples collected presently to samples collected in the months post-spill, and thus a measure of the relative continuing exposure.

Measurement of CYP1A in sea otters in the NVP project used a quantitative RT-PCR technique on peripheral blood mononuclear cells (Vanden Heuvel et al. 1993, 1994; Snyder et al. 1999). Although there are no archived samples of blood cells that would be suitable for the RT-PCR assay, the assay can also be applied to liver or other tissue samples, and archived frozen liver samples are available. These liver samples were collected from sea otters that died in 1989 subsequent to the spill, and time of death and extent of oiling on the pelage are known. Many of these otters were exposed to large quantities of oil, and showed histopathological changes (Lipscomb et al. 1993); CYP1A levels likely were greatly elevated. Further, hydrocarbon concentrations were measured on aliquots of the same samples (Ballachey and Kloecker 1997a, b), and in many cases (where otters were heavily oiled), concentrations were well above method detection limits. Preliminary assays of archived liver samples during the last year have demonstrated that we are able to isolate RNA (Figure 1) and obtain P4501A PCR products (Figure 2) on the archived liver samples.

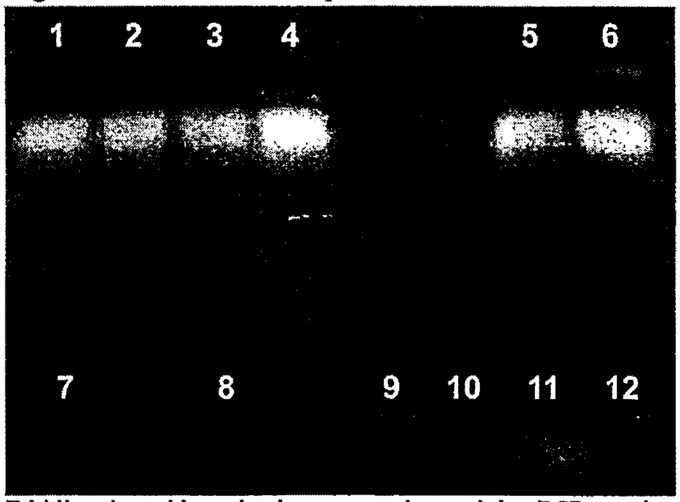
Figure 1. Total RNA extracted from frozen sea otter liver tissue



RNA was isolated from liver using TRI reagent protocol, Sigma. Two micrograms of each RNA sample was analyzed by electrophoresis in a 1% MOPS-EDTA-formaldehyde agarose gel and visualized by staining for 5 minutes with 100 µg/ml ethidium bromide in deionized water.

Lane 1 – VZ 081
Lane 2 - VZ 135
Lane 3 – SW 050
Lane 4 – VZ 060
Lane 5 – VZ 111
Lane 6 – VD 123

Figure 2. P450 1A PCR product from frozen sea otter liver tissue



Ethidium bromide-stained agarose gel containing PCR products resulting from amplification of sea otter liver P450 1A cDNA.
Lane 1 – VZ 081
Lane 2 – VZ 135
Lane 3 – VZ 081 positive control (glyceraldehyde-3-phosphate degydrogenase)
Lane 4 – SW 050
Lane 5 – VZ 060
Lane 6 – VZ 060 positive control
Lane 7 – VZ 111
Lane 8 – VD 123
Lane 9 – VD 123 positive control
Lane 10 – VZ 109
Lane 11 – SW 149
Lane 12 – SW 149 positive control

We propose to work in conjunction with the sea otter capture and CYP1A monitoring effort being proposed for the summer of 2001 in Project 01423. As part of that project, sea otters will be captured and blood samples taken for CYP1A evaluation. In this project, we propose to supplement the blood sampling/CYP1A effort with collection of liver biopsies from the same otters, also for analysis of CYP1A using the RT-PCR assay. This will enable us to establish the relation between CYP1A induction in blood and liver cells. We further propose to analyze 30 archived liver samples, including samples from heavily oiled otters.

The results of this study will provide a basis for comparison of cytochrome P4501A induction in sea otters in 1989, in 1996-98, and in 2001, and will help determine if there is a decline over time in CYP1A levels.

B. Rationale/Link to Restoration

This research will provide a means for us to relate present levels of CYP1A induction, measured in sea otters from oiled areas of PWS and other locations, with levels of CYP1A induction in oiled sea otters collected in 1989, after the spill, thus providing insight into the degree of exposure currently being experienced by sea otters. It also gives an opportunity for histological examination of liver tissues from sea otters in oiled areas, which may be informative in terms of understanding apparent differences in survival rates between areas. Additionally, adaptation of the assay for liver tissues will allow us to obtain samples from other sources (e.g., natural mortalities, subsistence hunters), for monitoring of CYP1A and comparison of oiled and unoiled levels.

C. Location

The samples will be collected in western PWS. Assays of CYP1A and histopathology will be done at Purdue University.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

We will interact with local communities in meetings to explain and discuss ongoing restoration projects (this effort coordinated with similar activities for project 01423).

PROJECT DESIGN

A. Objectives

1. Measure and compare CYP1A in blood (PBMC) and liver samples from sea otters captured in summer 2001.

2. Measure CYP1A in archived liver samples of oiled sea otters from 1989; compare liver CYP1A values from 2001 to 1989 samples.

3. Do histopathological examination of liver biopsies from 2001, to assess relation between CYP1A levels and histological change in the liver.

4. Relate CYP1A levels in 1989 liver samples with hydrocarbon concentrations measured previously, and histopathology collected previously on those samples.

B. Methods

In the NVP study, the RT-PCR assay (quantitative reverse transcriptase PCR assay; Vanden Heuvel et al. 1993, 1994; Snyder et al. 1999) was adapted to measure CYP1A levels in sea otters. This assay quantifies the messenger RNA (m-RNA) that codes for the CYP1A protein, and results are reported as molecules of mRNA per 100 ng of RNA. For sea otters, the assay has been applied only to peripheral blood mononuclear cells; we will adapt it for measurement of CYP1A in liver cells.

In summers of 2001, we have proposed (project 01423) to capture 30 sea otters (15 per area) in the same areas (Knight and Montague islands) that were sampled in the NVP project, so that additional data collected can be directly compared to previous (1996-98) results. Capture and handling methods will be similar to those employed previously (Bodkin et al. 1999). Sea otters will be sedated, body measurements taken, a tooth collected for age determination, and a blood sample taken by jugular venipuncture. In addition, a liver biopsy weighing approximately 0.5 gm will be surgically collected from 10 otters per area, by a qualified veterinarian. One portion will be frozen in LN2 and a second portion fixed in formalin. Following reversal, sea otters will be released in the same vicinity as captured.

Samples (liver, blood cells, and frozen archived liver) will be shipped to Purdue University for analysis in the laboratory of Dr. Paul Snyder. CYP1A will be measured by the RT-PCR assay, and liver samples in formalin will be examined for evidence of histological change.

The data will be used to determine the relation between CYP1A in blood and liver. We will compare mean CYP1A values in liver samples from 2001 and 1989. We will look for a correlation between CYP1A in liver and histopathological change in hepatic cells. We will also relate liver histopathology and CYP1A levels to serum chemistry, including serum enzymes, measured as part of work outlined in Project 01423. Finally, for the 1989 liver samples, we will correlate total hydrocarbons in liver (data from NRDA studies) and histopathology (Lipscomb et al. 1993) with CYP1A induction.

SCHEDULE

A. Measurable Project Tasks for FY 01

July:	Capture and sampling of sea otters.
August-Sept.:	CYP1A analyses on liver samples from 2001 and from 1989, data analyses.

B. Project Milestones and Endpoints

1. July 2001: Collection of liver samples from live otters.
2. Aug-Sept: Analyses of new (year 2001) and old (year 1989) liver samples for CYP1A. Data analyses.
3. April 2001: Report submission - April 15, 2001.

C. Completion Date

This is a one year project. Sample collections and laboratory assays will be completed in FY2001 and a final report submitted by April 15, 2002.

PUBLICATIONS AND REPORTS

We will provide a final report to the EVOSTC office by April 15, 2002. We anticipate a manuscript on the results to be submitted to a scientific journal in the year 2002.

PROFESSIONAL CONFERENCES

None planned for FY2001.

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

This project is dependent on funding of sea otter capture for monitoring cytochrome P450 as part of Project 01423; otherwise we cannot complete the stated objectives.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

This is a new project proposal.

PRINCIPLE INVESTIGATORS

Dr. Brenda Ballachey, B.S., M.S. 1980 Colorado State University, Ph.D. 1985 Oregon State University, is a Research Physiologist at the Alaska Biological Science Center of USGS, Biological Resources Division. She was Project Leader for sea otter NRDA studies from 1990 through 1996, and has been involved in all aspects of post-spill research on sea otters. She has authored or coauthored over 25 peer-reviewed publications, and is currently a co-principal investigator for the Nearshore Vertebrate Predator (NVP) project, examining effects of residual oil on health and recovery of sea otters and other NVP study species.

Dr. Paul Snyder is an Assistant Professor of Pathology and Immunotoxicology and Director of the Clinical Immunology Laboratory of the Department of Veterinary Pathobiology, Purdue University. He is also a Diplomate of the American College of Veterinary Pathologists. His research interests are in the area of mechanism-based studies on the pathology and immunology of xenobiotics on biological systems. He has been a PI on the Nearshore Vertebrate Predator project since 1995.

OTHER KEY PERSONNEL

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approved TC 8-3-00

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$9.0						
Travel		$2.2						
Contractual		$6.3						
Commodities		$0.6						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$18.1			Estimated FY 2002	Estimated FY 2003		
General Administration		$1.8						
Project Total	$0.0	$19.9			$0.0	$0.0		
Full-time Equivalents (FTE)		0.1						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

No costs are included for NEPA compliance, technical review session attendance, restoration workshop attendance, report writing, publications, professional conferences, or community involvement.

FY01

Prepared: 14 April 2000

Project Number: 01534
Project Title: Comparison of Cytochrome P450 1A Induction in Blood and Liver Cells of Sea Otters
Agency: DOI

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2001
B. Ballachey	Research Physiologist	GS 12 / 04	1.0	7.0		7.0
Technical support	Biologist	GS 7	0.5	4.0		2.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.5	11.0	0.0	
					Personnel Total	$9.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2001
Airfare & per diem, Indiana - Alaska RT (Snyder)	0.7	1	15	0.1	2.2
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.2

FY01

Prepared: 14 April 2000

Project Number:
Project Title: Comparison of Cytochrome P450 1A Induction in Blood and Liver Cells of Sea Otters
Agency: DOI

FORM 3B
Personnel
& Travel
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Contractual Costs:	Proposed
Description	FY 2001
4A Linkage	0.0
Assays of liver for cytochrome P450 1A, histopathology 50 @ $125	6.3
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$6.3

Commodities Costs:	Proposed
Description	FY 2001
Veterinary supplies	0.6
Commodities Total	$0.6

FY01

Prepared: 14 April 2000

Project Number:
Project Title: Comparison of Cytochrome P450 1A Induction in Blood and Liver Cells of Sea Otters
Agency: DOI

FORM 3B
Contractual &
Commodities
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2001
			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.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY01

Prepared: 14 April 2000

Project Number:
Project Title: Comparison of Cytochrome P450 1A Induction in Blood and Liver Cells of Sea Otters
Agency: DOI

FORM 3B
Equipment
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$0.0						
Travel		$0.0						
Contractual		$0.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$0.0			Estimated FY 2002	Estimated FY 2003		
Indirect								
Project Total	$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:
Project Title:
Name:

FORM 4A
Non-Trustee
SUMMARY

Revision 7-3-00
Approved TC 8-3-00

EVOS Trustee Council Restoration Program Final Report

Project Number:	01535
Restoration Category:	General Restoration
Proposer:	EVOS Restoration Office
Lead Trustee Agency:	ADFG
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	New
Duration:	1st yr. 2 yr. project
Cost FY 01:	$73.5
Cost FY 02:	$46.8
Geographic Area:	All
Injured Resource/Service:	All injured resources and services

ABSTRACT

This project will provide a final report for the activities of the Trustee Council, starting with the earliest damage assessment efforts and ending with the FY 02 Work Plan and disbursements of the final payment from Exxon. It will also include a complete history of the litigation leading to the civil settlement, which funds the Council. This project will increase public awareness and understanding of EVOS restoration activities, policies, and procedures. It will provide agencies and groups (facing a similar trustee situation) with a detailed history of the *Exxon Valdez* Oil Spill Restoration process, including highlights and pitfalls, so that others can benefit from lessons learned in the groundbreaking EVOS effort. This published history will include references and an index.

INTRODUCTION

This project arises from the need to provide a single source documenting 12 years of litigation, damage assessment, and EVOS restoration activities, policies, and procedures. It is appropriate to issue such a final report after the Trustee Council decides on its final work plan (FY 02), all the payments from Exxon are received and disbursed, and long-term programs for monitoring/research and habitat protection are in place.

The final report would cover:

Introduction
Chapter One: Litigation and the Settlements
Chapter Two: Damage Assessment
Chapter Three: Early Trustee Council
Chapter Four: Re-organization of Restoration Office and the Restoration Plan
Chapter Five: Research, Monitoring, and Restoration
- including the Work Plan process

Chapter Six: Habitat Protection
- including the nomination, evaluation, appraisal, and negotiation processes

Chapter Seven: Restoration Reserve, Investments, GEM, Long-term Habitat Protection
Chapter Eight: Public Advice and Public Information
Chapter Nine: Recovery Status
References
Index
Appendices
- Final and Annual Reports
- Bibliography
- Settlement

NEED FOR THE PROJECT

A. Statement of the Problem

The scope of EVOS litigation and restoration is unprecedented in U.S. environmental history. Although there were laws and regulations in place to guide the process, there was no manual available for a combined federal-state trustee council with such an enormous task ahead of it, guaranteed financial resources available to it, and a varied constituency taking part every step of the way. Much of what the Trustee Council did broke new ground and the entire process needs to be synthesized into a documented, readable history available to the public, government agencies, and any group that might face similar circumstances.

Over the years, the Trustee Council has received dozens of inquiries from other trustee groups and hundreds of inquiries from college students wanting to report on different aspects of the EVOS process. This final report would provide a single referenced source for these needs and others that might arise in the future.

B. Rationale/Link to Restoration

This effort provides vital information to the public, government agencies, and private groups concerning processes of litigation, damage assessment, and restoration efforts.

C. Location

No field work is planned for this project.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

This project will help document community involvement and TEK efforts, providing an argument for such efforts in future trustee situations.

PROJECT DESIGN

A. Objectives

Research, write, and publish a readable, documented history of EVOS litigation and Trustee Council activities from March 1989 to October 2001.

B. Methods

Research for the book will rely mostly on the public record. A thorough review will be conducted of EVOS documents, including Trustee Council minutes and transcripts, agenda packets, policies and procedures, restoration frameworks, planning documents, work plans, scientific reports, habitat protection packages, and more. In addition, court records, litigation-based scientific studies, settlement language, and any publicly available Alaska Department of Law and U.S. Department of Justice documents relating to the case will be scrutinized, along with legislative and Congressional records related to the settlement. A review of media articles from 1989-present will also help focus on public concerns and attitudes about the settlement, damage assessment, and Trustee Council activities.

Interviews of major players will be conducted to fill in gaps in the documentation, particularly as part of the litigation and damage assessment processes. Other interviews will provide personal assessments of the Trustee Council process.

The final report will be researched, written, and designed by the communications coordinator for the Trustee Council. To help ensure objectivity and make sure all essential topics are covered and documented thoroughly, an editor specializing in non-fiction historical writing will be identified and contracted as a consultant/editor. An effort will be made to find an outside publisher to provide peer-review, editing and design for the finished product (with financial assistance from the Trustee Council). If no publisher is willing to take on the project, then the final report will be published by the Trustee Council.

C. Cooperating Agencies, Contracts, and Other Agency Assistance
None

SCHEDULE

A. Measurable Project Tasks for FY 01

October - December, 2000
a. Research EVOS administration files
b. Research litigation records
c. Research legislative and Congressional records and Office of the Secretary records for Department of Transportation and Department of the Interior
d. Interview key parties
e. Organize documents

March 1, 2001
First Drafts of Chapters 1, 2 & 3 completed

June 1, 2001
First Drafts of Chapters 4, 5, & 6 completed

September 1, 2001
First Drafts of Chapters 7, 8, & 9 completed

September 30, 2001
Complete references, appendices

B. Project Milestones and Endpoints
The final report should be printed during the winter of 2001-2002. Publication date will depend on the schedule of a publisher. The Restoration Office will seek to have the publication available around March, 2002.

C. Completion Date
March 2002

PUBLICATIONS AND REPORTS

The final report will be published and an as-yet-undetermined number of copies will be made available to the public, stakeholders, PIs and agencies.

PROFESSIONAL CONFERENCES

Participation in professional conferences is not anticipated.

NORMAL AGENCY MANAGEMENT
This project would not fall under normal agency management.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT
Research for this project is underway in FY 00 with funds from the 00100 budget.

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 17 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 conduct all research and interviews, write the final report, work with an outside consultant/editor, rewrite the report (as needed), coordinate activities with the Restoration Office and Trustee Council for review and final approval of the text, arrange for photographs and artwork (as needed), and design and publish the final report (or work with a publisher to design and publish the report).

OTHER KEY PERSONNEL
Outside consultant/editor
- to be determined_

Introduction
Chapter One: Litigation and the settlements
Chapter Two: Damage Assessment
Chapter Three: Early Trustee Council
Chapter Four: Re-organization of Restoration Office and the Restoration Plan
Chapter Five: Research, Monitoring, and Restoration
Chapter Six: Habitat Protection
Chapter Seven: Restoration Reserve, Investments, GEM
Chapter Eight: Public Advice and Public Information

Appendices
Recovery Status - Update on Injured Resources and Services
Reprint Settlement in its entirety
Table showing estimated value of lost resources
Table of all species collected, high/low estimates of actual mortality
List of reimbusements by agency or by item?
GAO summary?

This publication will included a complete index and references.

Introduction

The Final Report for the EVOS Trustee Council will be based mostly on the administrative record. Where the administrative record is silent, some holes will be filled by the memory of key players. But memory is untrustworthy and often tainted by perception, so the plan is to use as little unsubstantiated recollection as possible.

I recognize, however, that a large part of the Restoration Process concerns the personality and passion of the people who have taken part in and followed this process over the past 11 years. To capture the personality of EVOS without tainting the public record of EVOS, it has been suggested that the final report contain an introduction to each chapter that outlines the events of that chapter. The introduction would be 1-4 pages in length and it would clearly be formatted differently so as to separate itself from the official record. In each introduction, key players would be able to tell the story of restoration in a more human and interesting way.

The Final Report will not be useful if it's not honest. The Trustee Council and the Restoration Office has stepped into quagmires of discontent from time to time. Mistakes were made, public anger has flared, and politicians and media have taken the Trustee Council to task (rightly or wrongly) for its actions or inaction. These issues need to be discussed in the context of the time and the circumstances. The chronic complaint that everything happened too slow must be discussed, for example, with the understanding that the process was new, unprecedented, perhaps unwieldy, and with a number of federal and state agencies involved, each of which had its own set of rules. Sorting this out was one of the monumental tasks of the early EVOS process.

The bottom line is that 10 years after the settlement and $900 million later, there is a lot to show for the effort. This final report will not only showcase the legacy, it will detail the struggle.

Review

This will be a Trustee Council-sponsored publication. It will not be published until the Trustee Council approves of the content. However, the size of this document makes it impractical to offer it for review to all concerned parties. It is proposed that this publication face review in three phases:

1) The writer of the final report will send individual chapters or segments to key people who were involved with the subject of that chapter. Comments from those individuals will be incorporated (or noted) before the final draft is submitted to the executive director.
2) An editorial board will be established to review the entire text and supporting materials. The editorial board will consist of one federal trustee, one state trustee, the executive director, the writer, and an independent editor. All edits/comments from the editorial board will be incorporated into the document.
3) An approved final draft will then be sent to each Trustee. Comments from individual Trustees will be reviewed by the editorial board. Board-approved changes will be incorporated into the document before approval of the final report is placed on the agenda as an action item.

Chapter One: Litigation thru settlement
The story of state and federal attorneys working, sometimes as adversaries, to get a final settlement from Exxon.

A) Early Legal Action

1. First legal response
   a. Describe first organizational meetings and discussion
   b. How was legal team organized?

2. Legal Framework
   a. (NRDA, CERCLA, Water Pollution Act) What were strengths/weaknesses?

3. Strategies
   a. What was the government's strategy for settlement?
   b. Based on law and NRDA studies, what hand did the government have to play?
   c. Discuss role of Contingent Valuation study vs. resource damage studies.

4. Damage Assessment
   a. What role did attorneys play in determining damage assessment studies?
   b. Why the gag order?
   c. What public/political/legal pressures resulted from the gag order
   d. Is there a chart showing estimated value of all lost resources?

5. Exxon's Liability
   How did Exxon help/hurt its legal standing during response and cleanup phase?
   Did early state response help/hurt government legal standing?

6. Politics
   a. What role did Cowper play in litigation?
   b. What role did Hickel play in litigation?
   c. What role did Legislature play in litigation?
   d. What role did Bush Administration play in litigation?

7. Attempted Federal Settlement
   a. What was it?
   b. How did it come about?
   c. How was it stopped?
   d. How did it affect state-fed relations?

B. The Settlements

1. First Settlement
   a. Detail where, when, who and how settlement reached and announcement made.
   b. What was mood of the attorneys involved at reaching this settlement?
   c. Describe main points of settlement?
   d. Back and Forth negotiations – What were the hot topics?
   e. How was the dollar figure reached?
   f. Describe the public reaction and detail legislative process
   g. Why did it fall apart?
   h. What was the key wording of the settlement? Why?
   i. Why a payout over 10 years?

2. Second Settlement
   a. How did it differ from first?
   b. What was it like getting everyone back to the negotiating table again?
   c. What was the mood of attorneys at starting over?
   d. Detail where, when, who and how settlement reached and announcement made.
   e. Was there a new political strategy for public acceptance?
   f. Describe public and legislative reaction
   g. Why did the second settlement survive? What were the political concerns?

3. The $100 million opener
   a. Describe opener, how it got there and why it was needed.
   b. How did Exxon respond to that?

4. The private plaintiffs
   a. How did this settlement impact plaintiffs case?

5. General
   a. 10 years later, do the attorneys/politicos involved believe it was a good settlement?
   b. Were there any opportunities missed?

INSET

With 10 years of hindsight, was it a good settlement?

What was gained or lost by reaching a quick settlement with Exxon? Contrast and compare with the class action lawsuit against Exxon. Could investment issue have been addressed at the time of the settlement? What is real-dollar value of the settlement for restoration?

Graphics, Illustrations, Tables, Cartoons

Graphic depicting settlement
Cartoons re: settlement
Recreated courtroom-style sketch of attorneys arguing before Judge Holland

Appendix

Reprint the settlement in its entirety?
Table showing estimated value of lost resources?

Chapter Two: Damage Assessment
This chapter deals with the earliest days of damage assessment planning, through implementation, and to the beginning of the Restoration phase.

Key Questions/Points
Start with day of spill, detail what meetings, planning took place at ADF&G, NMFS, and USFWS.

What is damage assessment?
- What laws impacted the damage assessment process?
- How is it defined under law?
- How is it carried out under law?
- What is considered injury: mortalities, chronic problems, showing cause-and-effect, localized injury versus region-wide or species-wide injury?

How was damage assessment effort organized?
- Who had the lead to organize efforts of all agencies?
- What was RPWG? How did it work?
- Was research well thought out or hastily conceived and implemented? Examples.
- What was gained from study that killed and oiled birds? At what PR cost?
  - Similar study of sea otters used available carcasses? Why not same for birds?
- How was injury assessed? Who made final decision? How does damage assessment differ from research and monitoring of Restoration Plan?
- First Workshop: how was it received by researchers? What was accomplished?
- First Release of Data: how, when, why, reactions

Legal Restrictions
- How much did attorneys influence what was and what was not studied?
- Was secrecy concerning research data a detriment to studies or to recovery?
- Describe public pressure and media pressure placed on scientists to disclose info?

Exxon Science
- Exxon released information strategically while government researchers were restricted from discussing results. 10 Posters.

Injured Resources
- Detail injuries per resource
- Detail recovery goals
- What resources were studied, but determined not injured

INSET
What would happen today under OPA 90? How would things be different?

Graphics, Illustrations, Tables, Cartoons
Select Cartoons
Chart showing structure and responsibilities of restoration team/agencies

Appendix
Table of all species collected

Chapter Three: Early Trustee Council & the Restoration Plan

This chapter follows the Trustee Council through the organizing years. Despite the difficult beginnings in the EVOS process, the fact is that the successful program that emerged was conceived and hatched during the first two years following the settlement and in the midst of heavy public participation, media pressure, and political pressure.

Key Questions/Points

Detail first meetings, discussions, decisions, public participation

How was the Restoration Office set up?
  Interagency approach: What were advantages and disadvantages of this approach?
  How were decisions made?
  Was process open to non-agency groups?
  How were inter-agency and inter-governmental disputes settled?

Discuss each step of the planning effort for the Restoration Plan (from inception to publishing).

Discuss early Work Plans and the public interest in work being done. (There were hundreds of public comments in 1992 compared to a just a few comments in 1999.

Discuss requirement that all decisions must be unanimous. How did this impact decision-making?

How much money was reimbursed, to which agencies, for what?
  Did reimbursements create a perception that money was being wasted?
  Could this have been done differently?

What were the GAO criticisms? How were they addressed?

What were the NYT criticisms? How did this impact the TC and the process?

Describe the impacts of transition from Bush Administration to Clinton Administration.

INSET

Step by Step review of the Restoration Plan planning process?

Graphics, Illustrations, Tables, Cartoons

Appendix

List of reimbusements by agency or by item?
GAO summary?
NYT article?

Chapter Four: Re-organization of Restoration Office and the Restoration Plan
If the first two years of the Restoration process could be described as a weighted boat plowing through the water, then 1994 would be the year the boat got on step. The current Restoration Plan has been in place since November 1994, but the main body of that plan was written in 1992. This chapter will mesh with the Restoration Planning effort described in the previous chapter and discuss the changes in the plan, addition of ecosystem-based research, peer-review, and the creation of the Restoration Reserve. It will also discuss the hiring of an independent administrator with an independent staff and how that affected the process.

Key Questions/Points

At its first meeting, the TC decided to hire an independent administrator. Why did this not happen?

How did hiring an executive director change things? Why Ayers?
- What steps were taken to centralize the administration ?
- How was new Restoration Office structured?
- Ayers transition to McCammon

The Summary of Options for the Draft Restoration Plan was circulated throughout the spill region in Spring 1993. Meetings were held in each community.
- What was the overall reaction?
- Summarize the public comment.
- What changes to the Restoration Plan were made as a result of the public comment?
- Habitat vs. R&M vs. permanent endowment vs. community vs. spill prevention

New aspects of Restoration Plan
- Ecosystem-based approach
  - How did this get started? Why? Herring/pink collapse.
  - Why a central role in Restoration Plan?
  - How does this differ from earlier research planning?
- Peer-review
  - How did this get started? Why?
- Restoration Reserve
  - How did this get started? Why?
- Other changes?

Graphics
- Restoration Plan at a Glance
- Adaptive Management
- Budget?

Chapter Five: Research, Monitoring, and Restoration

This chapter will discuss the inner workings of the research and monitoring effort and the annual Work Plan process.

What constitutes research, monitoring, and general restoration?
- Guidelines: What qualifies - what doesn't?
- Direct restoration vs. indirect
- Debate over community or economic restoration
- Normal agency management
- Connection to the injured resource

The role of the chief scientist
- Peer review
- Oversight. Providing overall direction.
- Working with science coordinator and executive director

Evolution of the Work Plan
- Compare first years' work plans and the process to the current system
- Invitation - How is it determined what types of projects will be sought?
- Proposal Review - Who reviews? How are comments/decisions derived?
- Draft Plan - How it's issued. Who reviews? Public response?
- TC Decision - Debating merits. Agency preferences.
- Follow through - keeping tabs on the projects
- Annual / Final Reports

Restoration Workshop
- Church meeting
- Annual planning process. Goals
- Effect of . . .

