99306

Ecology and Demographics of Pacific Sand Lance, *Ammodytes hexapterus* Pallas, in Lower Cook Inlet, Alaska

Project Number:	99306
Restoration Category:	Research
Proposer:	USGS Biological Resources Division
Lead Trustee Agency:	DOI
Cooperative Agencies:	N/A
Alaska SeaLife Center:	no
Duration:	3rd year, 4-year project
Cost FY 99:	$30,000
Cost FY 00:	$20,000
Geographic Area:	Kenai Peninsula, Lower Cook Inlet
Injured Resource:	Multiple (forage fish and upper trophic level predators)

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APR 15 1998
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

ABSTRACT

The purpose of this study is to characterize the basic ecology, distribution, and demographics of sand lance (*Ammodytes hexapterus*) in lower Cook Inlet. Recent declines of upper trophic level species in the Northern Gulf of Alaska have been linked to decreasing availability of forage fishes. Sand lance is the most important forage fish in most nearshore areas of the northern Gulf. Despite its importance to commercial fish, seabirds, and marine mammals, little is known or published on the basic biology of this key prey species.

INTRODUCTION

An estimated 250,000 seabirds were killed by *Exxon Valdez* oil pollution. Based on comparisons of pre-spill (1970s) and post-spill (1989-1995) data, long-term effects on seabirds attributed to oil pollution included: i) population declines, ii) reduced breeding success, and, iii) delayed breeding phenology. However, some purported effects of the spill may have been due in large part to natural changes in the Gulf of Alaska marine ecosystem-- in particular, declines in forage fish abundance (Piatt and Anderson 1996). The rate at which seabird populations will recover from effects of oil mortality are unknown, but is probably linked to population dynamics of forage fish species, of which sand lance is the most important.

Sand lance (genus *Ammodytes*) are zooplanktivorous, semi-demersal, schooling perciforms. They are ubiquitous to the boreo-arctic regions of the North Atlantic and North Pacific and are particularly abundant in coastal regions. There are three genera of sand lance (*Hyperoplus, Gymnammodytes, and Ammodytes*) distributed in the Northeast Atlantic from Novaya Zemblya to Spain. *Ammodytes* is also distributed in the Northwestern Atlantic from West Greenland to Cape Hatteras, North Carolina (Leim and Scott 1966, Winters and Dalley 1988) and in the North Pacific from the Bering Sea to southern California (Wilimovsky et al. 1988). Although several species of *Ammodytes* have been described for the North Atlantic and at least two in the North Pacific, *Ammodytes hexapterus* is the only species currently described in the Gulf of Alaska.

Sand lance serve as an important trophic link between zooplankton and marine vertebrate piscivores (Winters 1983) particularly on continental shelf ecosystems (Springer *et al.* 1996). In the North Pacific, sandlance are forage for fish, seabirds, and marine mammals. Seabirds consuming sand lance include red-faced cormorant (Hunt et al. 1981), black-legged kittiwake, common murre, thick-billed murre, pigeon guillemot, horned puffin, tufted puffin, brachyramphus murrelets, and rhinoceros auklet (Wilimovsky *et al.* 1988, Springer 1991, Piatt and Anderson 1996). Marine mammals consuming sand lance include Stellar sea lion, minke, sei, and humpback whales (Wilimovsky et al. 1988). Commercially important fish preying on sand lance include Pacific cod, halibut, lingcod, rockfish, and salmon (Wilimovsky et al. 1988).

Due to commercial fisheries for sand lance in the North Sea and around Japan, much is known about sand lance in these regions. In the North Pacific, however, sand lance are of little commercial importance. Despite their role as a forage species, there is a paucity of published information on their biology and population dynamics in this area.

NEED FOR THE PROJECT

A. Statement of Problem

Lack of recovery of species injured in the *Exxon Valdez* oil spill is currently thought to be linked to changes in forage fish abundance or composition. Changes in species composition or abundance of forage fish will have marked effects on predators, in terms of the time needed to find and consume fish, as well as in the relative energy value of that fish once consumed. Therefore, an understanding of the factors affecting forage fish distribution, abundance, and quality is vital to an understanding of predator distribution, abundance and recovery.

