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approved TC 8-6-01

River Otters and Fishes in the Nearshore Environment: A Synthesis

Project Number:	02593
Restoration Category:	Research
Proposer:	S. Jewett/UAF
Lead Trustee Agency:	ADFG
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	New
Duration:	1st yr. 1 yr. project
Cost FY 02:	$32.4
Cost FY 03:	$0.0
Geographic Area:	Prince William Sound
Injured Resource/Service:	River otters

ABSTRACT

This project will integrate data collected on river otters and fishes in Prince William Sound through efforts of the NVP/025 (Nearshore Vertebrate Predator), APEX/163 (Alaska Predator Ecosystem Experiment), and SEA/320 (Sound Ecosystem Assessment) projects. Social organization and population dynamics of river otters, specialized fish-predators, are dependent on abundance and availability of fishes. This project will test the dependence of sociality in river otters on the availability of schooling fishes and evaluate the relation between the spatial and temporal distribution of fishes and those of river otter groups.

INTRODUCTION

In this proposal, funding is requested for conducting an integrative analysis of data collected in NVP, SEA and APEX projects to explore the relation between river otter (*Lontra canadensis*) sociality and landscape use, and spatial and temporal variation in the abundance of forage and intertidal/demersal fishes. We expect to generate at least one manuscript through this effort. We will critically test the dependence of river otter sociality on the availability of schooling fishes (e.g., herring - *Clupea pallasi*, capelin -*Mallotus villosus*, sand lance - *Ammodytes hexapterus*, and salmon - *Oncorhynchus* spp.) and intertidal/demersal fishes using data collected by APEX, SEA, and NVP researchers on annual, seasonal, and spatial changes in distribution of fishes and data on spatial distribution and variation in sociality of river otters collected by NVP researchers.

Background

Sociality in river otter

River otters inhabiting coastal environments forage in the intertidal and subtidal zones for marine fishes and invertebrates (Ben-David et al., 1996, 1998; Bowyer et al., 1994). Coastal river otters in Prince William Sound (PWS), Alaska, USA, exhibit high variability in social organization. Recent studies documented the occurrence of solitary individuals (Blundell et al., 2000; *in press a*), concurrent with the existence of large groups of up to 18 individuals (Blundell et al., 2000; *in press a*; Rock et al., 1994; Testa et al., 1994). In addition, scent marking at communal latrines (Ben-David et al. 1998; Bowyer et al., 1995; Testa et al., 1994), and helping behavior have been reported for river otters in Prince William Sound (Rock et al., 1994).

Our recent studies demonstrated that male otters exhibited higher degrees of sociality compared with females and occurred more often in same-gender groups. In contrast, females occurred more often in mixed gender groups (Fig. 1; Blundell et al., *in press a*). We were able to determine that social groups of otters were not kin based (i.e., animals did not tend to associate more with kin; Fig. 2; Blundell et al., *in review a*) and that sociality did not result in greater indirect reproductive success for river otters (through increasing reproductive success of kin; Fig. 3; Blundell et al., *in review a*). Similarly, we did not find a relation between degree of sociality and direct reproductive success for either male or female otters (Fig. 4; Blundell et al., *in review a*). Although we were limited in our ability to evaluate the hypothesis that sociality in river otters was an anti-predator adaptation because of difficulties in assessing the risk of predation by marine mammals (e.g., killer whale - *Orcinus orca*, and sea lions - *Eumetopias jubatus*), our data indicated that otters were more social during periods with lower predation risk (Blundell et al., *in press a*).

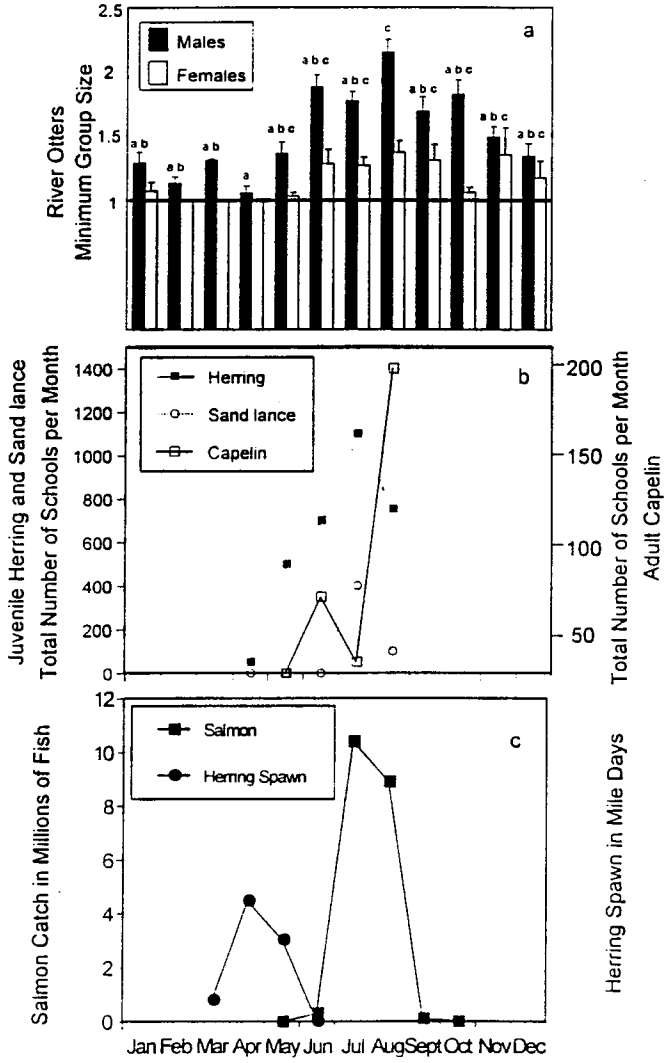

Figure 1 – Mean minimum size of groups for river otters inhabiting Prince William Sound, Alaska from 1996 to 1998 (top) in relation to availability of surface schools of pelagic fishes in the nearshore environment (middle; adapted from Brown et al., 1999), and the period of salmon availability (bottom) in southcentral Alaska and Prince William Sound (adapted from Groot and Margolis, 1991) and herring spawn measured in miles of aerial transects (ADF&G unpublished data, E. Brown pers. comm.). Seasonal changes in group-size of otters appear to correlate with the abundance of schooling fishes.

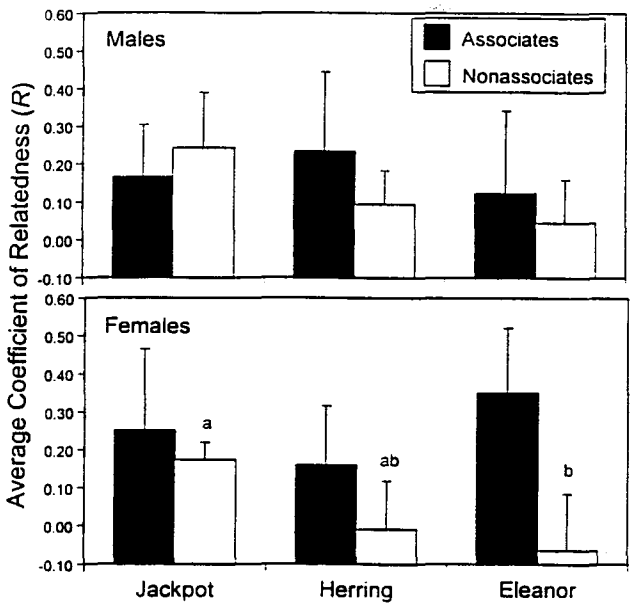

Figure 2 – An assessment, by gender, of the average relatedness ($R \pm$ SD) of radiotagged otters in Prince William Sound, Alaska (1996-1999) to river otters with which they associated (i.e., associates), compared with relatedness of individuals with which they did not associate (i.e., nonassociates). These data indicate that kinship did not influence group formation in river otters.

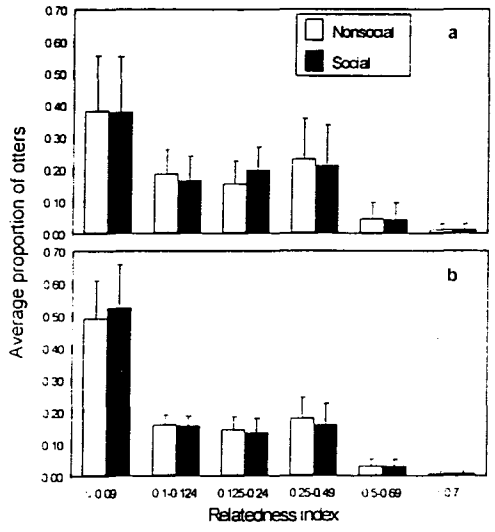

Figure 3 – An evaluation of indirect fitness, comparing the mean proportion (± SD) of relatives occurring in each relatedness category, between social and nonsocial otters, in Herring Bay, Jackpot Bay and Eleanor Island (**a**), and among all otters captured in northwestern PWS (**b**). There was no difference in mean proportion of relatives per category between social and nonsocial otters suggesting that social otters did not accrue indirect reproductive success through their association with relatives.

Our analysis indicated that larger groups of river otters occurred concurrently with availability of schooling pelagic fishes in PWS (Fig. 4; Blundell et al., *in press a*) suggesting that sociality influences foraging success on schooling fishes. Stable isotope analysis revealed that otters that were social in >10% of their locations had diets significantly higher in rapidly swimming pelagic fishes than did less social otters regardless of gender (Blundell et al., *in press a*). In addition, otters that were social >50% of the time had smaller home ranges than did less social otters, and asocial otters had the largest home ranges; an observation that agrees with increased foraging efficiency through cooperative foraging (Blundell et al., *in press a*).

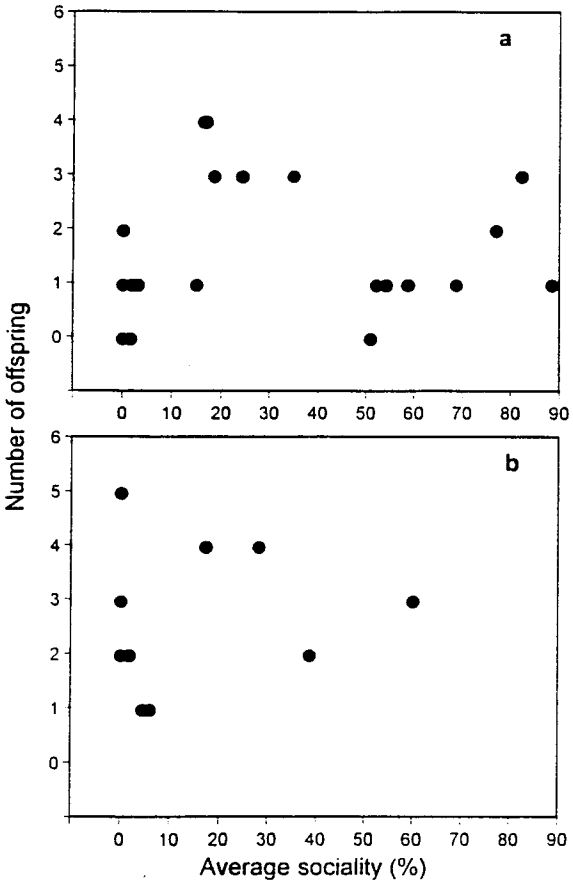

Figure 4 – An evaluation of direct fitness, comparing the degree of sociality (average percent of social locations among all years for each social otter) with the number of offspring for which the otter was identified as a parent. There was no correlation between sociality and number of offspring for male (a) or female otters (b) suggesting that sociality did not translate into higher reproductive success in either gender.

Taken in concert, our data and analyses indicate that sociality in river otters increases foraging success on schooling forage fish. Thus, the abundance and spatial and temporal distribution of these fishes will influence sociality in river otters. This observation is supported by experimental manipulations on captive otters at the Alaska SeaLife Center (project 348). In those experiments, foraging success on schooling fishes (e.g., pink salmon) were significantly lower than on intertidal fishes (e.g. kelp greenling) when otters foraged singly, but success dramatically increased when otters were allowed to forage in groups (Fig. 5; Ben-David, unpublished data). These and the stable isotope data indicate that solitary otters will benefit from foraging on intertidal and demersal fishes. The abundance and distribution of intertidal and demersal fishes, therefore, likely will determine spatial distributions and landscape use of solitary otters.

Sociality may be an important factor in determining dispersal patterns and gene flow in river otters. Our data indicated that although males exhibited higher levels of dispersal (including breeding dispersal), females dispersed greater distances, potentially because solitary existence prevents females from settling in neighboring home ranges (Blundell et al., *in review b*). In contrast dispersing males can join multi-male groups in neighboring home ranges. Thus, sociality in otters may influence the ability of otters to recolonize areas in which a catastrophic event (such as the *Exxon Valdez Oil Spill*) may cause extirpation of the local population (Blundell et al., *in review b*).

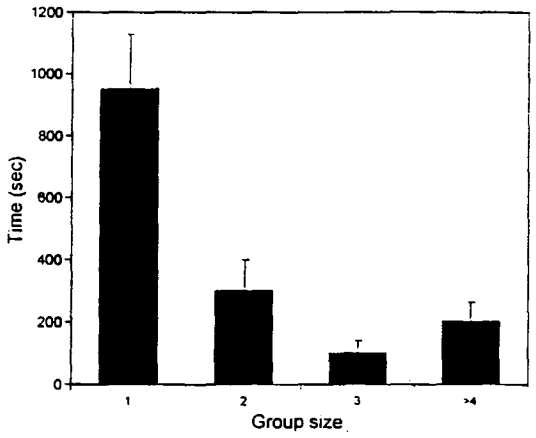

Figure 5 – Effects of group size on foraging efficiency as measured by the time from initiation of foraging to first capture of prey for captive river otters held at the Alaska Sealife Center, Seward, Alaska, USA (Ben-David et al., *in press*). Twelve otters were offered a school of 5 adult pink salmon (*Oncorhynchus gorbuscha*) and allowed to forage individually or in a group for 30 minutes (Ben-David, unpublished data). Increased group size significantly decreased time to first capture indicating increased foraging success.

Although our studies provide strong support for the relation between sociality in river otters and availability of schooling pelagic fishes, a critical test of this relation will require investigation of concurrent changes in spatial and temporal distribution of fish schools and those of otter groups. Data on annual, seasonal, and spatial variation in distributions of schooling fish was collected through efforts of the SEA project. Data on abundance and spatial distribution of intertidal and demersal fishes were collected in the NVP project. Similarly, data on spatial distribution and degree of sociality in river otters were collected by NVP researchers. An integration of these data using spatial and temporal models will provide insight to the mechanisms responsible for the formation of social groups in river otters and offer insights into how such factors will influence natural recolonization of river otter following local extirpation.

Spatial and temporal distribution of schooling fishes in PWS

From 1995 to 1999, information on forage fish distribution was collected using both aerial and acoustic surveys as part of the SEA and APEX programs. Extensive net sampling was included as a part of both acoustic survey programs. The aerial survey data sets include distributions of all surface schooling fish such as herring, sand lance, capelin and eulachon (however, information on juvenile herring and juvenile sand lance dominates the data). Seabird, shark, jellyfish, and marine mammal distributions are also recorded in the aerial data set. The acoustic data includes mainly herring and pollock, although there were some summer feeding adult capelin and sand lance schools documented in certain regions. The APEX acoustic/net sampling data also includes information about rockfish and sharks.

Methodology for the aerial surveys conducted for this project was developed in 1995-1996 and documented beginning in 1997 (Brown and Norcross 1997; Brown and Borstad 1998; Brown 1998; Brown et al., submitted) under the Sound Ecosystem Assessment (SEA) project. Broadscale measurements of forage fish distribution and abundance in PWS, the GOA inner shelf, and the OK were completed for June and July 1995-1997. In 1995-1996, other months were sampled. A broadscale survey was a single pass over most of the PWS coastline. In 1996-7, fine scale and repeat measurements were taken for a subset of herring nursery bays in eastern, northern, southwestern and central PWS in addition to the broadscale survey measurements. For

the APEX project, a single broadscale survey was conducted in July 1998 and 1999. In addition, we conducted daily, repeat surveys (n = 15) over the three APEX study regions in PWS (Northern, Central and Southwest), which represented the foraging range of two black-legged kittiwake colonies (Shoup Bay and Eleanor) as well as the study sites for APEX and NVP pigeon guillemot and APEX marbled murrelet projects.

Acoustic survey design, and thus data available, varied temporally and spatially between SEA and APEX. The study objectives varied as well; detailed studies on juvenile herring were the focus for SEA, whereas APEX was tasked with a broader goal of documenting distribution and fisheries oceanography of all available forage fish species (during seabird reproductive periods). For the SEA project, three broadscale acoustic surveys covering much of the nearshore (< 1 km) region of PWS were conducted in October 1995, March 1996, and July 1996. Starting in 1996, four representative herring nursery bays were selected; each representing a region (eastern, northern, southwestern and central) of PWS where juvenile herring were abundant. Temporally stratified (day and night; spring, summer, and fall) acoustic surveys were conducted in each of the four bays. For APEX, three broadscale acoustic surveys were completed annually during the fall (October or November), late spring (May) and mid-summer (July) starting in the fall of 1994 to the summer of 1997. From 1995 to 1996, both offshore and nearshore areas were surveyed. From 1998 to 1999, July was the only month surveyed and oceanography was dropped from the study objectives. Acoustic data collected prior to 1999 was scaled improperly. A supplemental fund was provided to this project to complete the rescaling of all surveys collected from 1995-98. In addition, APEX data was reprocessed and binned to enable comparisons with the SEA data. The combined SEA/APEX acoustic data will be incorporated into a single database. Raw data files were assembled and edited by Brown and Moreland; while the algorithms to rescale the data were developed by Dr. Ken Coyle (UAF) according to Thomas and Kirsch (1999). The rescaling was completed in November 2000.

The combined aerial/acoustic data will be "fused" and organized in bin groupings this summer as part of the APEX closeout work (Brown and Moreland 2000). This will entail normalization for the differences in spatial coverage, creating 3-D arrays of horizontal and vertical distribution, and clustering the acoustic data to identify schools. Each bin group created will be geocoded and thus perfectly suited for spatial analysis. This project will use the data set created for the APEX synthesis product.

Abundance of intertidal and demersal fishes in PWS

Abundance of intertidal and demersal (nearshore) fishes in PWS was estimated in an effort to determine differences in prey availability for river otters between oiled and nonoiled areas (Bowyer et al. *in review*). Fishes were sampled by SCUBA divers at 30 latrine sites used by otters in oiled and nonoiled areas in July 1996-97, as well as at 30 random sites at each location in both years. All fishes counted were classified into 3 size classes (<8 cm, 8-15 cm, >15 cm total length) and were identified to 8 categories: the perciformes – ronquils (Bathymasteridae), pricklebacks (Stichaeidae), and gunnels (Pholidae); as well as families in other orders, including cods (Gadidae), rockfishes (Scorpaenidae), sculpins (Cottidae), greenlings (Hexagrammidae), and other. While this data was invaluable in the determination of the status of recovery of river otters (Bowyer et al., *in review*), evaluating the data in relation to diet of otters (obtained through fecal and stable isotope analyses – conducted by G. M. Blundell and M. Ben-David) can be

instrumental in obtaining a better understanding of spatial distributions of otters, especially those solitary individuals. Additional information on abundance of intertidal and demersal nearshore fishes in PWS are available in Rosenthal et al. (1982), Barber et al. (1995), Laur and Haldorson (1996), and Dean et al. (2000).

NEED FOR THE PROJECT

A. Statement of Problem

As specialized fish-predators, river otters are dependent on abundance and availability of fishes and thus may act as a window to the spatial and temporal changes in fish distributions in the nearshore environment in PWS. Our recent explorations indicated that large groups of otters, composed mainly of males, occur concurrently with the nearshore migration of herring, capelin, sand lance, and salmon. In contrast, when forage fish are absent from the system river otters consume more intertidal and demersal fishes, and the degree of sociality declines. A critical test of the dependence of otter sociality on the availability of schooling fishes and the contribution of intertidal/demersal fishes to the diet of solitary otters (including reproductive females) can be achieved through integration of the wealth of data collected during previous phases of the NVP, SEA and APEX projects. This project is designed to integrate data collected on river otters in PWS through the NVP project and that on fishes collected in the NVP, SEA and APEX programs.

B. Rationale/Link to Restoration

Effective implementation of the *EVOS* Trustee Council's policy that "Restoration should contribute to a healthy, productive and biologically diverse ecosystem...", is complicated by the diversity and trophic interdependence of the numerous injured resources within the nearshore system. A synthesis of the data on the relation between spatial and temporal distributions of fishes and river otter sociality will result in a conceptual predictive model that can be used to address the potential effects of climate change on fishes and river otters. Such integration of data collected in different projects funded by the Trustee Council as part of the Restoration program will maximize benefits from these efforts and provide baseline information for evaluation of future changes in the environment (whether natural or human induced).

C. Location

Data analysis and report writing will be conducted in Fairbanks, Alaska, and Laramie, Wyoming. Investigators will travel between these locations as required.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

This project involved intensive data collection both in Prince William Sound, the Alaska SeaLife Center as well as in the different laboratories. We have recruited local high school, undergraduate and graduate students to assist in the data collection. We have interacted with

local communities and presented our findings to community members and the general public. Additional presentations will be organized in the future.

PROJECT DESIGN

A. Objectives

The objectives for FY02 are to complete data analyses, writing of at least one manuscript, and publication of results.

B. Methods

Data analysis on fish distributions and availability and river otter distribution and social organization will be conducted with GIS tools and appropriate mathematical and statistical models.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

This project is a collaborative research project of scientists from two university research centers and several laboratories (University of Alaska Fairbanks - Institute of Marine Science; University of Alaska Fairbanks - Institute of Arctic Biology – Spatial Ecology Laboratory; and the University of Wyoming). University of Alaska Fairbanks will be responsible for the research work order, and contracts to the University of Wyoming.

Professional services contracts and Research Work Order mechanisms will be used to transfer funds from Trustee Agencies to university and cooperators on this project.

SCHEDULE

A. Measurable Project Tasks for FY 00

This project will begin in October 2001 and will be completed in September 2003.

Oct.-Dec. 2001:	Complete spatial analyses of spatial and temporal data of fishes and otters
January 2002:	Attend Annual Restoration Workshop
Jan.-Sep. 2002:	Complete writing of manuscript(s) and submit for publication
Oct. 2002-Sep 2003:	Finalize publication of manuscript(s).

B. Project Milestones and Endpoints

FY 02: Data analysis and submission of manuscript(s)
FY 03: Finalize publication of manuscript(s)

C. Completion Date

The work will be completed by September 2003.

PUBLICATIONS AND REPORTS

Publications to be submitted by September 30, 2002:

Blundell, G. M., E. D. Brown, J. W. Kern, M. Ben-David, and S. C. Jewett. Forage fishes and river otter sociality: variation in spatial and temporal distributions. To be submitted to *Ecology*.

This manuscript will address the hypothesis that river otter sociality depends on the availability of schooling fishes. This hypothesis will be critically tested using data collected by SEA researchers on annual, seasonal, and spatial changes in distribution of forage fishes and data on spatial distribution and variation in sociality of river otters collected by NVP researchers. Analysis will require spatial modeling with GIS tools.

PROFESSIONAL CONFERENCES

The senior scientists on this project will present project results in 2002 at the annual *EVOS* meeting in January in Anchorage.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project is designed to integrate data collected on river otters (*Lontra canadensis*) in Prince William Sound (PWS) through the NVP project and that on fishes collected in the NVP and SEA programs.

PROPOSED PRINCIPAL INVESTIGATORS

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Stephen C. Jewett, Ph.D., has been at the School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, since 1974. He currently serves as Research Professor. During this time he has been involved in numerous benthic and intertidal investigations throughout Alaska that emphasize assessment and/or monitoring. He has authored or coauthored more than 40 publications in scientific journals and books. He has been the coordinator of the federal/state EVOS shallow subtidal investigations in Prince William Sound (1989-2000). Most recently he was a co-principal investigator on the NVP study, focusing on intertidal and nearshore fishes and invertebrates. His responsibility will include project coordination, data analyses, and writing of manuscript(s).

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Merav Ben-David, Ph.D. is an Assistant Professor in the Department of Zoology and Physiology, University of Wyoming. She has studied river otters in Prince William Sound since 1991 and has extensive experience in studying behavior of mammals and birds. Her research concentrates on the influence of animal behavior on ecosystem processes. She is an affiliated member of the IUCN/SSC otter specialist group. Most recently she was the principal investigator on the Captive River Otter Study (348), and affiliated with the NVP project. Her responsibilities in this project include data analysis and writing of manuscript(s).

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Gail M. Blundell defended her Ph.D. thesis on March 23, 2001. She conducted research on river otters in Prince William Sound as project leader for the river otter component of NVP. While collecting and analyzing data relative to NVP hypotheses, she also conducted her doctoral

research with an emphasis on behavioral ecology (gender differences in ecology, dispersion of individuals relative to prey resources and reproductive opportunities), spatial relationships (effects of relatedness on social organization and dispersion), and patterns of gender-biased dispersal and gene flow. She is an affiliated member of the IUCN/SSC otter specialist group. She will be the PI responsible for data analyses and writing of manuscript(s).

OTHER AFFILIATED INVESTIGATORS

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Evelyn D. Brown, Ph.D. candidate, has been with the University since 1995 as a research associate, working for the Alaska Department of Fish and Game for over 10 years prior to that. She has focused studies on Pacific herring (retrospective, stochastic modeling of recruitment), forage fish distribution and ecology (spatial analyses), and is currently working on development of airborne remote sensing tools for the marine ecological and fisheries research. This year, she will be completing a synthesis analysis of environmental factors affecting forage fish distribution in PWS and that same data set will be used for this study. Her responsibility on this project will be providing the SEA/APEX data and assisting with spatial analysis of fish distribution and publications. No funding is requested for E. Brown as she will be funded through other sources.

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John Kern has extensive experience in analyzing spatial data and knowledge of statistical modeling. He has been involved in data analysis of data collected through the NVP, SEA, and APEX projects. He will provide advice on data analysis. No funding is requested for Kern as he will be funded through other sources.

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Approved TC 8-9-01

2002 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002
Personnel		$0.0
Travel		$0.0
Contractual		$30.3
Commodities		$0.0
Equipment		$0.0
Subtotal		$30.3
General Administration		$2.1
Project Total		$32.4
Full-time Equivalents (FTE)		0.2
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
Estimated FY 2003					

Dollar amounts are shown in thousands of dollars.

Comments:

FY02

Prepared:

Project Number: 02593 Revision
Project Title: River Otter and Fishes in the Nearshore Environment
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2002 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002	[redacted]
Personnel		$17.4	
Travel		$1.3	
Contractual		$5.4	
Commodities		$0.1	
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS
Subtotal		$24.2	Estimated FY 2003
Indirect		$6.1	
Project Total		$30.3	$22.3
			[redacted]
Full-time Equivalents (FTE)		0.2	
	Dollar amounts are shown in thousands of dollars.		
Other Resources			

Comments:

The indirect rate is 25% TDC, as negotiated by the *Exxon Valdez* Oil Spill Trustee Council with the University of Alaska.

FY02

Prepared:

Project Number: 02593 Revision
Project Title: River Otter and Fishes in the Nearshore Environment
Name: Stephen C. Jewett

FORM 4A
Non-Trustee
SUMMARY

2002 *EXXON VALDEZ* TR E COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2002
Jewett, S.	PI/Research Professor		0.5	8.1		4.2
Blundell, G.	Research Associate		2.4	5.6		13.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.9	13.7	0.0	
					Personnel Total	$17.4

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 2002
Fairbanks to Anchorage		300.0	2	6	120.0	1.3
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$1.3

FY02

Prepared:

Project Number: 02593 Revision
Project Title: River Otter and Fishes in the Nearshore Environment
Name: Stephen C. Jewett

FORM 4B
Personnel
& Travel
DETAIL

2002 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Contractual Costs:	Proposed FY 2002
Description	
Subcontract: University of Wyoming (M. Ben-David)	4.0
Shipping, photocopying	0.4
GIS computer fee	1.0
Contractual Total	$5.4

Commodities Costs:	Proposed FY 2002
Description	
Project supplies	0.1
Commodities Total	$0.1

FY02

Prepared:

Project Number: 02593 Revision
Project Title: River Otter and Fishes in the Nearshore Environment
Name: Stephen C. Jewett

FORM 4B
Contractual & Commodities DETAIL

2002 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 2002
Description			
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number of Units	
Description		

FY02

Prepared:

Project Number: 02593 Revision
Project Title: River Otter and Fishes in the Nearshore Environment
Name: Stephen C. Jewett

FORM 4B
Equipment
DETAIL

UNIVERSITY OF ALASKA
FAIRBANKS

SFOS Budget Worksheet
Year 1
1 October 2001 -- 30 September 2002

SALARIES AND BENEFITS				
Wages	Months	Hrly. Rate		Total
Jewett, S.	0.50	$37.21	$3,237	
Blundell, G.	2.37	$21.47	$8,863	
Leave Benefits				
Jewett, S.			$19	
Blundell, G.			$1,773	
Staff Benefits				
Jewett, S.			$895	
Blundell, G.			$2,616	
TOTAL SALARIES AND BENEFITS				**$17,403**
TRAVEL				
Domestic				
2 R/T Fairbanks to Anchorage @ $300 ea.		$600		
Per diem (6 days @ $120/day)		$720		
Total Domestic			$1,320	
TOTAL TRAVEL				**$1,320**
SERVICES				
Subcontract: University of Wyoming (M. Ben-David)			$4,000	
Shipping, photocopying			$400	
GIS computer fee			$1,000	
TOTAL SERVICES				**$5,400**
SUPPLIES				
Project supplies			$100	
TOTAL SUPPLIES				**$100**
TOTAL DIRECT COSTS				**$24,223**
FACILITIES AND ADMINISTRATION	Type= TDC		Rate =	25.0%
			Base =	$24,223
				$6,057
TOTAL FUNDING REQUESTED				**$30,280**
ADFG Overhead	Type=	TDC	Rate=	0.07
			Base=	$30,280
				$2,120
TOTAL REQUESTED TO EVOS				$32,400

Revision 7-11-01
Approved TC 8-6-01

Permanent Archiving of Specimens Collected in Nearshore Habitats

Project Number:	02608
Restoration Category:	Monitoring
Proposer:	N. Foster/UAF
Lead Trustee Agency:	ADFG
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	New
Duration:	1st yr. 1 yr. project
Cost FY 02:	$61.6
Cost FY 03:	$0.0
Geographic Area:	Prince William Sound
Injured Resource/Service:	Nearshore and deep benthic ecosystems

ABSTRACT

This project will support acquisition and archiving of marine invertebrate specimens collected as part of EVOS assessment studies in Prince William Sound between 1990 and 1995. Specimens represent a time series of samples from eelgrass and kelp forest habitats. As a result of these efforts, there will be an improved set of baseline data for the marine biota of Prince William Sound.

INTRODUCTION

This project will support the acquisition and archiving in the University of Alaska Museum (UAM) of collections made by the University of Alaska School of Fisheries and Ocean Sciences from nearshore subtidal environments of Prince William Sound. The project will address the need to "analyze and synthesize existing data sets." including "collections of specimens and archived samples." described in the RFP. Specimens and samples archived at the UAM will be included in a system that assures their perpetual availability to the scientific community. The disposition of samples and documentation of scientific work based on them will be available on the Museum's website. At least one paper describing range extensions and biogeography will be prepared.

NEED FOR THE PROJECT

A. Statement of Problem

Collections made by the University of Alaska School of Fisheries and Ocean Sciences represent an extensive survey of the invertebrate fauna of Prince William Sound (Jewett et al. 1994). The physical condition of the specimens is excellent, and locality and taxonomic information are available with each, but this valuable collection and its associated data are not easily accessible, either to EVOS stakeholders or to scholars, and their long-term care is not assured. Unless collections are archived, they could be lost, neglected or ruined.

The scientific value of these specimens has been established. A subset was re-examined as part of research on potential introductions of nonindigenous species into Prince William Sound (Foster, chapter 9E in Hines et al. 2000). For that project, annotated species lists were developed to help taxonomic experts establish a baseline for the status of nonindigenous species in Prince William Sound (Foster and Feder, Chapter 10 in Hines et al. 2000). One hundred two species records in the data sets are derived from the EVOS specimens. Thirteen species are potentially undescribed, and seven are the first records of the species' occurrence in Alaska.

B. Rationale/Link to Restoration

The proposed project is closely linked to both the research and the monitoring needs of restoration. Because these specimens are the physical documentation of resources present in Prince William Sound, they are essential to assessment and to monitoring studies (such as GEM) which depend on accurate identifications for their scientific validity. As a result of these efforts, there will be an improved set of baseline data for the marine biota of Prince William Sound. These data will be both the physical specimens, available for teaching and research, and a remarkable set of geographical and time series data on distribution of marine invertebrates in biologically important subtidal habitats.

This new set of specimens will be a valuable addition to the systematic collections at the UAM which have been active and growing, particularly in the past decade. The UAM's biological collections will continue to expand in the near future through UAM's Arctic Archival Observatory. Through this project, all of the UAM's scientific collections will be brought into a single georeferenced database with extensive Worldwide Web interfaces for querying and mapping results. In addition to "label data" the database will include extensive information on how individual specimens were generated and how they have been used in subsequent investigations. In September of 2001, a new Curator of Fishes, Dr. Gordon Haas, will join the UA Museum staff and assume some responsibility for marine collections. Additionally, the Museum's long-term plan includes hiring a curator for marine invertebrates in FY 2003. The UAM is expanding its capacity for housing regional

natural history collections with an expansion campaign intended to approximately double the size of the existing structure.

C. Location

This work will take place at the University of Alaska Fairbanks. The project should benefit scientists, the lay public, educators, and subsistence users working in the Sound and Gulf of Alaska coast areas. Further, the Museum's marine invertebrate collections are accessible to the world-wide scientific community.

PROJECT DESIGN

A. Objectives

The project's objectives are to:

1. Keep specimens and associated locality data collected as part of oil spill studies from being lost.
2. Make information based on the specimens (that is, species composition and distribution of Prince William Sound and Gulf of Alaska marine invertebrate fauna) available to stakeholders.

B. Methods

The nearshore subtidal specimens represent a time series for four localities in Prince William Sound, Drier Bay, Lower Herring Bay, Moose Lips Bay, and Mallard Bay. Collections were made in 1990, 1991, 1993, and 1995. Specimens were collected by divers at three depths, (to 20 meters) within eelgrass beds. Identification to genus and species level was accomplished at the University of Alaska School of Fisheries and Ocean Sciences, with additional taxonomic assistance from Nora Foster, UA Museum and Dr. Jerry Kudenov, University of Alaska Anchorage.