Ecosystem Approach
- Species specific vs. ecosystem
- Big Three: SEA, APEX, NVP

Alaska SeaLife Center
- Support of . . .

Accomplishments / Highlights
- To be determined.

Chapter Six: Habitat Protection

This chapter will describe the public call for habitat protection, even long before the settlement was reached. It will detail the early efforts to put together a framework for acquiring habitat and detail the Large and Small Parcel Programs. One or two Large Parcel acquisitions will be analyzed in detail, showing the history of negotiations, the movement on price (appraisal vs. negotiated value), and the governments' reluctant acceptance of less-than-fee acquisition. The Small Parcel program will be similarly detailed (using a table) with several parcels highlighted. Parcels Meriting Special Consideration will be discussed.

Public Desire for Habitat Protection
- Restoration Plan Comments
- Letters, orchestrated campaigns
- Landowners push for habitat protection
- Anti-habitat protection -- debates

Habitat Protection Framework
- Minimum Threshold
- Nominations
- Evaluations
- Appraisals
- Negotiation

Large Parcels
- Noinations
- Evaluation
- Parcel descriptions (maps)
- Native ownership
- Unwilling Sellers (Port Graham, Chugach)
- Conservation easement vs. fee title
  - What types of easements
  - Public access
  - Management considerations
  - Landowner's retained rights
  - Subsistence
- History of Negotiations (one or two examples)
  - English Bay Corp?
  - Chenega Corp or Tatitlek Corp?
  - AKI or Old Harbor Corp?

Small Parcels
- Nominations
- Evaluation
- Parcel descriptions (table, maps)
- Parcels Meriting Special Consideration
- Sponsorship
- Describe importance of groupings
  - Kenai River
  - Uyak Bay
  - Emmonak?
- Highlights
  - Kenai River
  - Lowell Point -Seward
  - Overlook Park, Tulin, Beluga Slough, Spit - Homer
  - Horseshoe Bay - PWS

Habitat Protection Long Term Fund
- What will it look like?
- What are potential uses for this fund?
- How will it be managed?

Graphics
- Maps
- Tables - Large and Small Parcel programs
- Table showing Native selections total, fee total, conservation easement total

Chapter Seven: Restoration Reserve, Investments, GEM

This chapter will be a discussion about the Restoration Reserve, how it will be used, and the financial impact of investments.

Restoration Reserve

- What was the early vision?
- Who were main proponents?
- Why was it added to Restoration Plan?
- What was its worth?

Public Process

- Focus groups
- Community meetings
- Draft Plan - possible uses
- Organized campaign for habitat protection
- Final Decision

Investments

- Detail CRIS system, earnings, and fees
- Describe alternative investment systems (i.e. PERS, PFD, etc)
- History of Congressional action, meetings, lobbying
- Show loss of funds due to delay
- Show projected long-term benefits due to Congressional authorization
- What were the investment options
- TC investment strategies

GEM - the result of the Restoration Reserve

- GEM planning
- GEM review
- GEM Plan

Chapter Eight: Public Advice, Public Participation, and Public Information

This chapter will discuss the Trustee Council's efforts to keep the public informed and involved. Public participation will be presented in context, from massive interest with hundreds of public comments for early Work Plans to passive interest and a half-dozen comments for recent Work Plans.

Public Participation
- PAG
- Public comment at each meeting
- Teleconference to any site in spill region
- Community Meetings
- Community Involvement
- Annual Workshops

Public Advisory Group
- Settlement language
- Federal requirements
- Charter
- First nominations/selections
- Early issues/involvement
  - Work Plans
  - Restoration Planning
  - Habitat Protection Planning
- Community Meetings / Field Trips
- Later issues/involvement
  - Restoration Reserve
  - GEM
  - Habitat Protection

Community Involvement
- Call for more Native involvement
- CRRC proposal
- TEK
- Workshops

OSPIC/ARLIS

Public Information
- Newsletters, Annual Reports, Poster
- Alaska Coastal Currents - Radio Segments, Newspaper Columns
- Documentary, TC informational video, Slide Presentations
- Exhibits - ASLC, Traveling Exhibit
- Web Site
- Worldwide media contacts

Graphics
- List PAG members by position over time
- Chart subsistence projects by year and by percentage of Work Plan budget

Other Items

The re-opener?
What happened to EPA's role?
The role of US Dept. of Justice
The role of ADNR

Revision 7-3-00
approved TC 8- 00

2000 EXXON VALDEZ TRUSTI)UNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 2000	Proposed FY 2001
Personnel		$60.0
Travel		$4.5
Contractual		$0.0
Commodities		$0.0
Equipment		$0.0
Subtotal	$0.0	$64.5
General Administration		$9.0
Project Total	$0.0	$73.5
Full-time Equivalents (FTE)		0.7
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

		Estimated FY 2002			
		$46.8			

Dollar amounts are shown in thousands of dollars.

Comments:

FY01

Prepared:

Project Number:
Project Title: EVOS Trustee Council Final Report
Agency: Dept. of Fish & Game, EVOS Restoration Office

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
Joe Hunt	writer/researcher		8.0	7.5		60.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		8.0	7.5	0.0	
					Personnel Total	$60.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 2000
						0.0
						0.0
Anchorage-Juneau-Seattle	research/interviews	1.2	1	10	0.1	2.2
Anchorage	research/interviews	0.8	1	5	0.1	1.3
						0.0
						0.0
						0.0
rental cars				15	0.6	9.0
						0.0
						0.0
						0.0
					Travel Total	$4.2

FY01

Prepared:

Project Number:
Project Title: EVOS Trustee Council Final Report
Agency: Dept. of Fish & Game, EVOS Restoration Office

FORM 3B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRUSTI)UNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed
Description	FY 2000
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	

Commodities Costs:	Proposed
Description	FY 2000
Commodities Total	

FY01

Prepared:

Project Number:
Project Title: EVOS Trustee Council Final Report
Agency: Dept. of Fish & Game, EVOS Restoration Office

FORM 3B
Contractual &
Commodities
DETAIL

2000 EXXON VALDEZ TRUSTI)UNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed 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
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY01

Prepared:

Project Number:
Project Title: EVOS Trustee Council Final Report
Agency: Dept. of Fish & Game, EVOS Restoration Office

FORM 3B
Equipment
DETAIL

01543

approved TC 8-3-00

Evaluation of Oil Remaining in the Intertidal from the *Exxon Valdez* Oil Spill

Project Number:	01543
Restoration Category:	Monitoring
Proposer:	J. Short/NOAA
Lead Trustee Agency:	NOAA
Cooperating Agencies:	ALL
Alaska SeaLife Center:	No
New or Continued:	New
Duration:	1st yr. 1 yr. project
Cost FY 01:	$22.6
Cost FY 02:	$0.0
Geographic Area:	Prince William Sound, Gulf of Alaska
Injured Resource/Service:	Intertidal communities, sediments

ABSTRACT

This project will assess the amount of oil remaining from the oil spill on shorelines within (FY 01) and outside (FY 02) Prince William Sound. FY 01 funding will be requested in two phases. Phase 1 ($22,600) will produce a final sampling design to be implemented in the spring of 2001 (Phase 2, $500,000). Phase 2 will be presented for Trustee Council approval in December 2000. [NOTE: This project also requested funds ($22,000) for FY 03.]

INTRODUCTION

Oil from the March 1989 Exxon Valdez oil spill (EVOS) has been surprisingly persistent on some beaches. At the end of the 1992 cleanup season, natural processes were expected to disperse most of the oil remaining on shorelines. However, relatively un-weathered oil remains today at a number of locations that were heavily oiled initially, and protected from dispersion by storm-generated waves. The extent of the remaining oil is unknown, and this uncertainty engenders public and scientific concerns about the effects the oil may continue to have on humans and on fauna that may become exposed to the oil either directly or indirectly. The project proposed here seeks to address these concerns by providing a quantitative estimate of the amount of oil remaining. This estimate will inform any assessment of the significance of the amount of oil remaining, and including whether further oil removal efforts are warranted.

Estimating the oil remaining on beaches affected by the EVOS presents in a cost-effective manner presents a considerable challenge. Previous attempts to address this problem have mainly relied on Shoreline Assessment Cleanup Teams (SCAT), consisting of field teams performing comprehensive foot-surveys of impacted beaches. Although this approach may be useful for directing cleanup efforts immediately following a spill, it is less appropriate for producing a quantitative estimate of remaining oil, especially long after a spill when most oil remains obscured from casual view. Instead, a stratified random/adaptive sampling design will be developed, which will concentrate sampling effort in areas where oil is known to persist, while allocating some effort to discovering oil in areas where persistence is uncertain. This approach will guarantee a credible minimum estimate of remaining oil, and will provide a confidence interval for the most likely amount remaining throughout the affected region. This information is needed to predict oil persistence into the future, and to determine associated risks to vulnerable biota.

This project will focus on oil remaining on beaches inside PWS during FY01, but a follow-up assessment of oil remaining outside PWS is included as a subsequent phase of the project to be considered for FY02-FY03. Previous Trustee-funded projects have examined oil persistence along the Kenai-Alaska Peninsula coastlines in 1999 (Project 99495), and in the vicinity of Kodiak Island in 1995 (Project 95027). These studies confirmed the persistence of localized oil, but only provided minimum estimates of the extent of oil remaining. The same rationale for evaluating the extent of remaining oil inside PWS therefore applies to the spill area outside PWS as well.

This project will be divided into three phases. Phase 1 is development of the sampling design to be applied to the study area. Design alternatives will be developed during summer 2000 and presented at a workshop in October 2000 for consideration by peer-reviewers, trustee agency representatives, and other stakeholders. Phase 2 is execution of the adopted sampling design inside PWS during spring/summer 2001. Phase 3 is execution of a modified sampling design based on the experience of phase 2, applied to the spill area outside PWS during spring/summer 2002. The process and issues for sampling design development and adoption (phase 1) are addressed in the remainder of this proposal. The detailed project descriptions for phases 2 and 3 are contingent on the results of preceding phases. The projected project amounts of $500,000 for each of phases 2 and 3 are approximations that will be modified based on results of preceding phases.

NEED FOR THE PROJECT

A. Statement of Problem

Although the persistence of relatively un-weathered oil is clearly established on some beaches 10 years following the incidence of the EVOS, the cumulative extent of remaining oiled beach is controversial. One estimate places the area of beach that remains contaminated by oil at less than 450 m^2 (Page 1998), but the basis for this claim has not been presented. Other studies suggest more extensive contamination (Brodersen et al. 1999, Hayes and Michel 1999, Irvine et al. 1999). These latter studies have often found relatively un-weathered oil in the upper intertidal of beaches that are heavily armored by boulders and beneath mussel beds, in locations that were heavily oiled initially. The frequency that these remaining oil patches are encountered suggests that the area affected may exceed 450 m^2, perhaps substantially.

The extent of oil remaining on these beaches defines the lack of recovery for these sediments. The remaining oil may also impede the recovery of injured species that are still exposed to it. This exposure includes direct contact with water contaminated by the remaining oil, or indirect contact through ingestion of prey contaminated by the oil. The fact that the remaining oil is often so un-weathered indicates the oil is still a potent source of toxic polycyclic aromatic hydrocarbons (PAH), which elicit a manifold of adverse effects on biota exposed to them. These species may include black oystercatchers, clams, intertidal communities, mussels, Pacific herring, pink salmon, sea otters, subtidal communities, and harlequin ducks. In addition, subsistence uses, passive uses, recreation and tourism may also be impaired because of speculation that the area remains too contaminated for these uses.

B. Rationale

If a sufficiently large area of beach remains contaminated by oil, then ensuing concerns about the potential for on-going biological effects may prompt additional cleanup effort. The plausibility of oil-exposure linkages connecting fauna at higher trophic levels with oiled habitat, as well as the propriety of additional restoration options depend on an assessment of the amount of oiled habitat remaining in the spill area. Conversely, without this assessment, the public will continue to wonder how much of the spill area remains contaminated, and will likely make inappropriate decisions regarding resource use based on misperceptions about the extent of remaining oil. Also, scientists evaluating biological linkages to oil exposure will be less able to assess geographic correlation, compromising those studies.

Assessment of the extent of remaining oil should be done now to maximize benefits that may derive from the expected reduction in uncertainty regarding the extent of this oil.

C. Location

This project will be undertaken in Prince William Sound (PWS) during 2001, and in the spill-affected region outside PWS the following year contingent on results from PWS and funding approval. Communities directly affected by this project inside PWS include Cordova, Chenega, Tatitlek, Valdez and Whittier, and outside PWS include English Bay, Kodiak, Homer, Ouzinkie, Port Graham, Port Lions, Seldovia, and Seward. Benefits of the project will accrue especially to participants in subsistence, commercial fishing, and scientists studying resource recovery in the region, and more generally to the public at large.

COMMUNITY INVOLVEMENT

Community involvement is crucial to the success of this project. Residents of the impacted area may have local knowledge of oil persisting in physical settings and locations that are not known to the investigators of this project. Communication of this knowledge will improve the accuracy of the assessment of oil remaining. Communities in the region will be canvassed, especially the native and commercial fishing communities, during fall 2000 and winter 2001 to identify potential additional sampling compartments. This will involve presentation to these communities of a summary of where oil is presently known to persist, and an appeal for residents to identify any additional situations where oil has been recently observed. The final sampling design will address and incorporate these situations, to reduce the chance that significant repositories of oil remaining in the area are overlooked.

Local hire for field support and sampling will be used whenever possible during the second phase (sampling) of this project. This will likely include vessel and aircraft charters, and possibly some labor during sample collection. However, most of the labor will require specialized field sampling skills that will be furnished by the participating agencies.

Results of this project will be summarized as a map depicting locations and extent of remaining oil discovered, together with a report summarizing the statistical estimate of the amount of remaining oil. These materials will be accompanied by a press release announcing these findings to the media for general distribution, and public presentations will given in Anchorage, Cordova and Valdez to facilitate public review and commentary on the findings.

PROJECT DESIGN

A. Objectives

This project has 2 objectives:

1. Produce a point and interval estimate of the amount of oil remaining inside PWS, and characterize the weathering state of the oil remaining in each of the strata sampled.

2. Produce a point and interval estimate of the amount of oil remaining outside PWS, and characterize the weathering state of the oil remaining in each of the strata sampled.

B. Methods

1. Phase 1

The goal of phase 1 is to produce a final sampling design to be implemented in the field the following spring. A set of design alternatives will be developed by Auke Bay Laboratory staff during summer 2000 for presentation and consideration at a workshop to be held during October 2000. These design alternatives will be presented at this workshop to the Trustee staff, chief scientist, and peer-reviewers, for evaluation of suitability and cost-efficiency. Alternate designs suggested by other workshop participants may also be considered and compared. The decision to pursue phase 3 will also be resolved at this workshop. Final refinements to the design selected at the end of this workshop, along with a detailed study plan for phases 2 and 3 of this project will be presented to the Trustee Council for approval in December 2000.

Proposed sampling designs will need to address how remaining oil will be quantified, how sampling effort will be allocated, and the expected precision of the overall estimate of oil remaining (i.e. a power analysis). Two examples of how oil might be quantified include measurement of the surface area of beach where oil is visible on or beneath the surface, and measurement of the volume of oil recovered beneath a unit surface area of beach. Other metrics may be proposed, provided they are sufficiently well defined to permit quantitative extrapolation to the whole stratum sampled, along with an estimate of precision.

Choice of metric will define what is meant by "extent of remaining oil" in this study, and will strongly affect the precision of the final estimate. This is because measurement of beach surface area beneath which oil is visible is less expensive than measurement of the volume of oil per unit beach area, so more observations of the former may be obtained per unit cost. This increases the precision, but volume measurements would provide more information on likely persistence into the future. Choice of the metric will therefore require careful consideration and resolution at the October workshop, in order for this study is to provide a meaningful estimate of "remaining oil" that satisfies the concerns of the stakeholders.

The allocation of sampling effort will need to address 3 categories of sampling situations, with multiple sampling strata within each category: (1) locations of known oil, and tracked through time; (2) locations of known oil in 1989, but not tracked; and (3) other locations suggested by local residents with local knowledge. The first category includes the set of locations where oil is known to persist, based on recent published scientific investigations or on continuing monitoring studies. This set comprises at least 3 geomorphological settings (strata), viz., oil trapped beneath cobble-boulder armored beaches in the upper intertidal, oil trapped beneath mussel beds, and oil associated with fine grained sediments in protected bays (e.g. the "death marsh" in Bay of Isles). The locations where oil persists within this category are well known, so the sampling design does not need to deal with great uncertainty of oil location. It is expected that sampling within this category is certain to produce a minimum non-zero estimate of oil remaining, so a substantial portion of sampling effort will probably be allocated here.

The second category of sampling comprises PWS beaches that were heavily oiled in 1989, have the same geomorphological characteristics as the strata of category 1, but where oil persistence has not been verified. The third category comprises strata identified by local knowledge to contain persistent oil, and which are not already included in category 1. The sampling approaches that are appropriate for these different categories vary, and one of the sampling design challenges will be to provide an efficient basis for allocating sampling effort among these categories.

Some form of adaptive sampling (Thompson Ref.) will likely be required, first to distribute sampling effort among the 3 categories, and again to distribute effort within each category and stratum. To distribute effort among categories, a preliminary assessment of how frequently oil is detected within each strata of each category will provide a basis for distributing the remaining sampling effort, to maximize the precision and accuracy of the overall estimate of oil remaining. Within specific sampling strata, for example oil under armored beaches at known locations, an adaptive sampling design will probably still be necessary to cope with the patchy and infrequent occurrence of oil there. At the stratum-specific level, adaptive sampling basically involves sampling to assess the frequency of oil patch occurrence, followed by sampling within detected patches to estimate the patch size distribution. These estimates can be combined to estimate the amount of oil present in the sampled stratum as a whole.

Regardless of the design proposed, an analysis of the sampling design power to measure the extent of remaining oil as a function of sampling and analysis cost must be included with each design candidate, to facilitate cost/precision comparisons among alternative designs.

A small number of samples (~24) from strata where most of the remaining oil is detected will be analyzed by GCMS to verify the presence of EVO and to determine the quantitative weathering state (S&H 1997). The weathering state indicates the amount of remaining toxicity associated with the oil, and will contribute to estimating future oil persistence.

To accomplish phase 1 of this project, each participating agency (see sec. C below) will be provided $2K to support preparation for and attendance at the Anchorage workshop in October 2000. Also, two geomorphologists, Drs. James Gibeaut and Dan Mann will each be provided $2K support to attend this workshop. These two individuals have participated in previous related Trustee projects. Travel support for 5 attendees from outside Anchorage will also be provided. Selection of the final design and participants in phase 2 and 3 (execution) of this project will be identified at this workshop.

2. Phases 2 and 3

Because the execution phase of this project depends so heavily on the outcome of phase 1, the detailed project description for phases 2 (FY01) and 3 (FY02) are deferred to the end of the October workshop.

C. Cooperating Agencies, Contracts and Other Agency Assistance

Cooperating agencies for this project include the Alaska Department of Environmental Conservation, the Alaska Department of Natural Resources, the Alaska Department of Fish and Game, the U.S. Forest Service, and the U.S. Geological Survey. Initially, contracts to Drs. James Gibeaut and Dan Mann of $2K each will be provided to support attendance at the Anchorage meeting in October 2000.

SCHEDULE

A. Measurable Project Tasks for FY01

FY01:	
Oct 15 (approx):	Convene Anchorage design planning workshop.
Oct 30:	Submit detailed project description for phase 2 to trustee peer-reviewers
Nov 30:	Incorporate peer-review comments into final DPD for funding consideration by the Trustee Council in December. (End Phase 1)
Nov 30 – Apr 15:	(Phase 2) Present summary of known remaining oil deposits inside PWS and canvas communities for local knowledge of persistent oil. Identify sampling strata locations within each sampling category, based on existing maps of shoreline oiling and beach geomorphology.
Apr 15 – May 30:	Perform preliminary sampling to apportion final sampling effort.
Jun 1 – Sep 30:	Collect field samples.

B. Project Milestones and Endpoints

Schedule:

FY02	
Sep 30 – Apr 15:	Analyze phase 2samples.
Apr 15 – Sep 30:	Prepare final report and journal publication for phase 2. Objective 1 met at this time.
Phase 3:	
Sep 30 – Apr 15:	Present summary of known remaining oil deposits outside PWS and canvas communities for local knowledge of persistent oil. Identify

	sampling strata locations within each sampling category, based on existing maps of shoreline oiling and beach geomorphology.
Apr 15 – May 30:	Perform preliminary sampling to apportion final sampling effort.
Jun 1 – Sep 30:	Collect field samples.

FY03

Sep 30 – Apr 15:	Analyze phase 3 samples.
Apr15 – Sep 30:	Prepare final report and journal publication. Objective 2 met at this time.

C. Completion Date

September 30, 2003

PUBLICATIONS AND REPORTS

No publications will be submitted in FY01. It is anticipated that 2 research papers will be submitted to peer-reviewed scientific journals reporting results for phases 2 and 3 in FY02 and FY03 respectively.

PROFESSIONAL CONFERENCES

None Planned for FY01.

NORMAL AGENCY MANAGEMENT

If the oil spill had not occurred, neither NOAA nor the cooperating agencies would be conducting this project.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project will be coordinated through participation of the cooperating agencies. Formal coordination will commence at the proposed Anchorage workshop. All of the previous Trustee-funded studies on oil persistence in the spill region have been performed under the auspices of these agencies, and it is presumed that local knowledge is the only significant source of additional information relevant to this project outside these agencies.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

None

PROPOSED PRINCIPAL INVESTIGATOR

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FAX: (907) 789-6094
e-mail: 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.

OTHER KEY PERSONNEL

1. Jerome Pella, the senior biometrician at the Auke Bay Laboratory, will be consulted during preparation of the sampling design alternatives and associated power analyses.

2. Marianne See, Alaska Department of Environmental Conservation, will facilitate coordination with State of Alaska agencies.

LITERATURE CITED

Brodersen, C.C., J.W. Short, L. Holland, M.G. Carls, J. Pella, M. Larsen, and S.D.Rice. 1999. Evaluation of oil removal from beaches 8 years after the Exxon Valdez oil spill. Proc. 22nd Arctic and Marine Oil Spill Program, Environment Canada, Calgary, June 1999, pp. 325-336.

Hayes, M. O., and J. Michel. 1999. Factors determining the long-term persistence of Exxon Valdez oil in gravel beaches. Mar. Pollut. Bull. 38:92-101.

Irvine, G. V., D. H. Mann, and J. W. Short. 1999. Multi-year persistence of oil-mousse on high energy beaches distant from the Exxon Valdez spill origin. Mar. Pollut. Bull. 38:572-584.

Page, D.S. 1999. Quoted in USA Today March 4, 1999.

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

approved TC 8-3-00

Budget Category:	Authorized FY 2000	Proposed FY 2001	PROPOSED FY 2001 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
			$2.3	$2.3	$2.3	$2.3	$2.3	$11.1
Personnel	$0.0	$12.1						
Travel	$0.0	$4.4						
Contractual	$0.0	$4.0						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$20.5			Estimated FY2001	Estimated FY 2002	Estimated FY2003	
General Administration	$0.0	$2.1						
Project Total	$0.0	$22.6			$523.0	$500.0	$22.0	
Full-time Equivalents (FTE)	0.0	0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$0.0	$0.0				$0.0		

Comments:

The goal of phase 1 is to produce a final sampling design to be implemented in the field the following spring. Phase 2 will be the detailed costs of the field sampling and analyses. This is the budget for Phase 1 only, the planning phase. Estimated costs for Phase 2 is $500K.

NOAA Contribution: Jeff Short .5 mo@5K, Jeep Rice .25 mo @ 3K for a total NOAA contribution of 8K

FY01

Prepared: 4/12/00

Project Number: 01543 PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Lead Agency: NOAA

FORM 2A
MULTI-TRUSTEE
AGENCY
SUMMARY

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$2.1						
Travel		$4.4						
Contractual		$4.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$10.5				Estimated FY 2002		
General Administration		$0.6						
Project Total	$0.0	$11.1						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY01

Prepared: 4/12/00

Project Number: 01___ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: NOAA

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:	Position Description	GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2001
Jeff Short	Research Chemist	GS/13/6	0.2	10.4		2.1
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.2	10.4	0.0	
					Personnel Total	$2.1

Travel Costs:	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2001
Travel to Anchorage for planning workshop for					0.0
Short, Rice, Harris	0.4	3	6	0.2	2.4
					0.0
Gibeaut	0.6	1	2	0.2	1.0
Mann	0.6	1	2	0.2	1.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$4.4

FY01

Prepared: 4/12/00

Project Number: 01___ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: NOAA

FORM 3B
Personnel
& Travel
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Contractual Costs: Description	Proposed FY 2001
Jim Gibeaut	2.0
Dann Mann	2.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$4.0

Commodities Costs: Description	Proposed FY 2001
Commodities Total	$0.0

FY01

Prepared: 4/12/00

Project Number: 01___ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: NOAA

FORM 3B
Contractual &
Commodities
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2001
			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.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY01

Project Number: 01___ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: NOAA

FORM 3B
Equipment
DETAIL

Prepared: 4/12/00

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$2.0						
Travel		$0.0						
Contractual		$0.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$2.0				Estimated FY 2002		
General Administration		$0.3						
Project Total	$0.0	$2.3						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY01

Prepared: 4/12/00

Project Number: 01___ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: AK Dec of Environmental Conservation

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2001 EXXON VALDEZ TRUSTE_ _ JUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2001
Coordinator			0.5	4.0		2.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.5	4.0	0.0	
					Personnel Total	$2.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2001
					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

FY01

Prepared: 4/12/00

Project Number: 01____ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: Ak Dept of Environmental Conservation

FORM 3B
Personnel
& Travel
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Contractual Costs:	Proposed
Description	FY 2001
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed
Description	FY 2001
Commodities Total	$0.0

FY01

Prepared: 4/12/00

Project Number: 01___ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: Ak Dept. of Environmental Conservation

FORM 3B
Contractual &
Commodities
DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2001
			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.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY01

Project Number: 01____ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: AK Dept. of Environmental Conservation

FORM 3B
Equipment
DETAIL

Prepared: 4/12/00

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$2.0						
Travel		$0.0						
Contractual		$0.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$2.0				Estimated FY 2002		
General Administration		$0.3						
Project Total	$0.0	$2.3						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY01

Prepared: 4/12/00

Project Number: 01___ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: AK Dept. of Natural Resources

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2001
Coordinator			0.5	4.0		2.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal	[redacted]	0.5	4.0	0.0	[redacted]
					Personnel Total	$2.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2001
					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

FY01

Prepared: 4/12/00

Project Number: 01___ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: Ak Dept. Natural Resources

FORM 3B
Personnel
& Travel
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Contractual Costs:	Proposed
Description	FY 2001
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed
Description	FY 2001
Commodities Total	$0.0

FY01

Prepared: 4/12/00

Project Number: 01___ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: Ak Dept of Natural Resources

FORM 3B
Contractual &
Commodities
DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2001
			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.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY01

Project Number: 01___ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: AK Dept. of Natural Resources

FORM 3B
Equipment
DETAIL

Prepared: 4/12/00

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$2.0						
Travel		$0.0						
Contractual		$0.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$2.0				Estimated FY 2002		
General Administration		$0.3						
Project Total	$0.0	$2.3						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY01

Prepared: 4/12/00

Project Number: 01___ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: AK Dept of Fish & Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2001
Coordinator			0.5	4.0		2.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.5	4.0	0.0	
					Personnel Total	$2.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2001
					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

FY01

Prepared: 4/12/00

Project Number: 01____ PHASE ONE
Project Title:Evaluation of Oil in the Intertidal from the EVOS
Agency: ADF&G

FORM 3B
Personnel
& Travel
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Contractual Costs:	Proposed
Description	FY 2001
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed
Description	FY 2001
Commodities Total	$0.0

FY01

Prepared: 4/12/00

Project Number: 01___ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: ADF&G

FORM 3B
Contractual &
Commodities
DETAIL

2001 EXXON VALDEZ TRUSTE   JUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2001
			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.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY01

Project Number: 01___ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: ADF&G

FORM 3B
Equipment
DETAIL

Prepared: 4/12/00

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001
Personnel		$2.0
Travel		$0.0
Contractual		$0.0
Commodities		$0.0
Equipment		$0.0
Subtotal	$0.0	$2.0
General Administration		$0.3
Project Total	$0.0	$2.3
Full-time Equivalents (FTE)		0.0
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

			Estimated FY 2002		

Dollar amounts are shown in thousands of dollars.