B. Rationale/Link to Restoration

It is important to study the ecology and demographics of sand lance because: i) sand lance are one of the most important prey species consumed by seabirds, marine mammals, and commercial fish in Alaska; ii) changes in sand lance abundance and distribution therefore have direct effects on predators; and, iii) natural environmental changes may have reduced sand lance populations in recent years. These population changes may limit the ability of higher predators to recover from oil spill impacts.

Sand lance availability to higher predators is probably governed by behavioral and biological responses of sand lance to their environment. Predation on sand lance by various seabirds and fish is being studied with funding from Restoration Project 98163M. This project will focus on sand lance in Kachemak Bay, lower Cook Inlet, and assess how seasonal and diel movements of sand lance impact their availability as a food source for marine piscivores. We will also measure demographic and physical parameters, measure caloric content of sand lance throughout the year, and measure temporal changes in abundance and productivity of sand lance in Cook Inlet.

C. Location

The project is a portion of an ecosystem study of lower Cook Inlet (EVOS APEX Project 98163M). Sand lance research will be focused on Kachemak Bay because they are common there, and the area is logistically easy to work in. Comparative collections of sand lance will be made at Chisik Island and the Barren Islands. Sand lance will also be collected from sites in the center of the Cook Inlet. These collections will be from the stomachs of halibut and from incidental catches in ADF&G or UAF shrimp, herring, and flatfish trawls. Opportunistic samples of sand lance will also be obtained from other areas of Alaska by cooperators (NMFS, APEX, USFWS, ADFG).

COMMUNITY INVOLVEMENT

Local knowledge of sand lance spawning sites and of areas where they could be found buried at low tide have proven invaluable to this project. Communications with local residents during the summers of 1995 and 1996 have provided information on at least two sites where sand lance spawn. The first documented spawning observations for this genus were made by this project at one of these sites in the fall of 1996 and 1997. Further research was conducted at this site during 1998, and will continue in 1999.

PROJECT DESIGN

Although the project is based in Lower Cook Inlet, we expect through collaboration with other researchers (particularly in Prince William Sound) to integrate other populations of sand lance into our research. This will provide perspective to the Cook Inlet samples as well as to increase the range of knowledge on this key species.

A. Objectives

1. To establish how seasonal fluctuations in abundance of sand lance impact their availability as a food source for marine piscivores.

2. Measure demographic parameters of sand lance including age composition, growth rate, patterns of growth, and sex ratios and compare between regions.

3. Depending on collaborative efforts, genetic characteristics will be used to establish if distinct populations of sand lance occur within Cook Inlet and throughout the northern Gulf of Alaska.

4. Critical feeding and spawning habitat of sand lance will be described in relation to physical parameters (e.g., temperature, substrate type, salinity, and turbidity). Physiological adaptations will also be explored in relation to their habitat.

5. Estimates will be made of relative sand lance abundance and distribution within the Cook Inlet in relation to burrowing substrate.

6. The caloric content of sand lance will be investigated throughout the year to evaluate their value as forage for marine piscivores.

7. Sand lance early life history will be investigated using a 20-year historical database provided by Paul Anderson (NMFS, Kodiak).

B. Methods

FIELD COLLECTIONS:

Sand lance will be caught using a variety of nets to sample habitats near beaches, in nearshore areas, and offshore waters:

Beach Seines:
A beach seine (37m long, 28.6mm stretch mesh tapered wings, 6mm stretch mesh cod end in middle) will be used for all beach seining. Seines will be made in sets of two at each location at least every two weeks during the summer (May to October), and opportunistically during the winter (November to April), conditions and light permitting. Seines will be made at high and low tide until a comprehensive dataset is established to evaluate differences in sand lance catch between the tidal states.

Permanent sample locations within Kachemak Bay will be at Halibut Cove, Peterson Bay, China Poot Spit (summer and winter samples), and Eldred Passage, Yukon Island, and Seldovia Bay (summer

samples). These sites provide a wide range of physical conditions (exposure, water regimes, substrates etc.) with which to evaluate physical conditions preferred by sand lance. Comparative collections of sand lance will also be made in the Barren Islands (East Amatuli Cove) and Chisik Island (Snug Harbor). Sand lance will be obtained from APEX colleagues working in Prince William Sound, and opportunistically from other locations in Alaska.