The specimen archive consists of 30 "banker' boxes" containing alcohol-preserved specimens stored in vials within taped plastic bags. They have been sorted by taxon and locality. The physical condition of the specimens is excellent, locality and taxonomic information are available with each. There are about 800 specimens per box.

Incorporating the collections into the UA Museum Collection involves three tasks: accessioning, in which permanent records are created for assemblages of specimens to which the museum has title; cataloging, in which individual specimens are assigned numbers and entered as records in an electronic catalog; and finally the specimens are placed within the museum shelves, usually in taxonomic order. The specimens will be stored in sealed vials to assure quality. As part of cataloging, the specimens will be screened for quality, so that fragmentary, damaged or otherwise inappropriate specimens will not be retained. Quality screening will reduce the actual number of specimens acquired by over 50%. The cataloging process leads easily into the basis for a paper on range extensions and biogeographic relationships of Prince William Sound invertebrate fauna, and a draft could be completed within the first year of funding.

Responsibility for long-term care of these specimens will reside with the Museum. The new acquisition will supplement existing marine invertebrate collections which currently number approximately 50,000 lots. The Museum annually budgets funds to curators and collections managers for necessary maintenance supplies, for these specimens supplies would include replacement, alcohol, vials, and labeling paper. The curator or assistant will be responsible for requests for data or loans of specimens. (see letter of support, attached)

C. Cooperating Agencies, Contractors, and other Agency Assistance

The University of Alaska School of Fisheries and Ocean Sciences will donate the specimens and copies of associated locality data to the Museum. Max Hoberg, a Technician with the School of Fisheries will work on this project at the Museum.

SCHEDULE

A. Measurable Project Tasks for FY 02 (October 1, 2001- September 30, 2002)

November 30: Accession numbers assigned, accession log created
January 13-23: Attend annual restoration workshop
March 30: Specimen labels prepared
April 1: Specimens unpacked, sorted by taxon
April 15: Complete annual report to EVOS Trustees
August 1: Specimens sorted, labeled and incorporated into Museum shelving
July 30: All species locality data available to Gordon Jarrell to incorporate into Arctic Observatory database
August 31: Complete manuscript on distribution of marine mollusks and polychaetes

B. Project Milestones and Endpoints

1. Keep specimens and associated locality data collected as part of oil spill studies from being lost. This objective will be met by November 30, when specimens will be physically in the Museum and accessioned.
2. Make information based on the specimens (that is, species composition and distribution of Prince William Sound and Gulf of Alaska marine biota) available to stakeholders. This objective will be addressed by August 30 when a manuscript on the distribution of marine mollusks and polychaetes will be completed; it will be met when the publication has been accepted by a peer reviewed journal.

C. Completion Date

All milestones, except acceptance the resulting paper by a peer-reviewed journal will be completed within the fiscal year (before September 30, 2002).

PUBLICATIONS AND REPORTS

An annual report to the Trustees Council will be submitted by April 15, as required by the Invitation to Submit Proposals. A paper on distribution and habitats of subtidal annelids and mollusca (title and co-authorship to be determined), could be submitted to the following journals: the Veliger, International Review of Hydrobiology, or other journals to be considered.

PRINCIPAL INVESTIGATOR

Nora R. Foster
Aquatic Collection
University of Alaska Museum
Fairbanks, Alaska 99775
(907) 474-7994 fax
(907) 474 5469
fyaqua@uaf.edu

QUALIFICATIONS OF PRINCIPAL INVESTIGATOR

Education

University of Alaska B.S., 1969 Biological Sciences
University of Alaska M.S., 1979 Biological Oceanography

Employment

1999-present	Coordinator, Aquatic Collection, University of Alaska Museum (part-time affiliate)
1997-present	Taxonomic consultant, self-employed
1997	Project Manager/Biologist, Prince William Sound Science Center, Cordova, Alaska
1981-1997	Coordinator, Aquatic Collection University of Alaska Museum

Selected Reports and Publications

Lee, R. S. and N. R. Foster. 1985. A Distributional List with Range Extensions of the Opisthobranch Gastropods of Alaska. The Veliger 27(4):440-448.

Juday, G. P. and N. R. Foster. 1990. A preliminary Look at the Effects of the Exxon Valdez Oil Spill on Green Island Research Natural Area. Agroborealis 22 (1):10-17.

Foster, N. R. 1991. Intertidal Bivalves: A Guide to the Common Marine Bivalves of Alaska. University of Alaska Press. 152 pp.

Feder, H. M., N. R. Foster, S. C. Jewett, T. J. Weingartner, and R. Baxter 1994. Distribution of Mollusks in the Northeastern Chukchi Sea. Arctic 47(2):145-163.

Scheel, D., N. R. Foster, and K. Hough 1998. Habitat and Biological Assessment: Shepard Point Road and Port Project. Report to the City of Cordova, Alaska. Prince William Sound Science Center, Cordova, Alaska. (www.pwssc.gen.ak.us/~shepard).

Goddard, J. H. R. , and Foster, N. R. [in press] Range extensions of saccoglossan and nudibranch molluscs (Gastropoda: Opisthobranchia) to Alaska. Submitted to the Veliger March 2001.

Experience and Interests:

Taxonomy, ecology, and biogeography of marine invertebrates of the north Pacific and Arctic; care of invertebrate collections, zooarchaeology of shellfish

OTHER KEY PERSONNEL

Max K. Hoberg (UAF Institute of Marine Science)
Responsibilities: Manage project on day-to-day basis; assign accession numbers to specimens, enter data; unpack boxes; sort specimens by taxon; screen for quality; arrange in systematic order; design, print labels; order supplies.

Gordon H. Jarrell (UA Museum)
Responsibilities: Assure that data generated by this project is compatible with other Museum cataloging projects, especially the Arctic Observatory database; design computer printed labels and data interfaces for input and query of the database.
Stephen C. Jewett and Arny Blanchard (UAF Institute of Marine Science)
Responsibilities: Assist Jarrell and Hoberg with transfer of data files and specimens.

Howard M. Feder (UAF Institute of Marine Science)
Responsibilities: Contribute ideas and co-author paper on distribution of subtidal invertebrates.

Jerry Kudenov (University of Alaska Anchorage)
Responsibilities: Expertise on identification of annelids; contribute ideas and co-author paper on distribution of subtidal invertebrates.

LITERATURE CITED

Hines, A. H., G. M. Ruiz, J. Chapman, G. I. Hansen, J. T. Carlton, N. Foster & H. M. Feder. 2000. Biological invasions of cold-water coastal ecosystems: ballast-mediated introductions in Port Valdez / Prince William Sound, Alaska. Final Report to the Prince William Sound Citizen's Advisory Council, U.S. Fish and Wildlife Service and National Sea Grant Program.

Jewett, S. C., Dean, T. A, Smith R. O., Stekoll, M., Haldorson, L. J., McDonald, L., and Laur D. R., 1995. The effects of the Exxon Valdez Oil Spill on Shallow Subtidal Communities in Prince William Sound, Alaska, 1989-93. Restoration Project 93047 (Subtidal Study 2A) Final Report to the Alaska Department of Fish and Game.

Revised 9-12-01
Approved TC 8-6-01

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002
Personnel		$0.0
Travel		$0.0
Contractual		$57.6
Commodities		$0.0
Equipment		$0.0
Subtotal	$0.0	$57.6
General Administration		$4.0
Project Total	$0.0	$61.6
Full-time Equivalents (FTE)		0.0
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
Estimated FY 2003					

Dollar amounts are shown in thousands of dollars.

Comments:

FY02

Prepared: 8/16/01

Project Number: 02608
Project Title: Permanent Archiving of Specimens Collected in Nearshore Habitats
Agency: ADF&G

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Revisi 7-12-01
Approved TC 8-6-01

Budget Category:	Authorized FY 01	Proposed FY 02
Personnel		34.89
Fringe Benefits		9.41
Travel		0.44
Services		0.30
Commodities		1.00
Equipment		
Subtotal		46.04
Indirect		11.51
Project Total		57.55
Full-Time Equivalents		0.83

LONG RANGE FUNDING REQUIREMENTS
Estimated FY 03

Dollar amounts are shown in thousands of dollars

Other Funds		

Coments:
The indirect rate is 25% charged by the University of Alaska
All travel is for attendance at the annual restoration workshop

FY 02

Project Number: 02608

Project Title: Permanent Archiving of Specimens Collected in Nearshore Habitats

Name: University of Alaska Museum

FORM 4A

Non-Trustee SUMMARY

Prepared: 12-Jul-01

Personnel Costs:			Months	Monthly	Overtime	Proposed
	Name	Position Description	Budgeted	Costs		FY 02
	N. Foster	*Coordinator, Aquatic Collection	3	$3,375.00		$10,125.00
	M. Hoberg	Technician	6	$4,127.35		$24,764.10
		Subtotal				$34,889.10
Staff Benefits:						
	* Nora Foster 3 months at 520 hours x $19.47 justified because she does not receive salary support from the University of Alaska Museum benefit rate of 7.6% is used for temporary employees					
	Foster					$769.50
	Hoberg					$8,642.67
					Personnel Total	$44,301.27

Travel Costs:						
	Description	Ticket Price	Round Trips	Total Days	Total Per Diem	Proposed FY 02
	Foster- to Anchorage to attend restoration workshop	$200.00	1	2	$120.00	$440.00
					Travel Total	$440.00

FY 02

Project Number: 02608

Project Title: Permanent Archiving of Specimens Collected in Nearshore Habitats

Name: University of Alaska Museum

FORM 4B

Personnel & Travel DETAIL

Prepared: 12-Jul-01

Contractual Costs:	Proposed
Description:	FY02
communication, identification services and printing	$300.00
Contractual Total	$300.00

Commoditions Costs:	Proposed
Description:	FY02
We will require jars of various sizes, from .5 to 3 liters, ethyl alchohol for preservation, and paper for archival labels.	$1,000.00
Commodities Total	$1,000.00

FY 02

Project Number: 02608
Project Title: Permanent Archiving of Specimens Collected in Nearshore Habitats
Name: University of Alaska Museum

FORM 4B
Contractual and Commodities
DETAIL

Prepared: 12-Jul-01

Revision 7-6-01
Approved TC 8-6-01

Kodiak Archipelago Youth Area Watch

Project Number:	02610
Restoration Category:	General Restoration
Proposer:	Kodiak Island Borough School District
Lead Trustee Agency:	ADFG
Cooperating Agency:	Kodiak Island Borough School District
Alaska SeaLife Center:	Yes
Duration:	3rd year, 3-year project
Cost FY 02:	$57.8 (project cost) + $4 (ADF&G GA) = $61.8 (total)
Cost FY 03:	$53.9
Geographic Area:	Kodiak Archipelago
Injured Resources/Services:	Harbor seals, sub-tidal and inter-tidal communities, subsistence, archaeological resources, and commercial fisheries

ABSTRACT

The Kodiak Archipelago Youth Area Watch will engage students in projects with goals aligned with the general restoration efforts of the Trustee Council. Students and site coordinators will conduct interviews with local experts and document TEK, publishing it in a District oral history magazine. Participation of KAYAW adults and students in the annual Academy of Elders/Science Camp will be strongly recommended. Such participation will serve as another avenue for more tribal members to learn about restoration efforts, scientific monitoring techniques, and occupations related to such work. The value and implications of TEK will be strongly emphasized throughout the implementation of the KAYAW project.

INTRODUCTION

In FY 99, Chugach Regional Resources Commission collaborated with the Kodiak Island Borough School District to institute an internship program within the Community Involvement Project. This internship program chose one student in the communities of Akhiok, Larsen Bay, Old Harbor, Kodiak and Ouzinkie. In FY 00 this project was expanded to develop the Kodiak Archipelago Youth Area Watch Program. The program collaborated with four research projects in FY 00, including EVOS-sponsored 00482, PSP Field Testing Kit; EVOS-sponsored 00245, Harbor Seal Bio-Sampling; intensive monitoring with the Fisheries Industrial Technology Center and National Oceanic and Atmospheric Administration; and an algae testing project with Dr. Gerry Plumley.

During FY 01 the project included the expansion into two additional communities, Chiniak and Port Lions; site teacher training in collaboration with the Kodiak College; the construction of a web site for students, teachers, administrators, and project scientists to collaborate, share, and coordinate projects, as well as post data; additional equipment for monitoring activities; and, participation by students, teachers and scientists in the annual Science Camp held at Afognak.
All these steps will continue the project in the direction of student oceanographic monitoring in collaboration with the Fisheries Industrial Technology Center, continued beach monitoring for PSP and algal blooms, harbor seal bio-sampling, and hands-on training for a select number of students within the Kodiak Island Borough School District with western scientific knowledge and traditional ecological ways of knowing. A project with the National Marine Fisheries Service to investigate the presence of sandlance and capelin has been integrated as well.
The Youth Area Watch program instituted in the Prince William Sound and lower Cook Inlet has been one of the most popular and supported projects that the Trustee Council has implemented. The spill area does not strictly include only those areas; it also encompasses the Kodiak Archipelago and the Alaska Peninsula.

During the spring of 1998 Kodiak Island Borough School District personnel and the Chugach Regional Resources Commission personnel began to discuss the development of the Kodiak Youth Area Watch. In September 1998 CRRC was funded through the EVOS Trustee Council to implement the KYAW project. The KIBSD and the CRRC later signed a Memorandum of Agreement.

In January 1999 KYAW applications were sent to all eight communities in the Kodiak archipelago to prompt student, teacher, and community participation. The village of Larsen Bay had one intern, the village of Karluk had one intern and one alternate, the village of Old Harbor had one intern and one alternate, and the village of Akhiok had one intern. Each of the six student interns researched, locally, the effect of the 1989 oil spill in their village by interviewing elders and other community members. Students also participated in the 10^{th} year Symposium held in March 1999 where they reported on the status of their research activities within the KYAW Program.

During the remainder of the spring of 1999, CRRC and KIBSD personnel researched possible projects for the KYAW and sought to increase the number of students participating. CRRC later

submitted a proposal to continue the KYAW for FY 00. Once the proposal was approved, CRRC and the KIBSD signed a Memorandum of Agreement.

In FY 00, the KIBSD and CRRC were successful with implementing four core research projects, two of which were funded by the Trustee Council. These projects included 1) 00482, Field-Testing of PSP Test Kits for Subsistence Use; 2) 00245, Harbor Seal Bio-sampling, will train and involve KYAW participants in the program. They were trained in how to conduct a bio-sample, where to ship the sample, and what the uses of the seal are for research: 3) Dr. Gerry Plumley, University of Alaska-Fairbanks, received funding from the Alaska Science and Technology Foundation to test algae for a possible connection to the infection of PSP to shellfish. He has involved KYAW participants in FY 00 and will continue to utilize them in FY 01; and 4) the Fisheries Industrial Technology Center and National Oceanic and Atmospheric Administration have been working closely with the program to develop and implement a long-term, consistent monitoring program that will focus on salinity, water temperature, and a host of other oceanographic indicators. Comprehensive monitoring kits were purchased for the participants in each of the communities to use.

Increased involvement by students, teachers and community members was realized during the 1999-2000 school year to include: four students from Ouzinkie, one teacher and one community member; two students from Old Harbor, one teacher, and several community members; two students from Larsen Bay, one teacher, and one community member; two students from Kodiak, and one teacher; and two community members from Akhiok. Total involvement for 1999-2000 school year included ten students, four teachers, and over five community members.

During the 1999-2000 school year many KAYAW project activities took place. In the fall of 1999 a KAYAW orientation meeting took place in Kodiak to connect the District teachers with the scientists and their projects. During the Kodiak Island Borough School District Rural School's Science Fair the community members from Akhiok performed seal bio sampling with seals that had been harvested for a community dinner. A number of students from throughout the region, as well as their teachers, were exposed to the data collection and purpose of this project. Orders were taken to purchase equipment for the students to use. This was done through the recommendations given by the scientists, and coordinated by Brian Himelbloom and Bob Pfutzenreuter of University of Alaska-Fairbanks and the Fisheries Industrial Technology Center located in Kodiak. In December another meeting was held to further the development and organization of the KAYAW.

In 2000 a student/teacher orientation meeting took place to train participations in the use of the equipment and process data collection and reporting. Old Harbor School began to redesign their High School Science studies in order to integrate the KAYAW into their general requirements. During the 2000-01 school year the teachers focused more of their curriculum on marine studies, school-wide, K-12. Students began to collect data pertaining to ocean water temperature, presence of algae, general weather conditions, marine mammal sightings, and seal bio sampling. Students also began research regarding PSP and its presence in the Kodiak waters. In June of 2000 another training session took place that introduced participants to the collection of samples and use of the PSP testing kit created by Jellet Biotek.

During FY 01 we continued the efforts of the previous years of this program. The Alaska Native Harbor Seal Commission, through 01245, Harbor Seal Bio-sampling continued to support the program through bio-sample training in Old Harbor and Kodiak and included students and hunters from throughout the region. The Fisheries Industrial Technology Center and National Oceanic and Atmospheric Administration, and the National Marine Fisheries Service continue to collaborate with the project and students to collect oceanographic monitoring data. This information will be used to assist the Trustee Council with the Gulf Ecosystem Monitoring Plan. Data collected through this program will fill a hole of oceanographic information that will be necessary for the formation of a 100-year data set. Continued work with 01482, Field-Testing of PSP Test Kits for Subsistence Use was achieved in FY01 regarding beach monitoring and chronic PSP site identification. Students have begun to work on mapping traditional use areas, which include Sugtestun terminology. The Chiniak site is working to determine the presence and abundance of sandlance and capelin along some Chiniak Bay beaches, as well.

In addition, students and site coordinators selected local projects to conduct and expand. Connections to traditional knowledge with integration of TEK data were made to enhance project reports and individual projects. Individual projects were developed and many were entered into the Kodiak Regional Rural Science Fair that is coordinated with the Alaska Rural Systemic Initiative with support from the Alaska Federation of Natives. Teri Schneider, Alutiiq Studies Coordinator for KIBSD and Aleut Regional Coordinator for AKRSI is very interested in pursuing this continued integration. It has proven to be a factor to motivate students to pursue individual or small group investigations that make sense to where and how they live. Student projects were expected to be presented at the March 2001 TEK Conference and CRRC Annual Gathering, but because of a conflict with scheduling, KAYAW students were unable to attend. Students will report their projects directly to the tribal council in their community. An intense "Immersion Institute" took place in April for all of Kodiak's rural high school student. With help from Henry Huntington, all of our students were training in the documentation, integration and use of TEK, and learned interview techniques. Each student was given the opportunity to interview community members and Elders, which led to the first re-publication of the oral history magazine, *Illuani*. A number of KAYAW students, also, presented their projects to local and regional Elders and western science judges during the Kodiak Regional Science Fair. Five of our students, including three who were working with the PSP testing, won honors to present their projects at the Alaska Native Science and Engineering Society's Statewide Science Fair and the Alaska Science and Engineering Science Fair.

NEED FOR PROJECT

A. Statement of Problem

Kodiak Archipelago Youth Area Watch shares much of the same values and objectives as the original Youth Area Watch in the Chugach region. The KAYAW participants are committed to assisting in the restoration of the spill area through the collection and requisite samples and data for principal investigators of research projects. Research dollars are often scarce – the assistance of labor through this project to the four core projects is an invaluable asset to the overall restoration effort.

The public aspect of this is also invaluable to the Trustee Council. Youth involved in science, especially Alaska Natives, has been difficult to achieve in many cases. This project gives students hands-on experience and an avenue to achieve goals that may have once seemed impossible. The Youth Area Watch projects have received tremendous support throughout the spill area and beyond and the benefits of this project are felt in many different arenas. The Trustee Council would be supporting a win-win situation by funding this project again.

It is not sufficient for our KAYAW to wait for interested scientists to ask for help from the students, as has happened to some extent in Prince William Sound. Instead, the KAYAW will begin to create some of its own activities, building upon the special projects that some sites have already begun in previous years. Because they can't guarantee if or when outside scientists might become interested in the product of their efforts, students and site coordinators will begin to focus on addressing local interests and concerns. This will also help to build local support and give the students a sense of contributing to something substantive immediately, rather than just completing homework assignments and filing monitoring information for possible future use.

Given the need to have the tribes involved in GEM and in work related to documenting, learning and applying traditional knowledge, the KAYAW coordinator, site coordinators and student participants will organize a joint workshop with the tribes and the school district to outline a long term KAYAW program that draws upon traditional knowledge to develop a local environmental assessment and monitoring program. There are great resources among the students, the teachers, school district staff, and the Elders. Bringing them together on a collaborative project that focuses on the ecology, natural history and cultural perspectives of each could accomplish great things.

This work will begin with a traditional and scientific inventory of the local ecosystems around each community. The students will interview Elders, read scientific publications, and describe what exists in their area. The description will include species, how they interact, how they are affected by the physical environment, how humans have and could use them, what impacts those uses would have, and where and when the species is particularly sensitive. A thorough inventory will take the form of a series of reports on various species or areas, and together the series would make a natural history encyclopedia of the region. These reports can be integrated into the student-developed website that each community has already established. Additional communication will be enhanced through a monthly KAYAW newsletter that will be disseminated throughout the region. By understanding how the local system works from the local perspective, the community will then be able to design a monitoring program that looks at parameters they find relevant to their interests and observations.

Such a program will take some time to set up and get going, but will be well worth the effort, capitalizing on the opportunity that exists in Kodiak by giving some structure to the enthusiasm that persists for KAYAW.

B. Rationale/Link to Restoration

The Kodiak Archipelago Youth Area Watch will work in primarily three areas. First, harbor seals disastrously affected by the oil spill are being studied under 02245. KAYAW participants would assist in this recovery effort of the Alaska Native Harbor Seal Commission and Trustee Council. Secondly, the focus on the archaeological resources will be an additional focus this year, capitalizing on the expertise of the Native owned and operated "Alutiiq Museum and Archaeological Repository." Our own Dr. Sven Haakanson, Jr. is now the director of that facility and is excited about the opportunity to work directly with the KAYAW project. Finally, the Fisheries Industrial Technology Center, the National Marine Fisheries Service, and the National Oceanic and Atmospheric Administration have ongoing oceanographic monitoring that is being done with KAYAW students. The eagerness of these organizations has been confirmed through their commitment in the development of the current monitoring data into a long-term KAYAW project.

The public/youth involvement through this project in the restoration process will assist the Trustee Council in their mission to inform and involve the public regarding the restoration program. A more direct line of communication between the Trustee Council and the Kodiak Archipelago communities will be established through the gathering, the newsletter and the website.

C. Location

Kodiak Archipelago Youth Area Watch will take place in the Kodiak Island communities of Akhiok, Old Harbor, Port Lions, Ouzinkie, Chiniak, and Kodiak (Larsen Bay and/or Karluk may participate depending upon fluctuating student enrollment.) Site coordinators and students will be continually trained through the school district, Kodiak College, the Fisheries Industrial Technology Center, the National Marine Fisheries Service, the Alaska Native Harbor Seal Commission, the Alutiiq Museum and Archaeological Repository, and the National Oceanic and Atmospheric Administration, and as other opportunities present themselves with visits to our island communities from the many scientists that travel there. Teri Schneider will serve as the coordinator and principal investigator for the program for the school district, with outreach to tribal councils through the Kodiak Archipelago. Additionally, traditional ecological knowledge will be integrated into the program with the assistance of TEK Specialist, Dr. Henry Huntington.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

In addition to assisting in research, community involvement and the utilization of traditional ecological knowledge are at the heart of this program. Tribal councils, schools, communities, regional organizations, and researchers will all be collaborating to ensure that this project is a success. KIBSD will work closely to ensure that each of the tribal councils where there are KAYAW participants will have a voice in the research and curriculum of the program. Cooperation and communication will be enhanced between the Principal Investigator and Kodiak area community facilitator, Paul Panamarioff. Traditional ecological knowledge will be integrated into the projects that students and communities design and collaborating researchers will be encouraged to utilize TEK on their particular projects. As KIBSD resurrects the oral history magazine, *Illuani*, it will become an additional avenue to communicate the importance

and application of local knowledge with regards to the environment and natural resources. Highlights from Elder interviews will also be featured in the monthly KAYAW newsletter, the museum's newsletter, and the already established weekly Kodiak Daily Mirror feature developed by the Native Educators group, "Sugtestun Voice."

PROJECT DESIGN

A. Objectives

Selected students in the identified communities will participate in the project to accomplish the following objectives:

1. Communicate KAYAW activities to each site, local agencies, and tribal councils.
2. Identify all research and data collection activities.
3. Orient researchers on working with students.
4. Conduct research with the three projects with cooperating scientists.
5. Purchase additional monitoring and research equipment for expansion and maintenance of area-wide monitoring, as needed.
6. Complete site teacher training in cooperation with the Kodiak College, the Fisheries Industrial Technology Center, the National Marine Fisheries Service, the Alutiiq Museum and Archaeological Repository, and the Alaska Native Harbor Seal Commission regarding science monitoring, research, and traditional ecological knowledge.
7. Conduct school orientations for KAYAW students.
8. Maintain the Kodiak Archipelago Youth Area Watch web site to store data, provide information regarding all activities, and coordinate efforts of staff, students, researchers, and community members.
9. Involve KAYAW students, scientists and Elders in the annual Science Camp to be held in July and August of 2002.
10. Complete student project training with tribal council and site teacher.
11. Facilitate project follow-up training with site teachers.
12. Organize and host an annual workshop with the tribes and the school district to outline a long term KAYAW program that draws upon traditional knowledge to develop a local environmental assessment and monitoring program.
13. Conduct interviews with Elders and community members with regards to developing a traditional and scientific inventory of the local ecosystems around each community.
14. Host scientific researchers to present findings, research, and their understandings of the Kodiak Archipelago to school and tribal communities.
15. Continue KAYAW efforts throughout the summer months when school is not in session.
16. Identify and develop individual and small group student research projects that are relevant to their community.

B. METHODS

The Kodiak Island Borough School District's Alutiiq Studies Coordinator will communicate directly with tribal councils throughout the island to ensure their meaningful involvement in the

project. Researchers involved will sign agreements to ensure their follow-through to involve the youth in their projects.

Teri Schneider, Alutiiq Studies Coordinator and support staff of the Kodiak Island Borough School District will work cooperatively to plan the involvement and logistics of youth, tribal councils and researchers fieldwork. Additionally, training will take place with all involved parties to ensure that this project will work for everyone.

We have selected methods to choose students based on academic standing, personal interest, and potential for improvement. Approximately 50 students will be participating in the third year of the project. While distribution varies according to interest and ability of students that apply, it is expected that the distribution will be as follows: 14 from Old Harbor, 14 from Ouzinkie, 2 from Larsen Bay and Karluk, 12 from Port Lions, 2 from Chiniak, 2 from Akhiok, and 4 from Kodiak. Fourteen of these students will be designated as interns. These students will be the primary ones to travel to special events and will be the 'leaders' of the projects. The rest of the students will participate to a lesser degree but will be actively involved in the local implementation of the projects. The communities with a large number of students participating have chosen to integrate the KAYAW Project into their science curriculum, allowing all high school and/or middle school students to participate in either all, or part of the projects.

Early in the school year, participating KAYAW teachers will congregate in Kodiak to conduct a two-day training on what the program will encompass. We will ask that researchers attend as well. Protocols from principal investigators and program details will be discussed. In addition to the site teachers, we will invite tribal council representatives.

All of the coordinating projects, archaeological site surveys, preservation and maintenance, algae testing, bio-sampling, and oceanographic monitoring will take place geographically close to the participant's communities. It will be the responsibility of the site teacher and participants to determine field schedules. Harbor seal bio-sampling will require two training sessions and coordination with local seal harvesters. The oceanographic monitoring project will require coordinated efforts on contracted vessels and such. This will be negotiated between the individual licensed boat operators and KIBSD. Schedules will be determined when appropriate. Quarterly, students and support staff will congregate via audio-conference or in person in a chosen community to discuss progress, brainstorm ideas, and evaluate the program. Written reports describing the students' activities and the progress of the program will be submitted to EVOS quarterly. Training will be on going and project objectives will be met.

Ongoing projects will include:

1. Archaeological site surveys, preservation and maintenance – Alutiiq Museum and Archaeological Repository – Dr. Sven Haakanson, Jr. and the staff of the museum will work directly with students, both in the lab of the museum and on site in the villages, to identify archaeological sites while teaching proper preservation and maintenance of the identified sites. Students will learn about erosion (natural and human-caused), care of found archaeological materials, while discouraging "pot hunting." Students will engage in

discovering the scientific and cultural relevancy of found objects through their interaction with Elders and scientists, while engaging in the local harvest of wild resources.

2. Harbor Seal Bio-sampling, 02245 – Alaska Native Harbor Seal Commission – KYAW will work with local harvesters involved in the program to bio-sample harbor seals caught for subsistence purposes. Mitch Simeonoff, Akhiok, will work with CRRC and the school district to train and involve students.
3. Fisheries Industrial Technical Center and National Oceanographic and Atmospheric Administration - This will involve utilizing the monitoring kits we have acquired in establishing and continuing a long-term oceanographic monitoring program. Indicators to be monitored will include ocean temperature, salinity, alkalinity, tides, and other information as it pertains to the project.

In addition to these four core projects, students will work with their tribal council or local site teacher to identify a local research project to implement that is achievable. We will encourage the tribal councils to identify an area of TEK that may be of interest and integrate that with western science methods. TEK Specialist Henry Huntington will be called upon to assist in this effort.

The participation of the students in the annual Science Camp will be an additional component of this year's program. The annual Science Camp is an opportunity for students, teachers and community members from across the Island to learn from Elders and other culture bearers how traditional ways of knowing can be incorporated into western science. This camp will allow students to present their work to the other camp participants, educating and enlarging the support and momentum of the project. The Science Camp will be an opportunity for youth to recap that activities of the year and plan for the coming year. The KAYAW student participants will have the opportunity to provide some introductory training while showcasing their skills in water monitoring, seal bio-sampling and traditional observational skills to younger students and interested community members.

The development of a web site that will be integrated into the Kodiak Island Borough School District will be maintained, as well. The Kodiak School District's Technology staff will work with project staff to continue construction and maintenance of the site. The formation of this web site is seen as a necessary step to bring the program to a new level of communication, coordination, and information transfer. There will be links created between this site and each of the community's websites. The KAYAW website will continue to be a place to post oceanographic data, PSP and algae data and results, capelin and sandlance presence, and harbor seal bio-sample information, as well as appropriate TEK.

School credit for the youth involvement in this project is strongly encouraged. High school juniors and seniors are strongly encouraged to integrate a KAYAW project into their junior or senior project. Other school credit may be earned in integrated math, science, technology, Alutiiq studies, social studies, or language arts. This will encourage even more participation and give credibility to the project among site teachers and students who are thinking about applying to the project. Students and site coordinators will be contracted to continue their work when school is not in session to guarantee the continuity of their monitoring and documenting efforts.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

The Kodiak Island Borough School District will serve as the administering agency for this project. The KIBSD and the Chugach Regional Resources Commission have worked together in past years to begin the KAYAW. KIBSD, however, is confident that proposing directly to EVOS will help to streamline our efforts and alleviate communication challenges that have existed in previous years. KIBSD will work hard to coordinate and collaborate with tribal councils, site coordinators, researchers, and students on the successful implementation of the project.

Partnerships with the Fisheries Industrial Technology Center, the National Marine Fisheries Service, and the National Oceanographic and Atmospheric Administration will continue to perpetuate the marine mammal monitoring and ocean-monitoring components of the project. Staff from each of these organizations has already integrated our KAYAW students into their research and outreach component of their programs.

Henry Huntington will be contracted to consult with the KAYAW coordinator and provide training to KAYAW students and tribal councils in the skills needed to conduct TEK investigations.

Individuals with 6-pack licenses may be contracted to provide transportation to remote sites in the monitoring and documentation processes.

SCHEDULE

A. Measurable Project Tasks for FY 02 (October 1, 2001 - September 30, 2002)

October 15:	Confirm research and data collection activities
October 31:	Site teacher, tribal, and researcher orientation
October 31:	Monthly newsletter is developed and distributed
November 15:	Students selected and preliminary site research plan is developed
November 31:	Individual or small group projects submitted to regional science fair
December 15:	School site orientations
December 15:	Student orientation and training
May 15:	Regional workshop is conducted
May 15:	Summer plans for continued work by students and site coordinators are submitted to Principal Investigator
May 25:	Students and site coordinators for summer work to be completed sign Contracts
July 15 - August 15:	Students, site coordinators and researchers participate in Science Camp

On-going activities will include:

October 1 - September 30:	Students conduct archaeological site surveys, preservation and maintenance
October 1 - September 30:	Students analyze found archaeological objects
October 1 - September 30:	Students conduct harbor seal bio-samples
October 1 - September 30:	Students conduct their local research project

B. Project Milestones and Endpoints

Ongoing:	Communicate KAYAW activities to each site, local participating agencies, and tribal councils.
October 1:	Identify all research and data collection activities.
Annually and as needed:	Orient researchers on working with students.
Ongoing:	Conduct research with the three projects.
Annually:	Purchase additional monitoring and research equipment for expansion of area-wide monitoring, as well as replacing consumable materials, such as test strips.
Biannually:	Complete site teacher training in cooperation with the Kodiak College, the Fisheries Industrial Technology Center, the National Marine Fisheries Service, the Alutiiq Museum and Archaeological Repository, and the Alaska Native Harbor Seal Commission regarding science monitoring, research, and traditional ecological knowledge.
Annually:	Conduct school orientations for KAYAW students.
Ongoing:	Maintain the Kodiak Archipelago Youth Area Watch web site to store data, provide information regarding all activities, and coordinate efforts of staff, students, researchers, and community members.
Annually:	Involve KAYAW students, local scientists and knowledgeable Elders in the annual Academy of Elders/Science Camp to be held annually in July and August.
Annually:	Conduct student project trainings with tribal council and site teacher.
Annually:	Facilitate project follow-up training with site teachers.
Annually:	Organize and host a joint workshop with the tribes and the school district to outline a long term KAYAW program that draws upon traditional knowledge to develop a local environmental assessment and monitoring program.
Biannually:	Conduct interviews with Elders and community members with regards to developing a traditional and scientific inventory of the local ecosystems around each community.
Ongoing:	Host scientific researchers to present findings, research, and their understandings of the Kodiak Archipelago to school and tribal communities.

C. Completion Date

Objectives identified in the project design will serve as guidelines for community involvement within the civil settlement throughout the life of the restoration effort. It is expected that the KAYAW will be completed upon termination of the restoration and monitoring effort.

PUBLICATIONS AND REPORTS

Project reports that will include a description of student activities and the progress of the program will be submitted to EVOS quarterly.

PROFESSIONAL CONFERENCES

Concentration of presenting project progress and results will be done locally in conjunction with gatherings pertaining to training opportunities and during the annual workshop in Kodiak.