Comments:

FY01

Prepared: 4/12/00

Project Number: 01____ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: US Forest Service

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2001 EXXON VALDEZ TRUST OUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2001
Coordinator			0.5	4.0		2.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal	[redacted]	0.5	4.0	0.0	[redacted]
					Personnel Total	$2.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2001
					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

FY01

Prepared: 4/12/00

Project Number: 01____ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: US Forest Service

FORM 3B
Personnel
& Travel
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Contractual Costs:	Proposed
Description	FY 2001
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed
Description	FY 2001
Commodities Total	$0.0

FY01

Prepared: 4/12/00

Project Number: 01___ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: US Forest SErvice

FORM 3B
Contractual &
Commodities
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2001
			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.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY01

Prepared: 4/12/00

Project Number: 01___ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: US Forest Service

FORM 3B
Equipment
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$2.0						
Travel		$0.0						
Contractual		$0.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$2.0				Estimated FY 2002		
General Administration		$0.3						
Project Total	$0.0	$2.3						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY01

Prepared: 4/12/00

Project Number: 01____ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: USGS

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2001 EXXON VALDEZ TRUST OUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2001
Coordinator			0.5	4.0		2.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.5	4.0	0.0	
					Personnel Total	$2.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2001
					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

FY01

Prepared: 4/12/00

Project Number: 01____ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: USGS

FORM 3B
Personnel
& Travel
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Contractual Costs:	Proposed
Description	FY 2001
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed
Description	FY 2001
Commodities Total	$0.0

FY01

Prepared: 4/12/00

Project Number: 01___ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: USGS

FORM 3B
Contractual &
Commodities
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2001
			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.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY01

Prepared: 4/12/00

Project Number: 01___ PHASE ONE
Project Title: Evaluation of Oil in the Intertidal from the EVOS
Agency: USGS

FORM 3B
Equipment
DETAIL

66·00 file
Approved TC 8-3-00

Alaska Resources Library & Information Services (ARLIS)

Project Number:	01550
Restoration Category:	Public Information, Science Management and Administration
Proposer:	Restoration Office
Lead Trustee Agency:	All Trustee Agencies
Alaska SeaLife Center:	No
Duration:	Ongoing
Cost FY 01:	$129,100
Cost FY 02:	TBD
Geographic Area:	All
Injured Resource/Service:	All

ABSTRACT

Project 01550 represents the Trustee Council's contribution to Alaska Resources Library and Information Services (ARLIS). ARLIS serves as a central access point for information generated through the Trustee Council restoration process. In addition, ARLIS acts as the public repository for reports and other materials generated from and related to the cleanup, damage assessment and restoration efforts following the *Exxon Valdez* oil spill (EVOS).

INTRODUCTION

The budget for Fiscal Year 2001 is consistent with the commitment made on behalf of the Trustee Council when ARLIS was established in 1997. ARLIS is providing services that were previously provided through the Oil Spill Public Information Center (OSPIC). As directed by the Council, the contribution to ARLIS continues to decline. With the exception of Fiscal Year 1994, this activity has historically been funded under the Public Information, Science Management and Administration budget (Project 1100).

In Fiscal Year 2001, the Trustee Council will continue to support one librarian at ARLIS. In addition, the Council continues to contribute funding to support the building lease, subscriptions, and other expenses. Council funding in Fiscal Year 2002 and beyond will be assessed on an annual basis.

NEED FOR THE PROJECT

Over the years, a vast array of material has been produced as a result of the restoration program. ARLIS provides guidance to the principal investigators regarding preparation of the reports, distributes the reports to individuals and libraries as appropriate, and acts as a repository of all reports and publications generated as a result of the restoration process. ARLIS also supplies the principal investigators with research materials and reference service pertinent to their restoration projects.

ARLIS provides universal access to Alaska natural and cultural resources information. The ARLIS collection contains 150,000 books, including agency publications, technical reports, and masters and doctoral theses, 700 journals, maps and atlases, legal reference materials, federal and state documents, public review documents, administrative records, videotapes, audiotapes, slides, photographs, electronic databases, environmental education kits, and a circulating collection of furs, skulls, and mounted birds. These materials are cataloged in a global bibliographic database making most circulating items accessible to users around the world. The library catalog is available for searching at the ARLIS website at www.arlis.org.

Since it was established in October 1997, ARLIS annually receives 21,000 visitors, responds to 12,000 requests for information, performs over 8,000 interlibrary loans and circulates 11,000 books. Approximately 15% of the use of the library is directly related to the *Exxon Valdez* oil spill and the Trustee Council's restoration program. In addition, 15% of the materials borrowed by other libraries from ARLIS are EVOS materials.

A. Statement of the Problem

The Trustee Council's policies, as specified in the Restoration Plan, include a strong commitment to public information. ARLIS ensures that findings and results of restoration efforts are available to the public, scientists, and agency staff to help understand the status of injured resources and services and to plan for future restoration.

B. Rationale/Link to Restoration

Project 01550 provides essential support to implement the restoration program as directed by the Trustee Council and guided by the *Restoration Plan.*

C. Location

ARLIS is located at 3150 C Street, Anchorage, Alaska.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Project 01550 supports various aspects of community involvement. This includes public information efforts to assist the general public and spill community residents to learn about the restoration program. ARLIS provides research support to those principal investigators conducting research in the areas of subsistence and traditional ecological knowledge.

PROJECT DESIGN

A. Objectives

The fundamental objective for ARLIS is to provide research materials to governmental agencies, the general public and spill community residents.

Specific objectives for FY 01 include:

1. Provide access to local, state, national, and international users of restoration program information.

B. Methods

Not applicable to this project.

C. Cooperating Agencies, Contracts and Other Agency Assistance

ARLIS is a partnership of eight natural and cultural resource libraries and information centers including:

U.S. Fish and Wildlife Service Library
Alaska State Department of Fish and Game Habitat Library

U.S. Bureau of Land Management Library
U.S. Minerals Management Service Library
U.S. National Park Service Library
U.S. Geological Survey Library
Arctic Environmental Information and Data Center Library
Exxon Valdez Oil Spill Public Information Center

The University of Alaska Anchorage is also a partner, although its library collection is not a part of ARLIS.

ARLIS shares a library catalog with the Anchorage Municipal Libraries and the University of Alaska Anchorage Consortium Library. The holdings of all partner libraries can be searched from the ARLIS web site by anyone with Internet access.

ARLIS librarians are currently cataloging the CIIMMS (Project /391) collection, which will reside at ARLIS with the resulting database.

SCHEDULE

The Trustee Council operates on the Federal Fiscal Year (October 1 - September 30).

A. Measurable Project Tasks for FY 01 (October 1, 2000 - September 30, 2001)

On-going tasks throughout the fiscal year:

1. Review and approve format of final and annual reports, maintain a list of completed reports, and distribute reports to appropriate libraries. Catalog reports in a global bibliographic database for access throughout the world.
2. Maintain for public review the public record copy of the Trustee Council official record.
3. Maintain for public access a file of peer reviewed journal articles and conference papers resulting from Trustee Council funded research.
4. Provide reference service for oil spill related topics and other information needs to the Trustee Council, Restoration Office staff, science review staff, principal investigators, media, students and faculty, spill area residents, and the general public.
5. Acquire and catalog publications generated by the Trustee Council and other oil spill and restoration related materials deemed appropriate for the collection and necessary to the restoration program.

B. Milestones and Endpoints

1. Provide monthly reports to the Restoration Office on the status of the report format review and distribution process.

2. Provide quarterly reports and an annual summary of library usage statistics and staff projects.

C. Completion Date

Council funding in Fiscal Year 2002 and beyond will be assessed each year.

PUBLICATIONS AND REPORTS

Not applicable to this project.

NORMAL AGENCY MANAGEMENT

Funding in Project 01550 is for the sole purpose of supporting restoration program activities and may not be used for other purposes.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Unless otherwise specified by the Restoration Office, each project funded by the Trustee Council is required to submit an annual report and a final report. As the public repository, all reports are cataloged and housed at ARLIS.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

In October 1997, the Oil Spill Public Information Center (OSPIC) was consolidated with 7 other state and federal agency libraries to create ARLIS. Planning for the consolidation was done by library staff, with the guidance of a Management Advisory Group consisting of participating agency heads, through the U.S. Department of Interior, under the auspices of Vice President Gore's Reinventing Government program. Although ARLIS was established as a cost saving measure in response to federal and state budget cuts, the resulting library provides a vastly more comprehensive collection of Alaska resource information in a single location, served by highly qualified staff specializing in resource related information.

PROPOSED PRINCIPAL INVESTIGATOR

Carrie Holba, Librarian
Alaska Resources Library and Information Services (ARLIS)
3150 C Street, Suite 100
Anchorage, AK 99503
(907) 272-7547, 271-4742 fax
carrie@arlis.org

PRINCIPAL INVESTIGATOR

Carrie Holba holds a masters degree in Library and Information Science. In February 1991, she joined the staff of the Oil Spill Public Information Center, serving as public services librarian and then as director since 1992. Since OSPIC was consolidated with ARLIS in October 1997, Ms. Holba has served as reference service coordinator and a member of the ARLIS library management team, and continues to specialize in EVOS related reference service.

6-6-00 file
approved in 8-3-00

FFY 01 EXXON VALDEZ TRU! COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FFY 2000	Proposed FFY 2001	PROPOSED FFY 2001 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
			$0.0	$86.9	$0.0	$0.0	$42.2	$0.0
Personnel	$71.3	$75.6						
Travel	$0.0	$0.0						
Contractual	$45.0	$39.4						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$116.3	$115.0		Estimated FFY 2002				
General Administration	$13.8	$14.1						
Project Total	$130.1	$129.1		TBD				
Full-time Equivalents (FTE)	1.0	1.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

In Fiscal Year 2001, funding for ARLIS will be considered part of the Fiscal Year 2001 Work Plan.

2001

Project Number: 01550
Project Title: Public Information, Science Management and Administration - ARLIS
Agency: Multiple

FORM 2A
SUMMARY

DRAFT

Printed: 6/6/00

FFY 01 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FFY 2000	Proposed FFY 2001						
Personnel	$71.3	$75.6						
Travel	$0.0	$0.0						
Contractual	$0.0	$0.0						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$71.3	$75.6		Estimated				
General Administration	$10.7	$11.3		FFY 2002				
Project Total	$82.0	$86.9		TBD				
Full-time Equivalents (FTE)	1.0	1.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

2001	Project Number: 01550 Project Title: Public Information, Science Management and Administration - ARLIS Agency: AK Dept. of Fish and Game	FORM 3A TRUSTEE AGENCY SUMMARY

FFY 01 EXXON VALDEZ TRU! COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Personnel Costs: Name	Position Description	GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 2001
Holba	Librarian III	19F	12.0	6.3		75.6
	Subtotal		12.0	6.3	0.0	
					Personnel Total	$75.6

Travel Costs: Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 2001
				Travel Total	$0.0

2001

Project Number: 01550
Project Title: Public Information, Science Management and Administration - ARLIS
Agency: AK Dept. of Fish and Game

FORM 3B
Personnel
& Travel
DETAIL

DRAFT

Printed: 6/6/00

Contractual Costs:	Proposed
Description	FFY 2001
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed
Description	FFY 2001
Commodities Total	$0.0

2001

Project Number: 01550
Project Title: Public Information, Science Management and Administration - ARLIS
Agency: AK Dept. of Fish and Game

FORM 3B
Contractual &
Commodities
DETAIL

FFY 01 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FFY 2001
Replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency

2001

Project Number: 01550
Project Title: Public Information, Science Management and Administration - ARLIS
Agency: AK Dept. of Fish and Game

FORM 3B
Equipment
DETAIL

DRAFT

Printed: 6/6/00

FFY 01 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FFY 2000	Proposed FFY 2001						
Personnel	$0.0	$0.0						
Travel	$0.0	$0.0						
Contractual	$45.0	$39.4						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$45.0	$39.4		Estimated FFY 2002				
General Administration	$3.2	$2.8						
Project Total	$48.2	$42.2		TBD				
Full-time Equivalents (FTE)	0.0	0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

2001

Project Number: 01550
Project Title: Public Information, Science Management and Administration - ARLIS
Agency: Dept. of the Interior

FORM 3A
TRUSTEE
AGENCY SUMMARY

FFY 01 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 2001
	Subtotal		0.0	0.0	0.0	
					Personnel Total	$0.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FFY 2001
				Travel Total	$0.0

2001

Project Number: 01550
Project Title: Public Information, Science Management and Administration - ARLIS
Agency: Dept. of the Interior

FORM 3B
Personnel
& Travel
DETAIL

DRAFT

Printed: 6/6/00

Contractual Costs: Description	Proposed FFY 2001
Building Lease (contribution to ARLIS)	19.7
Subscriptions, acquisitions, other expenses (contribution to ARLIS)	19.7
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$39.4

Commodities Costs: Description	Proposed FFY 2001
Commodities Total	$0.0

2001

Project Number: 01550
Project Title: Public Information, Science Management and Administration - ARLIS
Agency: Dept. of the Interior

FORM 3B
Contractual &
Commodities
DETAIL

New Equipment Purchases: Description		Number of Units	Unit Price	Proposed FFY 2001
Replacement equipment should be indicated by placement of an R.			New Equipment Total	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

2001

Project Number: 01550
Project Title: Public Information, Science Management and Administration - ARLIS
Agency: Dept. of the Interior

FORM 3B
Equipment
DETAIL

approved TC 8-3-00

Checklist and Distributional Analysis of Marine Algal Species Collected as Vouchers Under Project CH1A

Project Number:	01551-BAA
Restoration Category:	Research
Proposer:	G. Hansen/OSU
Lead Trustee Agency:	NOAA
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	New
Duration:	1st yr. 1 yr. project
Cost FY 01:	$65.8
Cost FY 02:	$0.0
Geographic Area:	All
Injured Resource/Service:	Intertidal communities

ABSTRACT

During previous EVOS studies (Project CH1A), intense investigations were carried out on the intertidal algal communities of Prince William Sound, Kenai, Kodiak, and the Alaska Peninsula. As a byproduct of these studies, thorough voucher collections were made of the algal species present in more than 100 sites used for the study. The 7,300 voucher specimens were identified to species, curated, and cataloged, but no money was available at the time for publishing the wealth of information on algal biodiveristy and distribution they provided. This project will use these data to prepare regional checklists and biogeographic analyses of the species discovered and finally make available these critical habitat data for restoration and conservation efforts in Alaska.

INTRODUCTION

Macrobenthic marine algae or seaweeds form the base of the food chain in nearly all rocky intertidal and shallow subtidal communities. In areas where they flourish, they also benefit both the structural and chemical environment. Near-shore marine animals are all at least partially dependent on algae for survival, and the environmental stresses that impact the algae also impact these members of the higher trophic levels.

Even so, comparatively few environmental impact studies have been done on the macrobenthic marine algae. One reason for this appears to be that many of these plants are difficult to identify. They often require sectioning and microscopic examination for species determination, a time-consuming procedure prohibitive in most studies. Therefore, when algal investigations are done, identifications are often limited to genera and/or complexes that can be easily identified in the field, a short-cut that frequently leads to problems in data interpretation. In Alaska, other factors compound the difficulties. There are no illustrated keys to the marine algae of this region. During the CHIA studies, we were able to use two somewhat helpful identification guides: (1) the unillustrated keys of Gabrielson *et al.* (1989) covering the algae from Oregon to southeast Alaska and (2) the illustrated but out-of-date flora of Abbott and Hollenberg (1976) on the *Marine Algae of California*. These guides were useful, but they only covered a portion of the algae in the oil spill area. Therefore numerous individual taxonomic papers on the algae of other areas (Japan, Russia, Eastern Canada, Europe) had to be used to adequately cover the species encountered, and species identifications had to be made primarily by experts.

There have been a number of floristic studies that have included marine algae from Alaska, but most of these have been historical. In 1840, Postels and Ruprecht published a richly illustrated text on the algae collected during the 1826-29 Luetke expedition from Russia to southeastern Alaska. Later, Saunders (1901) described and illustrated many of the species encountered during the Harriman Alaska Expedition. Perhaps the most comprehensive of these early accounts were those of Setchell and Gardner who included many Alaskan species in their monumental books on the marine algae of the Pacific Coast of North America (1903, 1919-1925). The most important recent account of the marine algae of Alaska was by Lindstrom (1977). It was the first complete checklist of the marine algae of the entire state. This checklist, compiled primarily from the literature, was used as a baseline for Alaskan marine algal studies for many years. Calvin and Lindstrom went on to produce checklists of the algae of Berner's Bay (1977), Port Valdez (1980), and Juneau (1986), and a number of environmental impact studies have relied on these lists as starting points for their investigations. Perhaps the best known of these are the RCAC-funded studies of Port Valdez by Weigers *et al.* (1997) and Hines *et al.* (1999). Most recently, O'Clair and Lindstrom (2000) have produced an illustrated account of southeastern Alaska's algae entitled *North Pacific Seaweeds*. This volume will be of great value to all algal researchers working in that area.

During the EVOS investigations in Alaska, the importance of macrobenthic marine algae was finally recognized. Numerous researchers took part in algal studies that were well-funded by both EXXON and the Trustees. Volumes of data resulted from these studies, but little of this information has been made readily available to the public. Although there were numerous technical reports produced, few peer-reviewed articles or books have appeared on the data. Most of it remains on government or university shelves waiting for the opportune moment for publication. Many years have gone by since the spill, and it has become more and more imperative that this information is published now before it is forgotten.

NEED FOR THE PROJECT

A -- Statement of Problem.

During the EVOS studies by the University of Alaska, support was generously provided for the CHIA studies, but, due to its litigation sensitivity, no support was given for publishing the data. This left a huge amount of information unavailable to the scientific community and to the public. This proposal is for financial support for the preparation and publication of a peer-reviewed journal article on the occurrence and distribution of marine macroalgae in the oil spill area based on data derived from the CHIA algal voucher collection. In addition, it will provide the funding necessary to correct and update the taxonomy and nomenclature used for these specimens and their corresponding database, thus vastly improving the usefulness of this resource for environmental studies in Alaska.

Because so little was known about the marine algae of south-central Alaska during the EVOS studies, the CHIA algal teams (including the proposed PI) carefully collected and pressed voucher specimens for later identification from more than 100 sites visited during the study. At each site, at least one of every species present was collected, amounting eventually to many thousands of specimens. These were then sent to the proposed PI in Newport, Oregon, where they were identified, curated, cataloged and labeled. With the help of 2 part-time assistants and many volunteers, she was able to finish the entire collection by the 1994 deadline, but then the funding ended. There was no support for editing the database or for publishing the results. Now, before this wealth of information on the occurrence and distribution of marine algae in Alaska is lost, it is important to revive and edit the data and analyze the results for publication in a peer-reviewed journal that will be available to all that are interested.

B -- Rational/Link to Restoration.

The proposed paper will provide information on the algal biodiversity occurring in each of the areas studied by the CHIA teams. Without knowledge of the diversity of species present in an area, it is often difficult to accurately assess environmental impacts such as those encountered during the CHIA studies. Part of the problem appears to be that interactions between species frequently occur. For example, the death of one species might cause the death of another -- or allow it to flourish through a lack of competition. Algal species also vary greatly in their ability to withstand exposure to oil, hot water washes, and trampling. Damage to one species will not necessarily reflect damage to others. Some species (e.g., annuals like *Ulva fenestrata*) rebound quickly from perturbation while others (e.g., perennials like *Fucus gardneri*) may take several years to recover. Much of this variation in response is influenced by the life history and method of growth of the individual species and by their vegetative and reproductive seasonality, fecundity, and ability to disperse and recruit. If restoration procedures are used to expedite recovery of any algal species, it is imperative that these features and the environmental factors that trigger them are well understood--not just for the restored species but for all of those species impacting its fate. Otherwise time and money may be wasted.

C -- Location.

The project will be carried out at the CHIA collection herbaria located at JCSFOS in Auke Bay (AK) and at the Hatfield Marine Science Center in Newport (OR). One study trip will be made to the herbarium of the University of California at Berkeley to examine Alaskan type material, use the library, and discuss problematic species with the experts there. The project will include all 7,300 specimens collected as site vouchers by the CHIA algal teams. The resulting paper will be an essential resource for scientists monitoring and restoring the oil spill area. It will provide valuable information for marine biologists, teachers, and environmental managers working in Alaska, and it will be useful to those in the general public that use algae for food.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

Since this project involves mainly laboratory (herbarium) work, literature research, and writing, there will be no community involvement. However, the final paper will be of interest to native groups harvesting algae and/or herring roe-on-algae for food. To facilitate this more general use of the publication, common names will be included with the scientific names in this paper whenever possible.

PROJECT DESIGN

A -- Objectives.

The proposed publication will provide: checklists of the marine algae found in the Prince William Sound, Kenai Peninsula, and Kodiak/Cook Inlet regions studied by the CHIA teams. In addition, it will provide an analysis of the species distributions as they relate to geographic area, substratum type, wave exposure, and salinity and, when the data are available, to oil exposure and beach cleaning.

B -- Methods.

The project will involve the following stages of preparation: a preliminary library and herbarium study of the difficult species, corrections and additions to the voucher database, voucher specimen annotations, checklist preparation, data analyses, and manuscript preparation.

1. <u>Preliminary library and herbarium study of the difficult species</u>. Although I am familiar with most of the Alaskan algal species and the type specimens that represent them, there are a number of species complexes that I find particularly confusing. These will need to be researched at the University of California at Berkeley herbarium which houses the most complete set of Alaskan type specimens and the most complete algal library within the United States. Some of the more difficult complexes include species in the genera *Alaria, Mazzaella, Mastocarpus, Porphyra, Ceramium, Neorhodomela,* and *Polysiphonia*. Within the past 5 years, monographs have been written on several of these making identifications much easier. On others, I have projects in progress that will assist me in my final determinations. Some nomenclatural problems exist with the species, but by the summer of 2001 these should be resolved through discussions with S. Lindstrom for our NSF project on the *Marine Flora of Alaska*. The complexes that cannot be

resolved during the time-frame allowed will remain listed as species or generic complexes in the paper. During the EVOS studies, I did discover several new species. These will not be included in this paper, but it is hoped that the Trustee Council or GEM project will support the descriptive work necessary to describe these species by 2002.

2. Voucher database corrections and additions. The voucher database was designed and programmed by myself and a volunteer during the early CHIA studies in order to mainly produce specimen labels. It was initially written (from scratch!) in BASIC, and it was a wonderfully useful program. But, after entering the first few thousand specimens, I soon realized that the sorting procedure was way too slow. Therefore, I transferred the data into Fox Pro II, a program that my lab used for data entry until the close of the project in 1994. Recently, I imported the data into Access 2000, a database that is much easier to work with and that I have become an expert in during the past few years. Over the EVOS study years, a number of people in my lab were involved in data entry of the voucher specimens and numerous typographic errors were made. Before queries and analyses even begin to be possible, it is imperative that corrections are made. I will spend at least one month at this task and at incorporating the taxonomic and nomenclatural decisions described in #1 into the database. In addition, the known information on habitat types will be entered.
3. Voucher collection annotation. Except for a small reference set of specimens held my me in Newport, the CHIA voucher collection is currently held entirely at the herbarium in Juneau. It is a valuable resource for those studying algae in Alaska and only recently was examined by R. O'Clair for her book with S. Lindstrom on *North Pacific Seaweeds.* Since it is in active use, it is important that I go through the specimens to cross-check my earlier identifications and annotate the specimens for taxonomic and nomenclatural changes and for typographic mistakes. Since the data for these changes will be maintained in my Access database, it will be an easy matter to query the database for these changes and to generate Annotation Labels for all of the specimens. However, it will be a time-consuming task to attach these labels to all of the specimens concerned so that others will be aware of the changes. Therefore, in order to stick within the time-frame established for the project, an assistant will be employed to help with this task.
4. Checklist preparation. I will query the database for lists of species from the entire spill area and then from each of the geographic areas. As in our first preliminary CHIA project report (1991), I will indicate which species were new records to the area at the time of the study.
5. Data analyses. This will be performed with the assistance of M. Stekoll, my coauthor. Although we are still in the process of determining which analyses to use, some of the species group characteristics and preferences that we will try to reveal are:
    i. widespread vs. narrow distributions.
    ii. substratum preference (bedrock, boulder or cobble).
    iii. exposure preference (exposed or sheltered, and aspect).
    iv. low salinity tolerance (if salinity data is available)
    v. oil exposure and cleanup tolerance and/or quick recovery.

    Most of these preference or similarity groups can be determined through simple queries. If more elaborate analyses are used, they will be determined and performed by M. Stekoll. After obtaining our results, we will overlay the biological features of the species, particularly those that relate to taxonomy and life history. The influence of these genetic features on the group preferences will be discussed.
6. Manuscript preparation. I will prepare the first draft of the manuscript in MS Word. Stekoll will prepare the graphics in MS Excel or another program and edit the

Revision 7-1-00
01551

manuscript. I will be responsible for the final submission to *Botanica Marina* and for the final report.

C -- Cooperating Agencies, Contracts, and Other Agency Assistance. None at this time.

SCHEDULE (Revised 7/1/2000)

A-- Measurable Project Tasks for FY 01 (October 1, 2000 - July 1, 2001)

(By) January 1, 2001:

1. Attend the Workshop in Anchorage
2. Correct typographic errors and update nomenclature of the voucher specimen database as much as possible in Newport.
3. Visit Berkeley for 2 weeks to work on nomenclatural problems and examine type specimens -- further update the database.
4. Visit Juneau for 10 days to check the taxonomy of the voucher specimens, distribute and glue the annotation labels, and correct the database. Borrow particularly difficult specimens.

(By) April 1, 2001:

5. Complete checklists and begin work on the analyses, graphics and manuscript.
6. Visit Juneau for another 10 days to make final corrections to the specimens and database, do the analyses.

(By) July 1, 2001:

7. Complete the manuscript and submit it to a peer-reviewed journal.
8. Attend the Phycological Society of America meeting; give talk on the project.
9. Prepare and submit the final report.

B-- Project Milestones and Endpoints

April 1, 2001:	--Completion of collection annotations and database corrections.
	--Completion of analyses.
July 1, 2001:	--Completion and submission of manuscript
	--Presentation at PSA meeting

Completion Date: July 1, 2001

PUBLICATIONS AND REPORTS

Hansen, G. I., and M. S. Stekoll. "A checklist and distributional analysis of marine algal species collected as vouchers during the CHIA-Exxon Valdez oil spill studies". We will submit our manuscript during the summer of 2001 to *Botanica Marina*, a journal that frequently includes biogeographic studies of this type.

PROFESSIONAL CONFERENCES.

Phycological Society of America, Estes Park, Colorado. June 2001. "A distributional analysis of marine algal species collected by the University of Alaska during the Exxon Valdez oil spill studies in south-central Alaska".

COORDINATION AND INTEGRATION OF RESTORATION EFFORT.

The data published in this report will most directly assist the "Ecosystem Synthesis/GEM Transition" projects and should be considered a part of the ecosystem characterization of the entire EVOS area. In addition to providing an analysis of the habitat types used for damage assessment, the report will also provide vital base-line data for the future Gulf Ecosystem Monitoring program.

Currently, G. Hansen has projects on Alaskan marine algae and/or ecosystem characterization in progress or recently completed with the following people:

1 **Sandra C. Lindstrom** (Hansen & Lindstrom, "A Flora of the Benthic Marine Algae of Alaska". NSF supported & currently in progress. Two months of salary remain on this project for Hansen during the 2000-2001 academic year. However, the actual completion of this project will not occur until the Fall of 2001, after the proposed study is submitted.) Please see the comment below.

2 **Kathy A. Miller** (Miller & Hansen, "A checklist of the marine algae of the Kenai Fjords National Park" -- currently on hold since unsupported).