Fish Stomachs:
Halibut stomach contents will be used to establish presence of sand lance in deeper offshore waters. This method uses stomachs from halibut caught by charter boats during the summer. Results from 1996 and 1997 indicate many large sand lance occur offshore. Halibut stomachs provide valuable information on the summer movements and distribution of sand lance as well as to population age structure. Halibut stomachs are obtained through cooperation with the Alaska Maritime National Wildlife Service, with funding from EVOS APEX Restoration Project 98163K.

Trawls:
Bottom trawls (Apex Project 98163M) as well as Alaska Department of Fish and Game shrimp and herring trawls (Paul Desjardin, R/V Pandalus) are made routinely in Kachemak Bay. The location and depth of any sand lance caught in these trawls is routinely collected, and these data will be made available to us. Sand lance caught will be frozen and provided to us for later analysis.

Historical data from NOAA plankton trawls currently being compiled by Paul Anderson (NMFS) will be made available to us (APEX Project 98163L). This data will provide valuable information on the early distribution and abundance of sand lance larvae.

Digging:
Sand lance bury themselves in sandy substrates although the timing and reasons for such behavior and not fully understood. We will dig for sand lance on "clamming" tides in Halibut Cove, Peterson Bay, and in China Poot Bay as well as at other sites discovered through interaction with local clam diggers. This method of collection is important in winter months when sand lance are not found in beach seine samples. Critical substrate parameters (grain size, substrate composition etc.) will be measured at the same time as collections are made. Further analysis of substrates will be made using hydroacoustics (see below).

Hydroacoustics:
Hydroacoustic data will collected near beaches with high sandlance abundance and analyzed for bottom type using new Biosonics analysis software. This will allow us to assess substrate preferences for sand lance. Previous work by this project has produced an extensive data-set on the physical properties of beach substrates preferred by sand lance. We expect that further work using hydroacoustics may allow us to assess potential sand lance habitat by this method alone. This method may be valuable for future surveys of new areas and for impact assessments.

Other methods:
Underwater video was used in Prince William Sound for the assessment of forage fish schools during 1996 and 1997. Depending on the availability of this equipment and water visibility we will use this method to study sand lance schooling behavior, movements, and distribution in 1999.

LABORATORY ANALYSIS:

Lengths and weights of sand lance will be noted for 100 individuals (minimum if possible) collected at each site. These results will be used to establish length-weight relationships as well as growth over time.

Age determinations will be based on otolith interpretations according to the methodology of Macer (1966) and Scott (1968, 1973). Otoliths with poorly defined annuli will be omitted from the age determinations. Otolith area and ring areas will be measured using a video imaging system (Optimas) connected to a Nikon Optiphot-2 stereo microscope using 40x magnification.

Gonad development and stage of maturity will be classified according to the following stages; 0, immature; 1, maturing (developing); 2, ripe; 3, running; 4, spent; and 5, recovering. Specimens will be assigned these categories according to gonad condition described by Macer (1966).

To investigate population variablity we have archived specimens from all our study areas. Other specimens have been received and archived from other researchers in Seattle and the Aleutians. However, a thorough investigation of the literature pertaining to meristics of Atlantic sand lance has not revealed conclusive evidence of its value. We therefore do not intend to investigate meristic variability in *A. hexapterus*. However, continued research is still taking place on genetic approaches that are cost-effective and have the potential to provide conclusive results. We feel this area of study is important to fully understanding the species. Distinct morphological differences between sand lance in Prince William Sound and Cook Inlet further highlight the value of ascertaining the range of stocks and sub-populations. Genetic comparisons between different populations have not been budgeted for, and so we are currently searching for potential collaborators who may be interested in pursuing genetic work to complement their own interests.

Seasonal and annual variation in caloric content of sand lance will be established in collaboration with Dan Roby at Oregon State University. This work will be used to assess the relative value of sand lance to marine predators over a season as well in comparison to other forage species.

C. Contracts and Other Agency Assistance

A Cooperative Agreement has been established with Memorial University of Newfoundland to provide funding for a graduate student to conduct this work under the supervision of Dr. George Rose, Senior Chair in Fisheries Conservation, Fisheries and Marine Institute, St. John's, Newfoundland.