NORMAL AGENCY MANAGEMENT

Not applicable.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project will work closely with the Community Involvement and GEM Planning Project (02052) and the Harbor Seal Biosampling Project (02245).

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

Many changes have been made in this DPD as compared to the previously funded DPD primarily in response to peer reviewer comments and lead agency suggestions. Reorganization of the KAYAW has been suggested to make it more efficient and effective. One full-time certified teacher would have one half of her duties specifically dedicated to the coordination and implementation of the project. The other half of this staff person's duties correlated well with the overall objectives and goals of KAYAW. The need for better island-wide communication will be met with a monthly newsletter that will be distributed through the region. Site coordinators and student participants will be contracted for their continued services through the summer months when school is not in session so that continuity of monitoring and communication will not be broken. The KAYAW students and adult participants will host an annual gathering focusing on TEK documentation and ecological assessments of each community of the Kodiak Archipelago. Publication and distribution of TEK documentation will be integrated into the KIBSD oral history magazine that is bi-annually distributed. Henry Huntington will continue his involvement as a TEK consultant, providing training for students and KAYAW tribes. Because a few of the original projects KAYAW worked with have no longer been funded by their sources, and

because there is an on-going need to protect archaeological sites and objects around the archipelago, the additional project with the Alutiiq Museum has been organized.

PROPOSED PRINCIPAL INVESTIGATOR

Teresa L. Schneider
Kodiak Island Borough School District
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Kodiak, Alaska 99615
(907) 486-9276
Fax: 486-9152
tschneider@kodiak.k12.ak.us

PRINCIPAL INVESTIGATOR

Teri Schneider is the Alutiiq Studies Coordinator for the Kodiak Island Borough School District and the Aleut Regional Coordinator for the Alaska Rural Systemic Initiative. Teri has been in this position since 1997. She works closely with all KIBSD Native and rural educational programs and projects and many AKRSI statewide and regional educational projects with goals to integrate Native Ways of Knowing into the public school system. Teri, an Alaskan Certificated Educator, is a member and the advisor/coordinator of the Native Educators of the Alutiiq Region, a professional organization that works closely with the Alutiiq Elders Council to implement Native educational initiatives. She has experience in project development and administration, tribal relations, and managing budgets. Ms. Schneider will be responsible for all expenditures, contracts, and project management duties that are approved by KIBSD administrative staff.

OTHER KEY PERSONNEL

1. Katie Lyons, Administrative Assistant for KIBSD, will assist with logistical arrangements and communications.
2. Marie Barni, KIBSD Educational Support Services Administrator, will provide administrative oversight and guidance. She has extensive experience in developing and managing budgets.
3. Carla Lam, KIBSD part time Environmental Education Coordinator and Certificated Secondary Science Teacher will assist the Principal Investigator and site coordinators with student research and project design. Ms. Lam will also work to integrate aspects of the KAYAW research and procedures into the existing KIBSD science curriculum, which will eventually help to define how we "do" science education in our district.
4. Eric Waltenbaugh, KIBSD Itinerant Curriculum Specialist, will assist the Principal Investigator and site coordinators in the gathering reporting of TEK through his continued development of the oral history magazine, *Illuani.*

5. Teachers from each of the KAYAW sites will fill the role as site coordinators. They are actively involved in building KAYAW into the school's curriculum while providing organization and communication for such activities in each of their communities.
6. Brian Himelbloom, Susan Payne, Vicki Vanek, Sven Haakanson, Jr., Kate Wynn, and Bob Foy are all scientists who have dedicated numerous hours of their time for the benefit of our KAYAW students will continue to work closely with the KIBSD coordinator, site coordinators, and students.

Approved 7-[illegible]-01
Revision 7-[illegible]-01

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002
Personnel		$0.0
Travel		$0.0
Contractual		$57.8
Commodities		$0.0
Equipment		$0.0
Subtotal	$0.0	$57.8
General Administration		$4.0
Project Total	$0.0	$61.8
Full-time Equivalents (FTE)		0.3
Other Resources		$141.0

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 2003					
$53.9					

Dollar amounts are shown in thousands of dollars.

Comments:

FY02

Prepared: 07/06/01

Project Number: 02610
Project Title: Kodiak Archipelago Youth Area Watch
Name: Kodiak Island Borough School District
Agency: ADF&G

FORM 3A
TRUSTEE
AGENCY
SUMMARY

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002
Personnel		$17.6
Travel		$21.2
Contractual	$57.8	$16.2
Commodities		$0.5
Equipment		$2.3
Subtotal	$57.8	$57.8
Indirect	$4.0	$4.0
Project Total	$61.8	$61.8
Full-time Equivalents (FTE)		0.3
Other Resources		$141.0

LONG RANGE FUNDING REQUIREMENTS					
Estimated FY 2003					
$53.9					

Dollar amounts are shown in thousands of dollars.

Comments:
*No indirect costs will be taken by the Kodiak Island Borough School District. Administrative oversight, secretarial support and general grants management will be absorbed as cost sharing contributions to this project. Total cost sharing contributions from KIBSD include 0.5 certified staff, facilities and utilities, miscellaneous commodities, site coordinator costs, additional costs for the coordination of the Science Camp, and expertise from the Native Educators organization and the Academy of Elders.
*Costs for the Principal Investigator to attend the annual restoration workshop is estimated at $700.00.
*Reorganization of the KAYAW is necessary to make it more efficient and effective. One full-time certified teacher will have one half of her duties specifically dedicated to the coordination and implementation of the project. The other half of this staff person's duties correlated well with the overall objectives and goals of KAYAW. The need for better island-wide communication will be met with a monthly newsletter that will be distributed throughout the region. Site coordinators and student participants will be contracted for their continued services throughout the summer months when school is not in session so that continuity of monitoring and communication will not be broken. An annual gathering focusing on TEK documentation and ecological assessments of each community of the Kodiak Archipelago will be hosted by the KAYAW students and adult participants. Publication and distribution of TEK documentation will be integrated into the KIBSD *Illuani* (an oral history magazine) bi-annual publication. Henry Huntington will continue his involvement as a TEK consultant, providing training for students and KAYAW tribes.

FY02

Prepared:07-06-01

Project Number: 02610
Project Title: Kodiak Archipelago Youth Area Watch
Name: Kodiak Island Borough School District

FORM 4A
Non-Trustee
SUMMARY

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2002
	T. Schneider	KAYAW Coordinator (0.3)	12.0	1.3	2.0	17.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	12.0	1.3	2.0	
					Personnel Total	$17.6

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2002
	T. Schneider, up to two roundtrips to each rural KAYAW site	0.2	8	8	0.1	2.4
	Site coordinator and student travel to Kodiak for trainings	0.2	22	42	0.1	8.6
	Student, site coordinator, researcher and Elder travel to science camp	0.2	12	4	0.1	2.8
	Student, site coordinator, researcher and Elder travel to workshop	0.2	17	35	0.1	6.9
	T. Schneider, one roundtrip to the Trustee Council's Annual Restoration Workshop	0.3	1	2	0.1	0.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$21.2

FY02

Project Number: 02610
Project Title: Kodiak Archipelago Youth Area Watch
Name: Kodiak Island Borough School District

FORM 4B
Personnel
& Travel
DETAIL

Prepared:07-06-01

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Contractual Costs:	Proposed
Description	FY 2002
Professional technical services from Huntington Consulting	3.0
Vessel charters	1.5
Printing of monthly newsletter	0.5
Communications	0.5
Professional technical services website development and maintenance	1.0
Summer site coordinators	3.0
Summer student participants	3.6
Elder honorarium for workshop attendance	3.1
Contractual Total	$16.2

Commodities Costs:	Proposed
Description	FY 2002
Replacement of consumable water monitoring materials such as test strips, slides, etc.	0.3
Audiotapes	0.1
videotapes	0.1
Commodities Total	$0.5

FY02

Prepared:07-06-01

Project Number: 02610
Project Title: Kodiak Archipelago Youth Area Watch
Name: Kodiak Island Borough School District

FORM 4B
Contractual & Commodities DETAIL

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 2002
Additional marine station monitoring kits for new KAYAW sites. Price estimate from previous purchase.	2	0.7	1.4
Additional seal bio-sampling kit for new KAYAW site. Price estimate from previous purchase.	1	0.2	0.2
Tape recorders with microphones. Price estimate from previous KIBSD purchase.	4	0.1	0.4
Digital camera. Price estimate from previous KIBSD purchase.	1	0.3	0.3
			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**	$2.3

Existing Equipment Usage:	Number
Description	of Units
Marine station monitoring kits	5
Seal bio-sampling kits	7
Portable computer	1

FY02

Project Number: 02610
Project Title: Kodiak Archipelago Youth Area Watch
Name: Kodiak Island Borough School District

FORM 4B
Equipment
DETAIL

Revision 6-20-01
Approved TC 8-6-01

Detecting and Understanding Marine-Terrestrial Linkages in a Developing Watershed: Nutrient Cycling in the Kenai River Watershed

Project Number:	02612
Restoration Category:	Research
Proposer:	William J. Hauser Alaska Department of Fish and Game
Lead Trustee Agency:	ADF&G
Cooperating Agencies:	
Alaska SeaLife Center:	no
Duration:	October 1, 2001 to September 30, 2002.
Cost FY 02:	$44.6
Geographic Area:	Kenai River watershed
Injured Resource/Service:	sockeye salmon, Commercial fishing, Subsistence, Recreation

ABSTRACT:
This proposal will provide matching funding for a coordinator to serve a multidisciplinary team of agency-supported scientists that is designing a study of marine and terrestrial nutrient cycling in a watershed that was impacted by the *Exxon Valdez* Oil Spill (EVOS). The coordinator is a planner/writer who conducts public meetings, performs a literature review and develops, in cooperation with the team, a research plan to identify and measure nutrient sources, cycling, and pathways within the Kenai River watershed.

The Kenai River watershed provides a unique opportunity for research on a highly productive system that is comparatively small, largely accessible, and still reasonably undisturbed. The EVOS curtailed commercial fishing in 1989, causing changes in productivities of sockeye salmon and other species, in addition to allowing a massive input of marine nutrients born by the unharvested salmon. As a world-renowned fishing destination, the watershed is also at some risk from anthropogenic activities including habitat degradation, increased utilization and invasive species. Other studies concerning the contribution of marine nutrients to the ecosystem have examined watersheds of the Pacific Northwest that are now at lower than historic levels of salmon escapement. They suggest that there may be cascading impacts when marine derived nutrients normally supplied by salmon carcasses are diverted from an ecosystem. Terrestrial and aquatic insects and riparian vegetation also depend on nutrients derived from salmon. When nutrients normally supplied by salmon are withdrawn, productivity of the entire watershed is expected to be diminished.

INTRODUCTION

The Kenai River watershed is a rich, diverse ecosystem supporting a variety of fisheries and wildlife resources, which are important to the economy of the state and particularly the communities of the Kenai Peninsula. Nutrient pathways that sustain this rich ecosystem are complex and do not fit classic "River Continuum" models (Vannote et al. 1980). Nutrients such as nitrates, phosphates and reduced iron enter the watershed from a variety of marine, terrestrial and atmospheric sources. From the top of the watershed, inorganic materials enter the system from glacial meltwater (Koenings et al. 1986). Riparian habitats introduce organic nutrients, which are augmented with in river production of algal growth. The large lakes in the system (Kenai and Skilak Lakes) function as nutrient reservoirs from these sources, further modifying nutrient composition. Lower in the drainage, slow moving waters derived from wetland bogs bring in organic materials, offering a diversity to the upper glacial lake system. The hydrology of the system provides only one dimension of the nutrient pathways. Aquatic plants and microorganisms retain and process nutrients within the system. Resident and anadromous fish species in the ecosystem transport and redistribute nutrients. Nearly a million sockeye salmon enter the system annually to spawn and die, transporting marine derived nutrients up into the lakes and high reaches of the river system. Coho and chinook salmon transport marine nutrients into the highest tributaries on their terminal spawning migrations. Pink salmon, smelt, and lampreys are among other important anadromous species that contribute to additional marine nutrient loading and nutrient pathways.

The Kenai River watershed provides a unique opportunity for research on a highly productive system that is comparatively small, largely accessible and still reasonably undisturbed. However, it is also at some risk from anthropogenic activities including habitat degradation, increased utilization and invasive species. Cederhlom et al. (2000) suggested that, in the Pacific Northwest, there are cascading impacts when marine derived nutrients normally supplied by salmon carcasses are diverted from an ecosystem. A total of 137 species of vertebrates depended on salmon for nutrients. Terrestrial and aquatic insects and riparian vegetation also depend on marine nutrients derived from salmon (Piorkowski 1995, Mathisen 1972, Kline et al. 1993, Bilby et al. 1996, Wipfli et al. 1998, 1999). When nutrients normally supplied by salmon are withdrawn, productivity of the entire watershed may decline (Hyatt and Stockner 1985, Stockner 1987, Koenings and Burkett 1987, Schmidt et al. 1998). However, this decline in productivity may be confounded with other ecosystem effects such as overfishing (Pauly et al. 1998), fisheries interceptions or marine climatic effects (Beamish and Bouillon 1993, Francis and Hare 1994, Mantua et al. 1997, Hare et al. 1999, Finney et al. 2000). However, there is a large body of experimental evidence suggesting that the impact of nutrients from fertilization (or fish carcasses) is highly dependent on the density of fry and food web structure (Mazumder et al. 1988, Leibold 1992, Sarnelle 1992, Power 1992, Mazumder et al. 1990, Mazumder and Lean 1994, Mazumder and Edmundson 2001)

In the Kenai River, escapements of most chinook and sockeye salmon are heavily regulated and maintained at optimal levels above the Maximum Sustained Yield (MSY) (Fox et al. 2000) to

maintain "high sustained yields" (Tarbox et al. 1999). Over the past two decades, studies of Alaskan lake and riverine physics (Koenings and Edmundson 1991, LaPerriere and Edmundson 2000, Edmundson and Mazumder 2001a), water chemistry and nutrients (Edmundson and Koenings 1986, Litchfield and Kyle 1991, Edmundson and Carlson 1998), plankton (Edmundson and Koenings 1985, Koenings et al. 1990, Edmundson and Carlson 1998), and trophic interactions relative to salmon production (Koenings et al. 1986, Koenings and Burkett 1987, Kyle et al. 1988, Kyle 1994ab, Kyle et al. 1997, Edmundson et al. 1997, Schmidt et al. 1998, Edmundson and Mazumder 2001b) have been ongoing by Alaska Department of Fish and Game. Evidence of broodyear interaction and density dependence has been observed in Skilak Lake (Schmidt et al. 1995) suggesting that consecutive years of high escapements may depress production of sockeye salmon. Kyle et al. (1998) showed that fry recruitment from consecutive large escapements overgrazed the forage base in Frazer Lake (Alaska) and led to decreased survival of sockeye juveniles in subsequent generations. A brood-year interaction model for Kenai River sockeye salmon explained about 70% of the variation in adult return-per-spawner (Carlson et al. 1998).

NEED FOR THE PROJECT

A. Statement of the Problem

Increasing human activities throughout the Kenai River watershed holds the potential to adversely impact this rich and diverse ecosystem. The fisheries resources of the watershed contribute to commercial, sport and personal use fisheries that are vital to the economy of this area. These fisheries are and need to continue to be managed in a responsible and sustainable manner. Increasing land use and the use of the waterways, the risk of pollutants and loss of habitat all pose future threats to this system. The importance of marine nutrients and their contribution to productivity and biodiversity on an ecosystem scale has been suggested (Cederholm et al. 2000, Mathisen 1972 Larkin and Slaney 1997, Gresh, et al. 2000). The Alaska Sustainable Fisheries Policy mandates that wild stocks and habitats should be maintained at levels of productivity to assure sustained yields (Alaska Administrative Code, Title 5, Chapter 39.222), but not all contributions to the productivity of Alaskan watersheds are fully understood.

A small group of individuals representing agencies and organizations with interest in the Kenai River watershed met to discuss these issues on March 21, 2001. Attendees included: ADF&G Sport Fish, Habitat and Restoration, and Commercial Fish Divisions, EPA, EVOS TC, Prince William Sound Science Center, The Nature Conservancy, Kenai Watershed Forum, Kenai River Sport Fishing Association, Kenai Peninsula Community College, and the Kenai Peninsula Borough. The group developed the following problem statement:

> "We need to understand food-web dynamics in the watershed and the role of marine derived nutrients in the ecosystem so we can develop better information for managing harvest, land use planning, watershed development, and resource use."

This group lacks the resources to independently start such a research initiative, but proposed to facilitate drafting of a research plan that might then be used to seek large scale funding for a

multi-year, multi-agency ecosystem research initiative. The study of nutrients from marine and terrestrial sources will be the primary focus, but it is important to continue to recognize that other factors affect productivity of the watershed as well.

The funding requested in this proposal would provide matching funds to hire a coordinator (planner/writer) to facilitate the planning process, complete a literature review, and to draft and develop the research plan and seek funding sources.

B. Rationale/Link to Restoration

Rationale:
Cederholm et al. (2000), Mathisen (1972), Larkin and Slaney (1997), and Gresh, et al. (2000) presented details of many relationships and implications of marine-derived nutrients on an ecosystem scale and they discussed the historic dependence of aquatic, riparian, and upland animals and vegetation in the Pacific Northwest on these nutrients. Additional important nutrients enter a drainage from terrestrial sources and associated wetlands. Finney, et al. (2000) demonstrated that climatic changes, interception fisheries and anthropogenic activities can all have profound, and often confounding, effects on the productivity of a drainage. Finney et al. (2000) also pointed out that that the productivity of some systems is impacted differently from other systems by changes in marine-derived nutrient loading.

Research associated with this proposal will help to understand ecosystem effects of marine-derived nutrients brought into the Kenai River from sockeye salmon and other anadromous fish and from other sources in the drainage as well as the contributions from riparian areas to the freshwater and marine ecosystems. Sockeye salmon management on the Kenai River has been based on achievement of certain escapement levels, but after the *Exxon Valdez* Oil Spill, there was evidence of overescapement of sockeye salmon into the Kenai River (Schmidt, et al. 1995, Schmidt, et al. 1996). Questions about appropriate escapement levels for sockeye salmon in the Kenai River remain unanswered.

The Kenai River watershed includes tributaries with strikingly different geomorphology; e.g., the Moose River and Beaver Creek are slow-moving, low-lying meandering systems which drains bogs, lakes and swamps while the Snow River and the Killey River are higher-gradient, glacier-fed systems. The Russian River is a high-gradient, clear-water system. Each tributary contributes different nutrients to the Kenai River and the marine ecosystem and each drainage benefits differently from marine-derived nutrients.

Cederholm et al. (2000), Finney et al. (2000), and others hypothesize that salmon management strategies and decisions affect the entire ecosystem, however their hypotheses need to be tested. Knowledge gained through work based on this research initiative program will lead to better ecosystem-wide management decisions and add to the understanding of factors that may limit recovery of injured resources such as sockeye salmon and services such as sport, commercial and subsistence fishing and marine and terrestrial ecosystem linkages and interdependence. In addition, it will create a model with subcomponents that will serve as models for many other drainages in the Gulf of Alaska. This study area provides a unique research opportunity for an

important topic in a watershed that is still relatively healthy compared to other drainages in the Pacific Northwest but with good logistical access to the several subcomponents of the watershed.

Linkage:
The goals of this project are related to the goals of the Gulf Ecosystem Monitoring (GEM) program. The mission of the GEM program is "to sustain a healthy and biologically diverse marine ecosystem in the northern GOA 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 detect, and better understand the dynamics of nutrients in the Kenai River watershed ecosystem to provide information about how its productivity is influenced by natural changes and human activities so that better land use and resource management decisions can be made in the future. Salmon provide a direct linkage between the Kenai River watershed and the GOA ecosystems.

The work that will result from this proposed study is very consistent with the GEM Monitoring and Research Plan (EVOS TC June 5, 2001). Chapter 2.2 identifies a variety of human activities, which may impact the GOA ecosystem. Clearly, these can have a profound impact on the Kenai River watershed and information that leads to a better understanding about how that watershed functions will aid in land use planning and regulation of those human activities and preservation of important habitat.

Chapter 4 (EVOS TC June 5, 2001) focuses on the interactions of key ecological factors, including physical forcing, productivity, food, habitat and removals as the main theoretical controls on the ecosystem and its animal populations and it begins with watersheds. Finney et al. (2000) discusses how changes in both climate and fishery management strategies can affect the productivity of a watershed and how different watersheds are affected differently. Results from this proposed study will help to answer questions about productivity, food, habitat and removals and how they will affect the Kenai River watershed and the GOA ecosystem and the interdependence of these ecosystems.

Chapters 5.3, 5.4 and 5.5 of the GEM Monitoring and Research Plan (EVOS TC June 5, 2001) discusses marine-terrestrial connections and physical and chemical oceanography of the GOA. This study will contribute to that discussion through a greater understanding of how marine-derived nutrients are used and cycled in freshwater and how nutrients and freshwater that are derived from watersheds contribute to the productivity of the GOA ecosystem. A river that supports runs of anadromous fish provides a two-way conduit for the transport of nutrients, which enhance both the freshwater watershed and the marine ecosystem, but a detailed study of nutrient origin, flow and processing is lacking from a productive watershed such as the Kenai River.

Chapter 5.3 states "Watershed studies linking the freshwater and marine portions of the regional ecosystem could pay important benefits to natural resource agencies. As agencies grapple with implementation of ecosystem-based management, conservation actions are likely to focus on ecosystem processes and less on single species." Results from this study will be important for decision making by local, state and federal agencies for management of resources, people and

lands. In addition, these results will provide insights into both the past and the future through linkages with climate changes and the effects of fish and land use management (Finney et al. 2000).

C. Location

Kenai River Watershed. The Kenai River Watershed provides a unique opportunity to provide insight into the recovery of salmon in rivers all along the west coast of North America. There are two primary reasons for this. The first is that in one system, the Kenai River Watershed, researchers can investigate nutrient dynamics in virtually all the settings that occur separately in other west coast systems. Glacial inputs, clear headwater streams, large and small lake settings, wetland derived brown water systems, a high order stream and large inputs of marine derived nutrients all occur in this one watershed. Secondly, and perhaps most important, the Kenai River system is relatively intact. Watershed processes are occurring relatively undisturbed and salmon runs are similar to what they have been over the ages. Yet most of the system is road accessible. Research can be conducted in a setting that reflects the state that models the recovery goals of other west coast rivers.

COMMUNITY INVOLVEMENT

Agencies and community organization and groups would participate in the development of the research plan through open public meetings.

PROJECT DESIGN

A. Objectives

Specific project objectives:

1. Develop a plan for a multi-agency, multi-year study of the nutrient pathways in the Kenai River watershed.
   - The purpose of the plan will be to quantitatively link ecosystem productivity with salmon escapements into the Kenai River.
     - What is the role and function of marine-derived nutrients in the watershed?
     - What is the role and function of the watershed in the nearshore marine environment?
     - How are nutrients utilized and cycled in the ecosystem?
     - Are the growth rates of juvenile salmon related to the seasonal incremental increases in nutrients from salmon carcasses?
2. Annotated literature review and synthesis of published reports of nutrient origins, flow

and cycling in watersheds.

B. Methods

Development of the plan will be guided by a steering committee composed of committed agencies, user groups and organizations. Facilitated planning meetings of a scientific technical team would develop and refine the elements of the plan. The literature review will consolidate and provide annotated summaries of published reports. Plan drafts would be presented to the public for periodic public review and comment to gain broad public support and acceptance.

Components of the plan are expected to include:

- Stable isotope studies; e.g., trends over time, nursery lake sampling units, macroinvertebrates, fishes, and terrestrial vegetation and animals prior to and after salmon carcasses are assimilated into the system
- Nutrients (water chemistry); e.g., key locations in the mainstem, "outfall" of spawning areas, tributaries
- Classification and nutrients (water chemistry) of wetlands
- Identification of nutrient production and processing units
- Modeling of hydrography and nutrient transport, including nearshore marine waters

Potential funding partners for implementation of the plan include:

- U.S. Legislative Funding Request
- Kenai River Sportfishing Association
- State of Alaska, ADF&G – Capitol Improvement Project
- Gulf Ecosystem Monitoring Program
- The Nature Conservancy
- National Science Foundation

C. Cooperating Agencies, Contracts and Other Agency Assistance

Commitments for participation include:

Name	Organization	Role	Responsibility or Expertise
William Hauser	ADF&G – H&R, Anchorage	Principal Investigator	Logistical coordination (e.g., facilitate meeting time, place, agenda)
Contractor, to be hired	Private	Writer	Literature Review; develop plan for full study
Jim Edmundson	ADF&G – CF, Soldotna	Steering Committee	Technical – Chemical and biological limnology; sockeye salmon ecology
Asit Mazumder	University of Victoria	Technical Assistance	Physical, chemical and biological limnology

Name	Organization	Role	Responsibility or Expertise
Tom Kline	Prince William Sound Science Center	Steering Committee	Stable Isotopes
Phil North	US Environmental Protection Agency	Steering Committee	Aquatic habitat
Brett Huber	Kenai River Sportfishing Association	Steering Committee	Sportfishing
James Brady	ADF&G – CF, Anchorage	Steering Committee	Regional Supervisor
Bob Clark	ADF&G - SF, Anchorage	Steering Committee	Regional Supervisor
Brian Bue	ADF&G – CF, Anchorage	Steering Committee	Regional Research Supervisor
Mark Willette	ADF&G – CF, Anchorage	Steering Committee	Area Research Biologist
Gary Fanderi	Cook Inlet Aquaculture Association	Steering Committee	Commercial Fishing
Randy Hagenstein	The Nature Conservancy	Steering Committee	Land Conservation
Robert Rufner	Kenai Watershed Forum	Steering Committee	Fluvial Geomorphology
David Wartinbee	University of Alaska	Technical Assistance	Review
Mark Wipfli	US Forest Service, Juneau	Technical Assistance	Review
	Center for Streamside Studies, University of Washington	Technical Assistance	Review

Other Matching Financial Commitments for this work:

- The Nature Conservancy: $2,500
- Kenai River Sport Fish Association $15, 000
- Cook Inlet Aquaculture Association $500
- ADF&G – Sport Fish Division $4,500
- ADF&G – Commercial Fisheries Division $4,000 (in kind)

SCHEDULE

A. Measurable project tasks for FY01 (October 1, 2001 - September 30, 2002)

- Organize steering committee
- Hold organizational and planning meetings
- Hold public involvement meetings
- Complete literature review
- Develop Draft Research Plan
- Finalize Research Plan

B. Project milestones and endpoints

September, 2001 - Form agency and technical science teams, initiate planning meetings, start public and team meetings

Feb, 2002 – Draft Plan distributed for public comment and review

April, 2002 – Finalize Plan

May – Sept, 2002 – Investigate funding sources

C. Completion Date

30 September, 2002

PUBLICATIONS AND REPORTS

The Final Research Plan will be submitted as a Draft Final Report.

PROFESSIONAL CONFERENCES

None.

NORMAL AGENCY MANAGEMENT

This proposed project is beyond the scope of normal agency management responsibilities. Never the less, information gained through a study of this nature would greatly enhance land use planning and resource management-related decisions.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Several Trustee Council agencies will be cooperators with this project.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

NA

PROPOSED PRINCIPAL INVESTIGATOR

Bill Hauser will serve as the PI of project 02612.

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Approved TC 6-01

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002
Personnel		$7.0
Travel		$5.2
Contractual		$29.3
Commodities		$0.0
Equipment		$0.0
Subtotal	$0.0	$41.5
General Administration		$3.1
Project Total	$0.0	$44.6
Full-time Equivalents (FTE)		0.1

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 2003					

Dollar amounts are shown in thousands of dollars.

Other Resources								

Comments:

FY02

Project Number: 02612
Project Title: Detecting and Understanding Marine-Terrestrial Linkages in a Developing Watershed: Nutrient Cycling in the Kenai River Watershed
Agency: ADF&G

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared:

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2002
						0.0
W. Hauser	FB IV		1.0	7.0		7.0
C. Rosen**	Librarian		0.5	6.2		0.0
						0.0
** This cost is paid by ADF&G SF Division						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.5	13.2	0.0	
					Personnel Total	$7.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2002
					0.0
Anch - Kenai - RT a/	0.2	10	10	0.1	3.0
Anch - Seattle RT - for expert scientist	0.8	2	6	0.1	2.2
					0.0
					0.0
_a/ includes 10 one-day RT for PI or non-supported meeting participant					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$5.2

FY02

Prepared:

Project Number: 02612
Project Title: Detecting and Understanding Marine-Terrestrial Linkages in a Developing Watershed: Nutrient Cycling in the Kenai River Watershed
Agency: ADF&G

FORM 3B
Personnel
& Travel
DETAIL

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Contractual Costs:						Proposed
Description						FY 2002
Costs:	What	monthly rate		amount	cost	
	Contractor	6.0		6	36.0	
	office supplies	0.1		6	0.6	
	postage	0.1		6	0.6	
	copying	0.1		6	0.6	
	Subtotal				37.8	
	overhead		0.25		9.5	
				Subtotal	47.3	
Cooperators:	The Nature Conservancy:				$2.5	
	Kenai River Sport Fish Association				$15.0	
	Cook Inlet Aquaculture Association				$0.5	
	Sum of Contributions:				$18.0	
				Request from EVOS:	$29.30	
When a non-trustee organization is used, the form 4A is required.					**Contractual Total**	$29.3

Commodities Costs:	Proposed
Description	FY 2002
Commodities Total	$0.0

FY02

Project Number: 02612
Project Title: Detecting and Understanding Marine-Terrestrial Linkages in a Developing Watershed: Nutrient Cycling in the Kenai River Watershed
Agency: ADF&G

FORM 3B
Contractual & Commodities
DETAIL

Prepared:

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2002
			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

FY02

Project Number: 02612
Project Title: Detecting and Understanding Marine-Terrestrial Linkages in a Developing Watershed: Nutrient Cycling in the Kenai River Watershed
Agency: ADF&G

FORM 3B
Equipment
DETAIL

Prepared:

Monitoring Program for Near-Surface Temperature, Salinity, and Fluorescence in the Northern Pacific Ocean

Project Number:	02614
Restoration Category:	Monitoring
Proposer:	S. Okkonen/UAF
Lead Trustee Agency:	ADFG
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	New
Duration:	1st yr. 2 yr. project
Cost FY 02:	$38.2
Cost FY 03:	$17.1
Geographic Area:	Northeast Pacific Ocean
Injured Resource/Service:	All

ABSTRACT

This project will use a thermosalinograph and fluorometer, to be installed on a crude oil tanker, to acquire continuous, long-term measurements of the near-surface temperature, salinity, and fluorescence fields along the tanker route between Valdez, Alaska and Long Beach, California.

INTRODUCTION

The research proposed herein describes a two-year, proof-of-concept project to demonstrate the use of a crude oil tanker as a platform from which to acquire measurements of oceanographic field variables (near-surface temperature, salinity, and fluorescence) in the Northeast Pacific Ocean. The results from this project will be used as a basis to pursue GEM funding for long-term monitoring of oceanographic field variables from crude oil tankers.

NEED FOR THE PROJECT

A. Statement of Problem

In order to assess the long-term recovery of marine resources impacted by the *Exxon Valdez* Oil Spill against the background of climate-driven variability of those resources, long-term measurements of oceanographic conditions are required. Additionally, while the most significant spill-related impacts upon the marine environment occurred in coastal and near-shore domains, the long-term health of those marine ecosystems depends, in part, upon biophysical linkages to the shelf, slope, and open-ocean domains. Consequently, multi-decadal records of oceanic conditions within each of these domains is necessary to develop an understanding of natural and anthropogenic variability in the marine environment of the northern Gulf of Alaska.

B. Rationale

In recent years there has been increasing awareness of large-scale, multi-decadal changes in the climate of the world ocean. However, translating awareness of long-term climate variability into understanding the regional and local physical and biological consequences of a changing environment has been hampered by the dearth of long-term oceanographic measurements in the Northeast Pacific. Presently, the only multi-decadal time series of oceanographic conditions (temperature and salinity) in the region are for Ocean Station P/Line P and station GAK-1 near Seward, Alaska (Figure 1).

Commercial cargo vessels operating within established shipping corridors in the Northeast Pacific are potential ships-of-opportunity from which high-resolution measurements of oceanographic conditions could be acquired at regular intervals. Crude oil tankers, traveling between Valdez, Alaska and Long Beach, California, are particularly well suited for this purpose as individual tankers cross shelf, slope, and open ocean regimes every 10 to 14 days and will continue to do so for many years to come.

To demonstrate the suitability of tankers as a traveling platform, we propose to install a thermosalinograph (TSG) and fluorometer on a tanker to acquire high-resolution measurements of near-surface temperature, salinity, and fluorescence (a proxy for phytoplankton biomass).

Some might argue that satellites are better platforms from which to acquire these measurements of ocean surface conditions. However, ocean color and sea surface temperature sensors detect wavelengths in the visible and infrared portion of the electro-magnetic spectrum and are therefore

unable to detect sea surface features through the clouds which cover much of the Gulf of Alaska for much of the year. With respect to remote sensing of sea surface salinity, there are no satellite-borne salinity sensors at this time.

C. Location

Measurements of temperature, salinity, and fluorescence will be acquired along the tanker corridor between Valdez, Alaska and Long Beach, California (Figure 1).