3 **Jane Middleton** (I identified the many of the collections of Middleton and Dudiak used in their ADF&G oil spill reports and later by Bridget Callahan in her Checklist of the Marine Algae of Kachemak Bay. Middleton & Hansen are planning "A Guide to the Algae of Kachemak Bay" which is yet unsupported)

4 **Tom Suchanek and Gail Irvine** ("Characterization of habitat types present along the Shelikof Strait" -- I participated in the algal checklists and percent cover studies of this NPS funded project. The report is completed but not yet published)

5 **Tuck Hines, Greg Ruiz, John Chapman, Nora Foster, Howard Feder, and James Carlton** ("Biological Invasions of Cold-Water Ecosystems: Ballast-Mediated Introductions in Port Valdez/Prince William Sound, Alaska" -- I did the marine plant sections of this report, RCAC/Sea Grant funded and just completed.)

The data provided by the proposed project will assist in the completion of studies # 1, 2, and 3 and add insight to follow-up studies on # 4 and 5. It is particularly important that the proposed project be completed before #1 and 2 above so that credit for the CHIA collections can be given to the appropriate people and funding agencies.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS. Not applicable..

PROPOSED PRINCIPAL INVESTIGATOR:

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E-mail: Gayle.Hansen@hmsc.orst.edu

PRINCIPAL INVESTIGATOR QUALIFICATIONS

Gayle I. Hansen is a Marine Algal Taxonomist, Ph. D.(1976), specializing in the Alaskan and Oregon floras (see the attached CV). She is probably best known for her part in the British Columbia Marine Algal Flora series (1981, 1983) and for her *Checklist and Biogeographic Analysis of the Marine Algae of Oregon* (1997). As algal taxonomist for the CHIA project , she contributed to the design of the intertidal algal studies and trained the algal technicians (many whom had been her students) in appropriate algal identification and sampling methods. During the CHIA study, Hansen and the technicians collected and pressed the entire site voucher collection. Each year's collection was sent to Oregon where she identified the specimens with the aid of a compound microscope and the appropriate literature. In a volunteer effort, Hansen and a computer specialist designed and programmed the initial voucher database. When funding became available, 2 part-time assistants joined her to curate, label, and catalog the entire collection by the 1994 deadline. The CHIA Algal Voucher Collection is now kept by the University of Alaska in Juneau except for one reference set of specimens that is permanently left with Dr. Hansen. The database (still in need of proofing and updating) is kept in Oregon with a copy in Juneau for use with the specimens.

Responsibilities: Correcting the taxonomy and nomenclature of the CHIA-EVOS algal voucher-specimen collection and annotating the sheets; correcting the database and adding habitat information; preparing the regional checklists; working with Stekoll on the biogeographic analyses and graphics, and writing and submitting the final manuscript for publication.

OTHER KEY PERSONNEL

1. -- Michael S. Stekoll, Ph. D. (Professor of Biology, UAS and SFOS/UAF)
   Juneau Center for the School of Fisheries and Ocean Sciences
   University of Alaska Southeast
   11120 Glacier Highway
   Juneau, Alaska 99801
   Phone: 907-465-6279
   Fax: 907-465-6447
   E-mail: ffmss@uaf.edu

   Responsibilities: Dr. Stekoll will coauthor the paper and will be responsible primarily for helping with the biogeographic analyses, graphics preparation, and manuscript editing. Dr. Stekoll served as PI for the EVOS-CHIA algal studies as well as for the Herring Bay experimental and monitoring studies. Without his impetus and support, the CHIA algal voucher collections would never have been made.

2. -- A student worker from either UAJ or OSU. Responsibilities: Help with attaching annotation labels to each of the 7,300 voucher specimens.

3. -- EVOS/CHIA field personnel.
   Many of the CHIA algal technicians made heroic efforts to help us with our original collections. These included: Mandy Lindeberg, Robin Jenne, Brenda Konar, C. J. Rey, and Nancy Douglas. Larry Deysher, head of the CIK algal project was also extremely helpful. These and others will be acknowledged for their contributions in our paper.

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SUBCONTRACT THROUGH UAF

Biogeography of intertidal benthic seaweeds in south-central Alaska.

NEED FOR THE PROJECT

During the CHIA studies by the University of Alaska, support was provided for the field studies, but, due to its litigation sensitivity, no support was given for publishing the data. This left a huge amount of information unavailable to the scientific community and to the public. This proposal is for financial support to assist with the preparation and publication of a peer-reviewed article on the occurrence and distribution of marine macroalgae in the oil spill study area collected by the CHIA teams.

Because so little was known about the marine algae of south-central Alaska, the CHIA algal teams (including the proposed PI) collected and pressed voucher specimens for identification from more than 100 sites visited during the study. At each site, at least one of every species present was collected, amounting eventually to many thousands of specimens. These were sent to the proposed PI in Newport, Oregon, where they were identified, curated to herbarium sheets, cataloged and labeled. With the help of two part-time assistants and many volunteers, she was able to finish the 7,300 sheet collection by the 1994 deadline, but then the funding ended. There was no support for editing the database or for publishing the results. Now, before this wealth of information on the occurrence and distribution of Alaskan marine algae is lost, it is important to revive and edit the data and to analyze and summarize the results for publication in a journal that will be available to all that are interested.

PROJECT DESIGN

A – Objectives.

The proposed publication will provide: checklists of the marine algae found in the Prince William Sound, Kenai Peninsula, and Kodiak/Cook Inlet regions studied by the CHIA teams. In addition, it will provide an analysis of these species distributions as they relate to geographic area, substratum type, wave exposure, and salinity and, when the data are available, to oil exposure and beach cleaning.

B -- Methods.

Preliminary work with respect to the data base will be performed by G. Hansen of HMSC. M. Stekoll will assist with data analysis and report writing. Although we are still in the process of determining which analyses to use, some of the species group characteristics and preferences that we will try to reveal are:

widespread vs. narrow distributions.
substratum preference (bedrock, boulder or cobble).
exposure preference (exposed or sheltered, and aspect).
low salinity tolerance (if salinity data is available)
oil exposure and cleanup tolerance and/or quick recovery.

Most of these preference or similarity groups can be determined through simple queries. If necessary we will perform more elaborate analyses. After obtaining our results, we will overlay the biological features of the species, particularly those that relate to taxonomy and life history.

The influence of these genetic features on the group preferences will be discussed A manuscript will be prepared for submission to *Botanica Marinia* which will include a summary of the information detailed above.

C-- Project Milestones and Endpoints

July 1, 2001:	Completion of collection annotations and database corrections
	Completion of analyses
Sept. 30, 2001:	Completion and submission of manuscript

Completion Date: September 30, 2001

PUBLICATIONS AND REPORTS

Hansen, G. I., and M. S. Stekoll. "A checklist and distributional analysis of marine algal species collected as vouchers during the CHIA- Exxon Valdez oil spill studies". We will submit our manuscript during the summer of 2001 to *Botanica Marina,* a journal that frequently includes biogeographic studies of this type.

PROFESSIONAL CONFERENCES.

Phycological Society of America, Fort Collins, Colorado. July 2001. "A distributional analysis of marine algal species collected by the University of Alaska during the Exxon Valdez oil spill studies in south-central Alaska".

PRINCIPAL INVESTIGATOR QUALIFICATIONS (for the subcontract)

Dr. Michael Stekoll is a Professor of Biology at the University of Alaska Southeast, and the School of Fisheries and Ocean Sciences at the University of Alaska Fairbanks. He has served as the Principal Investigator for the coastal habitat injury assessment (CHIA) study and Herring Bay experimental and monitoring studies that examined the impacts of the EVOS on intertidal and subtidal algae. His specialties include studies of *Fucus, Macrocystis,* and other seaweeds in Alaska.

BUDGET:

Stekoll:

Salaries and Leave (80 hours)	$3,478
Benefits	1,033
Overhead @51.3%	2,314
Total	$6,824

Gayle hanzan oil spill porject 2001-2002
Apr-00

Salaries and Leave		Hours	$/hr	Leave	Total	
	Stakoll	80	42.87	0.014	$3,478	
	Res Tech	0	11.5	0	$0	
						$3,478
Benefits			Benefits			
	Stakoll		0.297		$1,033	
	Tech		0.078		$0	
				Subtotal		$1,033
				Salaries + Benefits		$4,510
Travel		No. Trips	Each			
	Domestic	0	200		$0	
	JNU-Meeting	0	1400		$0	
	Per Diem	0	139		$0	
						$0
Services						
	Sub-Contracts -diving				$0	
	Communications				$0	
	Drafting/duplication				$0	
	Library searches				$0	
	Equipment rent/maintenance				$0	
	Publication costs				$0	
	Postage shipping freight				$0	
	Boat charters				$0	
	Misc services				$0	
						$0
Supplies						
	Field gear				$0	
						$0
Equipment						
						$0
Tuition		Credits	each			
	GS	0	312		$0	
						$0
Total Direct Costs						$4,510
Overhead						
	Rate	0.515				$2,314
Total Project Costs						$6,824

AUTHORIZED UAF SIGNATURES WILL NOT BE AVAILABLE FOR ONE MORE WEEK.

Approved TC 8-3-00
Revision 6-8-00

FY 01 EXXON VALDEZ TRU : COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FFY 2000	Proposed FFY 2001						
Personnel		$0.0						
Travel		$0.0						
Contractual		$61.5						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal		$61.5		Estimated FFY 2002				
General Administration		$4.3						
Project Total		$65.8		$0.0				
Full-time Equivalents (FTE)								
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

2001

Project Number: 01551-BAA
Project Title: Checklist & Distributional Analysis of Marine Algal Species Collected During CH1A
Agency: NOAA

FORM 3A
SUMMARY

Revision 6-28-00
Approved T 7-3-00

2001 EXXON VALDEZ TRUS' COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
			[redacted]					
Personnel (including benefits)		$25,095.2						
Travel		$8,238.0						
Contractual		$6,824.0						
Commodities		$350.0						
Equipment		$2,500.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal		$43,007.2				Estimated FY 2002		
OSU Indirect Cost Rate = 43%		$18,493.0						
Project Total		$61,500.2						
			[redacted]					
Full-time Equivalents (FTE)		0.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Project Total - $61.5
+ 4.3 GA
$65.8

FY01

Revised: June 27, 2000

Project Number: 01551-BAA
Project Title: A checklist and distributional analysis of marine algal species collected as vouchers during the CHIA-EVOS studies
Name: Gayle I. Hansen

FORM 4A
Non-Trustee
SUMMARY

William Hatte 6/28/00
for Peggy S. Lowry
Director of Sponsored Programs
Authorized Institutional Representative

2001 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:						
Name	Position Description		Months Budgeted	Monthly Costs	Overtime	Proposed FY 2001
Gayle I. Hansen	Principal Investigator		3.5	6808.0		23,828.0
	$18400 + 48% fringe					0.0
						0.0
Yet to be determined	Curatorial Assistant					0.0
	$960 + 10% fringe-$1056		0.6	2112.0		1,267.2
						0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		4.1	8920.0	0.0	
					Personnel Total	$25,095.2

Travel Costs:	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2001
Description (flight costs are from: Travel.Yahoo.Com)					
1. Newport to Juneau to examine and annotate specimens,					0.0
analyze the data, and discuss the manuscript	550.0	2	20	120.0	3,500.0
additional = car rental at $40/day			20	40.0	800.0
2. Newport to Berkeley to examine Alaskan type specimens, use the	265.0	1	12	110.0	1,585.0
library, and discuss problem species with the experts					0.0
additional = limosine service to Berkeley	43.0	1			43.0
3. Newport to Anchorage for the EVOS Trustees meeting	500.0	1	3	110.0	830.0
4. Newport to Estes Park, Colorado, for the PSA meetings	550.0	1	5	110.0	1,100.0
additional = Limosine service from the airport	80.0	1			80.0
additional = meeting registration	300.0	1			300.0
					0.0
					0.0
				Travel Total	$8,238.0

FY01

Prepared: April 12, 2000
Revised: June 27, 2000

Project Number: 01551-BAA
Project Title: A checklist and distributional analysis of marine algal species collected as vouchers during the CHIA-EVOS studies
Name: Gayle I. Hansen

FORM 4B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed
Description	FY 2001
Dr. Mike Stekoll, lead algal PI on the EVOS/CHIA studies, will co-author the paper. He will provide 2 weeks of time to help primarily with data analysis and graphics. He will also edit the final manuscript. 2 weeks of time — salary $3,478 benefits $1,033 51.3% overhead $2,314 Total $6,825	$6,825.0
Contractual Total	$6,825.0

Commodities Costs:	Proposed
Description	FY 2001
Herbarium , computer, and microscope supplies: MS Office Professional and Quatro Pro, herbarium paper and glue, brushes, printer ink, diskettes, microscope supplies (slides, coverslips, microscope lightbulbs, microscope cleaning), etc.	300.0
Long Distance phone calls to M. Stekoll and M. Lindeberg.	50.0
Commodities Total	$350.0

FY01

Prepared: April 12, 2000
Revised: June 27, 2000

Project Number: 01551-BAA
Project Title: A checklist and distributional analysis of marine algal species collected as vouchers during the CHIA-EVOS studies
Name: Gayle I. Hansen

FORM 4B
Contractual &
Commodities
DETAIL

2001 EXXON VALDEZ TRUS[illegible] COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2001
			0.0
1. Notebook computer to house the database, use for data analyses and manuscript preparation.			0.0
It must be fast to handle the database and portable for transport to Juneau and Berkeley.			0.0
IBM Thinkpad A20M (P3/600) seems to be a good machine (MicroWarehouse = $2499)	1	2499.0	2,499.0
My current notebook computer is old and slow and almost completely worn out from			0.0
other projects. It really should be replaced for this project.			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**	$2,499.0

Existing Equipment Usage: Description		Number of Units	
Zeiss Axioskope Microscope	(Both microscopes are for examining algal specimens)	1	
Zeiss SR Stereo Microscope		1	
And my extensive algal library....!			

FY01

Prepared: April 12, 2000
Revised: June 27, 2000

Project Number: 01551-BAA
Project Title: A checklist and distributional analysis of marine algal species collected as vouchers during the CHIA-EVOS studies
Name: Gayle I. Hansen

FORM 4B
Equipment
DETAIL

Revision 7-6-00

Exchange Between Prince William Sound and the Gulf of Alaska

Approved TC 8-3-00

Project Number:	01552-BAA
Restoration Category:	Research
Proposer:	S. Vaughn/PWSSC
Lead Trustee Agency:	NOAA
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	Cont'd
Duration:	2nd yr. 3 yr. project
Cost FY 01:	$105.7
Cost FY 02:	$100.6
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 spanning 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 meteorological and physical data 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. 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.

At Hinchinbrook Entrance the summer and early fall months of 1995 (June through September) were characterized by outflow above about 150m and inflow below (Vaughan et al, 1999). Easterly offshore winds caused surface Ekman layer inflow, accompanied by deeper outflow. 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.

In December 1999, the ADCP mooring was redeployed in Hinchinbrook Entrance under EVOS project 00552. The mooring is scheduled for retrieval in July 2000, and for redeployment in September 2000. This proposal is for continued support of the Hinchinbrook mooring deployment.

This project will interface with other projects underway in PWS. GLOBEC Northeast Pacific (NEP) monitoring surveys in the northern GOA 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.

Anther project underway in PWS is the development of a near real-time nowcast/forecast (N/F) system, co-sponsored by the Oil Spill Recovery Institute (OSRI), the Alyeska Ship Escort and Response Vessel System (SERVS), and the PWS Region Citizens Advisory Council (PWS RCAC). 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. Current data are collected using a downward looking ADCP towed from one of the Alyeska SERVS vessels. East-west and north-south transects through central PWS, and repeated transects at Hinchinbrook Entrance (to eliminate the tidal contribution), were conducted in 1999. Funding has been secured to continue measurements in 2000.

NEED FOR THE PROJECT

A. Statement of the Problem

Mechanisms governing exchange between the northern GOA and PWS are not well 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 FY01. This project will contribute information to local news letters and newspaper articles. Results will be published in peer reviewed scientific journals. Results will be posted on a PWSSC 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 for continued deployment of an upward looking ADCP mooring in Hinchinbrook Entrance over the next two 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.

B. Methods

An upward-looking ADCP mooring (RDI 150 kHz broadband) will be deployed in the fall of each year (e.g., September) and retrieved in the summer (e.g., July). The approximate mooring location will be latitude 60 17.0', longitude 146 51.0', which is in the deepest part of Hinchinbrook Entrance at the northern end of the Montague Island trench. As configured, the 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. To maximize deployment time while still capturing the tidal cycle, the sampling interval will be 2 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.

The velocity and T/S data will be stored on the PWSSC network computers. Analyzed data products will be available via a PWSSC web site. Raw data will be available to other EVOS investigators after publication.

With a 2 hour sampling interval, continuous data collection is limited by battery power to approximately 9 months. The first deployment took place in December 1999. Retrieval is scheduled for July 2000. The second deployment, funded under FY00 552, is scheduled for September 2000. September was chosen to allow ample turn around time for the mooring. In subsequent years, deployment and retrieval are scheduled for September and May.

It is unfortunate that this collection strategy does not include measurements in the summer months. Previous summer observations at Hinchinbrook Entrance have revealed many interesting features. September and May were chosen for several reasons. With a maximum 9 month deployment time, a single mooring will miss 3 months of the year. Since severe weather often precludes shipboard work in the late fall through early spring, the summer months were chosen to miss. In the summer, the mooring time series will be supplemented by velocity measurements using a towed shipboard instrument as described below. Conditions in both September and May are usually mild enough to allow mooring work. Also, this time period covers the late fall and early winter when volume transports at Hinchinbrook Entrance are maximum. Efforts are underway to secure funding for a second mooring, so that year-round measurements will be possible. At this time, no sources have been identified for FY01.

Target cruise dates for the next two years are:

September 2000 - May 2001
September 2001 - May 2002

FY01 will include two mooring cruises (e.g., May 2001 and September 2001). FY02 will include one mooring cruise (e.g., 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. The time series obtained from the mooring will be supplemented by the velocity transects made with a downward-looking towed ADCP (funded under the OSRI N/F project). The repeated transects will capture the spatial variability of the Hinchinbrook Entrance flow patterns. T/S measurements on the SERVS cruises will be obtained using expendable CTDs (XCTDs). Conditions in the GOA, particularly in the trench southeast of Montague Island, will be documented by the GLOBEC group at the Institute of Marine Science (IMS) at the University of Alaska Fairbanks (UAF). 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.

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 mooring velocity time series coupled with time series of wind from the meteorological buoys will allow further investigation of surface Ekman layer inflow.

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.

C. Cooperating Agencies, Contracts and Other Agency Assistance

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

SCHEDULE

A. Measurable Project Tasks

FY01:

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

FY02:

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

FY03:

April 15, 2003:	FY02 Final Report due

B. Project Milestones and Endpoints

Milestones of each year will be the successful deployment and retrieval of the mooring. The endpoint of each fiscal year will be marked by the Annual Report due date (April 15 of 2001, 2002 and 2003).

C. Completion Date

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

PUBLICATIONS AND REPORTS

The following manuscript is in review and is expected to be published in FY01:

Physical Variability in Prince William Sound during the SEA Study (1994 - 1998), Fisheries Oceanography, October 2000.

This manuscript was previously entitled Physical Processes Influencing the Pelagic Ecosystem of Prince William Sound.

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, both of IMS/UAF (GLOBEC). This project will cooperate with 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
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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)/Mathmatics (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.

Vaughan, S. L., C. N. K. Mooers, and S. M. Gay III, 2000: Physical Variability in Prince William Sound during the SEA Study (1994-1998). J. Fish. Oceanogr. (submitted).

Gay III, S. M. and S. L. Vaughan, 2000: Seasonal Hydrography and Tidal Currents of Bays and Fjords in Prince William Sound, Alaska. J. Fish. Oceanogr. (submitted).

OTHER KEY PERSONNEL

Shelton M. Gay: cruise staging, instrument calibration and maintenance, data acquisition and analysis, contribute to journal publications.

LITERATURE CITED

Niebauer, H.J., T.C. Royer, and T.J. Weingartner, 1994: Circulation of Prince William Sound, Alaska. J. Geophys. Res., 99, C7, pp 14,113-14,126.

Vaughan, S.L., S.M. Gay, L.B. Tuttle, and K.E. Osgood, 1998:
SEA: Observational Oceanography in Prince William Sound.
Exxon Valdez Oil Spill Restoration Project Annual Report
(Restoration Project 97320-M), Prince William Sound Science Center,
Cordova, Alaska.

Vaughan, S.L., C.N.K. Mooers, J. Wang, S.M. Gay, and L.B. Tuttle, 1999:
Physical Processes Influencing the Pelagic Ecosystem of Prince William Sound.
Exxon Valdez Oil Spill Restoration Project Annual Report
(Restoration Project 98320-M), Prince William Sound Science Center,
Cordova, Alaska.

Revision 7-\-\-00
Approved TC . -00

2000 EXXON VALDEZ TRUSTI　　OUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$0.0						
Travel		$0.0						
Contractual		$98.8						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$98.8						
General Administration		$6.9						
Project Total	$0.0	$105.7						
Full-time Equivalents (FTE)		0.6						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY01

Prepared:

Project Number: 552
Project Title: Exchange between PWS and the Gulf of Alaska
Agency: NOAA

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Budget Category:	Authorized FY 2000	Proposed FY 2001

2000 EXXON VALDEZ TRUST OUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Personnel	$45.9	$48.3						
Travel	$7.0	$5.3						
Contractual	$28.6	$20.2						
Commodities	$4.0	$3.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$85.5	$76.8				Estimated FY 2002		
Indirect (28.6%)	$21.4	$22.0						
Project Total	$106.9	$98.8				$95.9		
Full-time Equivalents (FTE)		0.6						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

The federally negotiated indirect cost rate for the Prince William Sound Science Center is 28.6%.

A total of $482.00 is requested for attendance at the annual EVOS Workshop in Anchorage.

FY01

Prepared:

Project Number: 552
Project Title: Exchange between PWS and the Gulf of Alaska
Name: Prince William Sound Science Center

FORM 4A
Non-Trustee
SUMMARY

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2001
Shari Vaughan	Physical Oceanographer (PI)		3.5	7900.0		27,650.0
Shelton Gay	Physical Oceanographer		3.5	5900.0		20,650.0

							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		7.0	13800.0	0.0	
						Personnel Total	$48.3

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2001
	EVOS Workshop - Anchorage - January 2001	202.0	1	2	140.0	482.0
	1 r/t Cordova-Fairbanks	440.0	1	3	140.0	860.0
	1 r/t Cordova-Miami	960.0	1		0.0	960.0
	2 r/t Miami-Cordova	960.0	2	8	140.0	3,040.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$5.3

FY01

Prepared:

Project Number: 552
Project Title: Exchange between PWS and the Gulf of Alaska
Name: Prince William Sound Science Center

FORM 4B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed
Description	FY 2001
Vessel Charter (2 cruises, 2 days each @ $3000 per day)	12,000.0
Equipment calibration/repair	1,000.0
Network costs and maintenance ($100/computer-month)	1,600.0
Professional servies - mooring technician ($2000 per cruise)	4,000.0

Phone, fax, copying	800.0
Mail, freight, shipping	800.0
Contractual Total	$20.2

Commodities Costs:	Proposed
Description	FY 2001
Office supplies	500.0
Computer supplies	500.0
Marine supplies	2,000.0
Commodities Total	$3.0

FY01

Prepared:

Project Number: 552
Project Title: Exchange between PWS and the Gulf of Alaska
Name: Prince William Sound Science Center

FORM 4B
Contractual &
Commodities
DETAIL

2000 EXXON VALDEZ TRUSTI)UNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2001
			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.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	

FY01

Prepared:

Project Number: 552
Project Title: Exchange between PWS and the Gulf of Alaska
Name: Prince William Sound Science Center

FORM 4B
Equipment
DETAIL

01555

approved TC 8-3-00

CAN STRESS HORMONES BE USED AS AN INDICATION OF FOOD AVAILABILITY AND REPRODUCTIVE PERFORMANCE? AN EXPERIMENTAL APPROACH.

Project Number:	01555
Restoration Category:	Research (new)
Proposed By:	DOI-USGS; University of Antwerp, Belgium
Lead Trustee Agency:	DOI-USGS
Cooperating Agencies:	N/A
Alaska SeaLife Center:	No
Duration:	1st year, 1-year project
Cost FY 01:	$18,900
Geographic Area:	Middleton Island
Injured Resource:	Black-legged Kittiwake, Pelagic Cormorant

RECEIVED
APR 14 2000
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

ABSTRACT

This study will complement and enhance an existing *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) project (99479) that investigates how stress hormone levels (i.e., corticosterone) in adult seabirds relate to local food conditions and indicate the future reproductive health of a colony. This study will (1) test for differences in corticosterone levels between supplementally fed and unfed black-legged kittiwakes that are nesting at one colony, thereby removing any inherent environmental differences present when birds from two colonies are compared, (2) measure changes in corticosterone levels in adults throughout the breeding season including birds recently arriving from the wintering grounds, (3) explore the effects of adult gender on corticosterone levels, and (4) evaluate how corticosterone levels relate to the an individual's reproductive success and survival, as well as overall productivity of the colony. Results from a pilot study conducted in 1999 indicate the relationships among stress hormones, food availability, and reproduction may be more complex than previously suggested. A second year of data collection planned for the summer of 2000 will help elucidate these relationships. We are asking for minimal financial support to analyze plasma samples collected in 2000, and salary to complete and publish manuscripts. This study will assist other efforts to evaluate the efficacy of using corticosterone levels to assess the effects of fluctuations in food supply on the reproductive performance and survival of seabirds.

INTRODUCTION

In the Gulf of Alaska, some seabird and marine mammal species have experienced reduced productivity, increased mortality and resultant population declines during the past few decades (Hatch 1987, Merrick et al. 1987, Pitcher 1990, Hatch et al. 1993a, Byrd et al. 1999). Black-legged kittiwakes (*Rissa tridactyla*), for example, have failed to reproduce at many colonies in Alaska (Murphy et al. 1991, Hatch et al. 1993a, Irons 1996). Productivity in Alaska kittiwake colonies has declined from an average of about 0.6 young per nest in the 1960s and 1970s to less than 0.2 young per nest in the 1980s (Hatch et al. 1993a). Circumstantial evidence points to a deficient food supply as the cause of poor productivity in Alaskan kittiwakes and other seabirds (Hatch 1987, Hatch and Hatch 1990, Hatch et al. 1993a, Roberts and Hatch 1993, Piatt and Anderson 1996, Anderson and Piatt 1999). Depressed food supplies or other natural perturbations (called 'modifying factors') are thought to increase circulating levels of stress hormones (e.g., corticosteroids) in free-living animals (Wingfield et al. 1997), and cause these individuals to redirect their behavior away from reproduction towards survival (Silverin 1998). This stress response is thought to be an emergency reaction that promotes survival (e.g., through increased foraging) while temporarily suspending other unessential activities (Sapolsky 1987, Wingfield 1994).

The level of stress in an individual can be determined through measurements of circulating plasma levels of corticosterone in the peripheral system of most vertebrates (Wingfield et al. 1997). Recently, researchers have suggested using this "field endocrinology" approach to monitor the health of seabird populations (Wingfield et al. 1997; A. Kitaysky and J. Piatt, unpubl. proposal to the EVOSTC 1999). Indeed, these investigators suggest stress hormone levels can be used to assess the current health of a population (i.e., likelihood of successful reproduction) and to predict the vulnerability of the population to other deleterious events. They cite additional advantages to measuring stress hormones, including ease of obtaining samples, subject animals not being harmed, and the ability to collect incisive information in a few days. Traditional field methods, in contrast, may require weeks to collect alternative information, and enable biologists to recognize problems only after they have had an effect on a large number of individuals.