SCHEDULE

A. Measurable Project Tasks for FY 99 (October 1, 1998 – September 30, 1999)

Oct. 31	Masters Thesis will be completed and submitted to Memorial University
Dec. 30	Manuscripts on sand lance maturity, spawning, and growth will be published.
Dec. 30	Report on sand lance energetics will be submitted for publication.
Jan. 1	Analysis of historical trawl database for larval sandlance begins

April 15 Annual Report submitted

May 1 Final field season begins

Sep 30 End of field season

B. Project Milestones and Endpoints

Establishing how seasonal fluctuations in abundance of sand lance impact their availability as a food source for marine piscivores will continue with collections (trawl, seines, etc.) until the end of field work in FY99. Results and conclusions will be written up in the final report and publications in FY00.

Analyses of demographic parameters of sand lance in lower Cook Inlet, including age composition, growth rate, patterns of growth, and sex ratios will be completed in early FY99 and included in a Masters Thesis, and published papers.

Critical feeding and spawning habitat of sand lance will be described in relation to physical parameters (e.g., temperature, substrate type, salinity, and turbidity) in the completed Masters Thesis (early FY99), and subsequent publications (FY00).

Estimates of relative sand lance abundance and distribution within the Cook Inlet in relation to burrowing substrate will be completed for the final report in FY00.

Measures of temporal variation in caloric content of sand lance have largely been completed, but we are trying to fill some gaps (2 months in late winter). Results of this work are already in manuscript form for submission, but final results will also appear in the final report.

Sand lance early life history will be investigated using a 20-year historical database provided by Paul Anderson (NMFS, Kodiak), and results of this analysis will appear in the final report in FY00.

C. Completion Date

Field work for this project will be completed in the winter of FY 99/FY 00. Compilation and analysis of all data and production of a final report, and papers for publication, will be finalized in FY00.

PUBLICATIONS AND REPORTS

The first reports will be produced in 1998 in the form of peer-reviewed manuscripts in scientific journals. Other publications will include a Masters Thesis submitted to Memorial University of Newfoundland, and papers submitted to journals.

Completed manuscripts and products include:

Robards, M., N. Tileston, and J.F. Piatt. 1998. Electronic bibliography of Sand Lance (*Ammodytes* spp.): biology, fisheries, and general ecology. Exxon Valdez Oil Spill Trustee Council Restoration Project No. 98306. Interim Report. (926 references) 262 pp.

Robards, M.D., J.F. Piatt, and G.A. Rose. 1998. Maturation, fecundity and intertidal spawning of Pacific Sand Lance (*Ammodytes hexapterus*) in the northern Gulf of Alaska. Mss. submitted to **Marine Biology**.

Robards, M.D., G.A. Rose, and J.F. Piatt. 1998. Spatial Variation in Abundance and Growth of Pacific Sand Lance (*Ammodytes hexapterus)* in the Gulf of Alaska. Mss. under review.

Litzow, M.A., J.F. Piatt, A.A. Abookire, M. Robards and A.K. Prichard. 1998. Variability in Pigeon Guillemot Diet and Nearshore Fish Communities at Kachemak Bay, Alaska. Mss. submitted to **Canadian Journal of Zoology**.

Abookire, A.A., J.F. Piatt and M. Robards. 1998. The influence of meso-scale thermohaline differences on near shore fish distributions in Kachemak Bay, Alaska. Mss. under revision for submission to **Canadian Journal of Fisheries and Aquatic Sciences**.

Robards, M., J.F. Piatt, and A. Abookire. 1998. Temporal and geographic variation in fish populations in nearshore and shelf areas of lower Cook Inlet, Alaska. Mss. submitted to **Fishery Bulletin.**

PROFESSIONAL CONFERENCES

Money has been budgeted for the graduate student to attend the EVOS Annual Restoration Workshop and the APEX Annual Peer Review Meeting. Because of possible restriction of academic requirements, these meetings will only be attended if time allows.

NORMAL AGENCY MANAGEMENT

None of the proposed research described here would normally be conducted by the USGS, or any other government agency.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Close coordination has developed between us and ADF&G, UAF, NMFS, and USFWS for collections of sand lance offshore and in other areas of Alaska. Work on sand lance will also continue to be coordinated with other APEX investigators working in Prince William Sound , including Dan Roby, Bill Ostrand, Lew Haldorson,, and David Irons.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

This study plan is modified only slightly from past proposals. In particular, we had hoped to be able to use meristic characteristics to assess geographic variability in sand lance populations. However, careful literature review and examination of specimens obtained in previous field work suggests this approach will not work here. So, we are now emphasizing the possibilities for genetic work, although we do not anticipate doing this ourselves (nor have we budgeted for it)—rather, we are seeking assistance from potential collaborators for genetic analyses of sand lance.