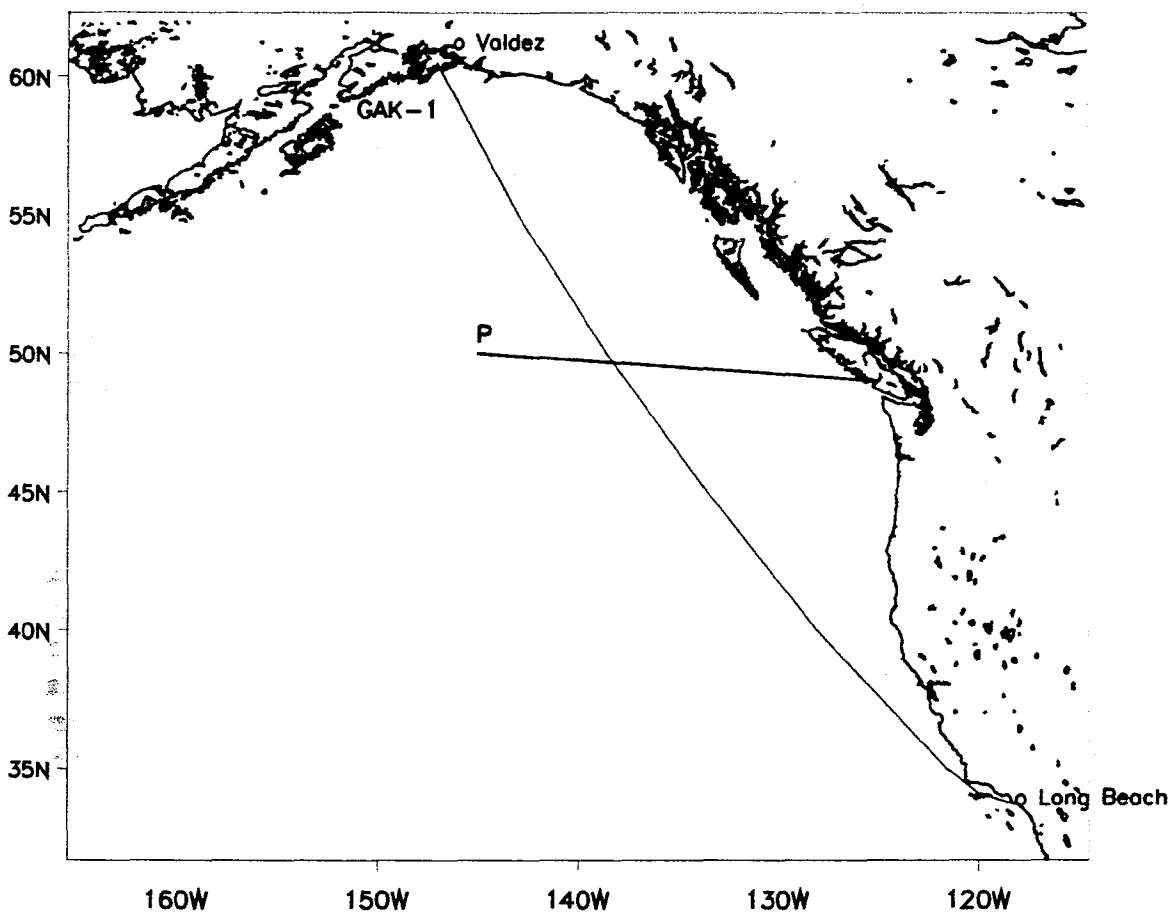

Figure 1

PROJECT DESIGN

A. Objectives

The objectives for this project are to:

1. Establish a working relationship with the crude oil tanker fleet to use individual tankers as platforms from which to acquire continuous, long-term measurements of oceanographic field variables (e.g. temperature, salinity, fluorescence) along the shipping corridor between Valdez, Alaska and Long Beach, California. Install a thermosalinograph and fluorometer on a tanker to acquire these measurements.

2. Identify the seasonal migration and evolution of frontal features associated with the Alaska Coastal Current (ACC), shelf break, and mesoscale eddies.

3. Identify the dominant length scales of variability (and seasonal modulation of those length scales) characterizing the near-surface temperature, salinity, and fluorescence fields along the shipping corridor. These scales of variability will likely differ between shelf and the open ocean.

4. Compare TSG/fluorometer measurements with TOPEX altimeter observations of the Gulf of Alaska eddy field.

5. Compare TSG/fluorometer data with contemporaneous NEP GLOBEC field data.

6. Provide temperature, salinity, and fluorescence field data to David Welch (Pacific Biological Station, Nanaimo, British Columbia) for comparison with coincident continuous plankton recorder (CPR) observations.

A. Methods

The TSG and fluorometer will be installed in the sea chest of a tanker. The sea chest draws seawater through an intake located a few meters below the sea surface. The exact depth of the intake water will depend on the particular vessel design and the amount of cargo and/or ballast carried. With approval of the ship's chief engineer, a remote temperature sensor will be installed as close to the intake as is practical to mitigate the biasing of the temperature measurements due to the ship's thermal inertia.

TSG and fluorometer measurements will be acquired once per five seconds (nominal). For a tanker traveling at 20 knots this translates to a sample spacing of ~50 m. This data stream will be merged will concurrent GPS navigation data and stored on the hard drive of a dedicated PC. Repeat measurements along the shipping corridor will allow time-space matrices of temperature, salinity, and fluorescence to be constructed. After a yearlong record of measurements is acquired, characteristic spatial scales of variability and their seasonal modulation will be determined from spectral and geometric analyses of the data matrices.

The seasonal evolution of frontal features associated with the ACC, the shelf break, and mesoscale eddies will also be monitored. Because of secondary circulation associated with frontal features, they tend also to be zones in which there are population aggregations across many trophic levels.

SCHEDULE

A. Measurable Project Tasks for FY 02 (1 October 2001 – 30 September 2002)

15 October 01:	Order instrumentation and ancillary hardware
15 December 01:	Install TSG and fluorometer on tanker
1 January 02 - 30 September 02:	Data acquisition

B. Project Milestones and Endpoints

1 Oct 2001 - ongoing	Project Design Objective 1
1 Dec 2001 - ongoing	Project Design Objectives 2, 4, 5, 6
1 Jan 2003 - 1 Mar 2003	Project Design Objective 3 (use first year of data)
1 Mar 2003 - 30 Apr 2003	Prepare manuscript(s), see Publications and Reports section below
15 Apr 2003	Submit annual report

C. Completion Date

30 September 2003	Completion of final report

PUBLICATIONS AND REPORTS

No publications are anticipated for FY 02.

Potential FY 03 publications: Seasonal evolution of frontal features in northern Gulf of Alaska; Comparison of TSG, fluorescence, and TOPEX altimeter observations of Gulf of Alaska eddies; Comparison of TSG, fluorescence and continuous plankton recorder observations in the Northeast Pacific Ocean (with David Welch, Pacific Biological Station, Nanaimo, British Columbia).

PROFESSIONAL CONFERENCES

Attend Trustee Council's annual workshop in Anchorage January 2002, 2003.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Data acquired for this project will be posted on the UAF/Institute of Marine Science web page.

Okkonen has an ongoing NASA-funded project to use the TOPEX altimeter to observe the mesoscale eddy field in the Gulf of Alaska and to share that data with collaborating NEP GLOBEC researchers (Tom Weingartner, UAF; Tom Royer, ODU)

Royer is a funded researcher with the NEP GLOBEC project for the next four years.

Existing collaborative relationships with NEP GLOBEC researchers will be exploited to:

(1) compare TSG surface field observations (this proposed research) with contemporaneous subsurface temperature and salinity measurements from within Prince William Sound and from the nearby shelf and

(2) use retrospective studies of historical VOS (XBT and XCTD) and GAK1 data to provide a historical context for consideration of the TSG data.

The opportunity also exists to make similar comparisons of the TSG data with historical and contemporaneous Ocean Station P/Line P data.

We also plan to share our data with David Welch, Pacific Biological Station, Nanaimo, British Columbia. He has a current project in which he has a continuous plankton recorder (CPR) deployed 5x/year on a tanker traveling between Valdez and Long Beach. The TSG/fluorometer/ CPR data sets would be highly complementary in that temperature, salinity, and fluorescence gradients could be directly compared with plankton distributions along the tanker route.

PROPOSED PRINCIPAL INVESTIGATOR

Stephen R. Okkonen
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Okkonen will have primary responsibility for initial data processing, length scale analyses, frontal feature analyses, and comparison with TOPEX data.

CO-PRINCIPAL INVESTIGATOR

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Royer will have primary responsibility for comparison of TSG data with GLOBEC data and with historical data.

OTHER KEY PERSONNEL

Dave Cutchin
San Diego, California

Dave Cutchin will be issued a sub-contract to install the thermosalinograph, fluorometer, and ancillary hardware on the tanker and to provide annual maintenance of the instruments. He was responsible for TSG installations on other VOS platforms both prior to and during WOCE.

Approved 8-6-01

2002 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002						
Personnel		$0.0						
Travel		$0.0						
Contractual		$35.7						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal		$35.7	Estimated FY 2003					
General Administration		$2.5						
Project Total		$38.2	$17.1					
Full-time Equivalents (FTE)		0.1						
			Dollar amounts are shown in thousands of dollars.					
Other Resources								

Comments:

FY02

Prepared: April 2001

Project Number: 02614
Project Title:
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2002 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002						
Personnel		$4.8						
Travel		$0.4						
Contractual		$8.2						
Commodities		$0.2						
Equipment		$15.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal		$28.6	Estimated FY 2003					
Indirect		$7.1						
Project Total		$35.7	$17.1					
Full-time Equivalents (FTE)		0.1						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

The indirect rate is 25% TDC, as negotiated by the Exxon Valdez Oil Spill Trustee Council with the University of Alaska.

FY02

Prepared: April 2001

Project Number: 02614
Project Title: Monitoring Program: near-surface temperature, salinity, & fluorescence fields in NE Pacific Ocean
Name: University of Alaska Fairbanks

FORM 4A
Non-Trustee
SUMMARY

2002 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2002
S. Okkonen	Research Assisant Professor		0.7	4.7		3.3
Web page Technician	Web page Technician		0.3	5.0		1.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.0	9.7	0.0	
					Personnel Total	$4.8

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 2002
Okkonen 1 R/T Kenai-Anchorage (attend Trustee Council workshop)		0.2	1	2	0.1	0.4
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$0.4

FY02

Prepared: April 2001

Project Number: 02614
Project Title: Monitoring Program: near-surface temperature, salinity, & fluorescence fields in NE Pacific Ocean
Name: University of Alaska Fairbanks

FORM 4B
Personnel
& Travel
DETAIL

2002 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Contractual Costs:	Proposed
Description	FY 2002
phone/fax/internet	0.2
software maintenance	0.1
shipping	0.9
Subcontact: D. Cutchins	7.0
Contractual Total	$8.2

Commodities Costs:	Proposed
Description	FY 2002
Project supplies	0.2
Commodities Total	$0.2

FY02

Prepared: April 2001

Project Number: 02614
Project Title: Monitoring Program: near-surface temperature, salinity, & fluorescence fields in NE Pacific Ocean
Name: University of Alaska Fairbanks

FORM 4B
Contractual & Commodities DETAIL

2002 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2002
thermosalinograph	1	6.9	6.9
remote temp. sensor	1	1.5	1.5
mount kit	1	0.5	0.5
kill cell	1	0.1	0.1
Fluorometer	1	3.0	3.0
GPS	1	0.5	0.5
computer	1	1.5	1.5
misc. hardware	1	1.0	1.0
			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**	$15.0

Existing Equipment Usage: Description	Number of Units	

FY02

Prepared: April 2001

Project Number: 02614
Project Title: Monitoring Program: near-surface temperature, salinity, & fluorescence fields in NE Pacific Ocean
Name: University of Alaska Fairbanks

FORM 4B
Equipment
DETAIL

02630

Approved

Planning for the GEM Long-term Monitoring and Research Program

Project Number:	02630
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:	3rd year of a 3-year project
Cost FY 02:	TOTAL $200, 000
Cost FY 03:	
Geographic Area:	Entire oil-spill region
Injured Resource/Service:	All injured resources and services

ABSTRACT

This project will conclude planning and begin initiation of the Council's vision for long-term monitoring and research in the Gulf of Alaska, the Gulf Ecosystem Monitoring and Research program (GEM). Planning and implementation during FY 02 will be based on the draft GEM Program Document until its review by the National Research Council (NRC) is complete. The document describes how a network of monitoring and research activities will be implemented over a five-year period starting in FY 03 using synthesis, research, modeling, and data management-information gathering. As directed by the Trustee Council, the GEM program is closely coordinated with, and complementary to, related large-scale marine science programs and organizations in the Gulf of Alaska and adjacent waters. In the first three months of FY 02, GEM planning will support the final review by the NRC, begin development of the FY03 *Invitation to Submit Proposals* and continue with further development of the draft GEM Monitoring and Research Strategic Plan.

INTRODUCTION

In conjunction with the 10th anniversary of the 1989 oil spill, the Trustee Council, in March 1999, formally dedicated a portion of the Restoration Reserve to long-term monitoring and research in the spill area and adjacent northern Gulf of Alaska. This project will conclude

planning for implementing the Trustee Council's vision, now known as the Gulf Ecosystem Monitoring and Research program (GEM). In FY 00 a draft scoping document, the GEM 2000 report (April 2000), was developed and submitted to the NRC for preliminary review. This report was preceded and followed by an extensive public involvement process. Meetings to gather advice on the content and future of GEM were held in communities throughout the spill-affected region with stakeholder groups, Alaska Native organizations, state and federal policy makers, and scientists. This consultation continued into FY 01 with a statewide GEM workshop that drew attendance from throughout the U.S. Building on ideas from the consultations, the workshop and preliminary NRC recommendations, the draft GEM Program Document, including a draft monitoring and research plan, was produced. In FY 02 GEM planning will support the final review by the NRC and continue development of the draft plan.

NEED FOR THE PROJECT

A. Statement of the Problem

In order for the Trustee Council's vision for GEM to be implemented over a five-year period starting in FY 03, the following activities need to be completed in FY 02: 1) collection and assimilation of reviews from the NRC, the scientific community and the public; 2) revision of the draft GEM Program Document into a form that can be approved by the Trustee Council; 3) development of the FY 03 *Invitation to Submit Proposals;* 4) establishing a set of committees and work groups to assist with further development of the GEM program; and 5) a series of workshops to assist in that effort.

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 monitoring and research 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

The transition to the GEM program will occur primarily at the Restoration Office in Anchorage, with input from spill-area communities and key experts outside Alaska. 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.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

The incorporation of substantial community involvement and the use of traditional ecological knowledge into the overall GEM program are important goals to be addressed during this phase of planning for the GEM project. The Restoration Office will work closely with Project 02052 as the Natural Resource Management Program for the Chugach region is developed in order to ensure that community interests are coordinated with plans for long-term monitoring and research. Advice from the communities will also be sought in how best to reconstitute the Public Advisory Group to ensure community participation. Community and TEK experts will be included as committees and work groups are developed and will be encouraged to participate in workshops.

PROJECT DESIGN

A. Objectives

Specific objectives are to:

1) Revise the draft GEM Program Document in response to NRC and public comment for Trustee Council approval.
2) Hold an oceanographic modeling workshop in October or November 2001.

3) Develop the content of the FY 03 *Invitation to Submit Proposals* and support development of the FY 03 Work Plan.
4) Continue development of the GEM Monitoring and Research Strategic Plan.
5) Consult and coordinate with other marine research efforts.

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 from October through December 2001:

(1) Revise the draft GEM Program Document for Trustee Council approval. The draft document will be revised as needed in response to preliminary NRC feedback received at their September 2001 meeting, and any additional comments received following the August 2001 Trustee Council meeting. The final NRC review is expected in the spring of 2002, and a final draft of the GEM Program Document will be developed and submitted to the Trustee Council for adoption.

(2) Hold an oceanographic modeling workshop. This workshop will be held in October or November 2001 in order to inform decisions on deferred modeling projects in December 2001.

(3) Assist in developing the FY 03 *Invitation to Submit Proposals* and (4) Continue development of GEM Monitoring and Research Plan.

Developing preliminary technical subcommittees by habitat type and working with the subcommittees to develop preliminary testable hypotheses and priorities for synthesis are the first steps in preparing the draft *FY 03 Invitation to Submit Proposals.* Most of this work in the fall of 2001 will be done by e-mail and telephone conferences, with the first subcommittee meetings possibly to take place in conjunction with the EVOS annual workshop in January 2002.

(5) Consult and coordinate with other marine research efforts. Obtaining detailed information about other ongoing data gathering efforts, including ongoing agency and university programs, will allow GEM to complement and take advantage of ongoing work, thus achieving greater scientific integration, applicability to management needs, cost savings, and efficiency. The focus will be on those in the Gulf of Alaska and north Pacific Ocean (PICES and NPAFC), as well as other large scale marine ecological monitoring programs with interest in the Gulf of Alaska such as GLOBEC , U.S. GOOS, and the Consortium for Oceanographic Research and Education (CORE).

C. Cooperating Agencies, Contracts, and Other Agency Assistance

Federal and state resource agencies will be actively involved in further development of GEM, as will other institutions, particularly the scientific committees involved with planning and implementing monitoring and research in the north Pacific Ocean. These include, for example, the North Pacific Research Board, the North Pacific Marine Science Organization (PICES), the North Pacific Anadromous Fish Commission (NPAFC), the Global Oceans Ecosystems Dynamics (GLOBEC) Northeast Pacific Project, the Ocean Carrying Capacity (OCC) study of the National Marine Fisheries Service (NMFS), the Fisheries and Oceanography Coordinated Investigations (FOCI) of NMFS, and other NOAA entities.

SCHEDULE

A. Measurable Project Tasks

October 2001:	Present draft GEM Program Document at PICES and NPAFC annual meetings
Oct/Nov 2001:	Hold oceanographic modeling workshop
Fall 2001:	Solicit habitat subcommittee members. Begin initial discussion of preliminary testable hypotheses and synthesis priorities. Continue ongoing incorporation of feedback on GEM Program Document.

B. Project Milestones and Endpoints

To be developed in full budget and DPD.

PUBLICATIONS AND REPORTS

The products of this project will be the GEM Program Document, Volumes I and II. No reports will be required and no additional publications are expected.

PROFESSIONAL CONFERENCES

The GEM Program will be discussed at the PICES and NPAFC meetings in October 2001, at the U.S. GOOS Committee meeting in February 2002, and at the American Fisheries Society National Meeting in August 2002. Attendance at additional professional conferences may be required for coordination and integration.

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 INVESTIGATORs

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spies@amarine.com

PRINCIPAL INVESTIGATOR

Ms. McCammon has 28 years of experience in Alaska in business, journalism, communications, and public policy, emphasizing natural resource issues. She has been Executive Director of the Trustee Council since 1994.

Dr. Mundy has 28 years of experience as a fisheries scientist, including 25 years in Alaskan fisheries research and management. As Science Coordinator since 1999, Phil has been key to development of the Gulf Ecosystem Monitoring (GEM) program. He has worked as a reviewer of research on the oil spill since 1989.

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.

approved TC 8-6-01

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 01	Proposed FY 02	PROPOSED FY 02 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
Personnel	$56.7	$9.6						
Travel	$20.0	$10.0						
Contractual	$161.5	$40.0						
Commodities	$5.5	$0.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$243.7	$59.6						
General Administration	$19.7	$4.2						
Project Total	$263.4	$63.8						
Full-time Equivalents (FTE)								
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

PREPARED 7/30/01

FY02

Project Number: 02630
Project Title: Planning for Long-Term Research & Monitoring Program -- INTERIM BUDGET
Lead Agency: ADFG/Restoration Office

FORM 2A
MULTI-TRUSTEE AGENCY SUMMARY

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 01	Proposed FY 02	LONG RANGE FUNDING REQUIREMENTS					
Personnel	$6.8	$9.6						
Travel	$20.0	$10.0						
Contractual	$0.0	$0.0						
Commodities	$5.5	$0.0						
Equipment	$0.0	$0.0						
Subtotal	$32.3	$19.6						
General Administration	$1.0	$1.4						
Project Total	$33.3	$21.0						
Full-time Equivalents (FTE)		0.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY02

Project Number: 02630
Project Title: Planning for Long-Term Research & Monitoring Program -- INTERIM BUDGET
Agency: ADFG & Restoration Office

FORM 3A
TRUSTEE
AGENCY
SUMMARY

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 02
						0.0
Intern			3.0	3.2		9.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		3.0	3.2	0.0	
					Personnel Total	$9.6

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 02
Travel for Restoration Office staff and other personnel as needed for PICES meeting (Victoria, B.C. in October), modeling workshop (including participants), and meetings with other potential collaborators.					10.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$10.0

FY02

Project Number: 02630
Project Title: Planning for Long-Term Research & Monitoring Program -- INTERIM BUDGET
Agency: ADFG & Restoration Office

FORM 3B
Personnel & Travel DETAIL

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Contractual Costs:	Proposed FY 02
Description	
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed FY 02
Description	
Commodities Total	$0.0

FY02

Project Number:02630
Project Title: Planning for Long-Term Research & Monitoring Program
Agency: ADFG & Restoration Office

FORM 3B
Contractual & Commodities DETAIL

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 02
			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:	Number	Inventory
Description	of Units	Agency

FY02

Project Number: 02630
Project Title: Planning for Long-Term Research & Monitoring
Program -- INTERIM BUDGET
Agency: ADFG & Restoration Office

FORM 3B
Equipment
DETAIL

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 01	Proposed FY 02	LONG RANGE FUNDING REQUIREMENTS					
Personnel	$7.4	$0.0						
Travel	$0.0	$0.0						
Contractual	$161.5	$40.0						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0						
Subtotal	$168.9	$40.0						
General Administration	$12.4	$2.8						
Project Total	$181.3	$42.8						
Full-time Equivalents (FTE)								
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY02

Project Number: 02630
Project Title: Planning for Long-Term Research & Monitoring
Program -- INTERIM BUDGET
Agency: ADNR

FORM 3A
TRUSTEE
AGENCY
SUMMARY

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 02
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.0	0.0	0.0	
					Personnel Total	$0.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 02
					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

FY02

Project Number: 02630
Project Title: Planning for Long-Term Research & Monitoring
Program -- INTERIM BUDGET
Agency: ADNR

FORM 3B
Personnel
& Travel
DETAIL

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Contractual Costs:	Proposed FY 02
Description	
Applied Marine Sciences (Chief Scientist Bob Spies) to assist with modeling workshop and development of first GEM invitation, including working with habitat subcommittees.	40.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$40.0

Commodities Costs:	Proposed FY 02
Description	
Commodities Total	$0.0

FY02

Project Number: 02630
Project Title: Planning for Long-Term Research & Monitoring
Program -- INTERIM BUDGET
Agency: ADNR

FORM 3B
Contractual & Commodities DETAIL

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 02
			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:	Number	Inventory
Description	of Units	Agency

FY02

Project Number: 02630
Project Title: Planning for Long-Term Research & Monitoring
Program -- INTERIM BUDGET
Agency: ADNR

FORM 3B
Equipment
DETAIL

Revision 9-24-01
Approved TC 8-6-01

Reconstructing Sockeye Populations in the Gulf of Alaska over the Last Several Thousand Years

Project Number:	02649
Restoration Category:	Research and monitoring
Proposers:	Daniel Mann and Bruce Finney, University of Alaska
Lead Trustee Agency:	ADF&G
Cooperating Agencies:	
Alaska Sea Life Center:	No
Duration:	First year, two-year project
Cost FY 02:	$88,100
Cost FY 03:	$28,200
Geographic areas:	Eshamy and Solf Lakes (Prince William Sound), Upper Russian Lake (Kenai River watershed) Delight & Desire Lakes (Kenai Fjords)
Injured Resource/Service:	Sockeye salmon

ABSTRACT

We want to reconstruct the last 2000 years of changes in sockeye salmon abundance in Eshamy Lake (Prince William Sound), Delight and Desire Lakes (Kenai Fjords), and Upper Russian Lake (Kenai River watershed) by analyzing ^{15}N in lake sediments. This new data will be synthesized with ongoing studies at Karluk Lake (Kodiak Island). Our research question is: *What is the normal variability in sockeye salmon populations in the Gulf of Alaska?* This research contributes to development of the GEM program by providing a valuable historical perspective on present conditions and by developing new hypotheses about the climatic causes of population fluctuations in Gulf of Alaska salmon.

INTRODUCTION

A. Laying a foundation for GEM

A priority for proposals solicited by EVOS for FY 02 is to establish a foundation for the GEM program. The primary mission of the Gulf Environmental Monitoring Program is to understand how natural and human-caused changes affect marine ecosystems in the northern Gulf of Alaska (GOA). We can learn a lot about present ecosystems by documenting their past responses to global changes and human activities. Information on ecosystem history can help us predict future changes. Here we propose a retrospective study of sockeye abundance in Prince William Sound and in the Kenai River watershed using the stable isotope tracers present in the sediments of spawning lakes. Our goal is to describe changes in sockeye salmon abundance over the last several millennia and to relate these changes to shifts in the climate/ocean system of the GOA and to human activities.

B. Sockeye salmon

Sockeye are an important for Native subsistence and for commercial and recreational fishing. The Trustee Council has previously made large investments in sockeye salmon recovery by purchases of stream bank, lakeside, and watershed habitats and by funding studies that detail the effects of over escapement caused by the spill. The over escapement impact was caused by the return of larger than normal numbers of spawning fish because of fisheries closures resulting from concern over oil contamination. Increased juvenile sockeye populations caused overgrazing of zooplankton stocks in spawning lakes, with consequent effects throughout the food chain. Growth rates were reduced during the freshwater part of the sockeyes' life history, and declines occurred in the health of adult fish. We have little idea about the relative severity of these over escapement effects relative to natural, prehistoric variations in sockeye populations.

C. The importance of retrospective studies

Retrospective studies like the one we propose here directly address the GEM program's goals of detecting and understanding of changes in the GOA ecosystem. To detect trends of change, we need historical data. To disentangle human-caused from nature-caused changes, we need historical data that extend back before the arrival of Europeans in the region (e.g., Finney et al., 2000). To understand the marine ecosystem, we need to describe the natural changes upon which human influences are superimposed. By understanding what happened in the past, we gain valuable perspectives on the present. In this time of global changes, learning how species and ecosystems responded to previous shifts in the environment can inform us about their future responses.

D. Previous retrospective studies of salmon populations

Finney et al. (2000) describe a 300-year record of sockeye population changes in seven lakes on Kodiak Island and the Alaska Peninsula using measurements of marine-derived

nitrogen preserved in the bottom sediments of spawning lakes (Fig. 1). Marked changes in population size were found both before and after the start of intensive fisheries around AD 1900. The prehistoric changes are related to climate change (see next section), and the post-1900 changes to a combination of both climate change and fishery activity. The ^{15}N method provides a powerful tool for reconstructing changes in salmon populations in the GOA region.

BACKGROUND

A. Recent changes in the GOA atmosphere/ocean system

The northern Gulf of Alaska has seen dramatic environmental changes over the last several millennia, many of which resulted from shifts in the position and intensity of the Aleutian Low (Cayan and Peterson, 1989; Lackmann and Gyakum, 1996; Mock et al., 1998). The intensity of the Aleutian Low varies at all time scales, though only those within the span of the instrumental record (ca. 100 years) are known with any certainty (Francis et al., 1997). The best studied of these variations is the Pacific Interdecadal Oscillation (PDO), which is the coupled variation in sea surface temperature (SST) and sea level pressure (SLP) resulting from the alternation between two, self-reinforcing, and quasi-stable circulation regimes in the North Pacific climate system (Latif and Barnett, 1996; Minobe, 1997; Overland et al., 1999). The PDO has undergone two complete oscillations since AD 1900 (Mantua et al., 1997). During positive phases of the PDO, the Aleutian Low moves eastward and intensifies, resulting in increased precipitation along the coast of the Gulf of Alaska. SSTs are cooler in the Alaska Gyre but warmer in nearshore waters. During negative phases of the PDO, the central northeastern Pacific warms, the Aleutian Low weakens, coastal precipitation lessens, and nearshore temperatures warm. Longer time-scale fluctuations (centuries to millennia) have occurred repeatedly in the North Pacific climate system (Mann et al., 1999). Studies of coastal tree rings extend the PDO record back to AD 1760 (Wiles et al., 1996, 1998, 199a).

Most of our proxy data for GOA climate prior to AD 1900 come from terrestrial sources (Mann and Hamilton, 1995). Both the Medieval Warm Period (ca. AD 900-1250) and the Little Ice Age (ca. AD 1250-1900) occurred in the GOA region, where they are evidenced by glacier fluctuations and by climatic changes recorded in tree rings (Wiles and Calkin, 1994; Wiles et al., 1998; Wiles et al., 1999 b). Fluctuations in summer temperature of several degrees centigrade are suggested (Wiles et al., 1996). The Medieval Warm Period is especially interesting for us today because it was the last time when global temperatures approached their post-1900 AD levels.

Moving further back in time, the Neoglacial interval (ca. 6000 BP – AD 1900) saw alternating cold and warm intervals each lasting several hundred years to one millennium (Calkin, 1988). Precipitation fluctuated as well, and in combination with temperature changes, caused snowlines to rise and fall by several hundred meters. Transitions from milder to colder conditions during the Neoglacial occurred rapidly in the space of several

years to several decades. In general terms, the magnitudes and rates of natural climate changes occurring in the GOA over the last several millennia are similar to those predicted to occur over the next several centuries (Mann et al., 1999). In effect, nature has done a series of experiments in the past about how the GOA ecosystem may respond to future changes in the atmosphere-ocean system.

B. Salmon responses to changes in the atmosphere/ocean system

Climatic shifts have dramatic effects on the biota of the North Pacific, including salmon, at a variety of time scales. Climate variability is linked to ecosystem change in the North Pacific primarily through its forcing effects on lower trophic levels (Francis et al., 1997). These effects work their way through the food web and are modified as they proceed by species' life histories, subsistence strategies, and by top-down effects like predation. Intensification of the Aleutian Low during phases of positive PDO triggers increased zooplankton biomass in the Alaskan Gyre, probably in response to increased wind-induced upwelling and vertical mixing (Brodeur and Ware, 1992; Brodeur et al., 1996; Sugimoto and Tadokoro, 1997). Phytoplankton and zooplankton populations seem to have increased during the reorganization of upper ocean circulation in response to the 1976/1977 regime shift (Francis et al., 1998).

Some of the most dramatic effects of climatic shifts on the marine biota are evident in the histories of salmon catches (Downton and Miller, 1998). Salmon catches in Gulf of Alaska waters closely track the PDO oscillation, with stock size positively correlated with the average winter/spring strength of the Aleutian Low (Beamish and Bouillon, 1993; Mantua et al., 1997). Northern (Alaskan) and southern (Oregon, California) salmon stocks vary roughly 180° out of phase (Francis and Sibley, 1991; Gargett, 1997).

There is no generally accepted explanation for how the Aleutian Low controls salmon populations in the North Pacific (Francis et al., 1998). One possible explanation is that increased wind mixing stimulates primary productivity in the Alaska Gyre, which provides more food for young salmon during the early marine stages of their lives. Gargett (1997) suggests that the critical link between physical forcing and salmon survival is the enhanced water-column stability in coastal areas during positive PDO phases, which increases primary productivity and subsequently food supply for salmon juvenile stages. Increased stream flow caused by increased rainfall in coastal areas during positive PDO phases may increase spawning success and hatchling survival. Probably all these factors interact to increase salmon stocks during positive phases of the PDO. Historical records are too short to tell us how climate/oceanographic parameters affect salmon populations.

C. Stable Isotopes in lake sediments as records of salmon abundance

Measurements of the natural abundance of stable isotopes make it possible to trace the flow of selected elements in ecosystems (Fry and Sherr, 1984; Owens, 1987; Peterson and Howarth, 1987; Wada et al., 1987). This has application in anadromous Pacific salmon systems because of the dichotomous nature of the two important nitrogen (N)

sources, which are marine N from the decay of carcasses of returning adult salmon, and atmospheric N_2 (Kline, 1991). The two sources of N can be distinguished by del^{15}N, which is defined as the per mil difference in $^{15}N/^{14}N$ compared to an air N_2 isotope standard. The premise underlying the use of stable isotope abundance is the relative enrichment of ^{15}N in Pacific salmon (~ +12) in comparison with atmospheric N_2 (0). Food webs based on N_2 fixation tend to be low in ^{15}N (Minagawa and Wada, 1984; Owens, 1987; Wada and Hattori, 1991).

When Pacific salmon return to freshwater to spawn and die, they import significant quantities of marine-derived nutrients. Because these nutrients carry a distinctive signature of heavy nitrogen (^{15}N), the amount of ^{15}N present in the accumulating in the sediments of the spawning lake can be used as a proxy for escapement (Kline, 1991). Studies have quantified the proportion of marine-derived nitrogen (MDN) released by adult salmon as a result of spawning migration (Kline et al., 1993). Measurable shifts in the MDN content of juvenile sockeye have been observed between years of strong and weak escapement. The N-isotope composition of lake biota reflects the recent history of MDN import into the lake ecosystem (Kline et al., 1993; 1994). In some lakes, this signal is transferred to the underlying sediments. Downcore changes in the abundance of MDN can reflect changes in the number of returning adult salmon (Finney et al., 2000).

D. Preliminary data for this study

Data from Karluk and Frazer Lakes on Kodiak Island indicate that sedimentary del^{15}N effectively tracks sockeye escapement (Fig. 1, Finney et al., 2000). We chose Frazer Lake as a test case for this method, as the lake was a "barren system" isolated by a waterfall from salmon prior to stocking in the late 1950s. Subsequently, a fish bypass was constructed and run size significantly increased, with an average escapement of about 200,000 since 1980 (Blackett, 1979; ADF&G, written comm., 1994). Such a large increase in escapement is clearly recorded by sedimentary del^{15}N (Fig. 1). The enrichment in del^{15}N is significant and strongly supports the hypothesis that sediment del^{15}N is influenced by salmon input of MDN. Similarly, data from Karluk Lake indicate a strong relationship between sediment del^{15}N and salmon escapement (Finney et al., 2000). Karluk Lake, one of the greatest sockeye systems in the world, had historical returns >5 million fish. Escapements averaged more than 1 million fish from the turn of the century until about 1935 but then fell to an average of less than 300,000 in the 1960s and 70s (Fig. 1; Koenings and Burkett, 1987a, ADF&G, written comm., 1994). The sedimentary del^{15}N in Karluk is significantly higher than Frazer, and it is consistent with greater salmon escapement. The large decline in sedimentary del^{15}N of about 3 parts per mil towards the top of the core reflects the decline in escapement in this system since the 1930s. These results indicate that sedimentary del^{15}N provides a valuable tool for reconstructing long-term changes in sockeye abundance.