Despite the appeal of using corticosterone levels as predictors of individual or colony health, stress hormones have the disadvantage of being responsive to a variety of physical, seasonal and environmental factors. For example the adrenocortical response, which produces stress hormones, can be affected by an individual's body weight, body condition, and gender (Astheimer et al. 1995, Fowler et al. 1994, Holberton et al. 1996, Wingfield et al. 1994, 1997, 1999; Duffy and Belthoff 1997; Newman and Zinkl 2000). Stress hormone levels also may change within a breeding season (Wingfield et al. 1997) or within a breeding stage if food availability changes or the level of parental care changes. In species like black-legged kittiwakes, which provide biparental care, males and females within a pair might exhibit different corticosterone levels if they contribute unequally to parental care (K. O'Reilly, pers. comm.). Additional environmental factors that may affect corticosterone levels include pollution, habitat conditions (Marra et al. 1998), intraspecific competition for nest sites or mates, and predation. Indeed, any stimulus that is perceived as imposing a threat, either real or anticipated, may cause a physiological response that results in increased stress hormone levels (Newman and Zinkl 2000). Consequently, care must be taken when cause and effect relationships that include corticosterone levels and other biological factors are investigated. Such care should include experimental manipulations that alter only the factor thought to increase stress hormone levels (e.g. food) while standardizing as many other factors as possible (e.g., habitat, predation, parental care needs).

To date, the relationship between food supply and corticosterone levels have been poorly investigated. A study on black-legged kittiwakes and common murres (*Uria aalge*) found that adults sampled at a food-rich colony had lower baseline levels of corticosterone compared to adults sampled at a food-poor colony (Kitaysky et al. 1999). Because stress hormone levels in these birds may have been caused by factors other than food (e.g., differences in predation levels or habitat characteristics between colonies or in the gender of sampled birds), these results provide only qualitative support for this relationship. A more controlled laboratory study found that black-legged kittiwake chicks, raised without parents, had elevated baseline levels of corticosterone when their diets were qualitatively and quantitatively restricted compared to chicks fed ad libitum (Kitaysky et al. 1999). No study to date has provided food to free-ranging adult seabirds at natural breeding colonies and tested for changes in corticosterone levels.

The relationship between stress hormone levels and reproduction has also been poorly investigated. Silverin (1986) found that male and female pied flycatchers (*Ficedula hypoleuca*) experimentally implanted with corticosterone decreased the frequency with which they fed their young and consequently had lower reproductive success. Similarly, black-legged kittiwake adults implanted with corticosterone brooded their young less and had lower inter-year return rates, although food provisioning to chicks by parents and chick fledging success was not lowered (Kitaysky et al. MS). Such changes in parental care suggest a negative relationship between elevated corticosterone levels and reproductive success. Unfortunately, sample sizes in these studies were low, and additional studies are needed to verify the reproductive consequences of elevated corticosterone levels.

A long-term decline in black-legged kittiwake numbers on Middleton Island (north-central Gulf of Alaska) coupled with the development of a unique study colony on the island presents an exceptional opportunity to explore more fully the relationships between stress hormone levels, food availability, and reproduction. Formerly one of the largest aggregations of kittiwakes anywhere in the world, black-legged kittiwakes at Middleton have declined from 166,000 in 1981 to fewer than 16,000 today, an 85% decrease (Fig. 1). Mean productivity on Middleton from 1983 to 1999 has been 0.06 chicks per pair (S. Hatch and V. Gill, unpubl. data), with successful nests restricted to man-made structures such as an old radar tower on an abandoned Air Force base and portions of a World War II shipwreck. Nesting attempts on natural cliffs surrounding the island have decreased, and virtually no young have fledged from such sites since 1988 (S. Hatch and V. Gill, unpubl. data).

Between 1995 and 1999, biologists have enhanced the radar tower to promote nesting by kittiwakes, while simultaneously allowing experimentation and observation of birds. To determine if food was limiting the productivity of kittiwakes on Middleton, a supplemental feeding study was initiated on the tower in 1996. Over the next four years, reproductive data, collected on birds limited to natural food conditions and birds supplementally fed, confirmed that food was limiting the ability of birds to reproduce (see details below). In 1998, an effort was begun to understand the physiological aspects of food availability and reproduction. Adult and chick testosterone levels were measured and related to food availability, sibling aggression, and chick survival (Lanctot et al. in prep[a]). Corticosterone levels of supplementally fed and unfed adults were sampled in 1999 for the first time, providing the initial data on which we base this proposal. We propose conducting a second year of data collection in 2000.

Our goal is to investigate whether baseline levels of corticosterone in free-living black-legged kittiwakes reflect stress associated with a deficient food supply, and to determine how corticosterone levels correlate with parental care, reproductive effort and success, and survival of individual black-legged kittiwakes. These relationships will be explored at the radar tower colony on Middleton Island, where food can be experimentally provided, adults can be observed and captured with ease, and corticosterone levels, reproductive performance, and survival of nesting individuals can be monitored accurately with minimal disturbance.

NEED FOR THE PROJECT

A. Statement of Problem

Biologists have actively monitored the status of seabird colonies in the North Pacific for more than 30 years (Hatch et al. 1994). A principal goal of these studies has been to understand the factors that regulate seabird populations and their ability to recover from natural and man-induced environmental perturbations (USFWS 1992). Most studies station personnel at seabird colonies where they monitor seabird breeding effort and reproductive success, and relate these parameters to local environmental conditions (Cairns 1987, Monaghan 1996). Given the expense and personnel time required to conduct such studies, researchers have searched for alternative ways to monitor seabird colonies that are inexpensive, practical, and applicable over a large geographic area. One such alternative is the measurement of stress hormones that may reflect local food conditions and the likelihood of successful breeding. In 1999, the EVOSTC funded project 99479 to investigate how corticosterone levels in adult seabirds relate to local food conditions and whether corticosterone levels can be used as an indicator of colony health. Preliminary comparisons between a food-rich (Gull Island) and a food-deprived (Chisik Island) seabird colony suggest that corticosterone levels in breeding adults reflect local food availability. Although these results seem promising, corticosterone measurements must be interpreted carefully. Stress hormones have the disadvantage of being responsive to a variety of physical, seasonal and environmental factors. This study will aid in the interpretation of project 99479 in four important ways. First, this study will test for differences in corticosterone levels between food limited (natural foraging conditions) and food unlimited (supplementally fed) black-legged kittiwakes nesting at one colony. In this way, any confounding environmental differences, such as predation levels and habitat characteristics, present when comparing birds from two colonies will be removed. Second, this study will measure changes in stress hormones in adults throughout the breeding season, including birds that have recently arrived from the wintering grounds. Relatively little is known about how food conditions on the wintering grounds influences a bird's ability to reproduce in the subsequent summer, and whether local food conditions on the breeding grounds can alter this ability. Third, this study will explore the effects of adult gender on baseline levels of corticosterone. Because male and female kittiwakes may contribute unequally to the reproductive effort (e.g., only males feed females during courtship), we predict stress hormone levels of males to be more strongly affected by food availability, especially before the breeding season. Fourth, the unique colony of kittiwakes nesting on the abandoned radar tower on Middleton Island will allow the relationships between corticosterone, food availability and colony reproductive success to be studied accurately and with little disturbance. Nest site characteristics are virtually identical throughout the tower, there is no predation of eggs or chicks, and adults can be sampled for corticosterone within 2 minutes of initiating a capture. Taken together, these factors make the tower colony at Middleton Island an ideal setting to explore the physiological aspects between food availability, reproduction and survival.

B. Rationale/Link to Restoration

Efficient and reliable methods are needed to determine how seabird populations respond to natural and human-induced environmental perturbations. Indeed, little is known about how seabirds respond to such stressful conditions and whether such conditions influence reproduction and survival of birds. Recently, researchers have suggested using physiological parameters indicative of an individual bird's stress level as a measure of a bird's potential to reproduce and survive. Traditional methods for assessing seabirds do not evaluate the direct relationships between environmental conditions, adult physiology and reproduction; they simply monitor whether individuals breed and survive. To evaluate the relationships between environmental conditions, adult physiology, and reproduction requires a unique research facility where environmental conditions can be experimentally modified, adult physiology can be measured, and the resulting reproduction can be monitored. Such a setting occurs at Middleton Island where a wild population of black-legged kittiwakes nests on the sides of an abandoned radar tower. This study will complement and enhance project 99479 by allowing a thorough assessment of the use of a stress hormones as a tool for assessing the effects of fluctuations in food supply on the survival and reproductive performance of seabirds.

C. Summary of Major Hypothesis

Ho: There are no significant differences in baseline levels of circulating corticosterone between black-legged kittiwakes that are supplementally fed and those relying solely on natural food conditions, after controlling for the effects of gender and breeding stage.

Ho: There is no significant relationship between natural forage fish conditions and baseline levels of circulating corticosterone in unfed black-legged kittiwakes.

Ho: There is no significant difference in parental care, breeding chronology, reproductive success, or over-winter survival between black-legged kittiwakes with elevated and depressed baseline levels of corticosterone, after controlling for the effects of gender, breeding stage, and food availability.

D. Location

The proposed field experiments will be conducted on Middleton Island (north-central Gulf of Alaska). Studies will be conducted at an abandoned radar tower that has been retrofitted to hold 210 nest sites equipped with supplemental feeding tubes and sliding glass windows. Among these sites, we have established two treatment groups to evaluate how stress hormone levels are affected by food provisioning, and to relate these levels to kittiwake reproduction and survival. Approximately 16,000 kittiwakes were counted on Middleton in 1999, of which 1,206 nested on the tower. An additional 100 nest sites are being prepared in April 2000 to support nesting of pelagic cormorants (*Phalacrocorax pelagicus*). See description of pelagic cormorant study below.

COMMUNITY INVOLVEMENT

Each year between four and six undergraduate and graduate students assist us in studying the seabirds on Middleton Island. These students learn not only about black-legged kittiwakes but also conduct studies on tufted puffins, rhinocerous auklets, glaucous-winged gulls and black oystercatchers. To date, two post-doctoral studies, three Master's theses, and one honor's thesis have been conducted on the seabirds at Middleton Island. These and other studies have involved collaboration among researchers from the University of Alaska Anchorage, Oregon State University, University of Antwerp (Belgium), Konrad Lorenz Institute for Comparative Ethology (Vienna), and the National Oceanic and Atmospheric Administration. In addition, numerous private groups visit the island each year to observe the large diversity of bird life that occurs on the island. For example, the Alaska state chapter of the Audubon Society is planning a field trip to Middleton in May. We typically invite these people to visit the tower and we explain our field research to them. The seabirds of Middleton Island were recently filmed by All Bird TV yielding a documentary entitled "Mysterious Middleton Island" that aired on the Animal Planet channel last fall.

The principal investigator will be available to present highlights of the research program to interested parties; and will provide information, photographs and articles for the Trustee Council newsletter if requested.

PROJECT DESIGN

A. Background and Results of Pilot Studies

Establishment of Tower Colony

Groundwork for this study has been laid by capitalizing on the fact that kittiwakes nest on an artificial structure on Middleton Island - an abandoned radar tower - which, with various enhancements has resulted in a colony that is uniquely accessible for observation and experimentation (Fig. 2a). As the exterior corrugated siding of this building was removed by high winds over the years, a limited number of horizontal ledges (2x4 cross members in the wall frame) became available to kittiwakes as nest sites. The first pair of kittiwakes nesting on the tower was noted in 1986, and numbers have steadily increased to the present level of 1200 pairs. In 1994, the tower walls were outfitted with 216 wooden ledges and the deteriorating inner wallboard was replaced with plywood paneling. Between 1995 and 1998, one-way sliding glass windows and feeding holes were installed behind 210 of these ledges (Fig. 2b-d). The feeding holes are designed so that plywood plugs can be inserted when pairs are not being fed. The one-way glass is virtually 100% effective, allowing feeding and observations of the birds to be conducted unobtrusively from inside the tower while the birds nest on ledges surrounding the tower. In 1996, a permanent AC power source was installed at the tower, enabling us to store large amounts of frozen fish on site in three chest freezers.

Supplemental Food Provisioning

Commercially available bait herring and capelin have been used to supplementally feed kittiwakes on the tower between 1996 and 1999. A recent analysis of kittiwake prey obtained in Prince William Sound indicated herring and capelin were at the high end of prey quality (Anthony and Roby 1997). Roughly, 4000 pounds of supplemental food were provided to kittiwake nest sites each year of our studies. Thiamine (vitamin B1) will be added to the capelin diet as a food supplement because this nutrient is known to be deficient in frozen fish (Altman et al. 1997, Crissey 1998). Members of each pair are fed individual items of food ad libitum each day in the morning and evening (and at mid-day during chick-rearing) by observers positioned inside of the building.

Capture and Measurement of Birds

In addition to the sliding one-way glass windows, narrow grooves have been cut in the plywood panels beneath each window at the height of the bird's tibio-tarsus (Fig. 2d). This groove allows researchers to slip coat hangers, whose ends are fashioned into small hooks, underneath adults and hook them by their feet. This method works so well that adults can be captured repeatedly within and between field seasons. P. Jodice and D.

Roby (unpubl. data) used this technique at the tower to capture 73 individuals twice during a 24-hr period for a doubly-labeled water study in 1998. The technique has the added advantage of catching birds quickly with no pre-capture disturbance that could artificially inflate baseline levels of corticosterone. Indeed, an initial analysis investigating how time from capture to blood sampling effects baseline corticosterone levels indicated a significant increase in corticosterone levels within as little as 2 min (Fig. 3). Previous researchers have noted a ten-fold or greater increase in plasma corticosterone levels measured within a few minutes of capturing and handling of a bird (Beuving and Vonder 1978, Harvey et al. 1980). Capturing of adult kittiwakes at natural cliffs with noosepoles in under 2 min is virtually impossible given the approach time needed to reach birds. Adults have been captured since 1995 at the tower, and virtually all adults nesting on the ledges are individually marked with a unique combination of color bands and USFWS rings. Unique markings allow us to follow individual birds throughout and across breeding seasons so as to monitor their breeding chronology, reproductive success and over-winter survival. The sex of most adults on the tower has been determined through a combination of morphological measurements, behavior, and genetics (Jodice et al., in press). Adult measurements also have proven useful for generating adult body condition indices which can be related to baseline levels of corticosterone.

Effects of Food Provisioning on Kittiwake Breeding Chronology and Reproduction

The easy viewing of kittiwake nest sites through the windows also allows nests to be monitored in detail. We can record easily the date when (1) adults begin to construct nests, (2) eggs are laid, lost or hatched, and (3) chicks are lost or fledged. The eggs and chicks residing in each nest can also be easily measured by simply opening the window behind each nest. For example, eggs can be individually measured for size, and then marked so that the emerging chick can be identified. This level of detail allows us to determine how food supplementation and egg order is related to egg size and chick sex (Lanctot et al. In prep [b]). Similarly, chicks can be measured at specific ages to determine growth, and blood samples can be taken periodically to determine changes in hormone concentrations. The one-way glass windows also allows the behavior of adults and their young to be observed easily. Depending on the parameter in question, up to 10 nests can be monitored simultaneously. During the past four years, we have measured adult attendance at nests, male and female feeding rates of young, chick begging rates (by first and second hatched chicks), and sibling aggression rates.

Results to date indicate unequivocally that supplementally feeding kittiwakes alters a variety of breeding parameters relative to kittiwakes subjected to natural food supplies (Gill 1999; Gill and Hatch, in prep.; Gill et al., in prep). During pre-egg laying, fed females begged food from their mates at significantly greater rates and attended their nests at lower rates than unfed females. During egg-laying and incubation, fed females initiated nests 3-4 days earlier and laid significantly larger second eggs than unfed females. During chick-rearing, fed pairs hatched their young earlier, had faster growing young, and had young that attained significantly heavier peak weights than unfed pairs. Further, parents at fed sites had significantly higher nest attendance during the second half of brood-rearing than parents at unfed sites. On average, unfed chicks survived at significantly lower rates than fed chicks, primarily because of the extremely low survival rate of second hatched chicks in the unfed nests. These results suggest a strong relationship between food availability and kittiwake breeding success. If stress hormones in adults are related to food availability, then we would predict kittiwake adults that are supplementally fed to have lower baseline levels of corticosterone relative to unfed kittiwake pairs.

Pilot Study of Corticosterone Levels at the Middleton Kittiwake Colony

In 1999, we initiated a pilot study to investigate how baseline levels of corticosterone in adult kittiwakes relate to food supplementation and reproduction. We collected blood samples from 10 males and 10 females that were and were not supplementally fed during three reproductive stages (prior to egg-laying, incubation and brood-rearing). In addition, blood was sampled from 20 birds one day after their arrival at Middleton in early April—about 1 ½ to 2 months prior to egg laying. Supplemental feeding began on 15 May in 1999, and pairs received food for about 26 days prior to the first eggs being laid. An analysis of corticosterone levels indicated kittiwakes that were supplementally fed had similar base-line levels of corticosterone as kittiwakes limited to natural food conditions during the pre-egg laying and incubation stages of reproduction (Fig. 4). This was not true during the chick-rearing stage, however, when supplementally fed kittiwakes had significantly lower levels of corticosterone (Fig. 4). Because we could not control the amount of food unfed kittiwakes obtained through natural foraging, these results appeared to indicate that unfed kittiwakes were able to obtain adequate amounts of natural food during pre-egg laying and incubation stages but not during brood-rearing (under the assumption that food availability is related to corticosterone levels). Our independent measures of food availability (quantity and type of food brought to nest sites by kittiwakes, rhinocerous auklets and tufted puffins) and reproductive success, however, did not support this supposition. Indeed, 1999 was a year with lower than normal food availability early in the season followed by an increase in food availability later in the season (S. Hatch and V. Gill, unpubl. data). Kittiwakes limited to natural food conditions also had poorer reproductive success than fed kittiwakes during pre-egg laying and incubation for most reproductive parameters (Table 1). During chick-rearing, there was no difference in fledging success (a key seabird monitoring variable) between fed and unfed kittiwakes despite significant differences in corticosterone levels (Table 1).

Taken together, these results suggest the relationships among adult base-line levels of corticosterone, local food conditions, and the reproductive success of a colony may be more complicated than previously thought. One factor that has been neglected is how the gender of a bird influences those parameters, though previous studies have identified gender as an important predictor of corticosterone levels (Duffy and Belthoff 1997, Wingfield et al. 1999). Further, an energetics study on the tower colony indicated male kittiwakes expend more energy in raising offspring than do females (P. Jodice and D. Roby, unpubl. data), suggesting females may be less stressed by deficient food supplies. Because most of the kittiwakes breeding on the tower had been previously marked and sexed (Jodice et al., in press), we investigated the effects of sex and food supplementation on corticosterone levels. Contrary to our expectations, we found no differences between males and females during pre-egg laying, incubation and chick-rearing stages (data not shown). There was, however, a tendency for females sampled during the pre-nesting stage to have higher levels of corticosterone if they did not subsequently breed at the tower colony (Fig. 5). No such pattern was found in males. Unfortunately, small sample sizes hamper a meaningful biological interpretation of the data from 1999.

We plan to explore these relationships further in 2000 by repeating this experimental design and supplementing our sample sizes during the pre-nesting stage.

B. Objectives

1. Determine whether male and female kittiwakes exhibit different baseline levels of corticosterone throughout the breeding season (i.e., pre-nesting, pre-egg laying, incubation, and brood-rearing) when they are and are not supplementally fed.
2. Determine whether baseline levels of corticosterone in unfed individual kittiwakes reflect local natural food conditions.
3. Determine whether parents with elevated levels of corticosterone provide lower levels of parental care (i.e., attendance during brood-rearing), have delayed breeding chronologies (i.e., laying, hatching and fledging dates), have lower reproductive success (i.e., egg laying success, hatching success, fledging success), and have lower over-winter survival.

C. Methods

The proposed research investigates wild birds nesting on the tower at Middleton Island. Field experiments will be conducted on birds marked in previous years to investigate the endocrinological characteristics of kittiwakes that have ad libitum food and those limited to natural forage conditions. Although we will focus on black-legged kittiwakes in this study, we also plan to begin testing methods for sampling pelagic cormorants that also breed on ledges of the tower (see below).

Corticosterone Sampling

To determine baseline levels of corticosterone, adult kittiwakes will be captured at the tower using hooked hangers (see above). Approximately 100-200 μL of blood will be drawn from the basilic vein of the wing of each adult within 2 minutes after capture is initiated (i.e., the time between inserting the hooked hanger into the window and when the blood is successfully extracted). After sampling, birds will be released at the tower and their nest will be monitored to determine when they return. Field sampling in 1998 and 1999 indicated adult kittiwakes typically returned to their nests within 1 to 10 minutes and successfully incubated eggs and raised broods afterwards (R. Lanctot, V. Gill, and S. Hatch, pers. obs.). Blood samples will be centrifuged within 1 hour of collection and the separated plasma will be stored below freezing until it can be removed from the field and sent to the Laboratory of Immuno-Neuroendocrinology at the University of Leuven in Belgium. Laboratory technicians will determine corticosterone levels blindly for each sample using radioimmuno-assay techniques (as described in Wingfield et al. 1992). This is the same technique being used by A. Kitaysky and J. Piatt in their corticosterone research on black-legged kittiwakes. Each sample will be measured in duplicate and intra- and inter-assay coefficients of variation will be calculated.

We anticipate sampling 40 birds (10 males and 10 females each from fed and unfed pairs) during each breeding stage (i.e., pre-egg laying, incubation and brood-rearing) in 2000. A larger sample of pre-nesting birds will be sampled within a few days after being first observed at the tower on Middleton. Blood will be collected from each bird only once during the breeding season to ensure samples from each stage are independent. Hormone levels within the pre-nesting birds may reflect their physiological response to prior winter conditions because the birds may not have been present in the local area sufficiently long to reflect local food conditions. Pre-egg laying birds will be sampled within 10 days of their first egg being laid. Ten days is the time it takes black-legged kittiwakes to form eggs (Neuman et al. 1998). Incubating birds will be sampled 14-16 days after their first egg is laid, and brood-rearing birds will be sampled 19-21 days after their first chick has hatched.

Natural Food Supply

The composition and seasonal changes in the natural food supply of kittiwakes will be determined three ways. First, we will collect regurgitated food samples from adults and chicks throughout the season. Adults and chicks instinctively regurgitate when captured. Emphasis will be placed on kittiwake pairs that are not being fed. Prey composition and biomass of collected regurgitations will be determined by laboratory analysis in the fall of 2000 through a contract with Falco Inc. (Alan Springer, pers. comm.). Second, we will conduct beach seining in the waters surrounding Middleton to monitor seabird prey. Third, we will collect food deliveries of adult tufted puffins and rhinocerous auklets to their young during brood-rearing. Although these species may use different forage fish as food, our long-term database (back to 1978) on food deliveries by these species allows the food availability within each year to be evaluated. These three sources of information will provide a crude but quantitative view of the natural food supply available to kittiwakes nesting at the tower. Based on the composition and quantity of forage fish, we will determine whether food (especially high caloric food) is lacking during each stage of reproduction. Here we would predict elevated corticosterone levels to be present in unfed kittiwakes during reproductive stages when the quantity or quality of food is limited. In contrast, kittiwakes that are supplementally fed should have consistently low baseline levels of corticosterone.

Corticosterone, Reproductive Success and Survival

To determine whether birds with elevated levels of corticosterone exhibit different life history tactics, we will contrast birds with elevated and depressed baseline levels of corticosterones with the level of parental care, breeding chronology, reproductive effort and success, and over-winter survival of individuals within the fed and unfed treatment groups. Food supply has been shown to affect these parameters in previous studies (Gill 1999; V. Gill and S. Hatch, unpubl. data).

Parental Care

As an indication of parental care, we will measure adult attendance at nests during brood-rearing. Previous research on Middleton indicated that adult attendance was highly sensitive to food availability and can have a strong effect on chick survival (in contrast to feeding rate which did not differ with food availability; see Gill 1999). Adult attendance will be quantified by recording the percentage of time each parent (male or female) is observed at its nest during incubation and chick-rearing.

Breeding Chronology

We will record two parameters that are indicative of breeding chronology. These will include laying date (date at which first egg of nest is laid) and hatching date (date at which first egg of nest hatches). These variables are extremely easy to record at the tower given our ability to approach nests without being seen.

Reproductive Effort

As a measure of reproductive effort, we will record the clutch size, egg size (egg length and width converted into egg volumes using Coulson's [1963] formulas), and egg weight (A and B eggs alone and together).

Reproductive Success

Measures of reproductive success will include egg laying success (whether pairs successfully laid at least one egg or not), hatching success (whether a pair successfully hatched at least one egg or not), fledging success (whether a pair successfully fledged at least one young or not). We will also determine the productivity (number of chicks fledged/nest) of fed and unfed treatment groups.

Over-winter Survival

Over-winter survival is relatively easy to determine in black-legged kittiwakes because adults exhibit strong nest site and mate fidelity across years (Coulson and Thomas 1985, Hatch et al. 1993b). For our purposes, over-winter survival will be the percentage of marked adults known to breed on the tower in one year that return to Middleton in a subsequent year. We conduct searches at all the Air Force buildings and natural cliffs to locate marked birds from previous years.

Statistical Analyses

For most analyzes, corticosterone levels will be compared and contrasted across food treatment groups (i.e., fed and unfed birds). We will attempt to reject the null hypothesis of no difference in baseline corticosterone levels (over all nest sites within a treatment group) between kittiwakes that are supplementally fed and those that are not. Similarly, we will test for differences in reproduction and survival between birds with high and low levels of corticosterone. Data will be normalized, if necessary and possible, and differences will be tested with parametric methods such as a one-way and multi-variate analysis of variance. Where data cannot be normalized, we will rank-transform data and/or use non-parametric methods such as the Kruskal-Wallis ANOVA to test for differences in results.

Pelagic Cormorant Pilot Study

Measuring baseline levels of corticosterone in pelagic cormorants has the potential to offer new insights into the physiological relationship between food availability and reproductive success. Cormorants, unlike black-legged kittiwakes, have the ability to dive for their food and may therefore have access to different (and additional) food resources. Several researchers have suggested that diving seabirds are able to buffer decreases in food availability better than surface feeders because they are not restricted to a two-dimensional feeding zone and have more flexible time budgets (i.e., time available to forage; Burger and Piatt 1990, Monaghan 1996). These differences might result in decreased corticosterone levels for these species. The development of a pelagic cormorant colony at the Middleton tower, along with the existing black-legged kittiwake colony, will facilitate an inter-species comparison that can investigate how foraging strategies interacts with food supply and reproductive performance.

In April 2000, we will begin testing protocols for capturing, banding, and sampling blood from pelagic cormorants using newly installed window sites on the tower. Adult pelagic cormorants are less tolerant to handling (R. Lanctot, pers. obs.) and frequently abandon nest sites after being captured. Consequently, we plan on using anesthetics (e.g., isoflurane) during capture to reduce abandonment. This technique has proven to be successful with other intolerant bird species (P. Flint, pers. comm.). If successful, we will sample up to five adults during each breeding stage in 2000. Cormorant chicks, in contrast, can be easily captured and sampled with little disturbance. We plan on measuring base-line levels of corticosterone from 10 nests (1 chick/nest) in 2000.

V. Cooperating Agencies, Contracts, and Other Agency Assistance

Seabird biologists Ms. Verena Gill and Dr. Scott Hatch of the US Geological Survey, with the assistance of five field assistants, will carry out the field component of this study. All field expenses associated with this project are borne by the Biological Resources Division of the US Geological Survey. Support is requested to provide salary to Dr. Richard Lanctot to analyze and write the reports and publications associated with this study. Dr. Marcel Eens of the University of Antwerp in Belgium will provide laboratory space at the Laboratory of Immuno-Neuroendocrinology in Leuven (through a collaboration with the University of Antwerp) and will coordinate the radioimmuno-assay analyses of plasma samples.

Permission to work on the tower and camp on Middleton Island has been received from Midico Corporation - a private consortium of business people who retained title of the land in the mid-1960s (Andy Milner, pers. comm.). The Federal Aviation Administration has also given us permission to land on the island runway and have access to water and electricity from their local facility. We have authorization from the Alaska Biological Science Center, Biological Resources Division of the U.S. Geological Survey and the State of Alaska to capture, band and sample blood from kittiwake adults and young. We have operated under similar permits since 1978 when field research began on the island.