PRINCIPAL INVESTIGATORS

Dr. John F. Piatt (Research Biologist GS13, Alaska Biological Sciences Center, USGS, Anchorage, AK) obtained a Ph.D. in Marine Biology from Memorial University of Newfoundland in 1987. His dissertation involved seabird-forage fish interactions. Since 1987, he has studied seabirds both at colonies and at sea in the Gulf of Alaska, Aleutian Islands, and Bering and Chukchi seas. His is an author on over 60 peer-reviewed scientific publications about seabirds, fish, marine mammals, and effects of oil pollution on marine birds. Dr. Piatt is responsible for overall coordination of the sand lance research project.

Martin Robards, M.Sc. Graduate Student, Memorial University of Newfoundland. Project Manager responsible for coordinating fishing effort, analysis of fish, data analysis, and report preparation.

LITERATURE CITED

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1998 EXXON VALDEZ TR[illegible] COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		$0.0
Travel		$0.0
Contractual		$28.0
Commodities		$0.0
Equipment		$0.0
Subtotal	$29.4	$28.0
General Administration	$3.5	$2.0
Project Total	$32.9	$30.0
Full-time Equivalents (FTE)		0.0
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 2000	Estimated FY 2001	Estimated FY 2001
$20.0	$0.0	$0.0

Dollar amounts are shown in thousands of dollars.

Comments: Contract to support Cooperative Agreement with Memorial University of Newfoundland

1999

Project Number: 99306
Project Title: Ecology and demographics of Pacific Sand Lance, Ammodytes hexapterus, Pallas, in lower Cook Inlet,. Alaska
Agency: USGS (BRD)

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: 4/14/98

1998 EXXON VALDEZ TR[illegible]E COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1999
						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 1999
					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

1999

Prepared:

Project Number: 99306
Project Title: Ecology and demographics of Pacific Sand Lance, Ammodytes hexapterus, Pallas, in lower Cook Inlet,. Alaska
Agency: USGS (BRD)

FORM 3B
Personnel
& Travel
DETAIL

4/14/98

Contractual Costs:	Proposed FY 1999
Description	
Cooperative Agreements with Memorial University of Newfoundland (entire amount is transferred to facilitate support of graduate student, and to make it easier for travel arrangements to be made from Newfoundland. The breakdown for use of these funds is as follows: Student support (stipend, benefits, tuition, other fees) - 26.6 K Travel (Nfld to AK for APEX meetings) - 1.4 K	28.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$28.0

Commodities Costs:	Proposed FY 1998
Description	
Commodities Total	$0.0

1999

Prepared:

Project Number: 99306
Project Title: Ecology and demographics of Pacific Sand Lance, Ammodytes hexapterus, Pallas, in lower Cook Inlet,. Alaska
Agency: USGS (BRD)

FORM 3B
Contractual & Commodities DETAIL

4/14/98

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1999
			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

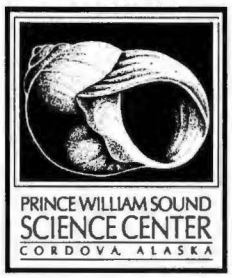
1999

Project Number: 99306
Project Title: Ecology and demographics of Pacific Sand Lance, Ammodytes hexapterus, Pallas, in lower Cook Inlet,. Alaska
Agency: USGS (BRD)

FORM 3B
Equipment
DETAIL

Prepared:

4/14/98



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PRINCE WILLIAM SOUND SCIENCE CENTER RESEARCH PROPOSAL

Date: 10 April 1998

To: *Exxon Valdez* Oil Spill Trustee Council

Project Title: 99311-Pacific Herring Productivity Dependencies in the Prince William Sound Ecosystem Determined With Natural Stable Isotope Tracers