In 2000 we retrieved four cores each from Solf and Eshamy Lakes in Prince William Sound. Solf is a "barren" lake into which salmon have been recently introduced, and Eshamy Lake naturally supports a vigorous sockeye run (Table 1). Preliminary analysis of one of the Eshamy Lake cores shows a striking del^{15}N record (Fig. 2). We have not

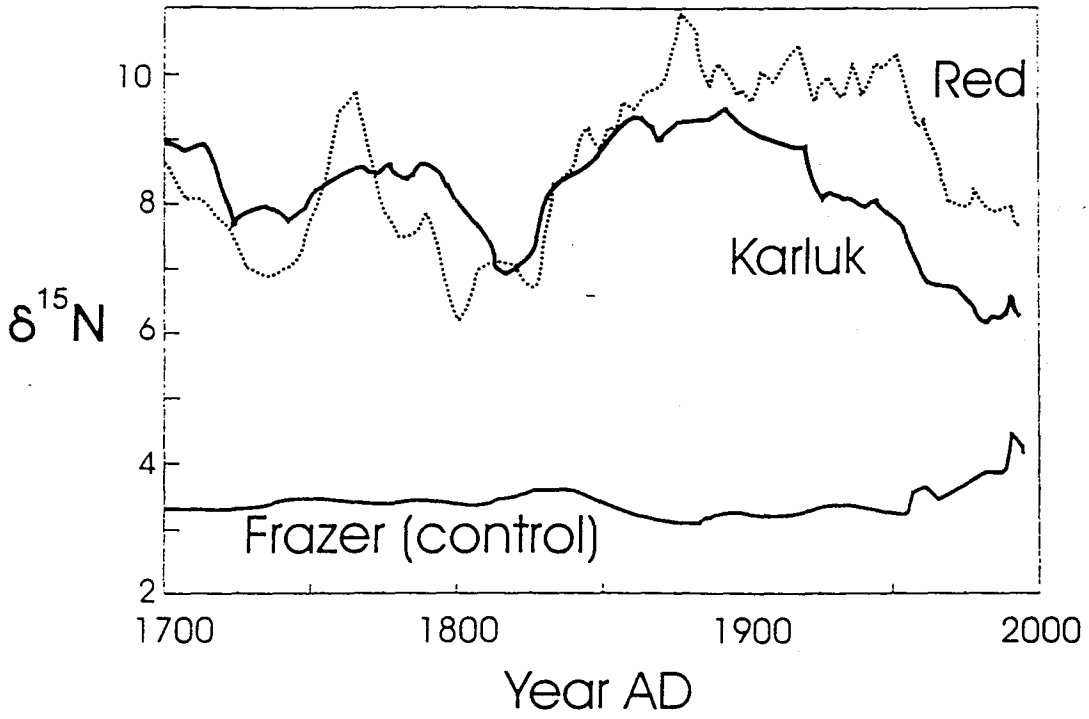

Figure 1. del^{15}N profiles from sockeye and control lakes on Kodiak Island over the past 300 years (Finney et al., 2000). Frazer Lake was barren of salmon until the 1950s, when a fish ladder was built.

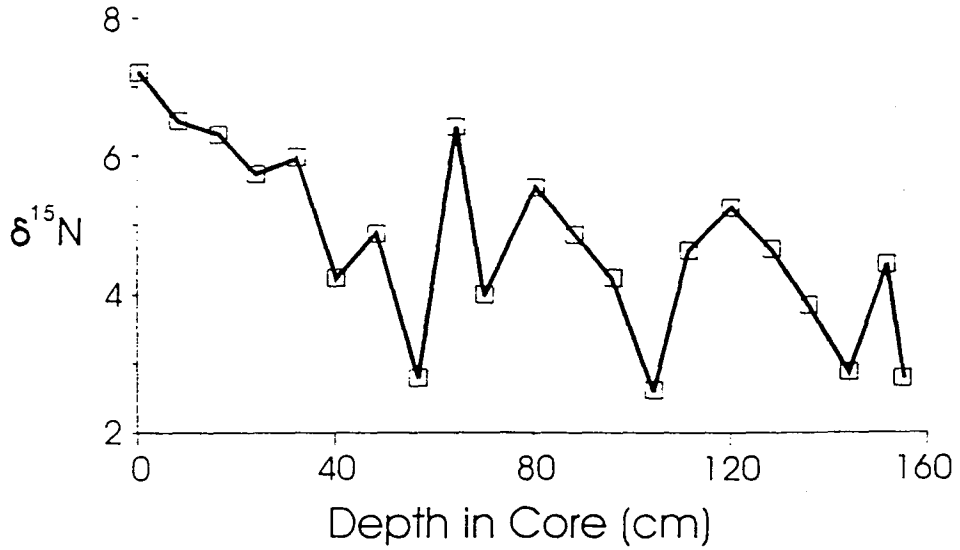

Figure 2. Preliminary del^{15}N profile from Eshamy Lake in Prince William Sound. We suspect this core extends back at least 4000 years. Wide variation in ^{15}N values indicate this lake has excellent potential to provide a high resolution record of salmon population changes.

obtained any radiocarbon dates from Eshamy Lake yet, though the presence of a shift in vegetation from alder to spruce at 130 cm depth in the core suggests that the core base probably dates to ca. 4000 years B.P. By comparison with previously analyzed lakes (Fig. 1), we judge that Eshamy Lake has the potential to provide an excellent del^{15}N record of sockeye spawning populations. Solf Lake will serve as a control for possible changes in non-salmon (e.g., aerosol) input of del^{15}N into Prince William Sound lakes.

Table 1. Characteristics of Study Lakes

Lake	Region	Lake type	Surface area (km^2)	Escapement (1000s fish)	Escapement/Area (1000s fish/km^2)
Eshamy	Prince William Sound	clear	3.6	40	11.1
Solf	Prince William Sound	clear, *control*	0.7	0	0*
Upper Russian	Kenai River	clear	4.6	75	16.3
Karluk	Kodiak Island	clear	39.5	1,000	25.3
Frazer	Kodiak Island	clear, *control*	16.6	(217)**	(13.1)**

*Stocking began in 1998; fish ladder constructed in 2000.
** Stocking began in 1950s; fish ladder built then.

NEED FOR THIS PROJECT

A. The Problem: What is "normal" for sockeye populations?

The recovery objective set by the EVOS Trustee Council for sockeye salmon is that adult returns-per-spawner should regain normal levels. But what is normal? If both the global environment fisheries management were stable then we might be able to define "normal". But change reigns in both nature and society, and what is normal for the last several decades may be unusual over longer time spans.

The retrospective studies we propose here can establish long-term, baseline records of changes in salmon populations in the GOA. We can use these records to define normalcy by estimating the frequency with which the observed population size occurred in the past. By knowing the extremes of natural population fluctuations in the past, we can identify abnormal population excursions as they occur in the future.

Understanding how environmental factors affect salmon populations is crucial for fisheries management in a time of global change. Also, sockeye may prove to be a useful indicator species for events within the larger GOA ecosystem. Before we can use sockeye as an indicator species, we need to understand how nonhuman factors control their numbers. From retrospective studies, we can generate testable hypotheses about how changes in the atmosphere/ocean system of the GOA will affect salmon populations in the near future. Nature has performed a series of experiments in past millennia, and we can gain access to the results of these experiments through analyses of del^{15}N in lake sediments.

B. Links: Giving GEM a time perspective

The goals of GEM are to detect, understand, and predict ecosystem changes in the GOA with the purpose of informing and assisting resource managers. Besides providing a more rigorous means of defining what is normal, our study will help lay the foundations for GEM by generating hypotheses that relate changes in the atmosphere/ocean system of the GOA to fluctuations in salmon numbers. The past is the key to the present, and climate has varied repeatedly over the last 2000 years. How did sockeye population respond to changes of several C^{o} in the past? The last time temperatures were as warm as today was during the Medieval Warm Period (AD 900-1250). How did sockeye populations respond to this previous warm period?

C. Study Sites

This study involves sockeye lakes in the northern GOA region that were affected by over escapement after the 1989 oil spill (Eshamy and Upper Russian Lakes) and two recently formed lakes in McCarty Fjord (Delight and Desire Lakes). Detailed sediment chemistry has been completed in the two Kodiak Island lakes, Karluk and Frazer (Fig. 2). Preliminary analysis has been done on Eshamy Lake (Fig. 1) in Prince William Sound. The field work we propose here is to core Upper Russian Lake in the Kenai River watershed in the spring of 2002. Delight and Desire Lakes, which rarely freeze, will be cored from rafts during the summer of 2002. We will use Solf Lake on Knight Island as a control for Eshamy Lake. Sedimentary ^{15}N levels in Solf Lake will provide a record of the background level of aerosol input of ^{15}N into PWS lakes. The Solf Lake cores also will be used to test the sensitivity of the ^{15}N method in picking up the first significant entry of anadromous fish into a lake that was barren prior to recent sockeye introductions.

COMMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

Archaeological records contain unsynthesized data concerning the interactions between humans and salmon populations during prehistoric times (see review in Mann et al., 1999). We suspect there is also a rich oral tradition in Native communities about the history and causes of changes in salmon abundance. Within the time constraints of this one-year project, our goals are to get data on sockeye population history and then to develop hypotheses about salmon-climate interconnections. Once we have the science figured out, we want to turn to the local people, the people actually living on the land, to share our ideas and get their ideas back. We anticipate asking EVOS for additional funds in FY 2003 to pay for several trips to Kodiak Island and to villages in PWS and on the Kenai Peninsula, where we will give brief presentations showing our results and initiate conversations about what factors control salmon populations in the GOA region.

PROJECT DESIGN

A. Objectives

We intend to reconstruct sockeye abundance in Eshamy, Upper Russian, Delight, and Desire Lakes using established methods of isotope analysis of lake-bottom sediments that are retrieved by coring. The specific objectives of this study are:

1) Develop sediment-core chronologies and measure downcore changes in lake-productivity indicators (organic C and C/N ratios) as well sedimentary del^{15}N.

2) Compare sediment data corresponding to the past few decades (e.g., the period of intensive investigations by ADF&G) to salmon population statistics. We then will develop calibration relationships between del^{15}N and salmon numbers.

3) Reconstruct paleolimnologic changes in each lake over the past several thousand years, using the results of Specific Objectives 1 and 2. Specifically, we will reconstruct time-series of lake productivity, input of marine-derived nutrients, and salmon escapement.

4) Compare del^{15}N records from PWS and the Kenai Peninsula to Finney's published and ongoing work on Kodiak Island. This synthesis will result in a valuable new perspective on changes in sockeye abundance in the GOA at decadal time scales over the last several millennia.

5) Compare reconstructed sockeye population fluctuations with published data sets on paleoclimatic changes in the GOA region. These data sets include tree rings, glacial records, and pollen records of vegetation change. From these comparisons, we will develop a series of hypotheses about how changes in the atmosphere/ocean system affect salmon populations.

B. Methods

1) Sediment cores

We already have cores from Eshamy, Solf, Karluk, and Frazer Lakes. Upper Russian, Delight, and Desire Lakes will be cored for the first time in this study. Existing cores from Karluk and Frazer Lakes that extend deeper than ones already described by Finney et al. (2000) are currently being analyzed in another project. The Kodiak cores will cover the same time scales as present in the Eshamy Lake record and, hopefully, as in the Upper Russian record.

Coring sites are identified from bathymetric maps, and sites are selected to avoid gravity-flow deposition and complicated bottom topography. We will obtain at least two, 1- 2 m long cores using the percussion corer that we built last year to obtain cores from each lake. High quality surface cores will be obtained with a device (Glew corer) designed for sampling unconsolidated sediments and obtaining an undisturbed sediment-water interface. The cores will be stored in a cold room and excess material archived for future studies.

Cores will be described for lithology, texture, color, and other properties, and photographed. Each core will be continuously scanned for magnetic susceptibility. Magnetic susceptibility, a measure of the abundance of magnetic minerals, provides important stratigraphic and sedimentologic information (e.g., King et al., 1983). For example, magnetic susceptibility is sensitive to volcanic ash abundance; visually undetected ashes often are easily detected in susceptibility profiles. Ash layers should be common in many of the lakes, given the close proximity to active volcanoes, and they are useful for correlating between cores and between different lakes. Sediment chronologies will be determined by a combination of ^{210}Pb-dating (Bruland et al., 1974) in the upper several tens of centimeters and by AMS-^{14}C dating of terrestrial plant macrofossils in sediments older than several centuries.

2) Reconstructing changes in sockeye salmon abundance

Changes in input of marine-derived nutrients (MDN) will be determined by analysis of del^{15}N. As discussed earlier, downcore changes in the abundance of MDN (from del^{15}N) reflect changes in the number of returning adult salmon, and thus is a proxy for escapement. Organic carbon content, C/N ratio, and del^{13}C also indicate changes in organic matter source (Hedges and Parker, 1976; Meyers, 1990). Time-series of organic C content, C/N ratios, and stable C and N isotopes will shed light on changes in the source and supply rate of organic matter. We will calibrate our MDN-based reconstructions in sockeye salmon escapement with recorded escapement records. The lakes we propose to study have had significant changes in escapement during the past few decades. These variations allow us to determine how well sedimentary del^{15}N reflects escapement (e.g., Fig. 1). Using recent calibrations, we will estimate prehistoric escapements from downcore changes in del^{15}N.

C. Cooperating agencies, contracts, and other agency assistance

Though no formal collaborations are planned with federal agencies within this brief project, in fact we are collaborating closely with ADF&G and USFWS in ongoing, similar studies of salmon paleoecology (e.g., Schmidt et al., 1997).

SCHEDULE

A. Project Tasks and Endpoints

December 31, 2001:	Complete del^{15}N analyses on Eshamy Lake and Solf Lake (control) cores; submit samples for ^{14}C and ^{210}Pb dating.
January, 2002:	Present preliminary results at Restoration Workshop and discuss their implications for design of GEM monitoring studies.
mid-March, 2002:	Core Upper Russian Lake.
June 30, 2002:	Complete del^{15}N analyses on cores from Upper Russian Lake; submit samples from this lake for ^{14}C and ^{210}Pb dating. Core Delight and Desire Lakes in Kenai Fjords.

July 31, 2002:	Complete literature reviews of proxy data describing climate/oceanographic changes in the northern GOA over the last several millennia. Develop hypotheses relating changes in salmon populations to climatic changes.
September 1, 2002:	Submit manuscript for publication in peer-reviewed journal concerning the applications of retrospective records of sockeye populations in fisheries management.
October 1, 2002:	Submit manuscript for publication in peer-reviewed journal concerning climate-oceanographic drivers of salmon populations in the GOA region. Also, develop a public lecture aimed at informing communities in the GOA region about our research.
December 7, 2002:	Present major finding at the American Geophysical Union Fall meeting.
January, 2003:	Present results and discuss implications for GEM projects at Restoration Workshop.
April, 2003:	Submit final report to EVOS.

PUBLICATIONS AND REPORTS

We plan on two publications published in peer-reviewed scientific journals. The first one concerns the use of retrospective data on sockeye salmon escapement inferred from lake-sediment records in fisheries management. Possible journals are *Fisheries Oceanography* and *Canadian Journal of Fisheries and Aquatic Science.* Our second publication will concern the connections between salmon populations and climatic change in the Gulf of Alaska region. Our target journal for publication is *Journal of Geophysical Research.*

PROFESSIONAL CONFERENCES

We will present our results at two scientific meetings, the American Geophysical Union meeting in San Francisco and a meeting of the American Fisheries Society.

PRINCIPAL INVESTIGATORS (see curricula vitae below)

Daniel H. Mann
Institute of Arctic Biology
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LITERATURE CITED

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Revision 9-5-01
Approved TC 8-6-01

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001- September 30, 2002

Budget Category:	Authorized FY 2003	Proposed FY 2002
Personnel		$0.0
Travel		$0.0
Contractual		$82.3
Commodities		$0.0
Equipment		$0.0
Subtotal		$82.3
General Administration		$5.8
Project Total		$88.1
Full-time Equivalents (FTE)		0.3
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
		Estimated FY 2003	Estimated		
		$18.8			

Dollar amounts are shown in thousands of dollars.

Comments:

1. Indirect costs at 25% as agreed with the University of Alaska Fairbanks.
2. 4% of direct cost will be spent on attending workshops and professional meetings for entire project.
3. Total project cost including 7% agency general administr tion (ADFG) will be $5.5 FY02
4. Publication cost-$4,000 to be submitted to Fisheries Oceanography and Canadian Journal of Fisheries and Aquatic Science and Journal of Geophysical Research.

FY02

Prepared:9/25/01

Project Number: 02649
Project Title: Reconstructing Sockeye Populations in the Gulf of Alaska over the Last Several Thousand Years: The Natural Background to Future Changes.
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001- September 30, 2002

Budget Category:	Authorized FY 2003	Proposed FY 2002
Personnel		$29.1
Travel		$4.5
Contractual		$26.2
Commodities		$6.0
Equipment		$0.0
Subtotal		$65.8
Indirect		$16.5
Project Total		$82.3
Full-time Equivalents (FTE)		0.3
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 2003	Estimated
$16.5	

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.

(Use this statement if there is a graduate student tuition and use proper resident or non-resident amount)

FY02

Prepared:6/22/02

Project Number: 02649
Project Title: Reconstructing Sockeye Populations in the Gulf of Alaska over the Last Several Thousand Years: The Natural Background to Future Changes.
Name: D. H. Mann and B. Finney

FORM 4A
Non-Trustee
SUMMARY

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001- September 30, 2002

	A	B	C	D	E	F	G	H	I	J	K
78											
79	**Personnel Costs:**							Months	Monthly		Proposed
80		Name		Position Description				Budgeted	Costs	Overtime	FY 2000
81		Mann		PI				2.0	9.1		18.2
82		Finney		Co-PI				0.75	7.3		5.5
83		Krumhardt		Technician				1.0	5.4		5.4
84											0.0
85											0.0
86											0.0
87											0.0
88											0.0
89											0.0
90											0.0
91											0.0
92											0.0
93						Subtotal		3.8	21.8	0.0	
94										**Personnel Total**	$29.1
95	**Travel Costs:**						Ticket	Round	Total	Daily	Proposed
96		Description					Price	Trips	Days	Per Diem	FY 2001
97		Fbks to Anchorage					0.25	6	6	0.1	2.1
98		Fbks to Upper Russian Lake					0.5	2		0.5	1.0
99		Fbks to AGU meeting San Francisco					0.6	1	4	0.2	1.4
100											0.0
101											0.0
102											0.0
103											0.0
104											0.0
105											0.0
106											0.0
107											0.0
108											0.0
109										**Travel Total**	$4.5
110											
111	**FY02**			Project Number: 02649						FORM 4B	
112				Project Title: Reconstructing Sockeye Populations in the Gulf of						Personnel	
113				Alaska over the Last Several Thousand Years: The Natural						& Travel	
114				Background to Future Changes.						DETAIL	
115				Name: D. H. Mann and B. Finney							
116	Prepared:6/22/01										

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001- September 30, 2002

	A	B	C	D	E	F	G	H	I	J	K
117											
118	**Contractual Costs:**										Proposed
119	Description										FY 2001
120	Laboratory analyses of N and C isotopes										6.0
121	AMS-radiocarbon dating, 20 samples @ $500/ea.										10.0
122	210Pb analyses, 3 @ $2000/ea.										6.0
123	Ski-plane charter, Kenai to Upper Russian Lake, 4 hrs										1.2
124	Float-plane charter, Homer to Delight and Desire lakes										3.0
125											
126											
127											
128											
129											
130											
131											
132											
133									**Contractual Total**		$26.2
134	**Commodities Costs:**										Proposed
135	Description										FY 2001
136	Material misc. cord, cable and rope for the corer and laboratory glasware for Dr. Finney's work.										1.5
137	Publications										4
138	Communications and copies										0.5
139											
140											
141											
142											
143											
144											
145											
146											
147											
148									**Commodities Total**		$6.0
149											
150	**FY02**		Project Number:								FORM 4B
151			Project Title: Reconstructing Sockeye Populations in the Gulf of								Contractual &
152			Alaska over the Last Several Thousand Years: The Natural								Commodities
153			Background to Future Changes.								DETAIL
154			Name: D. H. Mann and B. Finney								
155	Prepared:6/22/01										
156											

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001- September 30, 2002

	A	B	C	D	E	F	G	H	I	J	K
157	**New Equipment Purchases:**								Number	Unit	Proposed
158	Description								of Units	Price	FY 2001
159											0.0
160											0.0
161											0.0
162											0.0
163											0.0
164											0.0
165											0.0
166											0.0
167											0.0
168											0.0
169											0.0
170											0.0
171											0.0
172	Those purchases associated with replacement equipment should be indicated by placement of an R.								**New Equipment Total**		$0.0
173	**Existing Equipment Usage:**									Number	
174	Description									of Units	
175											
176											
177											
178											
179											
180											
181											
182											
183											
184											
185											
186											
187											
188											
189											
190											
191	**FY02**										
192											
193											
194	Prepared:6/22/01										

Project Number:
Project Title: Reconstructing Sockeye Populations in the Gulf of Alaska over the Last Several Thousand Years: The Natural Background to Future Changes.
Name: D. H. Mann and B. Finney

FORM 4B
Equipment
DETAIL

Revision 1-4-01
approved TC 8-6-01

A 6,300-Year Old Window into the Past: Retrospective Analysis of Nearshore Marine Communities Based on Analysis of Archeological Material and Isotopic Analysis

Project Number:	02656
Restoration Category:	Research

Proposers:

Dr. Gail Irvine
USGS-BRD
Alaska Biological Science Center
1011 E. Tudor Rd.
Anchorage, AK 99503

Dr. Jeanne Schaaf
National Park Service
2525 Gambell St.
Anchorage, AK 99503

Dr. Dan Mann
Institute of Arctic Biology, Irvine Bldg
University of Alaska,
Fairbanks, AK 99775

Lead Trustee Agency:	DOI--USGS
Cooperating Agencies:	
Alaska SeaLife Center:	No
Duration:	2 years
Cost FY 02:	$ 109.9
Cost FY 03:	$ 28
Geographic Area:	Gulf of Alaska
Injured Resource/Service:	Intertidal communities, clams

ABSTRACT

The primary purpose of this proposal is to investigate long-term (6,300 year) patterns of productivity and relative species abundances in nearshore, intertidal communities via retrospective analyses. These analyses will focus on excavated midden remains of a very rich, well-dated archeological site along the Katmai National Park and Preserve coast. Changes in nearshore marine communities will be assessed through examination of relative species abundances, size-frequency analysis, and other indicators of habitat changes. Isotopic analysis of shells will provide an assessment of long-term productivity patterns in the nearshore marine environment as related to major periods of climate change.

INTRODUCTION

Changes in marine ecosystems occur on multiple scales of space and time. In the near-term, recent biological information suggests that patterns in the abundances of marine organisms and productivity of their associated systems may change in a low-frequency cyclical manner (e.g., regime shifts; Francis et al., 1998; Hare and Mantua, 2000), or may undergo longer-term directional change (e.g., Bering Sea; Schell, 1998, 2000). Long-term changes may reflect changes in climate that have spanned decades, centuries or millenia. Such changes are known for coastal regions from a variety of data. Within Alaska, the coastal paleoenvironments and climate of the late Pleistocene and Holocene have been reviewed by Mann and Hamilton (1995) and Mann et al. (1998, 1999).

Long-term changes in marine ecosystems are difficult to investigate, and the entrees into such data are limited. Cores, isotopic analyses, pollen-grain analyses, tree-ring data, and archeological investigations have been used to examine long-term biological data. A combination of data may provide a multi-faceted approach that allows integration and interpretation of changes and processes occurring in nearshore marine environments.

A tremendous opportunity to gain long-term perspective on biological change in nearshore marine communities bordering the Gulf of Alaska is afforded by recent excavations of a coastal archeological site along the Katmai National Park and Preserve coast. This exceptionally rich site, excavated by a team lead by Dr. Jeanne Schaaf, has midden material dated to at least 6,300 radiocarbon years before present (BP). This site is unusual in its long history, excellent organic preservation, and well-defined stratigraphy, which allows layers to be related to dated occupation surfaces. The material at the site is quite abundant. The non-mixed nature of the material contributes to the clarity of the stratigraphy. There are at least 50 ^{14}C values for the site, determined from occupation surfaces and associated midden materials. The site appears to have been occupied pretty continuously over the last 6300 years except for a gap from approximately 2,000 to 4,000 years before present. This same gap has been noted from other sites across the whole region (the northern Alaska Peninsula and Kodiak). What sets this site apart from other sites along the Kenai Peninsula coast and SE Alaska is the abundance of the biological material and its excellent preservation. It is both the oldest identified and most extensively excavated site along the northern Alaska Peninsula.

In addition to the suite of ^{14}C values from the site, there are at least 50 other values from the Katmai coastal area that provide a broader context for the site. Paleoclimate data have been collected in nearby areas, including analysis of a peat deposit that spans 10,000 years and that contains a tephra (volcanic ash) stratigraphy and vegetational history of the entire Holocene (Hilton, 2000). The combination of radiocarbon dates and paleoclimate information provides a context within which a more detailed analysis of nearshore species found in midden remains can be made.

We propose a retrospective analysis of midden material to determine long-term patterns in nearshore productivity, their relation to climate changes, and ecological changes in composition of nearshore marine communities.

NEED FOR THE PROJECT

A. Statement of Problem

The GEM program is focused on monitoring species and processes in order to describe and understand changes in the oceanic and nearshore environments of the Gulf of Alaska. As an early part of the program, it has espoused the need for retrospective analyses in order to enrich our understanding of long-term changes in this region. The shorter-term cyclical patterns in species abundances and climate that are a focus of much of GEM, must be understood against the broader spectrum of truly long-term (century to millenial) changes and more directional climate change (e.g., global warming). Retrospective analyses of archeological sites may allow development of such a perspective. The goals of the proposed project are to develop long-term patterns of productivity and relative species abundances in the nearshore and investigate their relationship to climate change.

B. Rationale/Link to Restoration

In order to understand the effects of the *Exxon Valdez* oil spill and other perturbations, we need to have an increased understanding of how species are changing through time. This project focuses on the nearshore environment, an area that was heavily injured by the *Exxon Valdez* oil spill. Developing an understanding of long-term change in nearshore marine communities and investigating the relationship between productivity and climate will aid in the development of the GEM monitoring plan.

C. Location

Study is focused on the Mink Island archeological site on the Katmai National Park and Preserve coast, bordering the Gulf of Alaska.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

Retrospective analysis of archeological specimens involves the revealing of human use patterns of resources. This could enrich the cultural history of local native groups. Additionally, querying local groups about findings may reveal whether similar use of nearshore species is made now or was in the recent past. We will be happy to discuss our findings with native groups.

PROJECT DESIGN

A. Objectives

1. Assess long-term patterns in nearshore productivity via isotopic analysis of shells of selected invertebrate taxa found in different, dated layers of middens.

2. Evaluate the paleoecology of the assemblages found in the middens via relative species composition, abundances, etc., and compare to patterns of productivity.

B. Methods

The hypotheses and methods used to address them are outlined below.

H1: Changes in nearshore productivity, as evidenced by isotopic signatures of invertebrate shells, have changed in relation to major climate changes or trends in the Holocene.

H2: Changes in species composition, sizes, etc., of midden species assemblages reflect changes in climate, habitat, or human use patterns.

The methods used to test each of these hypotheses are given below.

H1: Changes in nearshore productivity, as evidenced by isotopic signatures of invertebrate shells, have changed in relation to major climate changes or trends in the Holocene.

Recent analyses of stable isotope ratios of baleen of bowhead whales suggest declining productivity in the Bering Sea (Schell, 1998, 2000). In this case, analysis of carbon isotope ratios provided a means of indirectly assessing relative primary production. The bowhead whales feed on zooplankton that they filter with their baleen, and are thus one step removed from the phytoplankton primary producers. Bivalve molluscs, the dominant constituents of the middens at the Mink Island site, are also filter feeders, but feed more commonly on phytoplankton, thus responding more directly to patterns in primary productivity. Although the relationship of short-term changes in primary productivity may be reflected in annular growth rates of bivalves, this type of analysis is not appropriate for archeological material where the dating of the material is not sufficiently precise.

Thus, we propose a combination of carbon and nitrogen isotopic analyses ($\delta^{13}C$, $\delta^{15}N$, ^{14}C) of bivalve shells from the Mink Island midden to examine long-term changes in nearshore primary productivity. Carbon is transferred relatively conservatively in food webs and stable isotopic analysis of $\delta^{13}C$ gives excellent information on sources and magnitudes of productivity. Recent studies of the relationships between stable carbon isotope ratios in phytoplankton and the growth of diatoms (Laws et al., 1995) and for

University of Alaska, Fairbanks). Contracts for natural stable isotope analysis are expected with the University of Alaska, Fairbanks. Another contract will be arranged for ^{14}C analysis via accelerator mass spectroscopy (AMS).

SCHEDULE

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

Oct 1– July 31:	Set up contracts
Oct. 1- March 31:	Evaluation of climate record, midden materials for selection of target dates and shells for analysis
Oct 1 - July 31:	Evaluate isotopic techniques, preliminary assessments of recent material, test archeological material
Nov 30– Sept 30:	Isotopic analysis of shell material.
Jan 14-23 (2 days):	Participate in EVOS Annual Restoration Workshop
February 1- Sept 30:	Ecological analyses of midden materials
August, 2002	Present project results to Ecological Society of America
April 15, 2003	Draft final report

B. Project Milestones and Endpoints

FY02: Natural stable isotopic analyses of recent (test) bivalves and archeological midden shells
Radiocarbon (^{14}C) analysis of selected clam shells
Data analysis
Ecological analyses of composition/size structure of selected midden species

FY03: Data analysis and synthesis, draft final report (April 15, 2003), manuscript preparation

C. Completion Date

A draft final report will be produced April 15, 2003.

PUBLICATIONS AND REPORTS

A draft final report will be produced April 15, 2003. Manuscripts for publication will be produced in FY03. Three manuscripts are planned: one focused on the relationship between isotopic composition of shells and major climate patterns over the last 7,000 years, a second focused on the ecological analysis of the midden material through time, and a third examining the implications of the ^{14}C analysis for long-term ocean circulation.

PROFESSIONAL CONFERENCES

I plan to present the ecological analysis of midden materials to the Ecological Society of America (FY02); these meetings are held in August of each year. In FY03, I plan to present a paper on the isotopic analyses to the annual meeting of the American Society of Limnology and Oceanography in Albuquerque, NM.

NORMAL AGENCY MANAGEMENT

The work involved in this project is not part of normal agency management.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

As the research proposed is very multidisciplinary in nature, we will be coordinating and integrating information with other researchers using stable isotopic analyses, especially those involved in retrospective analyses. Additionally, we will integrate our paleoecological analyses with available information from other appropriate archeological sites bordering the Gulf of Alaska.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

N/A

PROPOSED PRINCIPAL INVESTIGATORS

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PRINCIPAL INVESTIGATORS

Dr. Irvine is a Marine Ecologist with the Alaska Biological Science Center. She has extensive experience in coastal ecosystems in Alaska, the Pacific Northwest and the tropics. Her primary research interests have focused on population and community ecology of nearshore systems, oil effects, the design of long-term monitoring programs and associated research, plant-herbivore interactions, succession, and life history dynamics. She is also interested in broad-scale and long-term research. Gail has been a Principal Investigator on several EVOS-funded studies involving oiled mussel beds and the residual oiling of coastlines and has been involved in publishing results from both projects. Recently she was invited to author a chapter on "Persistence of Spilled Oil on Shores and its Effects on Biota" for The Seas at the Millenium, a three-volume assessment of the state of the world's oceans published by Elsevier Scientific Press. Over the last 4 years, she has also been involved in designing protocols for broad-scale, inferential monitoring of intertidal assemblages in Glacier Bay National Park and Preserve, then adapting the design for the small coastline of Sitka National Historical Park.

Dr. Schaaf is Director of the Lake Clark-Katmai Studies Center of the National Park Service. She has organized and spearheaded the archeological excavations occurring over the last four years at Mink Island, Katmai National Park and Preserve. In her previous position as an archeologist in the Regional Office of the NPS, she was responsible for managing the Shared Beringian Heritage Program, the National Archeological Survey Initiative Gulf of Alaska Coastal Survey and the Alaska region Cultural Sites Inventory. Jeanne has been both editor and author of publications concerning cultural traditions and archeological studies in Alaska.

Dr. Mann is a Research Associate at the University of Alaska, Fairbanks, with degrees in Anthropology, Forest Entomology, and Soil Science and Quaternary Studies. His research has focused on Holocene glacial histories, paleoclimate reconstructions, dynamics of coastal systems (geologic), dynamics of developing plant assemblages, and oil spill studies. He has published at least 12 papers on the paleoclimate of Alaska, with additional publications having different geographic focus. His CV is attached.