SCHEDULE

A. Measurable Project Tasks for FY 01 (October 1, 2000 – September 2001)

Field work will be conducted by us during the summer of 2000. Funds are being sought to analyze plasma samples from this summer, and to analyze and write manuscripts describing our results from the 1999 and 2000 field seasons.

October – December:	corticosterone analyses, regurgitated food analysis, conduct preliminary analyses of 1999 data.
January 16 – 26:	Attend Annual Restoration Workshop
February 11-14:	Attend Pacific Seabird Group Meeting
January – April 15:	Analyze 2000 data and prepare manuscript
April 15:	Submit final report.

B. Project Milestones and Endpoints

A determination of how baseline levels of corticosterone in male and female kittiwakes are related to natural and experimental changes in food availability will require at least two years of field research. The first year of data was collected in 1999 and the second year will be collected this summer. Consequently this project milestone will have been accomplished prior to receiving funds from the EVOSTC. Smaller, but more significant, milestones include analyses of plasma samples for corticosterone due December 2000, and analyses and manuscript preparation due April 15, 2001.

C. Completion Date

The study will be completed by April 15, 2001.

PUBLICATIONS AND REPORTS

A final report, which will be in manuscript format, will be presented to the EVOSTC by April 15, 2001. Presently, we plan on submitting two manuscripts from this study. The principal manuscript resulting from this study will be submitted to Hormones and Behavior and would be entitled "Effects of food availability on corticosterone levels and breeding success in male and female black-legged kittiwakes: an experimental study". A second paper, entitled "Effect of sampling time on the measurement of circulating levels of corticosterone in black-legged kittiwakes" will be submitted to Auk.

PROFESSIONAL CONFERENCES

We plan on presenting the results of this study at the Annual Restoration Workshop to be held in mid-January in Anchorage, and at the Pacific Seabird Group meeting to be held 11-14 February 2001 at Kauai, Hawaii. For both conferences, Dr. Lanctot, in collaboration with Ms. Gill, Dr. Hatch, and Dr. Eens, will present a talk describing how natural and experimental changes in food availability relate to corticosterone levels and reproductive success in male and female black-legged kittiwakes.

NORMAL AGENCY MANAGEMENT

The US Geological Survey would not normally conduct field endocrinology research. Blood sample collection equipment and laboratory analyses conducted to date have been funded by the Belgium Fund for Scientific Research (via a post-doctoral fellowship to Dr. Lanctot and a project grant to Dr. Marcel Eens). The post-doctoral fellowship ended in February 1999 and there is little money left in the project grant. Accordingly, no money is available to finance the plasma samples from 2000 or to pay Dr. Lanctot to complete the analysis and prepare manuscripts for this study.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This study tests an alternative endocrinology method for assessing forage availability at seabird colonies throughout the state of Alaska. The study complements and improves upon project 99479 that investigates similar concepts using two breeding islands that differ in natural forage availability. This study eliminates potential confounding problems associated with the breeding islands mentioned above, and investigates in more detail how baseline levels of corticosterone vary with food availability and breeding stage, and whether corticosterone levels are predictive of future reproduction and over-winter survival. Overall, this very controlled study will test the efficacy of using corticosterone to measure seabird responses to other environmental disasters.

PROPOSED PRINCIPAL INVESTIGATOR

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PRINCIPAL INVESTIGATORS

Principal Investigator and Project Leader – Dr. Richard Lanctot, Research Wildlife Biologist, Alaska Biological Science Center, Biological Resources Division, U.S. Geological Survey, Anchorage, Alaska. Obtained Ph.D. in Behavioral Ecology from Carleton University in Ottawa, Ontario in 1996. Since 1989, he has studied the breeding biology of seabirds and shorebirds throughout Alaska. His post-doctoral fellowship was on the effects of food supplementation on offspring sex ratio in black-legged kittiwakes, and how chick testosterone levels relate to sibling aggression and juvenile survival. He will be responsible for analyzing data and writing manuscripts.

Dr. Scott Hatch, Seabird Project Leader, Alaska Biological Science Center, Biological Resources Division, U.S. Geological Survey, Anchorage, Alaska. Obtained Ph.D. in Zoology from University of California, Berkeley in 1985. Since 1978, he has funded and led research studies on seabirds at Middleton Island. He has published extensively on seabird population trends in the North Pacific and is in charge of the North Pacific Seabird Monitoring Database. He will continue to supervise the research on Middleton in 2000.

Ms. Verena Gill, Seabird Wildlife Biologist, Alaska Biological Science Center, Biological Resources Division, U.S. Geological Survey, Anchorage, Alaska. Obtained M.S. in Biology from the University of Alaska Anchorage in 1999 (thesis topic was "Breeding performance of black-legged kittiwakes in relation to food availability: a controlled feeding experiment"). She has coordinated all aspects of field work at Middleton since 1993 and her thesis work laid the ground work for this study. She will continue to coordinate the field work on Middleton in 2000, and will be primarily responsible for the field collection of blood samples.

Dr. Marcel Eens, Professor in Biology at the University of Antwerp in Belgium. Obtained Ph.D. in Behavioral Ecology at the University of Antwerp in 1992, and has published extensively on hormone effects on behavior in a variety of species. He supervised Dr. Lanctot during his post-doctoral fellowship studies on hormones in kittiwakes. He will supervise the analysis of plasma samples at his laboratory in Belgium.

OTHER KEY PERSONNEL

Research Assistants – at least 4 volunteer biotechnicians and 1 biologist will be employed from May through August 2000 on Middleton Island.

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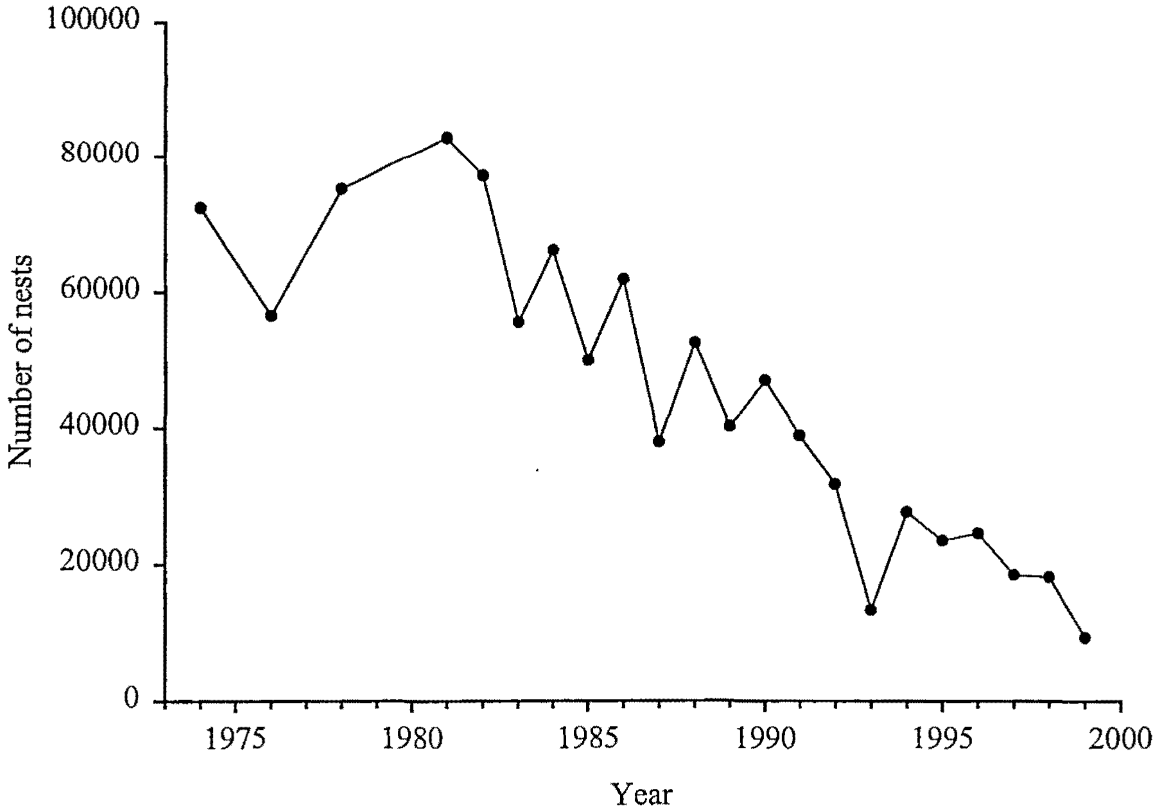

Figure 1. Population trend of black-legged kittiwakes on Middleton Island, 1974 - 1999 (Gill 1999).

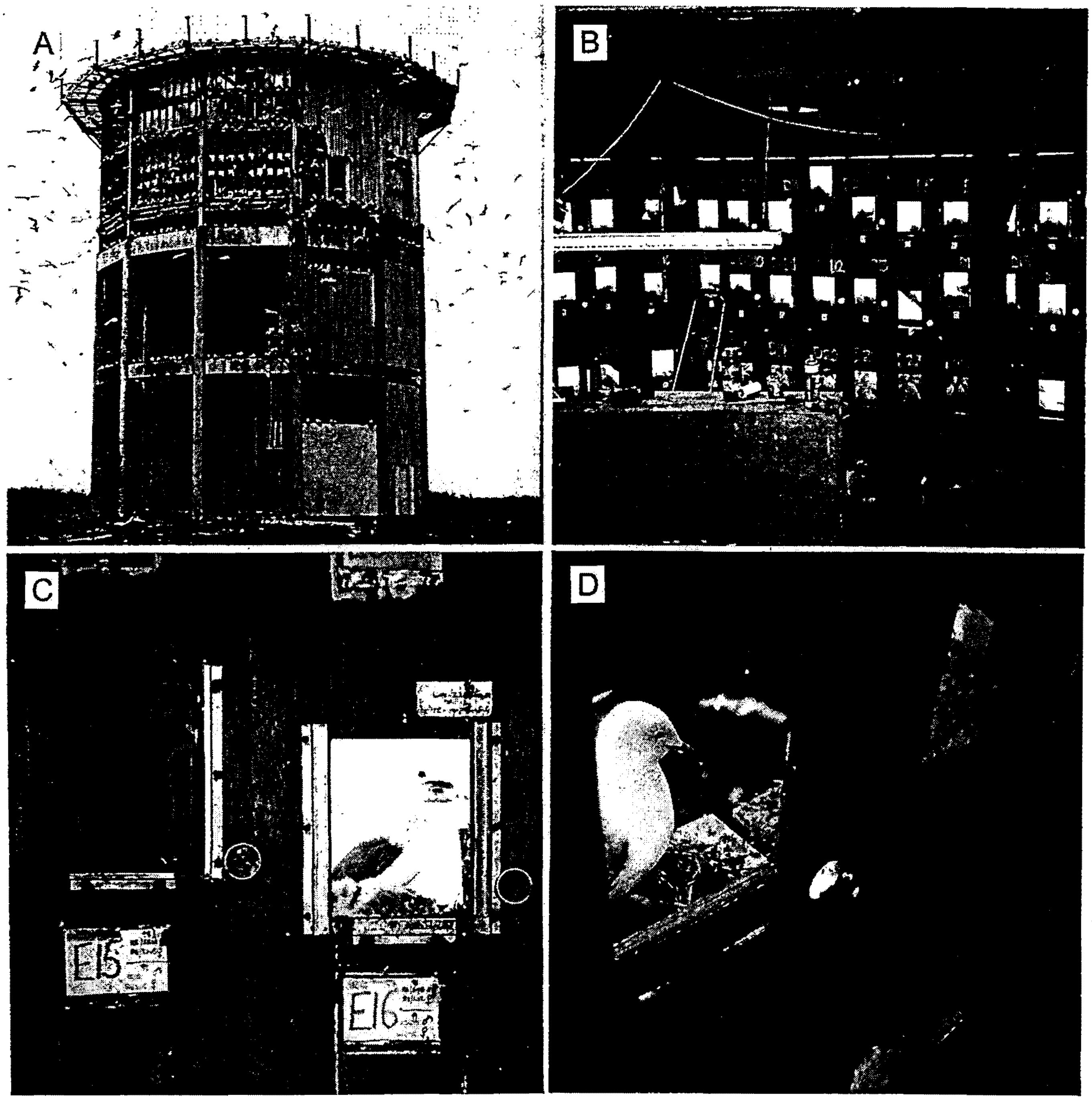

Figure 2. (a) An abandoned radar tower on Middleton Island provides high quality nest sites for black-legged kittiwakes. (b) The interior of the building offers a laboratory-like setting in which to study wild, cliff-nesting birds. (c) Artificial nest sites backed by one-way mirror glass enable close observation and manipulation (glass removed from site at right). (d) A small tray slides through the wall at each site to facilitate supplemental feeding.

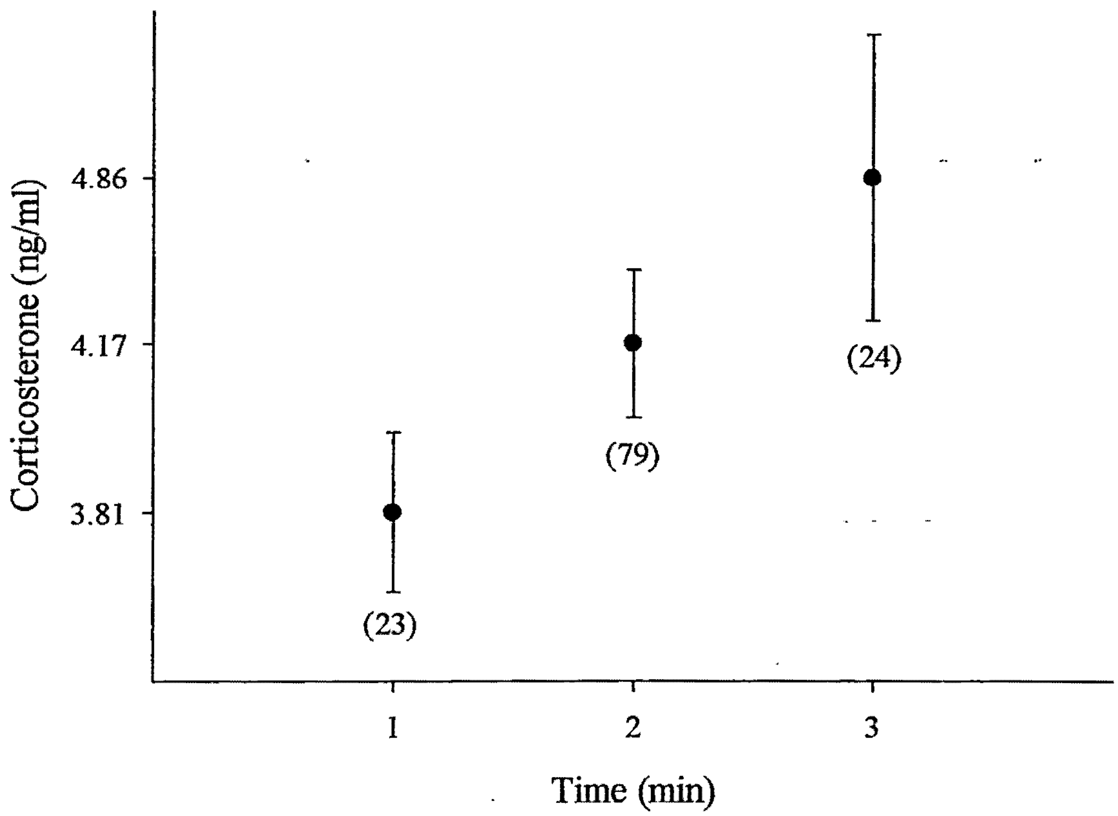

Figure 3. Base-line levels of corticosterone (mean +/- SE) from black-legged kittiwake adults in relation to time. Time refers to the duration between when a bird first became aware that a researcher was attempting to capture the bird and when blood was collected. One minute samples include those birds sampled in less than one minute (and so on). All adults regardless of feeding treatment, breeding stage (except pre-season), or gender are included in sample.

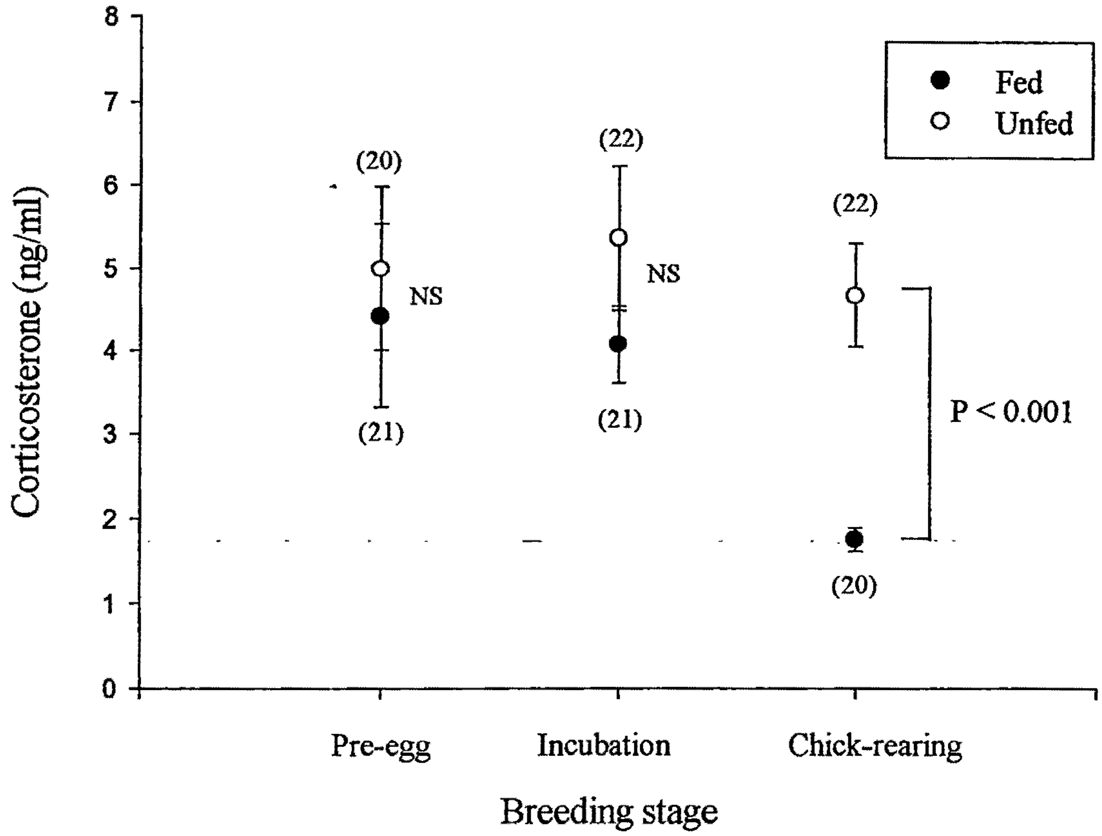

Figure 4. Base-line levels of corticosterone (mean +/- SE) from black-legged kittiwake adults that were supplementally fed (Fed) and limited to natural foraging conditions (Unfed) during three breeding stages at the Middleton Island tower colony in 1999. Males and females are combined within feeding treatments because there were no significant differences during any breeding stage (P>0.05).

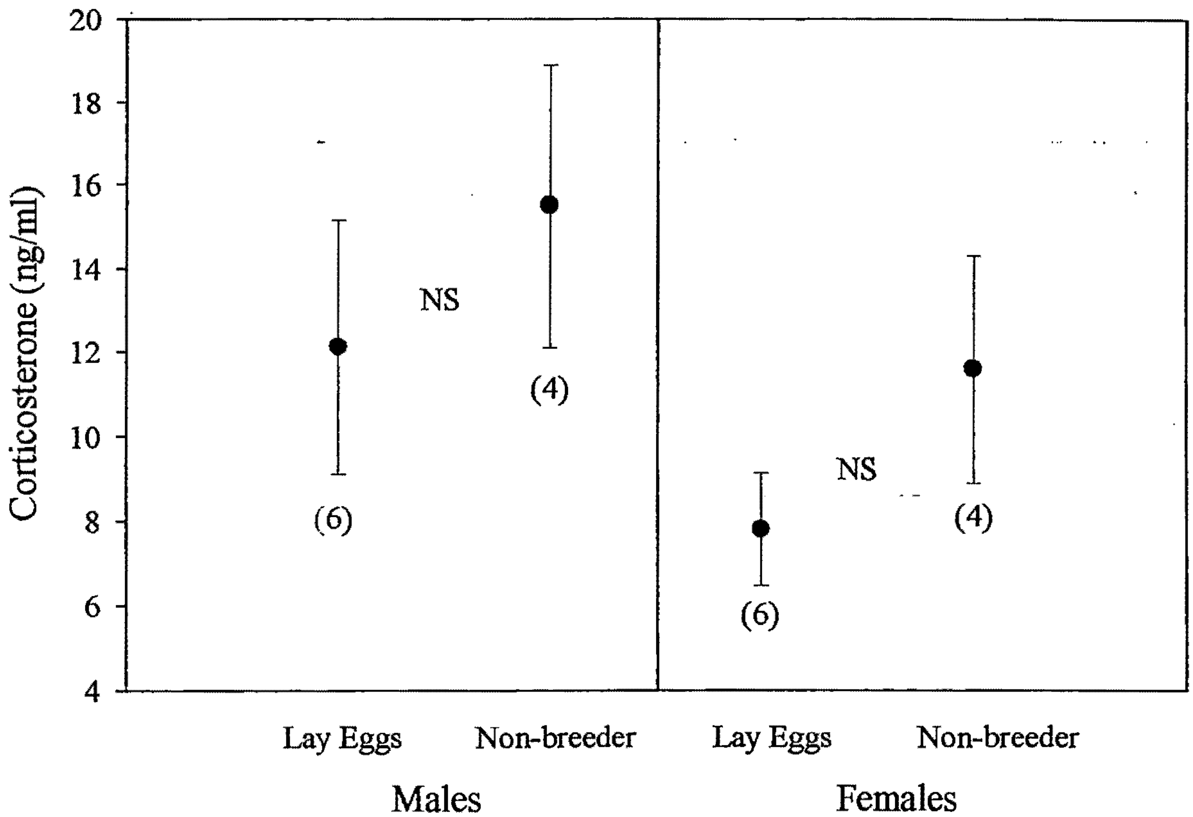

Figure 5. Base-line levels of corticosterone (mean +/- SE) from male and female black-legged kittiwake adults sampled shortly after arriving at the Middleton colony tower in 1999 (about 60 days before fed birds laid eggs and 70 days before unfed birds laid eggs). Corticosterone levels of males that eventually paired up and laid eggs did not differ significantly from males who never bred. The same was true for females but the difference was nearly significant (despite low sample sizes).

Table 1. Corticosterone levels and breeding parameters in black-legged kittiwakes (BLKI) in relation to supplemental feeding treatment, Middleton Island 1999. See methods for definition of parameters. Values are listed as mean ± standard error where applicable, and samples sizes are shown in parentheses below each variable.

Breeding stage	Parameter	Fed BLKI		Unfed BLKI
Pre-egg laying	Corticosterone (ng/ml)	4.42±1.11 (21)	NS	4.98±0.99 (20)
	Laying success	92% (48)	P < 0.001	37% (178)
	Laying date	10 June ± 1.0 (44)	P < 0.001	18 June ± 0.6 (65)
	Clutch size	1.68±0.08 (44)	P < 0.001	1.14±0.04 (65)
Incubation	Corticosterone (ng/ml)	4.07±0.47 (21)	NS	5.36±0.87 (22)
	Hatching success	43% (76)	NS	56% (75)
	Shift length (hrs)	4.26 (29)	P < 0.001	11.95 (27)
	Egg volume (cc)	46.33±0.40 (73)	P = 0.033	45.00±0.50 (74)
Chick-rearing	Corticosterone (ng/ml)	1.75±0.14 (20)	P < 0.001	4.67±0.63 (22)
	Fledging success	82% (33)	NS	79% (42)
	A-Chick growth (g/day)	16.37±0.34 (22)	P = 0.004	14.87±0.34 (30)
	Adult attendance (% of both adults)	56.15±0.99 (21)	P < 0.001	41.83±0.81 (26)

2001 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Approved TC 8-3-00

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$12,000.0						
Travel		$1,500.0						
Contractual		$2,100.0						
Commodities		$1,400.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$17,000.0				Estimated FY 2002		
General Administration		$1,854.5						
Project Total	$0.0	$18,854.5				$0.0		
Full-time Equivalents (FTE)		0.2						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$57,800.0	$57,800.0						

Comments: The Alaska Biological Science Center, Biological Resources Division, DOI-USGS, is responsible for coordinating all aspects of this project. Responsibilities include field logistics, collection of data and blood samples, hormone and data analyses, report writing, and presentation and publication of results. One other non-trustee ageny, the University of Antwerp in Belgium, will coordinate hormone analyses.

We anticipate no expenses for NEPA compliance (assuming a categorical exclusion), annual restoration workshop attendance, or community involvement. $1,700 has been budgeted to attend the Pacific Seabird Group Meeting in Hawaii, and $1,000 has been budgeted for manuscript preparation and publication costs.

Accounting, personnel hiring, purchasing, secretarial assisstance, computer equipment, and other office supplies will be provided by DOI-USGS. Other costs associated with project will be provided by DOI-USGS. These include $13,300 for air charters to Middleton Island, $2,800 for fish for feeding experiment, $1,600 for tower expansion for pelagic cormorant work, $200 for blood sampling supplies, $4,000 for fish regurgitation identification, $3,300 for four volunteers (travel and per diem), $5,100 for food for volunteers and field leaders, $24,500 for salary (1 month for Scott Hatch, 2 months for Verena Gill, 2 months for Charla Sterne), and $3000 for miscellaneous expense. Total costs borne by DOI-USGS for FY2000 is $57,800. A similar cost was expended by DOI-USGS in FY1999 to conduct the first year of this study.

Field work was conducted in 1999 and will be continued in summer of 2000. Final hormone and data analysis, and write-up will occur in 2001.

FY01

Prepared:10 April 2000

Project Number: 01555
Project Title: Can stress hormones be used as an indication of food availability and reproductive performance? An experimental approach.
Agency: DOI-USGS

FORM 3A TRUSTEE AGENCY SUMMARY

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2001
Name	Position Description					
Dr. Richard Lanctot	Principal Investigator - manages project, analyzes data, presents information at meetings, and writes manuscripts	GS/11/2	2.5	4800.0		12,000.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.5	4800.0	0.0	
					Personnel Total	$12,000.0

Travel Costs:	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2001
Description					
Pacific Seabird Group Meeting in Hawaii	600.0	1			600.0
Housing			5	110.0	600.0
Food			5	50.0	300.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$1,500.0

FY01

Prepared: 10 April 2000

Project Number:
Project Title: Can stress hormones be used as an indication of food availability and reproductive performance? An experimental approach.
Agency: DOI-USGS

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed
Description	FY 2001
4A Linkage	2,100.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$2,100.0

Commodities Costs:	Proposed
Description	FY 2001
Manuscript preparation and page charges	1,000.0
Miscellaneous (federal express of plasma samples and other packages)	200.0
Registration cost for Pacific Seabird Group Meeting	200.0
Commodities Total	$1,400.0

FY01

Prepared: 10 April 2000

Project Number:
Project Title: Can stress hormones be used as an indication of food availability and reproductive performance? An experimental approach.
Agency: DOI - USGS

FORM 3B
Contractual &
Commodities
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2001
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
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency
Camp gear (tents, sleeping bags, cook kits, etc.)	1	DOI-USGS
Electric freezers	4	DOI-USGS
Propane stove and heaters	2	DOI-USGS
Inflatable boat and outboard motor for collecting fish samples at sea	1	DOI-USGS
Float coats and basic survival gear	3	DOI-USGS
Tower supplies (cleaning solutions, gloves, buckets, electric cords, etc.)	1	DOI-USGS
Banding supplies (bands, measuring equipment, etc.)	1	DOI-USGS
4-wheel ATVs and trailer	2	DOI-USGS
Computers - pentium 1 minimum	2	DOI-USGS
Office supplies, copying, telephone, fax, postage, electronic mail	1	DOI-USGS

FY01

Prepared: 10 April 2000

Project Number:
Project Title: Can stress hormones be used as an indication of food availability and reproductive performance? An experimental approach.
Agency: DOI-USGS

FORM 3B
Equipment
DETAIL

2001 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$0.0						
Travel		$0.0						
Contractual		$0.0						
Commodities		$2,100.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$2,100.0				Estimated FY 2002		
Indirect								
Project Total	$0.0	$2,100.0				$0.0		
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$3,800.0	$3,800.0						

Comments: Laboratory equipment, office supplies, computer equipment, and secretarial assistance will be provided through the University of Antwerp and the University of Leuven in Belgium.