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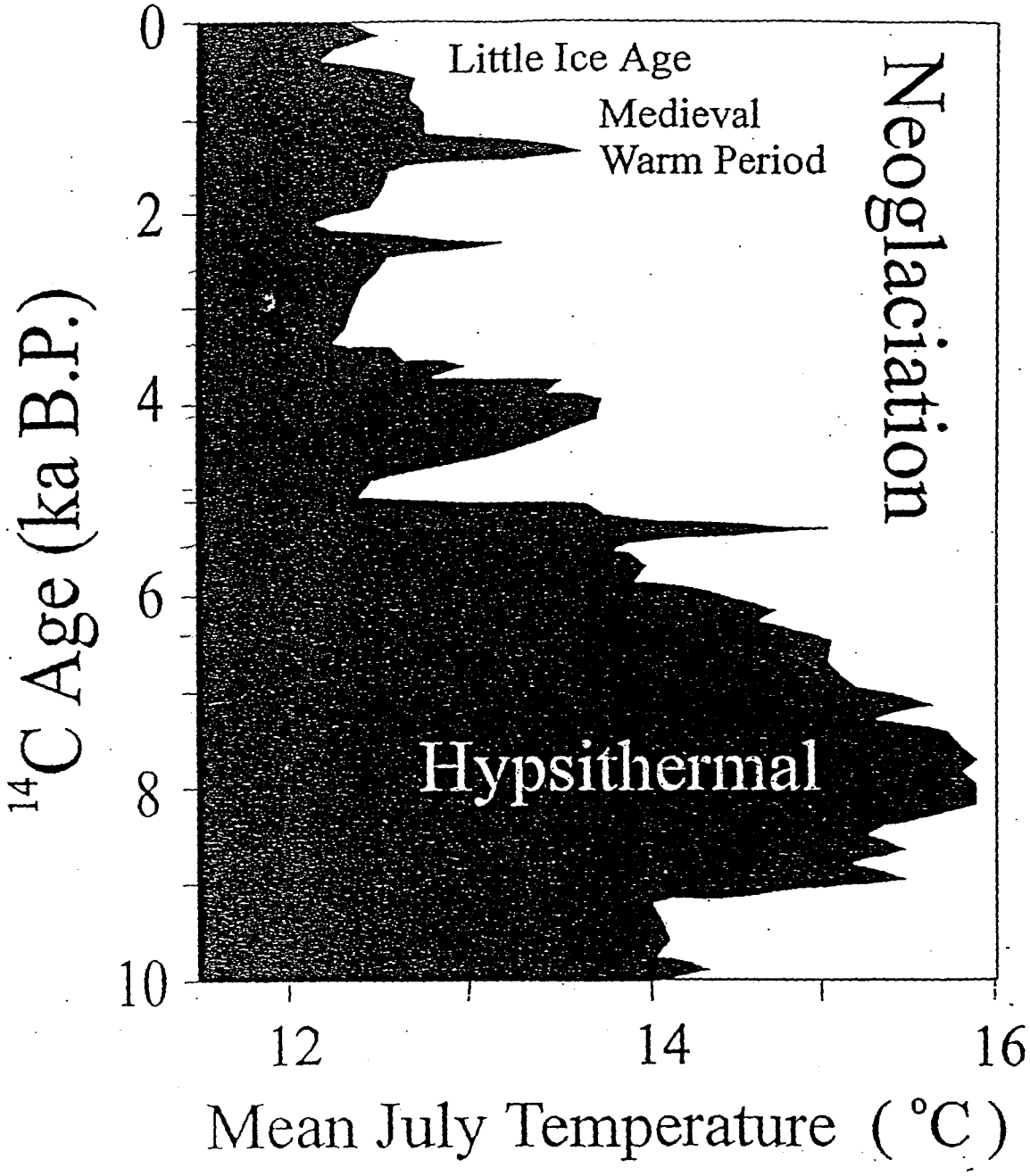
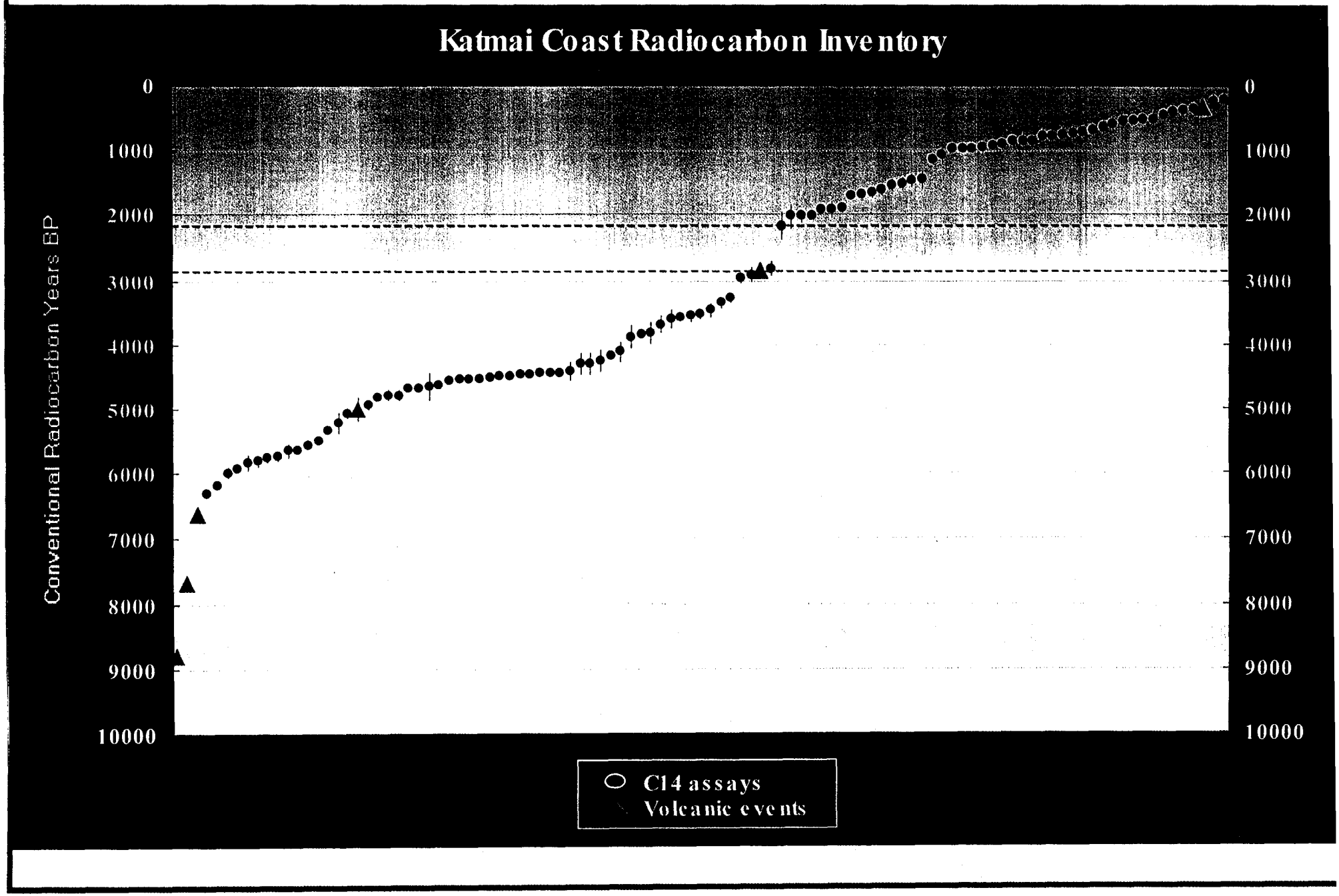


Figure 1. History of summer temperature in southern Alaska during the Holocene inferred from pollen transfer functions (redrawn from Heusser et al. 1985). The warmest period of the Holocene occurred between 9 and 6 ka, and was followed by Neoglaciation after 5-6 ka (from Mann et al. 1998).


Katmai Coast Radiocarbon Inventory
Conventional Radiocarbon Years BP
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
C14 assays
Volcanic events

Revision 7-9-01
Approved 7-8-01

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002	PROPOSED FY 2002 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	
							$109.9	
Personnel	$0.0	$48.4						
Travel	$0.0	$3.4						
Contractual	$0.0	$47.5						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$99.3			Estimated FY 2003			
General Administration	$0.0	$10.6						
Project Total	$0.0	$109.9			$28.0			
Full-time Equivalents (FTE)	0.0	0.7						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$0.0	$0.0			$0.0	$0.0		

Comments:

FY02

Revised: 7/9/01

Project Number: 02656
Project Title: A 6,300-Year Old Window into the Past...
Lead Agency: DOI--USGS

FORM 2A
MULTI-TRUSTEE
AGENCY SUMMARY

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002	LONG RANGE FUNDING REQUIREMENTS					
Personnel		$44.2						
Travel		$3.4						
Contractual		$47.5						
Commodities		$0.0						
Equipment		$0.0						
Subtotal	$0.0	$95.1						
General Administration		$10.0						
Project Total	$0.0	$105.1						
Full-time Equivalents (FTE)		0.7						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

FY02

Revised: 7/9/01

Project Number: 02656
Project Title: A 6,300-Year Old Window into the Past...
Agency: DOI-USGS

FORM 3B
Personnel
& Travel
DETAIL

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2002
Gail Irvine	Marine Ecologist	GS 12/9	2.0	8.3		16.6
Vacant	Biologist	GS 9/1	6.0	4.6		27.6
		Subtotal	8.0	12.9	0.0	
					Personnel Total	$44.2

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2002
Consult with Dr. Don Schell, University of Alaska, Fairbanks; review lab and procedures	0.2	1	2	0.2	0.6
Present results to Ecological Society of America, Annual Meeting, August 4-8, 2002; Tuscon, AZ	1.3	1	6	0.2	2.5
Registration	0.3	1			0.3
				Travel Total	$3.4

FY02

Revised: 7/9/01

Project Number: 02656
Project Title: A 6,300-Year Old Window into the Past...
Agency: DOI-USGS

FORM 3B
Contractual & Commodities DETAIL

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Contractual Costs:	Proposed
Description	FY 2002
	0.0
Research Work Order to UAF, Dan Mann	10.5
	0.0
Natural Stable Isotopic Analyses, 500 samples @ $26/sample	13.0
	0.0
AMS analysis of shell material, 40 samples @ $600/sample	24.0
	0.0
	0.0
	0.0
	0.0
	0.0
	0.0
	0.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$47.5

Commodities Costs:	Inventory
Description	Agency
Commodities Total	

FY02

Revised: 7/9/01

Project Number: 02656
Project Title: A 6,300-Year Old Window into the Past...
Agency: DOI-USGS

FORM 3B
Equipment
DETAIL

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2002

Comments:

FY02

Revised: 7/9/01

Project Number: 02656
Project Title: A 6,300-Year Old Window into the Past...
Agency: DOI-USGS

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002	LONG RANGE FUNDING REQUIREMENTS					
Personnel		$4.2						
Travel		$0.0						
Contractual		$0.0						
Commodities		$0.0						
Equipment		$0.0						
Subtotal	$0.0	$4.2						
General Administration		$0.6						
Project Total	$0.0	$4.8						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

FY02

Revised: 7/9/01

Project Number: 02656
Project Title: A 6,300-Year Old Window into the Past...
Agency: DOI-NPS

FORM 3B
Personnel & Travel DETAIL

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2002
Jeanne Schaaf	Archeologist	GS 12/9	0.5	8.3		4.2
						0.0
	Subtotal		0.5	8.3	0.0	
					Personnel Total	$4.2

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2002
				Travel Total	$0.0

FY02

Revised: 7/9/01

Project Number: 02656
Project Title: A 6,300-Year Old Window into the Past...
Agency: DOI-NPS

FORM 3B
Contractual & Commodities DETAIL

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Contractual Costs:	Proposed FY 2002
Description	
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	

Commodities Costs:	FY 2002
Description	
Commodities Total	

FY02

Revised: 7/9/01

Project Number: 02656
Project Title: A 6,300-Year Old Window into the Past...
Agency: DOI-NPS

FORM 3B
Equipment
DETAIL

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2002
Dan Mann	Quaternary geologist: paleoclimates and geomorphology		1.0	9.1		9.1
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.0	9.1	0.0	
					Personnel Total	$9.1

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 2002
						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

FY02

Revised: 7/9/01

Project Number: 02656
Project Title: A 6,300-Year Old Window into the Past...
Lead Agency: USGS contract to UAF

FORM 4B
Personnel
& Travel
DETAIL

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Contractual Costs:	Proposed FY 2002
Description	
Contractual Total	$0.0

Commodities Costs:	Proposed FY 2002
Description	
Commodities Total	$0.0

FY02

Revised: 7/9/01

Project Number: 02656
Project Title: A 6,300-Year Old Window into the Past...
Lead Agency: USGS contract to UAF

FORM 4B
Contractual & Commodities DETAIL

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2002
			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	

FY02

Revised: 7/9/01

Project Number: 02656
Project Title: A 6,300-Year Old Window into the Past...
Lead Agency: USGS contract to UAF

FORM 4B
Equipment
DETAIL

Revision 7-7-01
approved 8-6-01

Effectiveness Of Citizens' Environmental Monitoring Program

Project Number:	02667
Restoration Category:	Monitoring
Proposer:	Cook Inlet Keeper
Lead Trustee Agency:	ADEC
Cooperating Agencies:	
Alaska SeaLife Center:	No
Duration:	1st year, 1-year project
Cost FY 02:	$16,700
Cost FY 03:	
Geographic Area:	Cook Inlet basin
Injured Resource/Service:	This project takes an ecosystem approach towards monitoring and restoration and will result in direct and indirect benefits to all injured resources and lost or reduced services located in the Cook Inlet basin.

ABSTRACT

Cook Inlet Keeper will analyze five years of past data from the Keeper's Citizens' Environmental Monitoring Program (CEMP): the first consistent, credible, and coordinated community-based water quality monitoring program in Alaska. Keeper's Stream Ecologist will determine if sampling frequency, methods, parameters, and site selection are effective at meeting the monitoring objectives of detecting significant changes in water quality over time. The results will assist Cook Inlet Partners (Kenai Watershed Forum, Anchorage Waterways Council, Wasilla Soil and Water Conservation District) refine their community monitoring efforts and may lead to future community-based monitoring programs.

INTRODUCTION

Cook Inlet Keeper is requesting one year of funding from the EVOS Trustee Council through the Ecosystem Synthesis/GEM Transition: Community-Based Monitoring Programs. This project will analyze past data collections that will lead to more effective and scientifically defensible community monitoring efforts.

In 1996, Cook Inlet Keeper established its Citizens' Environmental Monitoring Program (CEMP) to actively involve citizens in collecting reliable water quality data in the Cook Inlet basin. With funding from Alaska's Department of Environmental Conservation and guidance from a Technical Advisory Committee, Keeper developed a Kachemak Bay Pilot Project as a working template that could be adopted by other groups interested in conducting citizen-based monitoring programs. The objectives of CEMP are to 1) inventory baseline water quality in the Cook Inlet basin, 2) detect and report significant changes and track water quality trends, and 3) raise public awareness of the importance of water quality through hands on involvement. Water quality parameters, data quality objectives, and site selection criteria were developed with a Technical Advisory Committee made up of professionals representing various federal, state, and local agencies and diverse scientific backgrounds.

In 1999, Keeper entered into an agreement with the Anchorage Waterways Council and the University of Alaska Anchorage's Environment & Natural Resources Institute to facilitate citizen-based water monitoring and assessment of the Anchorage Bowl. Keeper then entered into a similar agreement with the Wasilla Soil and Water Conservation District to begin monitoring in the Mat-Su Valley. As interest in CEMP continues to grow, there is a need to evaluate the effectiveness of the monitoring protocols and sampling design to meet the monitoring objectives. Keeper proposes to analyze five years of CEMP data to determine if sampling frequency, methods, parameters and site selection are effective at detecting significant change in water quality over time. These results will be useful to GEM when citizen-based monitoring programs are considered for funding in the future.

NEED FOR THE PROJECT

A. Statement of Problem

One of the biggest challenges to restore habitat and water quality following the *Exxon Valdez* oil spill has been the lack of adequate baseline data describing conditions before the spill. Since the oil spill, scientist have worked diligently to collect information describing recovery of species and habitats. But until recently there was no comprehensive long-term study to document water quality conditions in Southcentral Alaska. Baseline information provides a benchmark for measuring future changes in water quality and a basis for developing and implementing pollution prevention and best management practices.

As state and federal budgets for water quality monitoring continue to decline, citizens have stepped in to gauge the health of our public resources. Despite various philosophies on the

environment, everyone agrees that clean water and healthy fisheries should be protected. Diverse stakeholders such as fishermen, landowners, outdoor enthusiasts, Alaska Natives, scientists, educators, families, conservationists, and decision makers are expressing a desire to better understand and protect our water resources. Cook Inlet Keeper is leading the way and providing citizens with the opportunity to expand our knowledge of the Cook Inlet watershed.

Since Cook Inlet Keeper established Alaska's first consistent, credible, and coordinated volunteer water quality monitoring program in 1996, other groups throughout Alaska have requested Keeper's assistance in establishing volunteer monitoring in their communities. Toward that end, Keeper has formally partnered with the Anchorage Waterways Council, Kenai Watershed Forum, and Wasilla Soil and Water Conservation District to train more than 200 volunteers throughout the Cook Inlet watershed to monitor more than 90 freshwater and estuarine sites. With five years of data collected, it is important to ensure that sampling frequency, methods, parameters, and site selection are effective at meeting the monitoring objectives of detecting significant changes in water quality over time.

B. Rationale/Link to Restoration

Developing a monitoring system to detect and recognize significant change is challenging because natural systems are inherently dynamic and spatially heterogeneous. Many changes are not a result of human activity and are reflective of natural variability. An important step of every monitoring program is determining if the project objectives can actually be attained by the methods, parameters, and analyses used. To determine if a monitoring program is successful at detecting real change and not just natural variability, the statistic power of the monitoring design needs to be assessed.

With five years of data collected, Keeper can now determine if the CEMP protocols influence data variability which can affect data interpretation. Improvements in sampling protocols can then be made to better represent water quality in the Cook Inlet basin. Determining the effectiveness of CEMP protocols will ensure that monitoring projects developed by current partners (Anchorage Waterways Council, Kenai Watershed Forum, and Wasilla Soil and Water Conservation District) as well as future citizen-based programs around the Gulf of Alaska will be successful in detecting changes in water quality over time.

C. Location

The Cook Inlet watershed was hit hard by the *Exxon Valdez* oil spill. The currents in the Gulf of Alaska caused oil to move up into Cook Inlet, along the Kenai Peninsula and back down the Alaska Peninsula, soaking much of the shoreline and ocean floor with crude oil. As a result, many of Cook Inlet's coastal resources, and the services which they support, were impacted.

Although some recovery has occurred, Cook Inlet's sensitive resources face ongoing threats from a host of unsustainable activities, including rapid filling of wetlands; additional oil spills from an aging oil and gas infrastructure; discharge of pollutants from industrial activities; and increased nonpoint runoff from population growth and sprawl. Approximately 400,000 people, nearly 2/3 of Alaska's population, live in the vast Cook Inlet watershed, and a population

increase of 600% over the past thirty years has substantially magnified pressures on Cook Inlet's sensitive resources.

Communities involved in and affected by Keeper's Citizen Environmental Monitoring Program include Wasilla, Anchorage, Kenai, Soldotna, Ninilchik, Anchor Point, Homer, Seldovia, Port Graham, Nanwalek, and others. Citizens throughout the Cook Inlet watershed will benefit from refinements or changes that are made to CEMP protocols based on the results of this project. Citizens in other Gulf of Alaska watersheds will benefit when future citizen-based monitoring programs are developed.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

Because citizens are the true owners of public water resources, Keeper strives to involve them in hands on activities aimed at improving and protecting habitat and water quality and promoting resource stewardship. Citizen-based monitoring is a community-owned and community-driven effort. It is a highly effective way to bridge the gap between citizens and natural resource agencies. Citizens are directly involved in collecting and tracking water quality information, and have a greater sense of ownership of the monitoring findings.

Citizen monitoring is also an important way to integrate traditional environmental knowledge (TEK) with science. Many of the citizens who become involved in the monitoring efforts have a long history with their local regions. Keeper is set to begin working with Alaska Native organizations, including the Port Graham/Nanwalek Watershed Council and Ninilchik Traditional Council in citizen monitoring efforts. Keeper recognizes the powerful role that TEK can play to further water quality monitoring goals. Visual and other observations through narration, photographs and sketches may be one way to better incorporate TEK into citizen-based monitoring, and Keeper will continue to work to strengthen TEK components.

As part of citizen-based monitoring, participating communities have access to project information because they own and drive the project. Keeper compiles and presents all collected water quality monitoring findings in a variety of ways. In addition to publishing formal reports with narrative, charts, graphs, GIS maps and photos, Keeper also publishes monitoring information in its bi-annual newsletter and on its web page. Keeper often incorporates photos and GIS maps of water quality monitoring sites in its reports, articles, and web page as visual tools to help citizens understand the monitoring efforts.

Keeper values community participation, and believes the best way to involve people is by traveling to communities to gain a better understanding of local needs and interests. In 1998, Keeper produced the *Cook Inlet GIS Atlas* on CD ROM which synthesizes more than 125 computer map layers of pollution, habitat, streams, and other information. Keeper worked with over 20 community-based groups to take the CD ROM to 13 Cook Inlet communities to give citizens a visual understanding of their local watersheds, and to share Keeper's GIS mapping and water quality monitoring information. Since that time, Keeper has had several groups from throughout Cook Inlet request information and services to assist them with their efforts to understand their local watersheds.

PROJECT DESIGN

A. Objectives

The overall objectives of CEMP are to 1) inventory baseline water quality in the Cook Inlet basin, 2) detect and report significant changes and track water quality trends, and 3) raise public awareness of the importance of water quality through hands on involvement. The proposed project has the following objectives:

1. Evaluate whether CEMP sampling frequency, sampling methods, water quality parameters, and site selection are effective at detecting significant changes in water quality over time.
2. Generate recommendations for improvements to CEMP protocols to better represent water quality in the Cook Inlet, which will lead to more effective and scientifically defensible community monitoring efforts.

B. Methods

Keeper staff will analyze five years of CEMP data using 1) descriptive statistics, graphs, and analysis of variance to determine variability within sites, between sites, and over time and 2) power analysis to determine the statistical power of the sampling program to detect change.

The CEMP database consists of data collected from 1996 to 2001 at a total of 89 sites (47 estuarine, 42 freshwater) in the Kachemak Bay watershed. Surface water samples are taken at all monitoring stations monthly between September and April and twice monthly from May through August for a total of 16 sampling events per site per year. Primary parameters (water temperature, turbidity, pH, salinity, and dissolved oxygen) are measured using standard EPA-approved procedures and/or methods which are in use by established citizen volunteer monitoring programs (e.g. Friends of Casco Bay's Citizens Water Quality Monitoring Program, Texas Watch's Volunteer Environmental Monitoring Program). Methods for additional parameters (apparent color, conductivity, nitrate-nitrogen, ortho-phosphate, fecal and total coliform bacteria) are taken from the "Volunteer Estuary/Lake/River/Stream Monitoring: A Method's Manual" published by U.S. EPA.

All data are reviewed by Keeper's Research Coordinator to ensure they meet program data quality objectives. The data quality objectives and quality assurance procedures for this program have been designed to identify and correct problems in data collection and reporting. Should the results of quality assurance reviews indicate that the integrity of data are questionable and data quality objectives are not being met, the data are flagged as unacceptable for inclusion in the CEMP database. None of the suspect data will be included in the proposed data analysis.

The null hypothesis for the CEMP is that there will be no significant mean difference in water quality parameters over time. For the CEMP data to be sufficiently powerful enough to test this, Keeper needs to determine if 1) sample size for baseline data is adequate, 2) precision of CEMP methods are adequate, and 3) temporal and geographic coverage is adequate. The robustness of

the CEMP protocols to reject the null hypothesis will be analyzed with SPSS Base 10.1 for Windows and SamplePower 2.0 software.
Preliminary analysis will entail generating descriptive statistics and graphical presentations of the data from all sites. Descriptive statistics will include overall mean, standard deviation, and range and will be generated for each site for each water quality parameter. Outliers will be identified and interpreted. A temporal analysis using analysis of variance (ANOVA) will measure changes in water quality parameters over a variety of temporal scales (i.e. annual, seasonal, monthly) at each sampling site.

A power analysis, using sample size and standard deviations, will be performed for each parameter for each site. This analysis will determine what magnitude of change (i.e. effect size) the present sampling design can detect. If the effect size detectable is deemed too large, results from the power analysis will reveal what sample size and/or precision are needed to measure the desirable effect size. These results will provide insight into adequate sampling frequency as well as appropriate sampling methods and parameters.

In an effort to understand spatial trends in the data, sites will be grouped by location within the Kachemak Bay. Groupings could include freshwater vs. estuarine sites, north vs. south side-of-the-bay sites. ANOVA tests will be used to detect significant differences between sites and site groupings. These results will be valuable for determining if the geographic coverage of CEMP sites is adequate.

Correlation coefficients between parameters will be examined to see which water quality characteristics are related to each other. Correlations with ancillary data (i.e. precipitation, wind speed and direction, solar radiation) from Homer Airport's meteorological record will be explored.

Based on the results of the analysis, recommendations to improve the CEMP protocols will be proposed and presented to the CEMP Technical Advisory Committee. These improvements will be disseminated to the Cook Inlet partners in a project report. Keeper will also convene an annual water quality conference among current and potential monitoring partners and agencies to communicate findings from the analysis and to facilitate CEMP planning and development.

C. Cooperating Agencies, Contract, and Other Agency Assistance

Cook Inlet Keeper is the only organization requesting funds for this project.

SCHEDULE

A. Measurable Project Tasks for FY 02 (October 1, 2001 – September 30, 2002)

October 2001 – July 2002:	Analyze CEMP data to determine effectiveness of protocols
August– September 2002:	Production and release of project report which will include recommendations for improvements to CEMP protocols
Ongoing:	Work with new potential partners to help them develop

	credible monitoring programs. Potential new partners include: Port Graham/Nanwalek Watershed Council, Ninilchik Native Association, Eklutna Tribal Council, Native American Fish and Wildlife Society
December 2002:	Convene meeting with current and potential monitoring partners and agencies to communicate findings from analysis
March 2003:	Incorporate suggestions into the CEMP Quality Assurance Project Plan
April 15, 2003:	Submit final report to EVOS (FY02)

B. Project Milestones and Endpoints

The first project objective, which is completion of data analysis, will be complete by July 31, 2002. Production/release of analysis report, project objective #2, will be complete by September 30, 2002. Implementation of suggestions for refinement to CEMP protocols generated from analysis and agreed upon by the Technical Advisory Committee and partner groups will occur during FY 2003 and are not part of the proposed project objectives.

C. Completion Date

All of the project objectives will be met by the end of FY 2002. The final project report will be submitted to EVOS Trustee Council by April 15, 2003.

PUBLICATIONS AND REPORTS

In October 2001, Keeper will released "Cook Inlet Citizens' Environmental Monitoring Project Annual Water Quality Status Report" which will present five-years of water quality data collected by volunteers in the Kachemak Bay watershed. As with previous annual reports, the October 2001 report will be distributed to concerned citizens, agency personnel, tribal councils, and the press. Previous annual reports are available on the Keeper's web page at http://www.inletkeeper.org/cemp/cempd1.asp.

In September 2002, Keeper will release the proposed project report: "Evaluating the Effectiveness of Citizen's Environmental Monitoring Project", which will be distributed to current and potential partner groups, agencies, and concerned citizens.

PROFESSIONAL CONFERENCES

No travel funds beyond the Trustee Council's Annual Restoration Workshop are budgeted for FY 2002

NORMAL AGENCY MANAGEMENT

Not applicable.

COORDINATION AND INTEGRATION OF RESTORATION EFFORTS

Cook Inlet Keeper has a close relationship with many of the restoration efforts that have been funded by the Trustees Council. Most notably, Keeper shared its *Cook Inlet GIS Atlas* on CD ROM and Annotated Bibliography to assist the Kachemak Bay National Estuarine Research Reserve's Ecological Characterization Project, and the Cook Inlet Information Monitoring and Management Systems database project. Keeper is linked to the CIIMMS web page, and once its water quality database and interactive GIS maps become available on the Internet, they will be integrated with the CIIMMS database. The information Keeper shares with CIIMMS contributes greatly to a more holistic understanding of Cook Inlet's resources, pollution sources, and other conditions.

Keeper is working with Kachemak Bay National Estuarine Research Reserve to bring together citizen volunteer monitors and professional researchers to deploy a systematic array of electronic sensors along the south and north sides of Kachemak Bay, which will coincide with volunteer water quality monitoring sites, to assess water circulation patterns throughout the Bay. Keeper also collaborates with UAA's Kachemak Bay Campus which makes an in-kind contribution of lab space for water quality laboratory analysis.

Keeper cooperates with agencies that conduct water quality monitoring in the Cook Inlet basin. These agencies include: U.S. Geological Survey, Alaska Department of Environmental Conservation, U.S. Environmental Protection Agency, National Oceanic and Atmospheric Administration, Alaska Department of Fish and Game, Alaska Department of Natural Resources, and the Cook Inlet Regional Citizens Advisory Council. Representatives from each of these agencies participate as members of Keeper's TAC. Also, DNR's Division of Forestry invited Keeper to present its water quality information at a planning meeting to help it determine a need for monitoring forestry activities and impacts on the Kenai Peninsula, and the ADF&G has used Keeper's water quality reports to help guide their future plans for monitoring, so as not to duplicate existing efforts.

In addition to Trustees-funded Restoration Projects, Keeper collaborates with numerous other local and national groups and agencies. For example, Keeper is a partner in the Pratt Museum's Kachemak Bay Discovery Project, a member of the River Network and a member of the National Water Keeper Alliance. Keeper works closely with all monitoring efforts in Cook Inlet including those conducted by: the Anchorage Waterways Council, University of Alaska Anchorage's Environment and Natural Resources Institute, Wasilla and Homer Soil and Water Conservation Districts, Kenai Watershed Forum, Anchor Point Community Rivers Planning Coalition, Seldovia Oil Spill Response Team, and Port Graham/Nanwalek Watershed Council (memorandums of understanding attached). Keeper plans to include more partners in the future such as the Chickaloon Native Village, Ninilchik Traditional Council, Kenai National Wildlife Refuge, and more.

Cook Inlet Keeper's monitoring project has been funded through ADEC by EPA 319 nonpoint source grant money over the last three years, along with other sources to meet EPA's required 40% non-federal match. Keeper's other monitoring support has included grants from the Skaggs Foundation ($8,000 in 1999 and $5,000 in 2001), Norcross Wildlife Foundation ($10,000 in 1999 and $13,000 in 2001), River Network Watershed Assistance Grant ($20,000 in 1999), Bullitt Foundation ($10,000 in 2000), individuals and businesses (~$10,000/yr.) fees for GIS services (~$5,000/yr.), and in-kind contributions of time and services (~$25,000/yr.).

Keeper's monitoring budget for FY 02 is $205,313. Keeper anticipates a few more years of funding from EPA, including $105,000 in FY 02. Keeper will raise additional funding including grants, individuals, businesses and fees for services. Keeper currently has a grant pending with the U.S. Fish and Wildlife Foundation. Keeper is also exploring the feasibility of a business fundraising effort to solicit businesses to adopt monitoring sites for the cost of sampling equipment needed to monitor that site for one year.

Keeper is requesting $16,700 from EVOS for FY 02 to cover Keeper staff time and office supplies to perform the needed analysis, which will ensure the consistency and credibility of citizen-based monitoring in Alaska. Funding from EVOS will also help Keeper make citizen-collected data more useful to scientists and to make the data available for public access. This project will provide agencies and the public with the information needed to better understand threats to, and solutions for coastal resources, and will lead to improved stewardship and coastal watershed and wildlife habitat protection in Alaska.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

Not applicable.

PROPOSED PRINCIPAL INVESTIGATOR IF KNOWN

Name:	Sue Mauger, Stream Ecologist
Affiliation:	Cook Inlet Keeper
Mailing Address:	PO Box 3269, Homer, Alaska 99603
Phone number:	(907) 235-4068
Fax number:	(907) 235-4069
E-mail Address:	sue@inletkeeper.org

PRINCIPAL INVESTIGATOR

Sue Mauger is the Stream Ecologist for the Lower Kenai Peninsula Watershed Health Project at Cook Inlet Keeper. Sue joins the staff in Homer after completing a Masters in Fisheries Science at Oregon State University. Sue also has a B.S. in Zoology from Duke University and worked in the Chesapeake Bay studying Blue Crabs and coordinated research projects for Earthwatch Institute in Massachusetts. Sue became director of the volunteer monitoring project for the Xerces Society in Portland, Oregon in 1994, working with high school students and local citizens to develop benthic invertebrate monitoring programs in watersheds along the Oregon coast.

OTHER KEY PERSONNEL

Joel Cooper, Research Coordinator

Joel joined Keeper's staff in 1998 to coordinate and oversee Keeper's citizen water quality monitoring program. Prior to joining Keeper, some of Joel's work experience included conducting stream surveys for the U.S. Forest Service, serving as an Organic Chemist for the Rocky Mountain Analytical Laboratory, and working as Environmental Scientist for the Southern Illinois University Department of Pollution Control. Joel holds a B.S. in Environmental Studies focusing on forestry, chemistry, plant and soil sciences from Southern Illinois University.

Mike Gracz, Geographic Information System (GIS) Specialist

Mike is a forest ecologist with degrees from State University of New York College of Environmental Science & Forestry (B.S.) and the University of Washington (M.S.). He has backgrounds in computer mapping technologies, forest disturbance ecology and botany. Prior to joining Keeper in 1997, Mike worked for the Kenai National Wildlife Refuge, Alaska Maritime National Wildlife Refuge, and Olympic National Park.

Carl Schoch, Kachemak Bay Science Coordinator, Oceanographer/Quantitative Ecologist

Carl Schoch is the science coordinator for the Kachemak Bay Research Reserve in Homer, Alaska (a NOAA NERR), and adjunct researcher at Oregon State University. He has a Ph.D. in Oceanography from the College of Oceanic and Atmospheric Sciences at Oregon State University. Carl will serve as the statistical advisor for this project.

4-15(O)
approved TC 8-6-01

EVOS Trustees Council
Budget Form
October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002
Personnel		$11.0
Travel		$0.5
Contractual		$1.6
Commodities		$0.1
Equipment		$2.0
Subtotal		$15.2
Indirect		$1.52
Project Total		$16.7
Full-time Equivalents (FTE)		3.9
Other Funds		

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 2003					

Dollar amounts are shown in thousands of dollars.

Cook Inlet Keeper is requesting the full $16,700 for this one-year project from the EVOS Trustees Council.

NOTE: Budget should have included ADEC GA.
$15.6 Keeper
1.1 GA
$16.7

FY 02

Prepared:
12-Apr-00

Project Number: 02667
Project Title: Effectiveness Of Citizens' Environmental Monitoring Program
Agency: Cook Inlet Keeper

FORM 4A Non Trustee SUMMARY

EVOS Trustees Council
Budget Form
October 1, 2001 - September 30, 2002

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2001
S. Mauger	Stream Ecologist		3.0	2.8		8.4
J. Cooper	Research Coordinator		0.8	2.9		2.3
M. Gracz	GIS/Web Specialist		0.1	3.0		0.3
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		3.9	8.7	0.0	
					Personnel Total	$11.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2001
1 - RT Homer to Anchorage - Annual Restoration Workshop	0.17	1	2	0.05	0.3
1 Rental Car - 2 days for Annual Restoration Workshop ($50/day)					0.1
Accommodation 2 nights - Annual Restoration Workshop ($50/day)					0.1
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.5

FY 02

Prepared:
12-Apr-00

Project Number:
Project Title: Effectiveness Of Citizens' Environmental Monitoring Program
Agency: Cook Inlet Keeper

FORM 4B
Personnel
& Travel
DETAIL

EVOS Trustees Council
Budget Form
October 1, 2001 - September 30, 2002

Contractual Costs:	Proposed
Description	FY 2001
Communications (phone, fax, email) with TAC, other monitoring groups, etc.	0.5
Postage	0.1
Printing/copying of final report	1.0
Contractual Total	$1.6

Commodities Costs:	Proposed
Description	FY 2001
Supplies	0.1
Commodities Total	$0.1

FY 02

Prepared:
12-Apr-00

Project Number:
Project Title: Effectiveness Of Citizens' Environmental Monitoring Program
Agency: Cook Inlet Keeper

FORM 4B
Contractual & Commodities DETAIL

EVOS Trustees Council
Budget Form
October 1, 2001 - September 30, 2002

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2001
SPSS Base 10.1 Software for Windows	1	1.0	1.0
Sample Power 2.0	1	1.0	1.0
			0.0
			0.0
			0.0
			0.0
			0.0
Indicate replacement equipment with an R.		**New Equipment Total**	$2.0

Existing Equipment Usage: Description	Number of Units
19' patrol skiff	1
36' research vessel	1
Computers	8
Printers	2
GIS Map Plotter	1
Xerox machine	1
monitoring kits	41
monitoring meters	5

FY 01

Prepared:
12-Apr-00

Project Number:
Project Title: A Prototype Citizen-based Monitoring and Watershed Assessment
Agency: Cook Inlet Keeper

FORM 4B
Equipment
DETAIL

Revision 7-9-01
Approved TC 8-6-01

Project Title: Coordinating Volunteer Vessels of Opportunity to Collect Oceanographic Data in Kachemak Bay and Lower Cook Inlet

Project Number:	02671
Restoration Category:	Research and Monitoring
Proposer:	Cook Inlet Keeper, Kachemak Bay Research Reserve
Lead Trustee Agency:	ADFG(requested)
Alaska SeaLife Center:	No
Duration:	1st year, 1-year project
Cost FY02:	$34.8
Geographic Area:	Kachemak Bay/Lower Cook Inlet
Injured Resource/Service:	Subtidal and intertidal communities, sediments, mussels, clams, archeological resources

ABSTRACT

Cook Inlet Keeper and the Kachemak Bay Research Reserve will organize a network database of local community volunteers for the purpose of collecting oceanographic data from regional ships of opportunity. An extensive outreach program will be undertaken to identify and construct a database of private and commercial vessels making frequent trips in the Kachemak Bay, lower Cook Inlet and the Gulf of Alaska regions. Future work will be designed to utilize this extensive database to identify volunteer boats for collecting time-series of water quality parameters from transects along Kachemak Bay and extending into lower Cook Inlet. A thermo-salinograph, installed onto a vessel at the Kachemak Bay Research Reserve, will be used to clarify regions for future data collection. These data will also be correlated with existing stationary sensors and volunteer-monitoring projects to expand spatial and temporal knowledge of water quality and mixing patterns and their relationship to the dispersal of larvae and pollutants in the region.

INTRODUCTION

Cook Inlet Keeper and the Kachemak Bay Research Reserve are requesting one year of funding from the *Exxon Valdez* Oil Spill Trustees Council through the Ecosystem Synthesis/GEM Transition: Innovative Tools and Strategies to Improve Monitoring. We propose to coordinate the oceanographic data needs of the Kachemak Bay Research Reserve with the volunteer program organized by the Cook Inlet Keeper. Community volunteers have expressed interest in providing vessels as platforms to collect basic time-series of temperature and salinity in Kachemak Bay and lower Cook Inlet. Charter fishing boats, for example, traverse the length of Kachemak Bay and Kennedy Entrance twice each day on the way to the Barren Islands fishing grounds. The spatial and temporal distribution of these and other similar vessels has not been catalogued. This information is integral to establishing a protocol for using volunteer vessels in a long-term oceanographic data collection project. Temperature and salinity data can be continuously recorded using electronic loggers during these passages. These data are fundamental to understanding mixing dynamics in the Kachemak Bay region. The physical oceanography of this region has not been well studied and an understanding of the physical environment is critical to understanding the fundamental basis of ecosystem dynamics and habitat distribution.

The abundance of marine organism populations is highly variable in space and time, and possibly linked to fluctuations in oceanic water properties and circulation patterns. Evidence from research in the Pacific Northwest suggests that differences in primary productivity, salinity, and water temperature are often reflected in biological community dynamics. In estuaries such as Kachemak Bay, large gradients can occur at small spatial scales due to the effects of precipitation, surface runoff, groundwater flow, and evaporation. Outside Kachemak Bay, the regional circulation is characterized by ocean currents, such as the Alaska Coastal Current in the Gulf of Alaska flowing onto the shelf near the entrance to Cook Inlet. Nutrient rich bottom water is upwelled and mixed with surface water. As these enriched waters stream into Kachemak Bay, fresh water runoff from the surrounding ice fields and watersheds dilute the salinity and increase the sediment load. The inflowing water, therefore, initially supports a marine system while the north-side, outflowing water is more turbid and less saline. This difference needs to be quantified to further our understanding of the spatial and temporal patterns of observed changes in this system.

One of the unique characteristics of marine populations relative to their terrestrial counterparts is that early life stages of most marine species are planktonic and are moved by ocean currents for weeks to months. At present, we have only a limited understanding of how ocean circulation affects the various life stages of marine populations. This fundamental gap in our knowledge about marine populations limits advances on many fronts. Managing fisheries, understanding the dynamics and evolution of marine populations, and predicting the responses of coastal ecosystems to perturbations such as pollution, habitat loss, and the spread of exotic introduced species all await breakthroughs in our understanding of ocean circulation.

Despite numerous studies in the late 1960's -1970's, there has been limited work since that time in characterizing the physical oceanographic processes in the Kachemak Bay and lower Cook Inlet. The main study on circulation and mixing effects in Kachemak Bay is a study by Burbank

in 1977 (figure 1[1]).

Circulation in the greater Cook Inlet is dominated by strong tidal currents. The long, narrow configuration of Cook Inlet produces the world's second highest tidal heights (the highest are in the Bay of Fundy, Newfoundland). Tidal heights at the mouth and the head of the inlet are 180 ° out of phase. Thus water in the Cook Inlet acts somewhat like a standing wave (Whitney, 1999). The spring to neap tide variation can produce almost a two-fold increase in tidal velocities (SHIO, 1994). Wind is also an important factor affecting the circulation of water in Kachemak Bay and Cook Inlet. In the summer winds are predominantly from the South to Southwest, while in the winter the winds are from the North and Northeast (Wennekens et al., 1975; Whitney, 1999). In addition to the mean wind direction, strong, locally variable winds descend from the surrounding mountains and influence net circulation patterns. Circulation in the region is also strongly influenced by the flow of the Alaska Coastal Current. Water from the ACC becomes entrained into the strong inflow of the bay in the region of the Kennedy entrance.

Previous studies of Kachemak Bay have concluded that the circulation of water in the bay is complex and reflects the combined influences of diurnal and monthly lunar inequalities in tidal forcing, seasonal changes in the tidal regime, meteorological effects and fresh water forcing (Wennekens et al., 1975). Winds have a profound effect on the net circulation of both Kachemak Bay and Cook Inlet. Transient events such as gales may be the most significant factor impacting the transport and dispersal of planktonic larvae and pollutants (Wennekens et al., 1975). Burbank (1977) proposed the existence of several important gyres and eddies at the entrance to and interior of Kachemak Bay (figure 1) but no subsequent studies have further elucidated their spatial and temporal extent. The movement of water in this region is critical to understanding ecosystem dynamics such as larval dispersal, habitat distribution as well as for predicting patterns of pollutant (e.g. oil) dispersal. In other regions of Cook Inlet, back eddies such as the one on the north side of the East Forelands have been shown to deposit oil on the beach when the oil is originating from the south along the shoreline (Whitney, 1999). Thus the currents and eddies predicted for the entrance to and interior of Kachemak Bay could be extremely important for localized movement and shoreline deposition of organic matter and pollutants such as oil.

A daunting challenge in our understanding of marine ecosystems is identifying the connections between physical variability in the ocean and changes in marine communities. All ecosystems experience physically variable environments, but marine ecosystems are dominated by a particularly complex suite of physical forces. The dynamic nature of the fluid medium in which marine species live affects both the performance and movement of individuals. Studies of individual pieces in this puzzle have generated important insights. For instance, we have studies showing the effects of variation in water temperature, salinity or wave-generated hydrodynamic forces on survivorship and growth or the effects of the changes in ocean circulation on the movement of individuals. However, synthetic studies that integrate the effects of variation in several climatic components are rare. Also rare are studies providing insight into cyclic climatic changes, such as inter-decadal shifts, and unidirectional changes, such as climate change.

Kachemak Bay is a NOAA National Estuarine Research Reserve (NERR). The NERR system has 26 sites throughout the United States that are dedicated to research and education of the

[1] Figure 1 is attached separately to the electronic version of the proposal

marine/terrestrial interface of estuarine ecosystems. Kachemak Bay is located at the interface between land and ocean waters and thus near the juncture of major oceanographic and land-based processes. Watershed influences on the intertidal and bay habitats range from freshwater input, transport of nutrients, sediments and contaminants to topographic influences on winds and precipitation amounts and rates. Changes in watershed vegetation cover due to urbanization, spruce bark beetle infestation, logging and forest fires will alter transport dynamics and nutrient cycling, and thus the habitat quality and structure of biological communities in the intertidal zone and the bay itself. Oceanographic processes, working from the other end of the ocean-bay-shore continuum, influence nutrient transport, life history dispersal mechanisms of plants, invertebrates and fishes, sediments and contaminants. As part of the NERRs system, the Kachemak Bay Research Reserve has a program to continuously measure seasonal oceanographic water characteristics including nutrients, phytoplankton, temperature and salinity at two stations in the Bay (Homer and Seldovia) as part of the national System Wide Monitoring Program (SWMP). These sensor arrays measure water temperature, conductance, salinity, pH, turbidity, dissolved oxygen, depth, PAR, and fluorescence on a continuous basis. Additionally the National Weather Service, National Data Buoy Center, will be deploying a long-term data buoy in Kennedy Entrance in June 2001.

This study will work in conjunction with the existing studies in the region, both those on-going at the Research Reserve as well as within the Cook Inlet Keeper. On-going studies are similarly working to gain and organize a community-based network of volunteers as well as to further the understanding of circulation and mixing in Kachemak Bay. In addition, collaboration between the Keeper's Citizen's Environmental Monitoring Program and the Kachemak Bay Research Reserve's scientific programs allows for greater community involvement and understanding of the regional circulation and water quality.

NEED FOR THE PROJECT

A. Statement of the Problem

Many locally-operated vessels traverse the Kachemak Bay, lower Cook Inlet and Gulf of Alaska region for commercial fishing, charter fishing, transportation (ferries) and for recreational purposes. The spatial and temporal extent of these vessels over this region has not been catalogued. These vessels could be utilized to provide basic information to scientists on regional oceanographic conditions.

There is a need for understanding the movement and changes of water masses and seasonal mixing dynamics in this area. This study will address this need by using vessels of opportunity and an existing volunteer network to collect time-series of temperature and salinity in the Kachemak Bay region as well as by compiling a thorough background description of all scientific work completed throughout the region's history. A greater understanding of the previous work in the region will assist future studies by clarifying relevant variables for use in long-term monitoring. Additional coordination and

communication with on-going monitoring and oceanographic projects in the region will also enhance the applicability and viability of this study. The outreach program methods and database results, while initially focussed upon the immediate Kachemak Bay regional vessels, will be applicable at larger spatial scales including the lower Cook Inlet and the greater Gulf of Alaska region.

Using vessels of opportunity, it will be possible to seasonally monitor basic oceanographic variables. The collection and processing of these data is critical to understanding the underlying physical mechanisms controlling the ecosystem dynamics, and hence the distribution and recovery of many of the species listed in Table 4 of the invitation to submit restoration proposals. It is also information that is directly beneficial to recreation and tourism in this region, as well as vital to understanding the potential movement of water-borne pollutants such as oil.

B. Rationale/Link to Restoration

Given the lack of comprehensive information on vessel activity in the proposed study area, this study will provide a baseline dataset of the spatial and temporal distribution of vessels in the Kachemak Bay, lower Cook Inlet and Gulf of Alaska region. This data set of vessels will be further organized according to the stakeholder's interest in volunteering to assist with regional data collection. Utilization of these ships of opportunity provides a low-cost means to collect a time series of basic oceanographic data. Oceanographic data in this area is limited, thus these data will be used to enhance critical understanding of regional mixing processes and dynamics. These baseline data will be collected by volunteers in the community with the results benefiting local communities, villages and the greater scientific understanding of circulation and mixing in the bay. The use of the volunteer network of the Cook Inlet Keeper and ships of opportunity ensures stakeholder involvement in the project.

C. Location

This study will be undertaken in Homer with work involving the participation of personnel and volunteers from the Cook Inlet Keeper and the Kachemak Bay Research Reserve. An extensive outreach program, coordinated by the Cook Inlet Keeper, will include communities along Kachemak Bay and the lower Cook Inlet. Drift cards will be deployed at a range of locations and will be subsequently collected along the entire Kachemak Bay region. The benefits of the project will be realized by the entire community and stakeholders and the Kachemak Bay region. Community involvement will include the villages and Native corporations of Port Graham, Seldovia and Nanwalek. Preliminary transects for measuring temperature and salinity will focus upon regions of the bay and lower Cook Inlet which are traversed regularly by charter boats identified in the database. These preliminary transects will be used to establish which regions will be most beneficial for volunteer involvement in future data collection.

COMMUNITY INVOLVEMENT

Integral to this project is the degree of community involvement and participation in the study. The community based volunteer monitoring network of the Cook Inlet Keeper will be directly linked to the research needs of the Kachemak Bay region and the research reserve, forming closer bonds between the local groups and the scientific community.

Cook Inlet Keeper was the first community-based organization in Alaska to start a federally and state-approved volunteer water quality monitoring program. In 1996, Keeper convened a Technical Advisory Committee (TAC) composed of professionals from universities, state and federal agencies, and laid the framework to train volunteers to monitor physical, chemical, and biological parameters of water quality in and around Kachemak Bay. Since that time, Keeper has fostered similar monitoring programs in the Anchorage Bowl, Mat-Su Valley, and Kenai River watershed. Keeper is now leading the most unified, defensible community-based water quality monitoring effort in Alaska, and has been praised by Alaska's Department of Environmental Conservation for *laying a credible foundation that establishes the role of citizen monitoring as part of a comprehensive watershed management program from which all Alaskans can share in its rewards, both now and into the future.*

The outreach portion of this project will be organized under the Cook Inlet Keeper and will utilize their staff and extensive network of volunteers and citizen monitors to identify volunteer ships of opportunity, and assist in the design of transects, sampling locations and schedules. The primary goal of this project is to utilize the extensive coordinating experience of the Keeper in assembling a database of community vessels by location and seasonal activity, and to orchestrate an outreach program which will identify volunteers and vessels in the region. The Keeper will also host workshops for interested stakeholders to identify volunteers for long-term data monitoring from community-based vessels, as well as to assist the scientific community in identifying relevant variables and sampling locations for the data collection and long-term monitoring. Keeper volunteers and local communities will also be extensively involved in the deployment and collection of drift cards released at locations in the region in the fall and the spring.

We propose to include the larger oceanographic community in defining the variables to be monitored as well as in defining the temporal and spatial scales for data collection. A proposed scientific workshop being held in March, 2002 will focus upon the design of monitoring programs in the nearshore and offshore oceanographic environments in the Gulf of Alaska region. The possibility exists to coordinate a forum on the determination of oceanographic variables and temporal and spatial scales with the existing workshop being held. Coordination with this workshop will directly benefit this project, as well as address the concerns of the peer reviewers of the initial proposal, in that the larger oceanographic community will be consulted in the design and feasibility of an on-going monitoring program using ships of opportunity. Results from this workshop will greatly enhance the objectives of this study in clarifying both the pertinent variables for monitoring as well as the spatial and temporal scales of variability.

PROJECT DESIGN

A. Objectives

Six main objectives will be achieved by this study. These objectives are realized through a combination of the Cook Inlet Keeper Outreach program, and the Kachemak Bay Research Reserve Research and Development program.

CIK Outreach program:

1. Organize a network database of regional vessels according to their spatial and temporal distribution in the Kachemak Bay, lower Cook Inlet and Gulf of Alaska.

2. Prepare and execute an extensive outreach program including local workshops in order to identify these vessels and to communicate with potential citizens interested in volunteering their time and vessels for a long-term monitoring project

3. Establish a link between regional research objectives and data collection and an existing successful volunteer monitoring program.

KBRR Research and Development program:

4. Conduct a thorough investigation to compile all of the existing background oceanographic research on the Kachemak Bay and lower Cook Inlet in order to best evaluate which oceanographic variables will be the most relevant for collection in a long-term data set by ships of opportunity. Included in this investigation would be an analysis of on-going studies in similar regions as well as the KBRR oceanographic workshop, which would assist in achieving the goals of this project by combining the expertise of the greater oceanographic community in establishing relevant parameters to be monitored.

5. Collection of important drift card data for inferring regional surface currents. These data will be correlated with regional wind conditions, and time-series data (from both transects and stationary buoys) and used to infer seasonal surface circulation patterns.

6. Collect preliminary temperature and salinity data to evaluate important regions for future data collection with volunteer vessels. This preliminary data will be used to establish a protocol for correlation of future temperature and salinity baseline data sets with existing stationary sensor platforms measuring parameters of temperature, salinity, pH, DO, PAR, turbidity, Chla and nutrients. Data collection could be expanded in later studies by the inclusion of additional instrument sensors for water quality parameters along the same spatial and temporal resolution as designated in the course of this study.

A. Methods

There are two main phases of this project involving input from both the Cook Inlet Keeper (CIK) and the Kachemak Bay Research Reserve (KBRR). These two phases are the Cook Inlet Keeper Outreach program, and the KBRR Research and Development program. These two programs will occur concurrently, with some of the objectives detailed for the KBRR program dependent upon the results of the CIK Outreach program and the resulting vessel database.

The Cook Inlet Keeper will use its expertise in community volunteer involvement to develop an outreach program for identifying regional vessels. This outreach program will include local media and regional announcements in order to best identify community volunteers. The primary objective of the Keeper's outreach program will be the establishment of a comprehensive database of all regional vessels currently operating in the Kachemak Bay, lower Cook Inlet and, to some extent, the greater Gulf of Alaska region. This database will be organized according to the spatial and temporal distribution of these vessels in the region, the owners and operators of the vessels, and the nature of their activity (i.e. charter fishing, recreational charters, transportation/ferry, commercial fishing). Using community-based workshops, the Keeper will further refine the database to delineate which vessels would be interested in participating as a ship of opportunity in a data collection project to begin the following year.

The KBRR Research and Development program will use input from the oceanographic community as well as the database of vessels assembled by the Cook Inlet Keeper in defining scientific objectives for an on-going monitoring program. This work will involve: preliminary water quality data collection to define regions for future study; an on-going drift card study for inferring regional surface currents; an extensive survey into additional instrumentation for volunteer vessels; training of volunteers in instrument deployment; development of a protocol for data acquisition and processing; an extensive background research survey of existing regional studies and communication with on-going regional programs.

Once the database has been assembled, and vessels of opportunity have been identified, examination will be given to the spatial and temporal distribution of these vessels in choosing regions for data sampling. Preliminary data collection by the KBRR will focus on regions of high vessel spatial coverage identified in the database. The goal of this data collection will be to develop a protocol for data acquisition and processing as well as to define sub-regions for future data collection which characterize regional dynamics.

Preliminary transects will use a SeaCat thermo-salinograph installed onto a vessel at the Kachemak Bay Research Reserve. The Reserve's existing SeaBird CTD will also be used for obtaining profiles of salinity and temperature for use in conjunction with the one-dimensional samples from the thermo-salinograph. These preliminary transects will cover regions within the extent of the volunteer vessels, and will be used to further refine regions of importance for collection of oceanographic data. Transects will include along-axis and across axis locations, covering regions of inflowing and outflowing water to the bay. These

regions are also consistent with existing stationary NOAA and National Weather Service buoys as well as existing water quality monitoring programs. Data analysis will be performed on this preliminary work to refine the data processing protocol to be used in future work, specifically the production of graphs, maps, animations, and other correlation materials to graphically display information on seasonal oceanographic conditions and the relation to regional circulation and mixing processes. Data will be analyzed to identify critical regions for future study in other aspects of Kachemak Bay ecosystem dynamics.

Drift cards will be used to infer regional surface currents. A preliminary knowledge of these currents will help to further refine the relevant regions for future data collection by ships of opportunity. Drift cards will be constructed and deployed over two different seasons and for five different locations. Drift cards will be constructed of either plastic or painted wood and labeled with pertinent information for their recovery. Each drifter will be color coded by season and location, and labeled with the following:

When found: (date and time)

Where found: (latitude and longitude)

Who found it: (finder's name and address)

Return to: (KBRR address)

Deployments will occur in the Fall/Winter and in the spring. Locations for deployment include: Anchor Point, Beluga Slough, Homer Spit, Seldovia and Bear Cove. These locations are also consistent with regional data collection. Volunteers from the local community will be involved in retrieving and tracking the positions of drift cards. Retrieval will also be coordinated with the annual beach walk and clean up and will involve the participation of the KBRR, Cook Inlet Keeper and well as the Alaska Center for Coastal Studies.

The KBRR will examine the feasibility and viability of using additional instrumentation on volunteer vessels throughout the course of this study. Themo-salinographs provide a low-cost method of sampling salinity and temperature at a single-depth over a large spatial area. Additional sensors for dissolved oxygen, inorganic nitrogen or other water quality variables may be added to the sensor at any time. Profiles of water quality variables are not possible with this type of instrument, although with several vessels of different drafts sampling in the same spatial area, an approximate profile may be inferred.

In order to address the concern that profiles of water quality parameters are necessary to describe regional dynamics, a suite of instruments will be evaluated for use in future studies. These instruments may include: expendable bathythermographs (XBTs, manufactured by Sippican, Inc.) or low-cost thermo-sensors (TR-1050, RGB instruments) which both measure temperature profiles, SeaBird CTDs measuring temperature and salinity profiles, YSI instruments measuring salinity, temperature and dissolved oxygen profiles or an Acoustic Doppler Current Profiler (ADCP) measuring current velocity. These instruments will be examined for their feasibility in this study by cost, ability of a volunteer vessel to deploy the

instrument in a timely and accurate manner, and the overall importance of the resulting water quality data in describing regional oceanographic features and dynamics.

Once an instrument has been identified by this study, it will be purchased for use in training workshops and preliminary data collection. The KBRR, together with the CIK, will create datasheets for volunteers to use when participating in the future monitoring study. These datasheets will include the time, data, location of the sampling (as determined by existing shipboard GPS systems on volunteer vessels) and other additional information as determined throughout the course of the project. A workshop will be organized and executed to train volunteers on the use and application of the thermo-salinographs and any additional instrument identified for use in future surveys. The KBRR will develop a data acquisition and processing protocol throughout the study to efficiently download and process incoming data from the ships of opportunity.

In addition to the work described, a concurrent extensive background search of all previous regional oceanographic work will be compiled. Communication with personnel conducting other on-going projects in the Gulf of Alaska region will also be instrumental in defining the pertinent variables to be monitored in future data collection in this region, using the ships of opportunity identified in this study. The oceanographic workshop scheduled for March will be particularly useful in addressing these issues due to the proposed focus of the workshop on the development of monitoring systems for the Gulf of Alaska.

B. Cooperating Agencies, Contracts and Other Agency Assistance

The cooperating agencies on this project are the Cook Inlet Keeper, NOAA and the ADFG. The involvement of the ADFG however is only through the Kachemak Bay Research Reserve involvement as the KBRR is a NOAA funded research institution with state funded agency (i.e. ADFG) administration.

SCHEDULE

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

October 30:	Order equipment for KBRR boat (thermo-salinograph) Construct and deploy Fall Drift cards (KBRR) Develop outreach plan (CIK)
December 15:	Outreach plan developed, database set-up completed (CIK)
January 31:	Attend annual workshop
February 28:	Construct spring drift cards (KBRR)

March 15:	Outreach plan and database completed (CIK), Volunteers identified for future studies KBRR personnel involvement in workshop on oceanographic monitoring.
April 15:	Preliminary spring transects completed according to database location identification (KBRR, CIK) Submit annual report
May 30:	Begin summer data collection transects, deploy spring drift cards (KBRR, CIK)
July 31:	Analyze collected transect data (KBRR) Protocol established for data collection and processing (KBRR, CIK)
September 30:	Submit final report

B. **Project Milestones and Endpoints**

March 31, 2002:	Database of volunteers completed and organized according to temporal and spatial distribution of vessels. Fall/Winter drift cards deployed and being retrieved. Thermo-salinograph installed onto KBRR vessel. Oceanographic workshop completed, monitoring variables identified.
July 31, 2002:	Spring/Summer drift cards deployed and being retrieved. Preliminary data analysis completed, protocol established for data collection, processing and correlation with stationary buoys.
September 30, 2002:	Volunteer vessel database completed. Report completed including preliminary analysis of data collection and protocol for data collection and processing in future studies. Completion of drift card study.

C. **Completion Date**

Completion of project is by September 30, 2002

PUBLICATIONS AND REPORTS

An annual report will be filed in April 2002 and a final report will be provided at the end of FY 2002.

PROFESSIONAL CONFERENCES

No funds are requested for travel to professional conferences.

NORMAL AGENCY INVOLVEMENT

No aspects of this project are fully funded, and it should be noted that the SWMP instruments and data collection by KBRR requires non-federal match in order to continue.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This study is also coordinated with the local villages, volunteers and Native corporations of Port Graham, Seldovia and Nanwalek.

PROPOSED PRINCIPAL INVESTIGATORS

Dr. Diana Stram
PO Box 23
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(or dstram@gso.uri.edu)

Dr. G. Carl Schoch
Science Coordinator
Kachemak Bay Research Reserve
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Homer, AK 99603
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carl_schoch@fishgame.state.ak.us
(or: cschoch@bcc.orst.edu)

PRINCIPAL INVESTIGATORS

Dr. Stram has a Ph.D. in Oceanography from the Graduate School of Oceanography at the University of Rhode Island (2001). Her research has focussed upon interdisciplinary numerical modeling of physical and biological processes in estuaries. She has supervised the field collection of time-series data from the Rio Chone estuary in Ecuador, where she was the director of two separate research field surveys in the region, coordinating activities amongst government and community-based agencies. She served as a Pre-Doctoral Fellow for the Environmental Protection Agency under their Program to Develop Indicators of Estuarine Health and Integrity.

Dr. Schoch is the Science Coordinator for the Kachemak Bay Research Reserve in Homer, Alaska (a NOAA National Estuarine Research Reserve). He has a dual Ph.D. in Biological Oceanography and Geological Oceanography from the College of Oceanic and Atmospheric Sciences at Oregon State University (1999) and continues to work with his post-doc advisors (Lubchenco and Menge) as a Senior Fellow for the Partnership for Interdisciplinary Studies of the Coastal Ocean (PISCO) studying marine ecosystem dynamics. His research interests are in the physical and biological linkages between marine nearshore and continental shelf ecosystems, specifically how physical processes such as currents, wave energy, sediment dynamics, and nutrient fluxes structure intertidal and subtidal communities. His current research projects include studying larval distributions and forces affecting recruitment, monitoring the variability of primary productivity as a function of ocean climate, and investigating kelp bed community dynamics. He serves as the science advisor for the Olympic Coast National Marine Sanctuary Advisory Council, and is the chair of their Research Advisory Committee. He also serves as the technical advisor to the Sanctuary Marine Conservation Working Group, consulting on the design and development of a marine reserve network on the outer coast of Washington. He also consults to the Washington Department of Natural Resources on intertidal habitat modeling in Puget Sound and Georgia Straits.

OTHER KEY PERSONNEL

Cook Inlet Keeper personnel involved with the project:

Joel Cooper is the Scientific Research Coordinator for the Cook Inlet Keeper. He will be involved in overseeing and managing the outreach program and establishing the volunteer database.

Dale Banks is the Volunteer Monitoring Coordinator/Research Assistant for the Cook Inlet Keeper. He will assist the scientific research coordinator in the outreach program and the establishment and maintenance of the volunteer vessel database.

LITERATURE CITED

Burbank, D.C. 1977. Circulation studies in Kachemak Bay and lower Cook Inlet, vol.II of Environmental Studies of Kachemak Bay and lower Cook Inlet, L.L. Trasky et al. (eds.). Marine/Coastal Habitat Management Report, Alaska Dept. Fish and Game, Anchorage, AK.

SHIO. 1994. NOAA Hazmat Tidal Variation Program, 7600 Sand Point Way N.E., Seattle, WA 98115

Whitney, J. 1999. What the Actual Movement of Oil in Cook Inlet Tells Us About the Circulation in Cook Inlet. In, Proceedings of the Cook Inlet Oceanography Workshop, Johnson and Okkonen (eds.) Kenai, AK.

Wennekens, M.P., Flagg, L.B., Trasky, L., Burbank, D.C., Rosenthal, R. and F.F. Wright. 1975. Kachemak Bay, A Status Report. Alaska Dept. Fish and Game, Anchorage, AK.

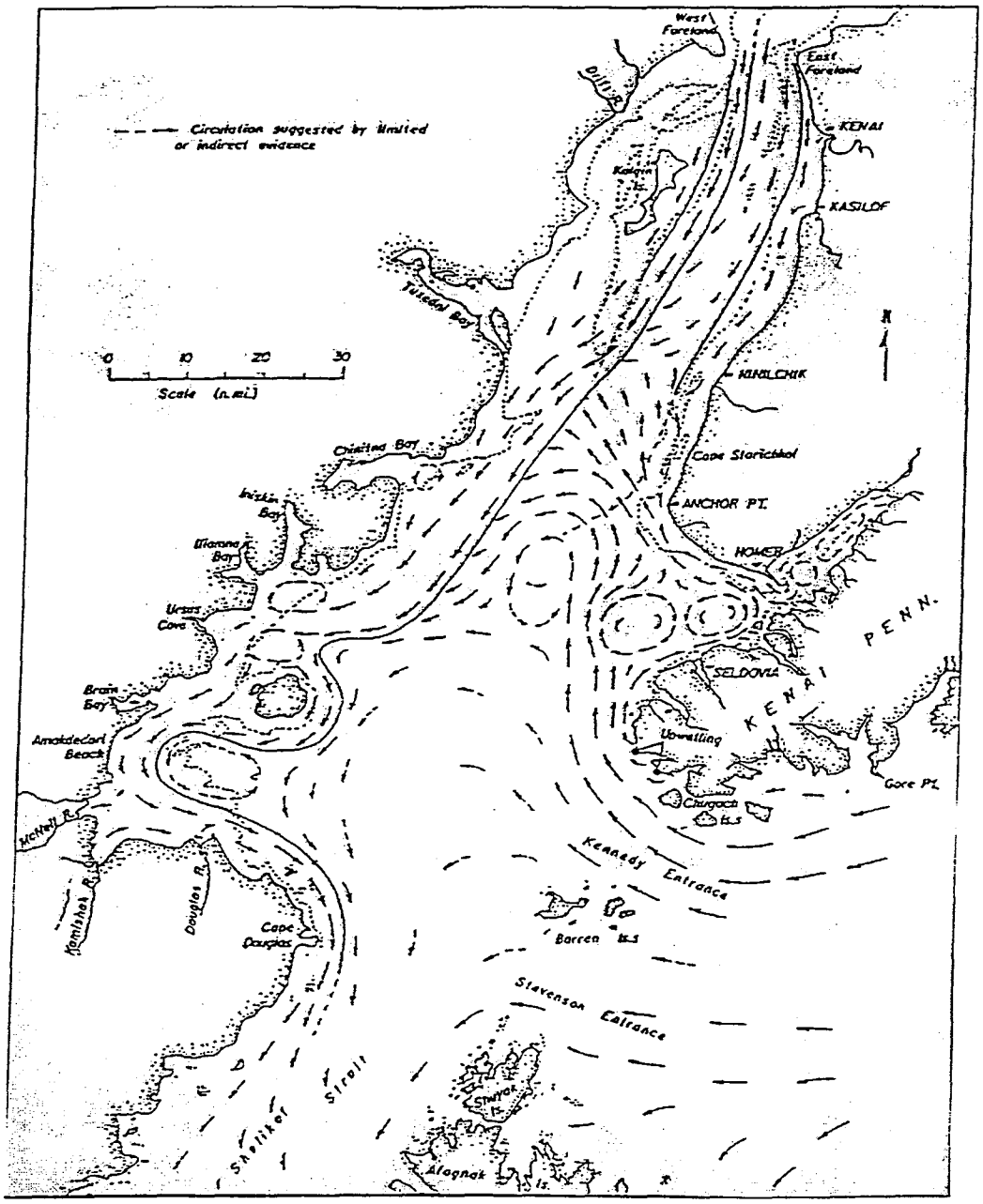

Figure 1: Net surface circulation proposed in Kachemak Bay and lower Cook Inlet (from Burbank, 1977)

approved 8-6-01
Revisin 7-9-01

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002
Personnel		$5.2
Travel		$0.4
Contractual		$15.2
Commodities		$0.0
Equipment		$12.2
Subtotal	$0.0	$33.0
General Administration		$1.8
Project Total	$0.0	$34.8
Full-time Equivalents (FTE)		0.1
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 2003					

Dollar amounts are shown in thousands of dollars.

Comments:
This project will benefit from work being undertaken by NOAA this year at no cost to the EVOS Trustees Council. These activities and estimated value in dollars may include:

$10,000/ stationary buoy deployed (2) = $20,000 ($20.0)
$10,000 per year for maintaining and processing buoy data (estimate)
Total NOAA matching funds: $ 30,000 ($30.0)

KBRR will provide office space and logistical support for Dr. Stram with an approximate value of $5000 ($5.0)

Approximate in-kind match available = $35,000 ($35.0)

FY02

Revised:7/9/01

Project Number: 02671
Project Title: Coordinating Volunteer Vessels of Opportunity to Collect Oceanographic Data in Kachemak Bay and Lower Cook Inlet
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2002
Name	Position Description					
Dr. Carl Schoch	Science Coordinator, KBRR		1.0	5.2		5.2
	(approx. 1 week/month for four mos)				0.0	0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.0	5.2	0.0	
					Personnel Total	$5.2

Travel Costs:	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2002
Description					
Annual EVOS meeting for Co-Pis in Anchorage for 2 days	0.2	1	2	0.1	0.4
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.4

FY02

Revised: 7/9/01

Project Number: 02671
Project Title: Coordinating Volunteer Vessels of Opportunity to Collect Oceanographic Data in Kachemak Bay and Lower Cook Inlet
Agency: ADFG

FORM 3B
Personnel
& Travel
DETAIL

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Contractual Costs:	Proposed
Description	FY 2002
Long Distance Phone Calls for KBRR project staff associated with the project	0.5
4A Linkage	14.7
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$15.2

Commodities Costs:	Proposed
Description	FY 2002
Commodities Total	$0.0

FY02

Revised: 7/9/01

Project Number: 02671
Project Title: Coordinating Volunteer Vessels of Opportunity to Collect Oceanographic Data in Kachemak Bay and Lower Cook Inlet
Agency: ADFG

FORM 3B
Contractual & Commodities DETAIL

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2002
1 SBE 21 Themo-salinograph plus shipping and handling	1	7.2	7.2
			0.0
Equipment purchase for sampling water quality variable profiles	1	5.0	5.0
(actual equipment purchase is dependent upon research and development phase			0.0
of project as described in the DPD)			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**		$12.2

Existing Equipment Usage: Description	Number of Units	Inventory Agency
SeaBird CTD instrument use in preliminary data collection (KBRR)	1.0	ADFG
Research Reserve vessel used in conducting preliminary transects	1.0	ADFG

FY02

Revised: 7/9/01

Project Number: 02671
Project Title: Coordinating Volunteer Vessels of Opportunity to Collect Oceanographic Data in Kachemak Bay and Lower Cook Inlet
Agency: ADFG

FORM 3B
Equipment
DETAIL

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FY 2003					
Personnel		$14.7						
Travel		$0.0						
Contractual		$0.0						
Commodities		$0.0						
Equipment		$0.0						
Subtotal	$0.0	$14.7						
Indirect								
Project Total	$0.0	$14.7						
Full-time Equivalents (FTE)		0.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY02

Revised: 7/9/01

Project Number: 02671
Project Title: Coordinating Volunteer Vessels of Opportunity to Collect Oceanographic Data in Kachemak Bay and Lower Cook Inlet
Agency: ADFG

FORM 4A
Non-Trustee
SUMMARY

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2002
Cook Inlet Keeper						0.0
Joel Cooper	Research Coordinator (.5 time for two months)		1.0	3.1		3.1
						0.0
Dale Banks	Volunteer Monitor Coordinator (.5 time for two months)		1.0	2.1		2.1
						0.0
						0.0
Dr. Diana Stram	Co-PI (approx. weeks)		1.0	9.5		9.5
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		3.0	14.7	0.0	
					Personnel Total	$14.7

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2002
					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

FY02

Revised: 7/9/01

Project Number: 02671
Project Title: Coordinating Volunteer Vessels of Opportunity to Collect Oceanographic Data in Kachemak Bay and Lower Cook Inlet
Agency: ADFG

FORM 4B
Personnel
& Travel
DETAIL

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Contractual Costs:	Proposed FY 2002
Description	
Contractual Total	$0.0

Commodities Costs:	Proposed FY 2002
Description	
Commodities Total	$0.0

FY02

Revised: 7/9/01

Project Number: 02671
Project Title: Coordinating Volunteer Vessels of Opportunity to Collect Oceanographic Data in Kachemak Bay and Lower Cook Inlet
Agency: ADFG

FORM 4B
Contractual & Commodities DETAIL

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 2002
Description			
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number of Units	
Description		

FY02

Project Number: 02671
Project Title: Coordinating Volunteer Vessels of Opportunity to Collect Oceanographic Data in Kachemak Bay and Lower Cook Inlet
Agency: ADFG

FORM 4B
Equipment
DETAIL

Revised: 7/9/01

Revised
7-8-01
approved TC
8-6-01

Project Title: **Assessing Pigeon Guillemot restoration techniques**

Project Number:	02674-BAA
Restoration Categories:	Restoration and Monitoring
Proposers:	John French PEGASUS ENTERPRISES Seward, Alaska George Divoky, Research Associate, Institute of Arctic Biology University of Alaska Fairbanks
Lead Trustee Agency:	NOAA
Cooperating Agencies:	None
Alaska SeaLife Center:	Yes
Duration:	1st year 2-year project
Cost FY 02:	$45,000
Cost FY 03:	$45,000
Geographic Area:	Resurrection Bay and Jackpot Is. (PWS)
Injured Resource:	Pigeon Guillemot

ABSTRACT

We propose to monitor Pigeon Guillemot restoration projects initiated between 1998-2000. We will conduct censuses of Resurrection Bay to determine survivorship and breeding behavior of birds fledged from the Alaska SeaLife Center (ASLC) and also monitor the occupancy and success of artificial nest sites we erected at ASLC, Hat Is., North Beach (Caines Head), and Jackpot Is. We will assess the characteristics of these sites, the nest boxes, and reproductive behaviors observed within the avian habitat at ASLC in order to delimit the efficacy of nest boxes as a restoration or monitoring tool.