Corticosterone analyses will be conducted at the Laboratory of Immuno-Neuroendocrinbology at the University of Leuven in Belgium, under the direction of Dr. Marcel Eens who resides at the University of Antwerp.

Salary support of $3,800 was provided in FY2000 and will be provided in FY2001 by a grant from the Fund for Scientific Research-Flanders in Belgium to Dr. Marcel Eens. This consists of $1,800 for a laboratory assistant and $2000 for Dr. Eens salary.

No money is requested for report writing, NEPA compliance, annual restoration workshop attendance, community involvement, or indirect costs.

Program management will be conducted through the DOI-USGS lead agency.

FY01

Prepared: 10 April 2000

Project Number:
Project Title: Can stress hormones be used as an indication of food availability and reproductive performance? An experimental approach.
Name: University of Antwerp, Belgium

FORM 4A
Non-Trustee
SUMMARY

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:							
	Name	Position Description		Months Budgeted	Monthly Costs	Overtime	Proposed FY 2001
	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
		Subtotal		0.0	0.0	0.0	
						Personnel Total	$0.0

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2001
	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
					Travel Total	$0.0

FY01

Prepared: 10 April 2000

Project Number:
Project Title: Can stress hormones be used as an indication of food availability and reproductive performance? An experimental approach.
Name: University of Antwerp, Belgium

FORM 4B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed
Description	FY 2001
None	
Contractual Total	$0.0

Commodities Costs:	Proposed
Description	FY 2001
Laboratory costs for corticosterone analyses ($11.50 x 180 samples)	2,100.0
Commodities Total	$2,100.0

FY01

Prepared: 10 April 2000

Project Number:
Project Title: Can stress hormones be used as an indication of food availability and reproductive performance? An experimental approach.
Name: University of Antwerp, Belgium

FORM 4B
Contractual &
Commodities
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2001
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
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units
Laboratory space and equipment to conduct corticosterone analyses	1
Office supplies, copying, telephone, fax, postage, electronic mail	1

FY01

Prepared: 10 April 2000

Project Number:
Project Title: Can stress hormones be used as an indication of food availability and reproductive performance? An experimental approach.
Name: University of Antwerp, Belgium

FORM 4B
Equipment
DETAIL

01558

approved TC 8-3-00

Harbor Seal Recovery: Application of New Technologies for Monitoring Health

Project Number:	01558
Restoration Category:	Research
Proposer:	S. Atkinson/UAF
Lead Trustee Agency:	ADFG
Cooperating Agencies:	None
Alaska SeaLife Center:	Yes
New or Continued:	New
Duration:	1st yr. 3 yr. project
Cost FY 01:	$280.2
Cost FY 02:	$128.4
Geographic Area:	Gulf of Alaska
Injured Resource/Service:	Harbor seals

ABSTRACT

This project will investigate the potential for new technologies to assess and monitor the endocrine and immune systems as diagnostic measures of the health of harbor seals. Analysis of thyroxine (T_4), triiodothyronine (T_3), and cortisol (primary metabolic and gluconeogenic hormones), and measurement of immunoglobulins (IgG, IgM, and IgA) and the body burden of organochlorine contaminants will provide an assessment of both permanently captive seals as well as seals that are brought into the Alaska SeaLife Center for rehabilitation. The work will also employ community involvement through the Alaska Native Harbor Seal Commission. Once the profiles of healthy seals and those failing to thrive in their natural environment are assessed, these techniques will be evaluated for routine monitoring of free-ranging seals in an effort to restore this species.

INTRODUCTION

The potential exists for several environmental factors to impact the biology of harbor seals (*Phoca vitulina*), resulting in poor survival, recruitment and reproductive rates. While the leading hypothesis is that changes in the availability of high quality prey have reduced the carrying capacity of the Gulf of Alaska, a contributing factor to poor survival and reproduction may include exposure to organochlorine contaminants (OCs), with associated endocrine and immune system impairment (Addision, 1989; De Swart *et al.*, 1994, 1996; Ross *et al.*, 1995; Reijnders, 1986). OCs and their by-products are bioaccumulated, biomagnified and transferred through lactation from mother to pup (Beckmen *et al.*, 1999; Gallenberg and Vodicnik, 1989; Vreel *et al.*, 1996; Wagemann and Muir, 1984). These contaminants and by-products may continually affect a population of animals even though no major polluting event has occurred. The adverse effects on the physiology of the animal may be subtle or subclinical, or may manifest themselves with symptoms such as, 'failure to thrive' or 'failure to reproduce'. The systems that typically respond to environmental changes, including contamination or suitable prey, are the endocrine and immune systems. This proposed study will develop technologies to examine these two systems to be used to monitor the health of individuals and the well being of subpopulations.

The endocrine system is a complex system that integrates the environment in which an animal lives, with the physiology of that animal. As seasons, nutrition and other environmental parameters change, the neuroendocrine system is the first to work toward ensuring that the body can adapt to the changes. Many compounds in the environment are known to interfere with the endocrine systems of mammals and are often referred to as 'endocrine disrupting compounds' (EDCs). The most commonly known EDCs are the organochlorines, including polychlorinated biphenyls (PCBs), DDT and it's metabolites, as well as the phthalates. Some EDCs are known to bind with estrogen receptors (Katzenellenbogen, 1995), either mimicking or blocking the effects of estrogens. Extreme examples of the effects of OCs on reproductive function are the neoplastic occlusions of the uterus resulting in infertility and the development of hermaphroditic offspring (Helle *et al.*, 1976; Baker, 1989; Reijnders, 1998). PCBs can also compete for binding sites on the transport proteins for the thyroid hormones, resulting in hypothyroid conditions that can affect early development or later reproductive performance (Brouwer, 1989). The results from these endocrine disruptions can be varied and also include suppression of the immune system (De Swart *et al.*, 1996; Ross *et al.*, 1995). Atkinson and Oki (2000) used thyroxine and cortisol concentrations along with several morphometric measurements to assess the well being of yearling Hawaiian monk seals that appeared to be malnourished. Their results suggest that a suite of measurements, including these hormones, provides a good indication of the physiology of a seal and its ability to adapt to suboptimal environments.

The immune system of marine vertebrates is a rapidly advancing area of interest, both in the basic components of the immune system as well as the development of immunodiagnostic reagents. Baseline information on the immune system of pinniped species is critical to any future field assessment of immunocompetence. The lack of baseline information on the immune system of the harbor seal population in Europe hindered assessment of the role of pollution-induced immunosuppression in the phocid distemper virus outbreak of 1988 (Dietz *et al.*, 1989a; Vos and Luster, 1989). Studies of levels of immunoglobulins and of isotypes of those immunoglobulins have been reported for a few species of pinnipeds. Cavagnolo and Vedros (1979) evaluated IgG, IgM and IgA levels in sera and colostrums of adult and immature northern fur seals (*Callorhinus ursinus*), finding low immunoglobulin levels in the sera of pups during the first four months of life. Baker (1984) found similar results for overall gamma globulin levels in grey seal (*Halichoreus grypus*) pups. Carter *et al.* (1990) measured specific immunoglobulin isotype levels in sera and colostrums of the grey seal. Ross *et al.* (1993) evaluated IgG levels in the harbor seal, and also evaluated lymphocyte function in this species by measuring responsiveness to a T-cell mitogen. A number of reports have appeared describing ELISA's or other immunoassays measuring pinniped antibody levels against canine distemper virus (e.g. Dietz, *et al.*, 1989b; Carter, *et al.*, 1990; Bengston, *et al.*, 1991; King, *et al.*, 1993). It is of note that some of the latter studies utilized antibodies specific for canine immunoglobulins to measure pinniped immunoglobulins, with which they cross-react. In assays such as the ELISA's mentioned above that require the use of anti-immunoglobulin indicator antibodies it is generally preferable to utilize species-specific antisera when available, but such antisera are not readily available for most species of pinnipeds.

This project will utilize our ability to montior several hormones and immunoglobulins, and relate their function to the body burden of contaminants and the overall health of individual seals. We propose to provide critical reagents and methodologies necessary for the assessment of several aspects of immunocompetence levels in the harbor seal, and to establish baseline data on these levels for the duration of the project in selected populations of harbor seals. The project will also result in the production of species-specific antisera for use in assays of immunoglobulin class specific antibody levels in the harbor seal population against pathogens, toxins, or other antigens of potential health importance. This project will also determine critical baseline concentrations of the thyroid hormones and cortisol of captive seals, housed in a stable environment with regular and balanced diets, to compare with free-ranging seals. In doing so, we can assess whether the seals in the Gulf of Alaska are being exposed to endocrine disrupting and/or immunosuppressive agents at level that are impacting their ability to survive, grow and reproduce. If contaminants are affecting the physiology of harbor seals, then we need to incorporate this into the working hypothesis under which this species is being managed. In addition, assessing the effects of environmental contaminants should be incorporated into any long-term plans for monitoring harbor seals. Monitoring endocrine and immune levels can also be used as indicators upon which parameters needed to model the population dynamics of harbor seals can be developed. This will become increasingly important if this species continues its population decline in the Gulf of Alaska.

NEED FOR PROJECT

A. Statement of Problem

Harbor seals were one of the resources that were injured by the 1989 *Exxon Valdez* oil spill (EVOS). To date this species is listed as 'not recovering'. Several studies have focused on the general health and metabolism of these seals as it relates to their diet, body condition and habitat (Projects 001, 341, 371, and 441). The proposed study will compliment these investigations as it will utilize new techniques to enhance our understanding of the health and physiology of the species and incorporate the possible affects of environmental organochlorine contaminants. If the techniques can be combined to develop a concise indicator of a given animal's health, then these techniques should be incorporated into the routine assessment and monitoring of harbor seals in the Gulf of Alaska.

B. Rationale/Link to Restoration

In order to recover any species whose population has experienced a major decline, it is necessary to fully understand the biology of the species. A few species of marine mammals have failed to recover with the enactment of the Marine Mammal Protection Act (e.g. Hawaiian monk seals and Steller sea lions). Other species have declined precipitously since the Marine Mammal Protection Act, with some subpopulations more affected than others (e.g. Alaskan harbor seals). The problems that these species face are multifaceted and complex. Many times a combination of factors will synergize to produce a devastating effect (such as the 1988 harbor seal epizootic in the North Sea), while either factor alone may not have had clinical effects. In understanding what the Alaskan harbor seals are experiencing, it is essential to know the degree to which they are being subjected to immunosuppressive or endocrine disrupting agents. Restoration of the species can only be successfully accomplished if the species is thoroughly understood. With this knowledge we can begin to predict the devastating effects of environmental changes and model the long-term population dynamics. In addition to predicting the impact of a given environment, we can also begin to manipulate animals and their environments to assist in their recovery.

The information gained from this study will enable us to assess two groups of animals, those that live in a stable, consistent environment (captivity), with those that experience the natural environment (rehab seals). Seals brought in for rehabilitation are generally young animals that are failing to thrive in their environment. They may not be able to naturally survive the weaning process due to a variety of factors, including immuno-incompetance or inadequate maternal investment (ie, poor milk quality or shorten lactation period). Through morphometric measurements, assessment of immune and endocrine function, and measurement of body contaminant levels, we can evaluate the degree to which these animals are adapting to a changing environment. Once these techniques have been perfected at the ASLC, we plan to test their application to a long-term, field-monitoring program. The ability of harbor seals to adapt to a changing environment is essential to the recovery of this species. Knowing what the animals are dealing with and their ability to adapt will enable resource managers to predict the recovery or mitigate the future decline of this species.

C. Location

Years 1 and 2 of this project will be undertaken at the ASLC using harbor seals that are currently resident and permitted for research under the Marine Mammal Protection Act for research. It will also utilize animals that will be brought in for rehabilitation under the terms of an existing letter of authorization, and through our collaboration with the Alaska Native Harbor Seal Commission. Year 3 of this work is proposed for free-ranging seals in Prince William Sound and areas near South Central Alaska.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

This project will involve a growing collaboration with the Alaska Native Harbor Seal Commission. In addition to the native communities, we propose working with coastal fishing communities to increase the awareness of the plight of this species. In working with community facilitators, we will request that nearby communities inform us of harbor seals needing rehabilitation, including orphaned pups. These animals provide a wealth of information as they have incorporated any environmental constraints into their physiology. As coastal communities come into contact with these animals more often than we know about, we propose working with these communities to increase our sample sizes. Through the development of brochures and speaking with local community groups, we will collaborate to ensure that seals requiring rehabilitation are brought to ASLC. Partnerships with the Civil Air Patrol and US Coast Guard will be sought to provide transportation of seals to ASLC from neighboring communities. During the rehabilitation process, these animals will be monitored for biochemical changes that indicate their ability to adapt.

This project will also coordinate with the existing volunteer and intern programs at ASLC to make opportunities available for spill-area residents who would like to spend time volunteering at ASLC. To a large extent this will increase our awareness of traditional and local knowledge of harbor seals as well as incorporate local expertise into the project. This project is budgeted for one graduate student and one research associate who will receive training to increase their level of expertise in marine mammal physiology as well as provide the necessary time to ensure that our community involvement is successful.

PROJECT DESIGN

A. Objectives

The overall goal of this project is to develop and test new methods of monitoring the physiology of harbor seals. In doing so the project has the following five objectives:

1. Determine seasonal and circadian patterns of total and free triiodothyronine (T_3), thyroxine (T_4), and cortisol in healthy captive harbor seals (Yr 1).
2. Develop new antibodies specific to harbor seal immunoglobulin classes IgG, IgM and IgA (Yr 1).
3. Determine seasonal patterns of IgG, IgM, and IgA, in healthy captive harbor seals (Yrs 1 and 2).
4. Determine endocrine and immunoglobulin profiles and measure organochlorine concentrations for rehabilitation seals periodically throughout the rehabilitation process (Yrs 1 and 2).
5. Assess endocrine and immunoglobulin profiles for free-ranging seals in Prince William Sound and in South Central Alaska (Yr 3).

B. Methods

Objective 1. Eight harbor seals (4 males, 4 females) housed at the ASLC will have monthly blood samples collected to assay for total and free T_4, T_3, and cortisol. In addition, circadian patterns of these hormones will be assessed from the eight seals during the seasonal extremes of the summer and winter solstices, with samples collected at 2 to 3 hourly intervals over a 24-hour period. A single blood and blubber sample will be collected for organochlorine analysis.

The analyses for these hormones have previously been validated for other pinniped species (Atkinson and Oki, 2000) and will be validated for harbor seals. Concentrations of cortisol will be measured in unextracted plasma using a single-antibody radioimmunoassay (Atkinson and Oki, 2000; Atkinson and Adams, 1988). The plasma will be heated at 60°C for 30 minutes to denature cortisol-binding proteins before assaying directly. Samples will be analyzed in batches to reduce inter-assay variation. Concentrations of total and free T_4 and T_3 will be measured in unextracted plasma using solid phase radioimmunoassays (Diagnostic Products Corporation, Los Angeles, CA) that are specific to either total or free, T_4 or T_3 (Atkinson and Oki, 2000). The standard curves of each assay will be log-logit transformed, enabling extrapolation of sample concentration (Robard, 1974). A profile of the variation in total and free T_4 and T_3 will be generated and analyzed.

Objective 2. The prerequisite for development of heavy chain specific antisera for the major immunoglobulin classes of the harbor seal is the production of purified preparations of each of these immunoglobulin classes. These purified immunoglobulin classes will be obtained from pooled sera from captive animals at ASLC and will be used as the source of the immunoglobulins to be purified. The first step toward purification of individual immunoglobulin isotypes (IgG, IgM, and IgA) from serum will be to remove non-immunoglobulin proteins, leaving a mixture of all immunoglobulin isotypes present. Serum samples will be centrifuged (five minutes at 10,000 rpm) to remove any large particulate matter present. The supernatant will then be filtered through a 0.45 μm and then a 0.2 μm filter to further remove any remaining particulates and/or aggregates. The next step involves separating serum proteins in the filtrate based on molecular weight. The serum will be placed in a Millipore UltraFree®-15 centrifugal filter device with a molecular weight cutoff of 100,000 daltons. During a thirty-minute centrifugation step (2000 x g) proteins less than 100,000 daltons pass through the filter, while those greater than 100,000 daltons are retained above the filter. Since the immunoglobulin isotypes being studied have molecular weights greater than 100,000 daltons, they will be retained in the fluid retained in the UltraFree®-15, and can be removed and kept available for use in further purification steps. This filtration technique has proven more satisfactory than techniques involving differential precipitation of serum proteins in saturated ammonium sulfate.

Aliquots of such partially purified and concentrated samples will then be applied to one of the types of chromatography columns for purification of a particular immunoglobulin isotype. Antiserum will be produced in rabbits against the precipitated immunoglobulins to permit preliminary analysis of the IgG, IgM, and IgA immunoglobulins in harbor seal serum. Grabar-Williams immunoelectrophoresis will be used in initial examination of harbor seal whole and precipitated serum for immunoglobulins.

In order to obtain immunogens suitable for production of heavy chain specific antisera for immunoglobulins of the harbor seal, purified immunoglobulins will first be enzymatically partially digested with papain to obtain the equivalent of Fab and Fc fragments for each isotype. Use of whole heavy chains as the immunogen produces antisera which include antibodies against the variable region of the heavy chain, which may cross-react with immunoglobulins of various isotypes. The Fc fragment contains only heavy chain constant regions and is more likely to induce isotype specific antisera if used as the immunogen. Purified "Fc" fragments of each isotype will be reduced with 2-mercaptoethanol and alkylated with iodoacetamide to break the disulfide bonds between the linked heavy chains. Chromatography using a Sephacryl S-400HR column will then be used to separate the heavy chain fragments from the other peptides which may be present (e.g. the J-chain of IgA or IgM). Once the purity of heavy chain preparations has been determined, they will be used to produce isotype-specific antisera that can be used to determine specific IgG, IgM, and IgA levels within a sample. Rabbits will be used to produce these antisera. The animals will be immunized by standard approved protocols. The titer and specificity of the antisera will be determined by (1) standard indirect ELISA (wells coated with purified harbor seal immunoglobulin heavy chain), followed by the rabbit anti-heavy chain antibody being tested, followed by enzyme-labeled anti-rabbit immunoglobulin, and finally by the indicator substrate) and (2) immunoelectrophoresis (IEP) methods including Grabar-Williams, Rocket IEP, Crossed IEP , and Tandem Crossed IEP. The antisera will be partially purified by use of the Millipore UltraFree®-15 centrifugal filter device followed by purification by Protein G Sepharose^R affinity chromatography to obtain the IgG fraction of this rabbit antisera. The purified antisera will be labeled with biotin or an enzyme (e.g. alkaline phosphatase or horseradish peroxidase) using standard labeling linkers (Pierce). The resulting antisera will be analyzed for specificity by several methods, including application of the antisera to Western blots of whole heavy chain preparations obtained by reduction/alkylation of the respective whole immunoglobulin isotype preparations.

Once the antisera for each immunoglobulin's heavy chain isotype has been made, it will be possible to regularly monitor immunoglobulin levels as an indicator of immune status of a population of harbor seals. It will also be possible to determine the level of each isotype present in, for example, samples obtained during a vaccination trial, at particular points in time of interest to a veterinarian or researcher (e.g. during pregnancy, drug therapy, maturation stage, etc.).

Objective 3. An ELISA protocol similar to that described by Suer *et al.* (1988) has been used to evaluate serum antibody levels in several species of marine mammals against several antigens (e.g. Patterson *et al.*, 1994). A "sandwich" ELISA protocol will be employed in an effort to determine general immunoglobulin levels in these samples. In the sandwich ELISA, a plastic solid phase matrix (polystyrene microwells) is coated with unlabeled antibodies against the antigen in question, i.e. in this case against on of the heavy chain isotypes (gamma, alpha, or mu for IgG, IgA, and IgM respectively) of immunoglobulins from the harbor seal (prepared via completion of Objective 2 above). The sandwich ELISA conducted in this manner will allow quantitation of general immunoglobulin levels in samples by comparison with a standard curve generated using preparations made with known concentrations of immunoglobulins purified from the harbor seal.

Blood samples will be collected on at least a monthly basis by project personnel based at the ASLC. Aliquots of each sample (and aliquots of other samples of harbor seal sera which become available) will be quantified for isotype levels using the ELISA described above in completion of Objective 2.

Objective 4. Using the previously described techniques, we will measure total and free T_3, T_4, cortisol, and IgG, IgM and IgA in harbor seals that are brought in for rehabilitation. ASLC has the ability to hold 10 seals for rehabilitation. An assessment of the level of contamination by organochlorines will also be performed from either blood or blubber samples. As these measurements will be diagnostic, the frequency of sampling will be based on the overall condition of the seals and not all of these animals will have the same numbers of samples collected. It is envisioned that samples will be collected upon entrance and before release of all seals. In addition, samples may be collected periodically to assess any effects of different milk formuli that are fed to very young seals as well as upon weaning when the diet and digestive efficiency of the animals is maturing. Experimental protocols are based on models using 10-12 harbor seals admitted for rehabilitation. These protocols will comply with the ASLC Institutional Animal Care and Use Committee (IACUC) and Marine Mammal Protection Act (MMPA) guidelines.

Seals admitted for rehabilitation at the SeaLife Center are held in quarantine and placed in individual holding tanks. Currently, the EVOS funded project Harbor Seal Recovery, Phase II, conducted by Dr. Mike Castellini, collects health data such as blood chemistry and morphometrics weekly from each harbor seal admitted for rehabilitation. Blood chemistry and hematology values are used in conjunction with body composition to detect significant changes in health status that might alter water balance, cause anemia, or compromise basic metabolic status (Castellini et al., 2000, 1993). Blood urea, nitrogen (BUN) ketone bodies, and free fatty acids, as well as hematocrit, hemoglobin, and erythrocyte sedimentation rate are measured.

Assimilation efficiencies will be determined for harbor seals prior to and during the weaning process, as well as once the animals are on a stable fish diet. Meal size and feeding frequency will be kept constant during the experimental period. Food digestibility in these seals will be determined using manganese (Mn^{++}) as an inassimilable dietary marker. Concentrations of Mn^{++} from subsamples of the food items fed to individual seals during the acclimation and collection periods, will be analyzed using atomic absorption spectrophotometry (Fadely et al. 1990). Feces will be collected during the course of the feeding trail to determine the clearance rate of food items and fecal Mn^{++} concentrations. Differences in the Mn^{++} concentrations between diet and feces will be used to calculate AE. In addition, diet and fecal samples will be freeze-dried and analyzed for energy (cal/g), nitrogen, total lipid, and ash as reported in Keiver et al (1984). To quantify the passage of digesta (mean retention time) and fecal Mn^{++} concentrations, carmine red will be used as a marker to estimate emptying time of the stomach (Ashwell-Erikson and Elsner 1981).

Objective 5. The methodology of this objective will be developed over the first 1 to 2 years of the project. The feasibility of sampling as well as the necessities of sample processing will continually be evaluated with the goal of developing techniques that are feasible for field collections. It is hoped that Year 3 will be a collaborative effort with harbor seal researchers that regularly collect samples from free-ranging seals. The sites of collection, numbers of animals and the permits to cover the sampling of wild seals will be negotiated with other researchers who may be collecting samples concurrently. Discussions will also be held with the Alaska Native Harbor Seal Commission to assist with the planning of the field testing.

C. Cooperating Agencies, Contracts and Other Agency Assistance

This project will primarily be based at ASLC, with the National Marine Fisheries Service permits for the captive seals being held by ASLC with Dr. S. Atkinson serving as the Principal Investigator of that permit. Seals needing rehabilitation will be sought with the guidance of the Alaska Native Harbor Seal Commission. The letter of authorization for these seals is also held by ASLC, with Susan Inglis, Director of Research and Rehabilitation Operations serving as the PI.

The samples collected for endocrine evaluation will be analyzed in the Marine Mammal Endocrinology Lab of Dr. S. Atkinson, housed at ASLC. The samples for immune assessment will be analyzed by Dr. Bobby Middlebrooks, University of Southern Mississippi. A subcontract within this proposal has been negotiated. The samples for contaminant measurements will be analyzed by the Northwest Fisheries Science Center of the National Marine Fisheries Service. A subcontract for these samples has been negotiated with Dr. Peggy Khran.

SCHEDULE

A. Measurable Project Tasks for FY 01 (October 1, 2000 – September 30, 2001)

October 2000:	Blood sampling commences on a monthly basis. In addition, single samples will be taken to initiate the hormone validations and immunoglobulin development.
November 2000:	Blood and blubber samples from the captive seals will be sent for contaminant analysis.
December 2000:	Blood samples will be collected to assess circadian pattern of T_3, T_4 and cortisol.
January 2001:	Endocrine assays will be undertaken with batches of samples to assist with quality control.
May-June 2001:	Seals collected for rehabilitation arrive at ASLC.
June 2001:	Circadian sampling will be performed.
June- September:	Endocrine and immunology samples analyzed.
September-October:	Rehabilitation seals released.

Depending on the age and health of these seals, they are typically kept until Most of the analyses will be accomplished by Sept 2001, although there will be some analyses to complete during FY 02.

B. Project Milestones and Endpoints for Year 1

1. Establishment of baseline levels of total and free T_3, T_4 and cortisol levels in the serum: The hormone concentrations from captive animals will serve as our baseline for both the rehabilitation seals and the free-ranging seals. Both circadian and seasonal baselines will be established. This will be completed during Year 1.

2. Development of species-specific antisera against immunoglobulins of the harbor seal: An important outcome of the proposed project will be the production of such antisera against immunoglobulin isotypes of the harbor seal. These antisera will be available for and of use in future studies involving immunoglobulins of this species. The antisera will also be available for use in ELISA's to measure immune response and immune levels against specific antigens of interest in the harbor seal population. For example, the antisera can be used in future studies involving use of ELISA's to measure antibody levels against selected viruses, toxins, or bacterial antigens of interest and importance in wild populations of the harbor seal. This will be completed during Year 1.

3. Establishment of baseline levels of immunoglobulin isotypes in serum and saliva: The sandwich ELISA (using the respective anti-isotype antisera as capture antibody) will provide data on general immunoglobulin levels in the harbor seal. This will be completed during Years 1 and 2.

C. Completion Date

The anticipated completion date of the captive portion of this project is October 2002. At this point we will hope to be able to recommend that these techniques be applied to a field-monitoring program. If this is accomplished the feasibility of field sampling will be determined by October 2003.

PUBLICATION AND REPORTS

It is anticipated that all of the work conducted under this proposal be published in peer-reviewed international journals. Potential journals include, General and Comparative Endocrinology, Comparative Biochemistry and Physiology, Marine Mammal Science, and Journal of Developmental and Comparative Immunology. In addition, any student projects will be presented in thesis or dissertation format as well as submitted for journal publication. The presentation of work at conferences and workshops will be encouraged. Such conferences may include, Society for Marine Mammalogy, International Association of Aquatic Animal Medicine, or any EVOS workshops.

PROFESSIONAL CONFERENCES

No professional conferences are requested for FY01. The PI will request to attend the Biennial Conference of the Biology of Marine Mammals in Vancouver, Canada in FY02.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The PI of this proposal also serves as the Science Director of the ASLC. Through this avenue, the PI holds regular discussions on the projects that are currently taking place at ASLC, and is already collaborating on the technical aspects of this study. This project will be using the same animals as have been used for projects 341, 371, and 441, and it is anticipated that discussions will be held whenever scientist are in Seward for sample collections. It is also anticipated that Year 3 samples will be collected from a shared field site, integrating existing field projects with our sample collections.

This project will benefit from new equipment that has recently been purchased by UAF and UAF Foundation in an effort to establish an endocrinology laboratory at ASLC. The lab will be regulated under the Nuclear Regulatory Commission License to UAF. It is in this lab that the students and research associate on this project will work.

PROPOSED PRINCIPAL INVESTIGATOR

Shannon Atkinson, Ph.D.
University of Alaska Fairbanks,
School of Fisheries and Ocean Science,

Institute of Marine Science,
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Phone 907-224-6346 Fax 907-224-6360
Email shannon_atkinson@alaskasealife.org

PRINCIPAL INVESTIGATOR (qualifications)

The PI of this project is a new professor at UAF, with half time duties to serve as the Science Director at ASLC. She has 18 years experience in analyzing body fluids for hormone concentrations. She has established and worked in two other endocrinology laboratories, one at Hawaii Institute of Marine Biology, University of Hawaii, and the other at Murdoch University in Western Australia. The PI also has extensive experience working with a variety of marine mammals, including the endangered Hawaiian monk seal, California harbor seals, northern elephant seals, Risso's, rough-toothed, white sided, and bottlenose dolphins, and, humpback, beluga, and false killer whales. The PI will be responsible for the completion of all project objectives. Her curriculum vitae is attached.

OTHER KEY PERSONNEL

Ms. Susan Inglis is the Director of Research and Rehabilitation Operations at ASLC. She has extensive experience in the rehabilitation of seals and birds. She has 15-year experience managing research projects, including numerous species of fish, sea birds and marine mammals. Her organizational and technical skills will be invaluable to this project. Her curriculum vitae is attached.

Dr. Bobby Middlebrooks is a Professor at the University of Southern Mississippi. He has an immunology laboratory that focuses on the basic components and functioning of the immune systems of marine vertebrates. He has developed immunodiagnostic assays for pinnipeds and is highly qualified to undertake the immunological aspects of this study. He will be responsible for the developing any specific reagents necessary to assay for immunoglobulins in harbor seals, as well as for performing and analyzing the results from those assays. His curriculum vitae is attached.

Salaries have been included for a research associate and a graduate student. The research associate will assist with the overall coordination of the sample collection from the captive seals as well as organize and coordinate sample collections from the rehabilitation seals. The research associate will also work with the community facilitators to increase the sample size of rehab seals entering ASLC. This will include collaborations with the Civil Air Patrol or Coast Guard to assist with transport of seals from nearby communities. In addition, the research associate will work in the endocrinology lab at ASLC and help to maintain quality control and assurance standards for the assays performed there.

The graduate student will be responsible for drafting the experimental designs and sampling protocols. They will assist with the sample collections and perform the laboratory work. With assistance from the PI, they will analyze the data and present them in graphical and tabular form. They will be responsible for the first draft of any manuscripts that arise from the work included in their thesis or dissertation.

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approved TC 8-3-00
Revision 7-6-

2001 EXXON VALDEZ TRUSTE)UNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001
Personnel		$0.0
Travel		$0.0
Contractual		$112.2
Commodities		$0.0
Equipment		$0.0
Subtotal		$112.2
General Administration		$7.9
Project Total		$120.1
Full-time Equivalents (FTE)		1.3
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

		Estimated	Estimated		

Dollar amounts are shown in thousands of dollars.

Comments:

PLUS Alaska SeaLife Center
bench fees $160.1

PROJECT TOTAL $280.2

FY01

Prepared:

Project Number: 01558 Revised
Project Title: Effect of Oil Products on Endocrine and Immune Systems in Harbor Seals
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Budget Category:	Authorized FY 2000	Proposed FY 2001

2001 EXXON VALDEZ TRUSTI OUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Personnel		$41.9
Travel		$1.6
Contractual		$45.2
Commodities		$1.0
Equipment		$0.0
Subtotal		$89.7
Indirect		$22.5
Project Total		$112.2
Full-time Equivalents (FTE)		1.3
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

		Estimated 2001	Estimated 2002		
			$120.0		

Dollar amounts are shown in thousands of dollars.

Comments:

The indirect rate is 25% TDC, as negotiated by the *Exxon Valdez* Oil Spill Trustee Council with the University of Alaska.

Student personnel costs include resident tuition of $3006 per year.

FY01

Prepared:

Project Number: 01558 Revised
Project Title: Effect of Oil Products on Endocrine and Immune Systems in Harbor Seals
Name: Shannon Atkinson

FORM 4A
Non-Trustee
SUMMARY

Personnel Costs:						
Name	Position Description		Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
Shannon Atkinson	PI/Professor			10.5		2.6
TBA	Research Associate		3.5	5.5		19.2

	TBA	M.S. Student	[redacted]	12.0	1.7		20.1
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal	[redacted]	15.5	17.7	0.0	[redacted]
						Personnel Total	$41.9

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2000
	R/T Mississippi to Seward, AK	1.0	1	7		1.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$1.6

FY01

Prepared:

Project Number: 01558 Revised
Project Title: Effect of Oil Products on Endocrine and Immune Systems in Harbor Seals
Name: Shannon Atkinson

FORM 4B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed
Description	FY 2000
Hormone analysis (195 Samples x4 Hormones @$13/sample)	10.1
Blood chemistry and proximate analyses (ALSC)	5.0
Contaminant Analysis	10.0
Dr. Middlebrooks Subcontract	20.0

Contractual Total	$45.2
Commodities Costs:	Proposed
Description	FY 2000
Blood collecting supplies and regeants	1.0
Commodities Total	$1.0

FY01

Prepared:

Project Number: 01558 Revised
Project Title: Effect of Oil Products on Endocrine and Immune Systems in Harbor Seals
Name: Shannon Atkinson

FORM 4B
Contractual & Commodities
DETAIL

2001 EXXON VALDEZ TRUST OUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed 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
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	

FY01

Prepared:

Project Number: 01558 Revised
Project Title: Effect of Oil Products on Endocrine and Immune Systems in Harbor Seals
Name: Shannon Atkinson

FORM 4B
Equipment
DETAIL

FY 01 EXXON VALDEZ TRUST OUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FFY 2000	Proposed FFY 2001						
Personnel		$0.0						
Travel		$0.0						
Contractual		$149.6						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal		$149.6		Estimated FFY 2002				
General Administration		$10.5						
Project Total		$160.1		$0.0				
Full-time Equivalents (FTE)								
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

2001	Project Number: 01558 Project Title: Alaska SeaLife Center Bench Fees Agency: ADF&G	FORM 3A SUMMARY

approved TC 8-3-00

Evaluation of Yakataga Oil Seeps as Regional Background Hydrocarbon Sources in Benthic Sediments of the Exxon Valdez Spill Area

RECEIVED
APR 14 2000
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

Project Number:	01599
Restoration Category:	Research and Monitoring
Proposer:	Jeffrey W. Short NMFS, Auke Bay Laboratory ABL Program Manager: Dr. Stan Rice NOAA Program Manager: Bruce Wright
Lead Trustee Agency:	NOAA
Cooperating Agencies:	U. S. Geological Survey Payne Environmental Consultants
Alaska Sea Life Center:	No
Duration:	1 year
Cost FY01:	$ 10,500 (closeout)
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 Exxon Valdez 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 a liquid 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

Water sampling will focus on 4 streams in the Cape Yakataga area, 2 of which receive oil from seeps and 2 of which do not. Three water samples will be collected from each of the two streams that receive seep oil. One 4 L water sample will be collected oil above the point of oil entry, another sample will be collected 100 m downstream of the oil-seep entry point into a stream, and a final sample will be collected just above tidal influence near the stream mouth on the GOA. Only 1 water sample will be collected from each of the streams that do not receive seep-oil.

Each water sample will be partitioned into a dissolved and particulate fraction as describe by Payne et al. (International Oil Spill Conference, 1999). Particulate material will be separated from each water sample, and then split into two subsamples. One subsample will be analyzed for PAH, and the other will be split again according to density in a high-density liquid to separate coal from inorganic rock, the density-separated samples will be analysed individually. This will permit estimation of the proportion of total PAH contributed by coal particles in the suspended particulates of these streams. The filtered water samples will also be analyzed for PAH to determine the dissolved PAH content.

Approximately 12 benthic GOA sediment samples and 5 PWS samples will be collected and analyzed for PAH to determine the extent of coal-contributed PAH to sediments across the GOA from Yakutat to PWS. Each of these sediment samples will be subjected to a high-density liquid to separate coal particles from the remainder of the sediment. 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.

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 FY01

FY01:

Sep 30 - Apr 15: Prepare final report and research paper reporting the results of this project in a peer-reviewed journal.

B. Project Milestones and Endpoints

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.

PROFESSIONAL CONFERENCES

Results from this project will be presented at the Arctic Marine Oilspill Program sponsored by Environment Canada in June, 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

The sampling design was modified in response to new information presented in reports by Exxon-sponsored scientists in fall 1999.

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.

approved TC 8-3-00

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001	ADEC	ADF&G	ADNR	USFS	DOI	NOAA
			PROPOSED FY 2000 TRUSTEE AGENCIES TOTALS					
							$3.0	$7.5
Personnel	$24.9	$4.7						
Travel	$5.1	$1.4						
Contractual	$17.5	$2.5						
Commodities	$1.3	$1.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$48.8	$9.6			Estimated			
General Administration	$5.0	$0.9			FY 2002			
Project Total	$53.8	$10.5			$0.0			
Full-time Equivalents (FTE)	0.3	0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$0.0				$0.0	$0.0		

Comments:

Total NOAA Contribution: 10.1K Jeff Short 1 mo @ 10K
Total DOI Contribution: 6.6

FY00

Prepared: 4/13/99

Project Number: 01599
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

2001 EXXON VALDEZ TRUSTI OUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$2.1						
Travel		$1.4						
Contractual		$2.5						
Commodities		$1.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$7.0			Estimated FY 2002			
General Administration		$0.5						
Project Total	$0.0	$7.5			$0.0			
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY00

Prepared: 4/13/99

Project Number: 01599
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

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
Jeff Short	Research Chemist	13/6	0.2	10.4		2.1
						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		0.2	10.4	0.0	
					Personnel Total	$2.1

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
					0.0
AMOP conference in Calgary, Alberta	0.8	1	2	0.3	1.4
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$1.4

FY00

Prepared: 4/13/99

Project Number: 01599
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
Personnel
& Travel
DETAIL

2001 EXXON VALDEZ TRUSTI)UNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Contractual Costs:	Proposed
Description	FY 2000
Payne Environmental Consultants	2.5
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$2.5

Commodities Costs:	Proposed
Description	FY 2000
Page Charges for manuscript	1.0
Commodities Total	$1.0

FY00

Prepared: 4/13/99

Project Number: 01599
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

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed 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
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY00

Project Number: 01599
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
Equipment
DETAIL

Prep 1/13/99

2001 EXXON VALDEZ TRUSTI)UNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$2.6						
Travel		$0.0						
Contractual		$0.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$2.6			Estimated FY 2001	Estimated FY 2002		
General Administration		$0.4						
	$0.0	$3.0						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:
USGS Contribution: K.Kvenvolden, Group Leader Chemist, .5 mo @ 13.2K for a total USGS contribution of 6.6

FY00

Prepared: 4/13/99

Project Number: 01599
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

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
Keith Kvenvolden	Group Leader, Organic Geochemistry	GS-14	0.2	13.2		2.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.2	13.2	0.0	
					Personnel Total	$2.6

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: 01599
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

Prep: ' '/13/99

Contractual Costs:	Proposed
Description	FY 2000
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed
Description	FY 2000
Commodities Total	$0.0

FY00

Prepared: 4/13/99

Project Number: 01599
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
Contractual &
Commodities
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed 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
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY00

Prepared: 4/13/99

Project Number: 01599
Project Title: Evaluation of Yakataga Oil Seeps as Regional Background Hydrocarbon Sources in Benthic Sediments of EVOS Area
Agency: DOI- USGS

FORM 3B
Equipment
DETAIL

Kodiak Archipelago Youth Area Watch

Project Number:	01610
Restoration Category:	General Restoration
Proposer:	P. Brown-Schwalenberg/CRRC
Lead Trustee Agency:	ADFG
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	Cont'd
Duration:	2nd yr. 3 yr. project
Cost FY 01:	$61.8
Cost FY 02:	$61.8
Geographic Area:	Kodiak
Injured Resource/Service:	All

ABSTRACT

This project is a collaboration between the Chugach Regional Resources Commission and the Kodiak Island Borough School District to conduct a Youth Area Watch Program. In FY 00, students from Akhiok, Larsen Bay, Old Harbor, Port Lions, Kodiak City, and Karluk participated. In FY 01, the project will expand to two additional communities, Chiniak and Port Lions. Other activities in FY 01 will include: site teacher training in collaboration with the Kodiak College; construction of a web site for students, teachers, administrators, and project scientists to collaborate, share, and coordinate projects, as well as post data; purchase of additional equipment for monitoring activities; and participation by students, teachers, and scientists in the annual science camp held at Afognak.

NOTE: PROJECT WAS FUNDED CONTINGENT ON SUBMITTAL AND APPROVAL OF REVISED DPD AND BUDGET. REVISED DPD AND BUDGET HAVE NOT YET BEEN RECEIVED.

01630

Approved TC 8-3-00

Planning for Long-term Research and Monitoring Program

Project Number:	01630
Restoration Category:	Research/Monitoring
Proposer:	Restoration Office, *Exxon Valdez* Oil Spill Trustee Council
Lead Trustee Agency:	Restoration Office (ADFG)
Cooperating Agencies:	All
Alaska SeaLife Center:	No
Duration:	2nd year of a 3-year project
Cost FY 01:	$136,000
Cost FY 02:	TBD
Geographic Area:	Entire oil-spill region
Injured Resource/Service:	All injured resources and services

ABSTRACT

In March 1999 the Trustee Council, using funds from the Restoration Reserve, established a $120 million fund for a long-term research and monitoring effort in the spill area and adjacent northern Gulf of Alaska. Development of what is now called the Gulf Ecosystem Monitoring (GEM) program was initiated in FY 99 and will continue through FY 02. In FY00 a draft GEM Program was developed and submitted to the National Research Council for review. In FY 01, a draft monitoring plan will be finalized in conjunction with spill-area stakeholders, coordinated and refined 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), and then delivered for review to the National Research Council. This project will also help develop the *FY 02 Invitation* which will request proposals for projects to accomplish the transition to the long-term program. This project will be accomplished through the combined efforts of the Restoration Office and the Chief Scientist.

INTRODUCTION

In March 1999, the *Exxon Valdez* Oil Spill Trustee Council, using funds from the Restoration Reserve, established a $120 million fund for a long-term research and monitoring effort in the spill area and adjacent northern Gulf of Alaska. The GEM fund will act as an endowment, providing annual funding of $5 to $10 million depending on investment earnings. Accordingly, the Restoration Office staff and representatives of Trustee agencies have begun to develop what is now called the Gulf Ecosystem Monitoring (GEM) program. The mission of GEM is to sustain a healthy and biologically diverse marine ecosystem in the northern Gulf of Alaska and the human use of the marine resources in that ecosystem through greater understanding of how its productivity is influenced by natural changes and human activities. The goals of GEM are to (1) detect: serve as an early warning system by detecting annual and long-term changes in the marine ecosystem, (2) understand: identify causes of change in the marine ecosystem, including natural variation, human influences, and their interaction, (3) predict: develop the capacity to predict the status and trends of natural resources, (4) inform: provide integrated and synthesized information to the public, resource managers, industry and policy makers, and (5) solve: develop tools, technologies, and information that can help resource managers and regulators improve management of marine resources and address problems that may arise from human activities.

A first draft of the GEM Science Program was made available for public review and comment in 1999; a revised draft was submitted to the National Research Council for review in 2000. During the years FY 01 and FY 02, the program will be finalized and a Research and Monitoring plan will be developed. Implementation of GEM is scheduled to begin in FY 03 (October 2002).

NEED FOR THE PROJECT

A. Statement of the Problem

Development of a successful GEM program is a complex undertaking, with a number of aspects and requirements that will go through several iterations. First, it is essential that the program be based on input from scientists and natural resource managers familiar with marine ecosystems, long-term ecological monitoring and research programs, and 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 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 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 the progress made toward satisfying these requirements in FY 00 be continued in FY01.

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 long-term observation and, possibly, restoration actions, are needed if injured resources and services are to be fully restored. The 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 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 GEM 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 FY 99. The Council's Community Involvement Coordinator and an expert in traditional ecological knowledge (Project \052) have participated in the discussions that led to the first draft of the GEM program. In FY 00, a series of visits to spill-area communities, public meetings, and presentations to stakeholder groups further involved 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 sustain a healthy and biologically diverse marine ecosystem in the northern Gulf of Alaska and the human use of the marine resources in that ecosystem through greater understanding of how its productivity is influenced by natural changes and human activities. The goal of this project is to design the GEM program and monitoring plan.

Specific objectives are to:

(1) Develop and present a draft GEM Science Program (accomplished in FY 00) and draft GEM Research and Monitoring plan to the public and various stakeholders for review, discussion, and comment;

(2) Consult and coordinate with biologists, oceanographers, and other scientists to receive technical comment on draft products. These consultations will focus upon those working with prior or ongoing agency and university research and monitoring programs, plans, projects, and databases in the Gulf of Alaska and north Pacific Ocean. Another key group will be those involved in establishing other large scale marine ecological monitoring programs, including efforts in the Gulf of Mexico and the Gulf of Maine.

(3) Assist with independent peer review by the National Research Council of the revised GEM program plan and draft GEM monitoring plan;

(4) Through FY 01 and FY 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 Science Program and final GEM Research and Monitoring plan, reflecting the comments of the National Research Council, and contribute to development of the FY 02 and FY 03 *Invitations to Submit Proposals* to invite proposals to transition to GEM in FY 02 and then implement GEM starting in FY 03.

B. Methods

The methods described below are organized by project objective (in parentheses) and only pertain to activities proposed to be carried out in FY 01:

(1) Present draft Research and Monitoring Plan to public and EVOS scientists. A conceptual draft of the GEM Research and Monitoring plan will be developed at the end of FY 00, and the first task of FY 01 will be to present this plan for review at the *Exxon Valdez* Oil Spill Trustee Council Annual Workshop October 12-13, 2000. The plan presented in October will have already had the benefit of review by numerous stakeholders at small workshops ("focus groups") conducted under Project 00630. Comments received at the annual meeting are expected to include specific information on recommended samples and measurements to be obtained and the locations and timing of field work.

(2) Consultation with scientists. Additional comments will be obtained from scientists working with other large-scale monitoring and research programs and projects in the northern Gulf of Alaska or the north Pacific Ocean (e.g., GLOBEC, PICES, FOCI), and with others working on large scale programs in the Gulf of Mexico and Gulf of Maine. The Science Coordinator has been invited to present the monitoring plan to PICES scientists at the PICES annual meeting in Hakodate, Japan, in October 2000. In addition, comments will be sought from scientists helping to develop the US Global Ocean Observing System. Obtaining detailed information about other ongoing data gathering efforts will allow GEM to be refined to

complement and take advantage of ongoing work, thus achieving greater scientific integration, applicability to management needs, cost savings, and efficiency. Finally, the results from Project 00455, regarding data and information management strategies for GEM, will be discussed among stakeholder representatives and incorporated into the final GEM program documents.

The comments received from the annual workshop attendees will be integrated into the draft document, along with comments received from other scientists. The revised Research and Monitoring Plan will then be presented to the Trustee Council for adoption prior to forwarding to the National Research Council for review.

(3) Independent peer review. It is essential that appropriate versions of the GEM Research and Monitoring Plan are subjected to independent peer review, and this review 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, the National Research Council's (NRC) Polar Research Board and Board on Environmental Science and Technology have established a committee to review the GEM Program and GEM Monitoring Plan (see Project 01360). 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.

The NRC Committee will complete its preliminary review of the GEM Science Program early in FY01. Using this review for guidance, the GEM Science Program will be revised and circulated for public comment, and a final version of the GEM Science Program will be adopted by the Trustee Council in FY 02. A similar process will be followed when the NRC Committee delivers its review of the GEM Research and Monitoring Plan.

(4) Transition Projects. The *FY 02 Invitation to Submit Proposals,* which is scheduled to be issued in February 2001, will invite proposals to assist in the transition to a long-term research and monitoring program. 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.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

Representatives of all Trustee agencies are involved in developing the GEM program and monitoring plan. In addition to a direct role in developing GEM, 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 GEM (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

<u>**FY 01**</u>

October 2000:	Present draft GEM Research and Monitoring Plan at Annual Workshop and at PICES annual meeting
November 2000:	Draft GEM Research and Monitoring Plan available for public comment
January 2001:	Draft GEM Research and Monitoring Plan presented to Trustee Council for adoption
February 2001:	Submit draft GEM Research and Monitoring Plan to NRC; receive interim report from NRC on GEM Science Program

<u>**FY 02**</u>

November 2001:	Receive final report from NRC on draft GEM Science Program and Research and Monitoring Plan
Dec 2001/Jan 2002:	Revise GEM Science Program and Research and Monitoring Plan based on NRC review; circulate for public comment; adopt final documents

B. Project Milestones and Endpoints

Progress toward project objectives in FY 01 will be completed according to the schedule above. The following overall milestones are key:

1. Assist in developing draft Research and Monitoring Plan; coordinate review and revision with EVOS annual meeting in October 2000, public meetings, the Trustee Council, and the NRC.
2. Revise GEM Science Program incorporating NRC comments.
3. Contribute to *FY 02 Invitation.*

A. Completion Date

The GEM Science Program is scheduled to be completed and approved by the Trustee Council in January 2001. The GEM monitoring plan is scheduled to be completed and approved by the Trustee Council in January 2002. Implementation of GEM will begin with the FY 03 work plan cycle and will be ongoing.

PUBLICATIONS AND REPORTS

The products of this project will be the GEM Science Program and the GEM Research and Monitoring plan. No reports will be required and no additional publications are expected.

PROFESSIONAL CONFERENCES

The Science Coordinator has been invited to present the draft GEM Monitoring Plan to the PICES Annual Meeting in Hakodate, Japan, October 2000.

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. 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.

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)
<molly_mccammon@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

Dr. Phil Mundy, Science Coordinator
Exxon Valdez Oil Spill Trustee Council
645 G Street, Suite 401
Anchorage, Alaska 99501
907-278-8012
907-276-7178 (fax)
phil_mundy@oilspill.state.ak.us

Dr. Andrew Gunther, Vice President
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approved TC 8-3-00

FY 01 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 00	Proposed FY 01	PROPOSED FY 01 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
			$9.5	$28.3	$72.7	$8.5	$7.2	$9.8
Personnel	$0.0	$44.7						
Travel	$15.0	$15.0						
Contractual	$60.0	$60.0						
Commodities	$5.5	$5.5						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$80.5	$125.2				Estimated FY 2002		
General Administration	$4.2	$10.8						
Project Total	$84.7	$136.0						
Full-time Equivalents (FTE)								
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

PREPARED 7/27/00

FY01	Project Number: 01630 Project Title: Planning for Long-Term Research & Monitoring Program Lead Agency: ADFG/Restoration Office	FORM 2A MULTI-TRUSTEE AGENCY SUMMARY

FY 01 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET

October 1, 200(ptember 30, 2001

Budget Category:	Authorized FY 00	Proposed FY 01						
Personnel		$6.8						
Travel		$15.0						
Contractual		$0.0						
Commodities		$5.5						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$27.3				Estimated FY 2002		
General Administration		$1.0						
Project Total	$0.0	$28.3						
Full-time Equivalents (FTE)		0.1						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY01

Project Number: 01630
Project Title: Planning for Long-Term Research & Monitoring Program
Agency: ADFG & Restoration Office

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 01
						0.0
Claudia Slater	Agency Liaison		1.0	6.8		6.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.0	6.8	0.0	
					Personnel Total	$6.8

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 01
Travel for Restoration Office staff and other personnel as needed for National Research Council review sessions, public meetings on GEM, and coordination between GEM and other monitoring programs.					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

FY01

Project Number: 01630
Project Title: Planning for Long-Term Research & Monitoring Program
Agency: ADFG & Restoration Office

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed
Description	FY 01
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed
Description	FY 01
Database, mapping, and other materials for Restoration Office	5.5
Commodities Total	$5.5

FY01

Project Number:01630
Project Title: Planning for Long-Term Research & Monitoring Program
Agency: ADFG & Restoration Office

FORM 3B
Contractual &
Commodities
DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 01
			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.	**New Equipment Total**		$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY01

Project Number: 01630
Project Title: Planning for Long-Term Research & Monitoring Program
Agency: ADFG & Restoration Office

FORM 3B
Equipment
DETAIL

FY 01 EXXON VALDEZ TRU: COUNCIL PROJECT BUDGET

October 1, 200 ptember 30, 2001

Budget Category:	Authorized FY 00	Proposed FY 01						
Personnel		$7.4						
Travel		$0.0						
Contractual	$60.0	$60.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$60.0	$67.4				Estimated FY 2002		
General Administration	$4.2	$5.3						
Project Total	$64.2	$72.7						
Full-time Equivalents (FTE)		0.1						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY01

Project Number: 01630
Project Title: Planning for Long-Term Research & Monitoring Program
Agency: ADNR

FORM 3A
TRUSTEE
AGENCY
SUMMARY

FY 01 EXXON VALDEZ TRU! COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 01
Carol Fries	Agency Liaison		1.0	7.4		7.4
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.0	7.4	0.0	
					Personnel Total	$7.4

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 01
					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

FY01

Project Number: 01630
Project Title: Planning for Long-Term Research & Monitoring Program
Agency: ADNR

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed
Description	FY 01
Applied Marine Sciences (Chief Scientist Bob Spies) to participate in development, presentation, and review of draft GEM Science Program and Restoration and Monitoring Plan. Funds are included for review of plan by core peer reviewers and for travel by the Chief Scientist to Trustee Council and PAG briefings and meetings on other monitoring efforts.	60.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$60.0

Commodities Costs:	Proposed
Description	FY 01
Commodities Total	$0.0

FY01

Project Number: 01630
Project Title: Planning for Long-Term Research & Monitoring Program
Agency: ADNR

FORM 3B
Contractual &
Commodities
DETAIL

FY 01 EXXON VALDEZ TRU!   COUNCIL PROJECT BUDGET
October 1, 200- --ptember 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 01
			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.	**New Equipment Total**		$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY01

Project Number: 01630
Project Title: Planning for Long-Term Research & Monitoring Program
Agency: ADNR

FORM 3B
Equipment
DETAIL

FY 01 EXXON VALDEZ TRU! COUNCIL PROJECT BUDGET

October 1, 200_ _ _ptember 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 01
Ken Holbrook	Agency Liaison		1.0	7.4		7.4
						0.0
						0.0
Plus $1.1 GA						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.0	7.4	0.0	
					Personnel Total	$7.4

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 01
					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

FY01

Project Number: 01630
Project Title: Planning for Long-Term Research & Monitoring Program
Agency: USFS

FORM 3B
Personnel
& Travel
DETAIL

FY 01 EXXON VALDEZ TRU! COUNCIL PROJECT BUDGET
October 1, 200υ - september 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 01
	Agency Liaison		1.0	6.3		6.3
						0.0
						0.0
Plus $0.9 GA						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.0	6.3	0.0	
					Personnel Total	$6.3

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 01
					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

FY01

Project Number: 01630
Project Title: Planning for Long-Term Research & Monitoring Program
Agency: DOI

FORM 3B
Personnel
& Travel
DETAIL

FY 01 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET
October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 01
Bruce Wright	Agency Liaison		1.0	8.5		8.5
						0.0
Plus $1.3 GA						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.0	8.5	0.0	
					Personnel Total	$8.5

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 01
					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

FY01

Project Number: 01630
Project Title: Planning for Long-Term Research & Monitoring Program
Agency: NOAA

FORM 3B
Personnel
& Travel
DETAIL

FY 01 EXXON VALDEZ TRU! COUNCIL PROJECT BUDGET
October 1, 200(ptember 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 01
Marianne See	Agency Liaison		1.0	8.3		8.3
						0.0
Plus $1.2 GA						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.0	8.3	0.0	
					Personnel Total	$8.3

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 01
					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

FY01

Project Number: 01630
Project Title: Planning for Long-Term Research & Monitoring Program
Agency: ADEC

FORM 3B
Personnel
& Travel
DETAIL