INTRODUCTION

The oil spilled from the T/V *Exxon Valdez* on Good Friday 1989 (EVOS) caused widespread injury to a variety of state and federally managed resources in Prince William Sound (PWS) and the Gulf of Alaska (GOA). The oiling of coastal habitat extended from the point of grounding in PWS west to Chignik on the Alaska Peninsula. The highest mortality of seabirds is thought to have occurred in and around the Barren Islands with the highest body count on the shores of the Kodiak Archipelago. Over 600 Pigeon Guillemot (*Cepphus columba*) carcasses were found and identified following the spill, with only 135 from PWS. This suggests that up to 80% of fatal injury to guillemots occurred outside the Sound.

Despite the large number of guillemot mortality outside of PWS, much of the early Natural Resource Damage Assessment (NRDA) effort and the early restoration and monitoring work on guillemots concentrated on birds and habitat on and around Naked Island in PWS (Oakley and Kuletz 1996). In part, this was due to it being in one of the most heavily oiled parts of the spill area, and because there was pre-spill census, feeding and productivity data from Naked Island (Oakley 1981, Kuletz 1983). Later studies were conducted at Jackpot Island (Seiser 2000), in a much more lightly oiled part of PWS, and Kachemak Bay, in Lower Cook Inlet (Prichard 1997). Over a decade after EVOS, the Pigeon Guillemot is one of the four seabird species that have failed to recover to pre-spill numbers. Reasons for this failure are unknown but may include: 1) changes in prey quality or availability, 2) increased predation on eggs and nestlings or 3) continuing exposure to oil by either guillemots or their prey. Much of the fieldwork conducted on the Pigeon Guillemot's lack of recovery examined the role of prey in chick growth (Golet 2000) or the potential of oil ingestion decreasing survival in chicks (Prichard et al. 1997)

In 1998 the EVOS Trustee Council initiated Pigeon Guillemot Research at the Alaska SeaLife Center (ASLC) (EVOS project #98327). This project continued the examination of prey quality and oil ingestion on nestling condition but since it was conducted in a laboratory setting provided levels of control that could not be obtained in previous studies. Moreover, at the end of the nestling period all chicks were released into the wild after being banded with unique color-band combinations. Of the 145 chicks fledged from ASLC in 1998-2000, over 50 could be expected to survive to breeding and recruit at the natal colony, based on known rates of recruitment for wild cohorts. Guillemots display high levels of philopatry to the natal area (Divoky 1998) and over 90% of the surviving birds should attempt to recruit in northern Resurrection Bay. The majority of guillemots recruit in their third summer and the next three years provide a unique opportunity to obtain data on the effect of nestling condition on survival to breeding. Major differences in survival and recruitment related to diet or oil dosing would add much to our understanding of the lack of recovery for this species.

In 1998 the same research project that raised guillemot chicks at ASLC also began a study on the feasibility of nest-site provisioning as a restoration option for Pigeon Guillemots. Guillemots are cavity nesters that breed in a wide range of cavity types that provide eggs and chicks protection from predators (Storer 1952). While receiving far less attention than nestling caloric intake and oil ingestion, predation on guillemot nest contents in PWS Pigeon Guillemots has increased over the last two decades (Hayes 1995, Seiser 2000) and could be a major factor in the continuing low numbers in PWS. Nesting cavities that supported successful breeding when predation rates were low may now be unable to provide safety to nest contents or breeding adults during the 80-day breeding period. Both the Pigeon Guillemot and its congener, the Black Guillemot (*C. grylle*), breed in man-made nest cavities and populations of the latter have been able to expand their

range and increase in numbers through the provision of artificial nesting cavities (Divoky 1998). To examine the potential of artificial nest sites, arrays of nest boxes and decoys were installed in northern Resurrection Bay in 1998-2000 and on Jackpot Island in 2000. No use of the Resurrection Bay sites has yet occurred but time is required for any new nest site to be occupied by birds in breeding condition, especially in an area of low breeding density such as Resurrection Bay. Once established as breeders, guillemots show high levels of site-fidelity with 95% of individuals breeding in their site of the previous year (Divoky 1998). Prospecting nonbreeders typically attempt to recruit at established sites where they can breed with an experienced bird rather than prospecting for new sites with another inexperienced bird. While new nest sites are occupied on a regular basis, it takes time for their discovery and occupation by two birds not currently associated with another site. Moreover, refinement of nest placement techniques means that the 50 sites installed in Resurrection Bay in 2000 probably have the highest chance of attracting and supporting breeding guillemots.

The summers of 2002-2004 are critical ones in assessing the results of the captive release and nest-site provisioning conducted in 1998-2000. The potential for observing the majority of the ASLC fledglings that return to Resurrection Bay is high. The release of 145 fledglings over a three-year period greatly increased guillemot production in northern Resurrection Bay where the resident 30 breeding pairs could be expected to produce only 30 chicks annually. Assuming normal survival to breeding and natal philopatry, over 50 of the ASLC fledglings should return to northern Resurrection Bay. These returnees will also assist in the assessment of the attractiveness of artificial nest sites as natural nest sites could become limiting as the pool of potential recruits in the region more than doubles.

In addition to our proposed work in Resurrection Bay we intend to conduct an examination of nest-box provisioning at extant colonies in PWS. At Jackpot Island, where the number of breeding birds has been increasing (Seiser 2000) we installed 21 nest boxes late in the breeding season in 2000. The former colony has high densities of guillemot nests and has been increasing in numbers while the latter has low densities and has been declining. Two of the boxes placed on Jackpot in 1996 have been utilized by breeding guillemots and it may be that the success of nest-box provisioning is dependent on density or population trend. This work has been permitted by the US Forest Service to continue through 2004.

Guillemots are an excellent monitor of nearshore conditions. The Black Guillemot was chosen as a target species for the Arctic Monitoring and Assessment Program, a circumpolar monitoring program, and Pigeon Guillemots could be an important part of the monitoring that is intended to take place under the Gulf Ecosystem Monitoring (GEM) program. Our proposed research will include two components that could provide benefits to a long-term monitoring program in the GOA. The first intends to increase the number and accessibility of guillemot nests by determining how to best create man-made Pigeon Guillemot colonies. We intend to analyze the use of the man-made nest sites installed 1998-2000 and within the ASLC avian habitat to determine the characteristics that allow them to attract prospecting birds and allow successful breeding. Data obtained will allow us to refine our nest-box installations and allow determination of how nest boxes could best be placed at other restoration or monitoring Seabirds typically breed in inaccessible locations and habitats and use of man-made nest sites has provided some of the most detailed data on breeding seabirds (Coulson 1988). The development of guillemot colonies could allow the creation of a network of monitoring locations that would provide relatively easy collection of nesting information or tissue from eggs or

chicks. Currently most guillemot nests in the GOA are accessible only through rock climbing. In addition, determining their exact location requires additional time in the field. This is not the case with nests in man-made structures.

Observations from 2001 breeding season.

Three important sets of observations have been made so far regarding restoration objectives of project 01327. First, starting June 3, 2001 clusters of up to five (5) Pigeon Guillemots have been seen flying, swimming and foraging in the waters immediately south of ASLC. Early sightings reported at least one bird being banded. Most sightings have been of one (1) to three (3) birds. The most recent report, July 6, 2001,observeded five birds together and that all five had both USFWS with colored bands, although exact combinations were not reported. On July 7, 2001 an ASLC education staff member reported seeing a Pigeon Guillemot descend from the from the western nest box array just off the ASLC viewing platform.

The other two significant early findings from the 2001 season occurred in the ASLC avian habitat where three (3) female Pigeon Guillemots from the 1998 season and four (4) female and six (6) male Pigeon Guillemots from the 2000 season were added to the resident collection from project 98-00327 rather than being fledged into Resurrection Bay.

Earlier observations of the three birds from the 1998 year class and reports from observations in the wild lead to expectations that first and second year birds would have some white winter plumage mixed with the black breeding plumage giving the immature birds a salt ans pepper appearance. As the spring 2001 molt progressed it became apparent that this was the case for only four (4) of the first year birds. Six of ten first year Pigeon Guillemots in the ASLC habitat now have summer plumage indistinguishable to the untrained eye from the mature breeding plumage of Pigeon Guillemots. This could force revision of our current assumptions regarding the actual age of "mature" Pigeon Guillemots observed in the wild.

The third observation is that only are the third year Pigeon Guillemots actively prospecting for nest sites within the ASLC habitat but they are being joined by first year birds. Indeed, on June 19, 2001, two (2) Pigeon Guillemot eggs found in the habitat. Both the third year female and her mate, a first year low calorie diet male from Couverdon Is., were observed tending the eggs. On July 1, 2001 a Tufted Puffin was observed with the remains after destroying the Pigeon Guillemot eggs. Two puffin eggs have also been destroyed by other puffins this year.

NEED FOR THE STUDY

A. Statement of problem

Pigeon Guillemot populations in Prince William Sound have decreased greatly in the past two Decades, going from 15,000 to 5,000 individuals (Laing and Klosiewski 1993). They have failed to recover from declines that began before the EVOS and both the reasons for the lack of recovery or workable restoration options are still unknown. As stated above, potential reasons for the the lack of recovery are not clear but could include a change in prey from high to low lipid fish resulting in decreased breeding success and/or adult survival, residual oil in the nearshore increasing mortality, or increased predation on nest contents by mink and avian predators associated with the nearshore.

Studies that focused on the role of prey quality and oil ingestion are now completed (Golet 1999, Prichard et al 1997) but without a clear indication of the reason for the decline and continued low carrying capacity. Unfortunately most of these studies centered on the relationship of prey quality or oil ingestion to nestling growth or condition at fledging and failed to determine how the variables affected post-fledging survival. The assumption was that post-fledging survival was related to fledging condition although there is not proof of this for guillemots.

From 1998-2000 research was conducted at the Alaska SeaLife Center that examined the response of chick growth and blood parameters to diet treatments and oil dosing. Data from that work is currently being analyzed by Dan Roby at Oregon State University and George Divoky of the University of Alaska Fairbanks to determine how diet and dosing treatment affected growth, blood chemistry, and fledging age and mass. While these current analyses are important examinations of how variability in caloric and oil ingestion can affect nestling growth and fledging condition, they too assume that variation in nestling and fledging quality affects post-fledging and pre-breeding survival. Changes in these two demographic variables directly affect population growth (unlike any measure of nestling or fledging condition) and information on the relationship between chick condition and survival to breeding would allow the development of population models that incorporate prey quality and oil ingestion. Information on this relationship will be of use in determining the utility of past and future field studies of nestling condition.

Nest box provisioning remains one of the few direct restoration options available for Pigeon Guillemots. Assessment of nest-provisioning efforts takes time both because recruitment cannot be expected to be immediate and also since nest installation techniques need to be refined during the course of a project. The 65 nest sites installed in Resurrection Bay and the 21 nest boxes on Jackpot Island need to be monitored for a number of years to determine if they will be occupied and allow breeding success similar to natural site. The considerable effort that was put into building and installing these sites will be wasted if they are not monitored over the next few years. We propose to combine the monitoring of those nest boxes with a pilot program that would include the collection of nestling down and feathers for chemical analysis and also determine if creation of a network of guillemot monitoring sites in man-made structures is possible.

B. Rationale/Link to Restoration

Our proposed work would have direct benefits to 1) understanding the reasons for the decline and lack of recovery of Pigeon Guillemots in PWS and 2) development of a direct restoration technique that has been known to increase guillemot populations elsewhere.

Fledging mass has been linked to post-fledging survival in some Black-legged Kittiwakes (Coulson and Porter 1985) and Gannets (Sula capensis) Jarvis 1974 but not in an Atlantic Puffins (*Fratercula arctica*) Harris and Rothery 1985. The Pigeon Guillemots fledged from the ASLC offer a unique and valuable resource in that not only are nestling mass and age known but the actual caloric intake and oil dosing is known. The survivors of the 145 fledglings released from ASLC provide an opportunity to examine the affects of nestling conditions on subsequent survival. It is unlikely an opportunity like this will occur again and if it does it will only happen after an extensive captive-rearing program. Determination of the dietary factors relating to survival to breeding would allow modeling of guillemot populations using specific values for caloric intake or oil ingestion. This would greatly increase our understanding of population

trends during periods of regime shifts or chronic oiling and allow refinement of future research and restoration efforts on this species..

Nest site provisioning could be a relatively simple and straightforward restoration technique, once managers know more about the conditions when it can be successfully deployed. Guillemots are a generalist cavity nester that occupy a number of sites with the primary requirement being overhead cover (Storer 1952). If artificial sites are successful in attracting breeding adults they can be used to enhance productivity, recruitment and immigration. Recruitment to newly provisioned sites may take time but if the sites can provide nesting success that is equal to or higher than natural cavities nest boxes could be an important restoration option when predation rates are high. Examination of nest boxes on Jackpot Island show that nest boxes when properly placed are occupied by Pigeon Guillemots and can provide advantages over natural sites. When personnel associated with this proposal visited Jackpot in 2000 we found that the 1996 installation of 14 boxes by U.S. Fish and Wildlife personnel had the majority of boxes in locations where terrestrial predators had easy access to the nest cavity. Only two boxes were placed on vertical substrates separated from horizontal avenues that would allow terrestrial predators access to the nesting cavity. Both of those boxes had been used by nesting guillemots, one in 1998 and the other in 2000. The 1996 placement of boxes on Jackpot Island may indicate why the 15 nest boxes placed on Naked Island have not been able to attract guillemots due to the fact they allow access to terrestrial predators.

Our proposed research will examine the use of artificial nest boxes in a range of conditions:

1. locations where there are currently no birds (ASLC and abandoned army pier on North Beach within Caines Head SP in Resurrection Bay)
2. locations with small numbers of birds (Hat Island in Resurrection Bay)
3. locations with increasing populations (Jackpot Island in Prince William Sound).

Examining nest installations in this range of conditions should allow us to determine if nest-site provisioning can be used as a restoration option and in what conditions it would be most useful.

Modification of available nest sites within the ASLC avian habitat would allow us to further refine and test those conclusions.

C. Location

Surveys of Resurrection Bay will be conducted primarily from Fox Island north with emphasis on determining the number of guillemots and the presence of any captive-raised birds at Caines Head, Thumb Cove and Humpy Cove. Observations of the nests at ASLC will be made by project and ASLC staff throughout the breeding season (May-August). Jackpot Island will be visited at least once during the summer. Other sites known to support Pigeon Guillemot colonies under docks will be visited if no-cost opportunities present themselves.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

A. Community involvement and public education

1. Community involvement

This project is based in the oil spill community of Seward. Two of the major entities involved in this project, ASLC and Pegasus Enterprises hold business addresses in Seward. Dr. French and the ASLC education staff have regularly involved the local and transient visitor populations in various aspects of previous ASLC Pigeon Guillemot research (EVOS Project 01327). We plan to enhance that interaction with a public education component of our proposed work.

The investigators and ASLC staff will conduct seasonal briefings of Kenai Fjords National Park personnel, including seasonal rangers, and employees of various cruise and charter boat companies. Additional presentations will be done as dictated by project evolution. Transportation for censusing and travel to colonies will involve cruise boats, U.S. Coast Guard Auxiliary vessels and other platforms of opportunity.

2. Public Education

As the assessment phase of a longer term project, the Principal Investigators recognize the importance of communicating project findings to the public, resource managers and other interested parties rather than sole reliance on peer reviewed publications. Alaska SeaLife Center, its constituents and publications, provide an excellent avenue to facilitate this interchange.

Two intern positions will be shared between the project research and the ASLC Education Department. These interns will both participate in data collection and in the development of public education materials, the latter under the guidance of the Principal Investigators and the ASLC educational staff. Outreach efforts will focus on disseminating project results, enhancing awareness and appreciation of seabirds as indicators of the GOA environment, and communicating integrated GEM findings to the public. The emphasis will be on dissemination through ASLC but will include materials for the general public. Such materials may include, lectures, short courses, summary publications, visitor displays, and videotapes.

B. Traditional Ecological Knowledge

Through his former involvement on the PAG, the subsistence foods safety program, the Oil Spill Health Task Force, and his long time residence in the spill area, Dr. French has established contacts in communities throughout the spill area. We will either use those connections, or those obtained through Ms. Sarah Ward, Spill Area-Wide Coordinator, Dr. Henry Huntington, Traditional Ecological Knowledge Specialist, and the community facilitators to identify major changes in colony locations, and to help optimize site selection for possible monitoring locations. In all cases contacts with predominantly Alaska Native communities will be coordinated, with Ms. Ward, Dr. Huntington, and the appropriate local community facilitator. All such contacts will be made in a manner consistent with the "Protocols for including indigenous knowledge in the Exxon Valdez oil spill restoration process" adopted by the Trustee Council in December, 1996.

All reasonable effort will be made inform local Alaska Native students of the two internship positions jointly shared with ASLC, and to encourage their applications.

PROJECT DESIGN

A. Objectives

1. Determine the survivorship and recruitment of captive-raised Pigeon Guillemots fledged from the Alaska SeaLife Center in 1998-2000.
2. Examine the association of Pigeon Guillemots with man-made nest-sites and social arrays installed in Resurrection Bay and at Jackpot Island 1998-2000, including determination of characteristics important to Pigeon Guillemot breeding success, and potential use for restoration and monitoring.

B. Methods

Our proposed research will test the following basic hypotheses, which relate to the primary objectives listed above:

Hypothesis 1. Captive rearing, caloric value of nestling diet, and oil ingestion by nestlings do not affect post-fledging survival or recruitment of Pigeon Guillemots at their natal location.

Hypothesis 2. Man-made nest sites and associated social attraction arrays are able to attract prospecting pairs and recruit breeding birds.

Hypothesis 3. Pigeon Guillemots breeding in man-made nest cavities have reproductive characteristics similar to those breeding in natural cavities.

Methodology employed by this project will consist of the following:

Objective 1. Survival and recruitment of captive raised birds

Surveys of Resurrection Bay will be conducted semi-monthly at two-week intervals from 15 May to 15 August. The purpose of the surveys will be to search for banded birds released as fledglings in 1998-2000 from the ASLC. 145 birds were released from the ASLC and with normal survival and philopatry over 50 birds should return as adults to northen Resurrection Bay. First breeding for guillemots is typically in years 3-4 so the majority of birds should recruit from 2002-2005. When a banded bird is observed during a survey its color-band combination will be noted and its position determined with a GPS. Preliminary information will be recorded on its plumage, social behavior with other guillemots, and attachment to any specific shoreline structure. When the survey is completed, or on the next day that weather permits, we will attempt to relocate the bird and determine breeding status (through its association with a nesting cavity) and sex (as indicated by position during copulation or other sex-specific behaviors). For birds that are paired, whether breeding or not, we will determine whether the mate is a ASLC-fledged bird and if so will obtain its identity by reading the color-band combination. When an ASLC-fledged individual is associated with a nest box or natural cavity, we will attempt to access the site in order to determine if breeding is occurring. The contents of the nest (number of eggs or chicks), and their condition (size and state of incubation for eggs and mass and wing

The project staff would work with EVOS representatives, and those of ASLC to assure that any modifications to the ASLC avian habitat are cost effective and meet all the internal requirements of ASLC. Either permanent installment of box attachment points, or the design and construction of appropriate nest boxes would require additional "bench fees" for ASLC. Any contingent funding would have to be in place for installations to be complete by April 2002."

F. Cooperating Agencies, Contracts and Other Agency Assistance

We will work with the Anchorage Office of Division of Migratory Bird Management of the U.S. Fish and Wildlife Service on all research conducted in Prince William Sound. That office has conducted Pigeon Guillemot research at Naked Island over the last 25 years and with post-spill censuses and breeding productivity assessment conducted annually since 1989. They have also conducted Pigeon Guillemot research at Jackpot Island. We will assure that our fieldwork is done so as to provide census or productivity data that is compatible with their database.

SCHEDULE

A. Measurable Project Tasks for FY 02 (October 1, 2001 - September 30, 2002)

October 1-30:	Develop position descriptions and recruiting materials for project interns.
October - December:	Negotiate specific design modifications for ASLC avian habitat
December 1:	Begin intern recruitment
January 1:	First quarterly report due
January 14-20	Restoration Workshop
January - March:	Nest box and site modicications in ASLC habitat
February 1-15:	Arrange logistics for censuses of colonies with nest boxes
February 15:	Begin intern selection
April 1:	Complete intern selection Second quarterly report due
April 15:	Annual report (EVOS 01327) due submit DPD for 2003 year, if warranted
May 15 - August 15:	Semi-monthly surveys and nest checks of Resurrection Bay man-made nest sites, social arrays and colonies. Develop ASLC education materials
June 25:	Examination of nest boxes on Jackpot
July1:	Third quarterly report due
July 15 - 31	Assess chick development at ASLC and nest boxes in Resurrection Bay
August 1-15:	Determination of nesting success in next boxes on Jackpot Island
September 1-15:	Final surveys of Resurrection Bay sites
September - October:	Data analysis
October 1:	Fourth quarterly report due
December 31, 2002:	Submission of first manuscripts
April 15, 2003	Annual report (EVOS 02674) due
January 31, 2004:	Submission of remaining manuscripts
April 15, 2004	Submission of final report

chord for chicks) will be obtained. When we find a site where nesting is occurring, we will attempt to obtain information on nest contents from the date of discovery until fledging occurs.

Objective 2: Association of Pigeon Guillemots with artificial nest boxes and social attraction arrays.

We will determine the attractiveness of Pigeon Guillemots to artificial nest boxes and decoys by conducting surveys of all natural and man-made colonies in northern Resurrection Bay. On semi-monthly boat surveys of all colonies north of Fox Island we will determine the number and distribution of birds on the water and in close proximity to natural and man-made nest sites. Our principal objective will be to determine if guillemots are recruiting to the artificial nest boxes installed from 1998-2000 but we will also obtain information on populations at natural colonies for comparison with data from 1999-2000. When we observe birds entering or leaving a nest box we will access the site at the earliest possible time to determine nest contents. The contents of the nest (number of eggs or chicks), and their condition (size and state of incubation for eggs and mass and wing chord for chicks) will be obtained. The access provided by the man-made nest sites will allow nest contents to be accessed more frequently than natural sites and active nests in man-made sites will be checked at least on every survey (twice monthly) with opportunistic visits when possible. We will attempt to determine if growth rate of chicks in artificial sites is comparable to that found in natural cavities.

In Prince William Sound we will examine the comparative use of the nest boxes installed in 1996 and installed by project 00327 in 2000 on Jackpot Island. We will visit Jackpot Island in early July to determine the number of breeding birds and the occupation of man-made sites. If possible, a second visit will be made approximately a week before fledging begins to assess the productivity of both man-made and natural nest sites.

The ASLC avian habitat offers a unique opportunity to study and intensive observation of a group on newly maturing and prospecting Pigeon Guillemots as they choose between a variety of man-made alternatives for nesting. Since there has already been some prospecting behavior during the 2001 breeding season and one pair of eggs laid, the 2002 season should provide excellent opportunities to closely observe prospecting and nest-site choices being made. Since the Tufted Puffins have proven to be actively protecting nesting resources, this provides another natural factor to be considered in both site selection and breeding success.

The placement of nest boxes more similar to those used at other project sites into the habitat would facilitate close observation of interaction of Pigeon Guillemots with those boxes. It would also facilitate the study of design modifications intended to either make the boxes more attractive, or less prone to destructive interaction with other species, such as puffins. Since the habitat pool is not large enough for puffins to fly, it should be relatively easy to place nest boxes where they are inaccessible to puffins.

Since none of the thirteen (13) Pigeon Guillemots in the habitat have established a successful nesting site, the ASLC habitat presents a unique opportunity to study nest site selection. The colony size is within the normal distribution of colonies seen on Naked Island by Oakley and Kulitz (1996). These birds are naive having neither the guidance of successful nesting in the past nor exposure to behavior of more mature nesting pairs. As the maturity and experience of the habitat guillemots increases this opportunity will be lost.

B. Project Milestones and Endpoints

Objective 1. Survival of captive-raised chicks.

September 1 - annual data gathering completed for Resurrection Bay
October 1- completion of analysis of nestling condition of re-sighted birds

Objective 2. Occupancy, breeding success and characterization of nest-box utilization

September 1- annual data gathering completed
October 1 - completion of analysis of nest site occupation
November 1 - completion of analysis of nest site characteristics

Objective. Public Education

April 1 - hire interns shared with ASLC
September 1 - completion of public education materials

C. Completion Date

All fieldwork will be completed by September 2003 and a final report will be submitted by April 15, 2004

PUBLICATIONS AND REPORTS

The following publications are projected. This projection is approximate and should be considered incomplete. Annual reports will be submitted April 15, 2003 and 2003 with a final report submitted April 15, 2004.

A minimum of three manuscripts will be produced and submitted to peer reviewed scientific journals. Manuscripts anticipated at this time include: 1) the effects of captive rearing, diet treatments and oil dosing on survival to breeding in Pigeon Guillemots; 2) the utility of man-made nest cavities in creating colonies or increasing colony size to monitor Pigeon Guillemots; 3) the desirable characteristics of man-made nest cavities for Pigeon Guillemots.

Non-technical publications and those intended for the general public are discussed under "Community Involvement and Public Education".

PROFESSIONAL CONFERENCES

Results of the research will be presented at the Pacific Seabird Group annual meeting in 2003 and 2004, typically held in February and March. The paper presented at the 2003 meeting will report on the results of guillemot feather analysis. The paper in 2004 will be on the survivorship of captive-raised released from ASLC.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Research in Resurrection Bay will attempt to incorporate volunteers, interns and staff from the ASLC in Seward. We will work with the ASLC Director of Education and interns working on this project to inform Center visitors of the goals of this project, including the importance of reporting any sightings of banded birds to ASLC or project personnel. In the spring of 2002 when the ASLC aviary will first have the possibility of having sexually mature guillemots of both sexes, a nest box will be placed in the aviary both to facilitate breeding and to educate the public on the utility of artificial nest boxes.

Analysis of resightings of captively raised birds will be done in cooperation with Dan Roby of Oregon State University (EVOS Project 01327) who is analyzing growth rates and blood parameters from the 1998-200 cohorts.

Research on Jackpot will be done in close cooperation with David Irons of the Anchorage office of the U.S. Fish and Wildlife Service's Division of Migratory Bird Management. That office has been conducting research on Naked Island since the mid-1970s and on Jackpot Island since the early 1990s. Their long-term data base on population size and productivity will be continued with the information obtained by the proposed research.

Opportunistic collection of Pigeon Guillemot feathers, eggs, chicks and adults will occur during the course of fieldwork when addled eggs or dead individuals are encountered. All tissue will be given to Geoff York of the Biological Research Division (BRD) of USGS for analysis or archiving in the tissue bank being developed by BRD and Paul Becker of NOAA.

PRINCIPAL INVESTIGATORS

John French is the sole proprietor of PEGASUS ENTERPRISES, a consulting company based in Seward, Alaska. He has a Ph.D. in Biological Chemistry from the University of Michigan. From 1980 to 1998, he was a faculty member at the University of Alaska, including ten years at the Fishery Industrial Technology Center, and five as the Director. He retired from the University in 1998 as a Professor of Seafood Biochemistry. While working for the University, he taught a variety of seafood and natural resource related courses as well as biochemistry and toxicology. He has successfully completed over two million dollars worth of grants and contracts, and published several peer reviewed manuscripts. Immediately following EVOS, he was the only Alaskan on NOAA's Toxicological Experts Panel which assessed, and assisted in communication of, the risks involved in consumption of subsistence foods from the spill area. He also served as an advisor to ADFG in communicating this information to residents of the villages within the effected area. He was the Science/Academic Representative on the EVOS-PAG from 1991-1995. He has lived and worked in Seward since 1998. He is a Founder Member of ASLC and supplied substantial volunteer assistance to the pigeon guillemot research there (#01327) during 1999 and 2000.

George J. Divoky, Ph.D. is a Research Associate at the Institute of Arctic Biology in Fairbanks. He was Co-Principal Investigator on EVOS Project 01327 that raised and released Pigeon Guillemots from the ASLC and installed nest boxes and decoys in Resurrection Bay and Jackpot Island. He was an editor on the results of a workshop on seabird restoration and has been conducting research at a man-made colony of guillemots for two decades. He currently is

investigating Black Guillemot breeding chronology and feather composition as indicators of global change.

OTHER KEY PERSONNEL

Shane Roy is a graduate student at Alaska Pacific University. In 2000 he participated in the raising and release of Pigeon Guillemots and in the installation of boxes and decoys in Resurrection Bay and Jackpot Island. In 2001 he will be conducting fieldwork on Pigeon Guillemots on Naked Island as part of his master's research.

Amy Haddow of the ASLC will supervise the interns when they are developing educational materials at the ASLC and will work with other project personnel in the creation of educational materials on seabirds and Pigeon Guillemots.

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Revision 7-20-01
Approved TC 8-6-01

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002						
Personnel		$0.0						
Travel		$0.0						
Contractual		$39,840.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$39,840.0	Estimated FY 2003					
General Administration		$2,800.0						
Project Total	$0.0	$42,640.0						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

$ 42.6
+ 17.8 ASLC bench fees
$60.4 Project Total

Project Number: 02674-BAA
Project Title: Assessing Pigeon Guillemot Restoration Techniques
Agency: NOAA

Prepared: 7/27/01

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2002
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.0	0.0	0.0	
					Personnel Total	$0.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2002
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.0

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Contractual Costs:	Proposed
Description	FY 2002
4A Linkage	39,840.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$39,840.0
Commodities Costs:	Proposed
Description	FY 2002
Commodities Total	$0.0

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 2002
			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:	Number	Inventory
Description	of Units	Agency

Prepared:

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002	
Personnel		$28,375.0	
Travel		$3,065.0	
Contractual		$4,200.0	
Commodities		$2,300.0	
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS
Subtotal	$0.0	$37,940.0	Estimated FY 2003 $45,000.0
Indirect		$1,900.0	
Project Total	$0.0	$39,840.0	
Full-time Equivalents (FTE)		0.4	
	Dollar amounts are shown in thousands of dollars.		
Other Resources			

Project Number: 02674
Project Title: Assessing Pigeon Guillemot Restoration Techniques
Name: Pegasus Enterprises

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2002
George Divoky	Co-Principal Investigator		2.5	5670.0		14,175.0
John French	Co-Principal Investigator		2.0	7100.0		14,200.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		4.5	12770.0	0.0	
					Personnel Total	$28,375.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 2002
Seattle-Anchorage		330.0	4	21	45.0	2,265.0
Seward-Jackpot Is		800.0	1	2		800.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$3,065.0

Contractual Costs:		Proposed
Description		FY 2002
Vehicle rental		500.0
Housing in Seward		1,000.0
Telephone services		500.0
Bookkeeper		1,200.0
ASLC Interns	2@2001	***
Boat rental for surveys		1,000.0
	Contractual Total	$4,200.0

Commodities Costs:	Proposed
Description	FY 2002
Food at study sites	500.0
Climbing gear	300.0
Nest box construction / repair	700.0
Motion sensitive camera for monitoring arrays	800.0
Commodities Total	$2,300.0

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 2002
			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:	Number	
Description	of Units	
Computers	3	
HP 6300 Scanner	1	
Laser/Inkjet printers	3	
High resolution digital camera	1	
Digital video camera	1	
Analog video cameras	4	
VCRs	3	
Nest box fabricating tools		
Marine safety equipment		
Technical safety equipment		

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002	LONG RANGE FUNDING REQUIREMENTS					
Personnel		$0.0						
Travel		$0.0						
Contractual		$16.6						
Commodities		$0.0						
Equipment		$0.0						
Subtotal		$16.6	Estimated FY 2003					
General Administration		$1.2						
Project Total		$17.8						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY02

Project Number: 02674-BAA
Project Title: Assessing Pigeon Guillemot Restoration Techniques
Agency: NOAA

FORM 3A
TRUSTEE
AGENCY
SUMMARY