Federal/State/Privatefunding:
Amount requested: $97.7

Desired time period for grant: One year, 1 Oct, 1998- 30 Sept, 1999

Principal Investigator: 10-IV-98
Thomas C. Kline, Jr. Ph. D. /Date

Contracting Officer: Penelope Oswalt

Center Approval:

Date: 4/10/98

G. L. Thomas, President

Pacific Herring Productivity Dependencies in the Prince William Sound Ecosystem Determined With Natural Stable Isotope Tracers

Project Number:	99311
Restoration Category:	Research
Proposer:	Prince William Sound Science Center Cordova, Alaska
Lead Trustee Agency:	ADF&G
Cooperating Agencies:	
Alaska SeaLife Center:	
Duration:	Year 2, 2-year project
Cost FY 99:	$ 97.7K
Cost FY 00:	$
Cost FY 01:	$
Cost FY 02:	$
Geographic Area:	Prince William Sound
InjuredResource/Service:	Pacific herring, indirectly - their predators, CommercialFishing

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TRUSTEE COUNCIL

ABSTRACT

The advective regime connecting the northern Gulf of Alaska (GOA) with Prince William Sound (PWS) may affect recruitment and nutritional processes in Pacific herring (*Clupea pallasi*). Research of the Sound Ecosystem Assessment (SEA) program has shown that herring have significant dependence on GOA carbon. Accordingly, herring are subject to changes in carbon flow occurring between GOA and PWS. The first step in understanding of how this fundamental environmental process affects herring recruitment is to isotopically analyze a time series of herring for which energetic data have been collected. This will expand upon the data series available from SEA providing a total four-year time period corresponding to one period in the cyclicity of herring population abundance in PWS.

INTRODUCTION

Stable isotope ratios of carbon and nitrogen have been shown to serve as effective tracers of energy supply in the Prince William Sound study area (Kline 1997a, 1997b, 1998a, 1998b) This is due to (1) the conservative transfer of carbon isotope ratios between the lower tropic levels (phytoplankton to zooplankton to forage fishes, etc.) of Prince William Sound (PWS) and adjacent Gulf of Alaska (GOA) waters up to the top consumers and (2) the naturally occurring gradient in $^{13}C/^{12}C$ productivity generated in the Gulf compared with the Sound. Herring acquire these isotope ratios in response to the importance of the food in bulk body tissues. Isotope ratio analysis of tissues thus provide insight into both habitat usage and assist in quantifying amounts derived from various areas. Nitrogen isotope ratios, in turn, provide excellent definition of relative trophic level. The heavy isotope of nitrogen is enriched by about 0.3 % with each trophic level and thus can accurately indicate the relative trophic status of species within an ecosystem (Minagawa and Wada 1984, Fry 1988) and is useful for food web model validation (Kline and Pauly 1998, Kline 1998b).)

RESULTS FROM PRIOR WORK and ANTICIPATED RESULTS

Juvenile herring and pollock are the dominant pelagic fishes in PWS and both consume zooplankton. Samples of opportunity from 1994, and samples collected during broadscale surveys in Fall 1995 and Spring, 1996 have been analyzed (Fig. 1). Commencing in May, 1996, herring analysis focused on a four-bay time series (Fig. 2) established by Norcross et al. Accordingly, isotopic analysis of the four bays in a time series is a collaborative study.

Samples of juvenile herring and pollock collected between 1994 and 1996 shifted in $^{13}C/^{12}C$ content from which a change in carbon source dependency was inferred (Fig. 1). Although both species shifted in concert to greater GOA dependency in 1995 than 1994, pollock were consistently less dependent on GOA carbon. Juvenile pollock and herring occupy different levels in the water column, have different schooling behavior, and recruit from the larval stage at different times, effecting access to a different forage-base as confirmed by the data. This difference may not be reflected in the species composition of diet but instead the where and when of the production cycle is integrated into the isotopic signature which reflects the assimilated carbon pool in the fish. Pollock may be at an advantage since they metamorphose earlier and thus have first access to prey. The greater reliance on GOA-derived carbon in herring may reflect their dependence on carbon generated later in the season during the time when advection of GOA production was nearly the sole carbon source in 1995 as suggested by the data (Fig. 1). The concordant shift to greater GOA dependency by both species in 1995 implies system-wide bottom-up effects permeating the whole ecosystem due oceanographic processes.

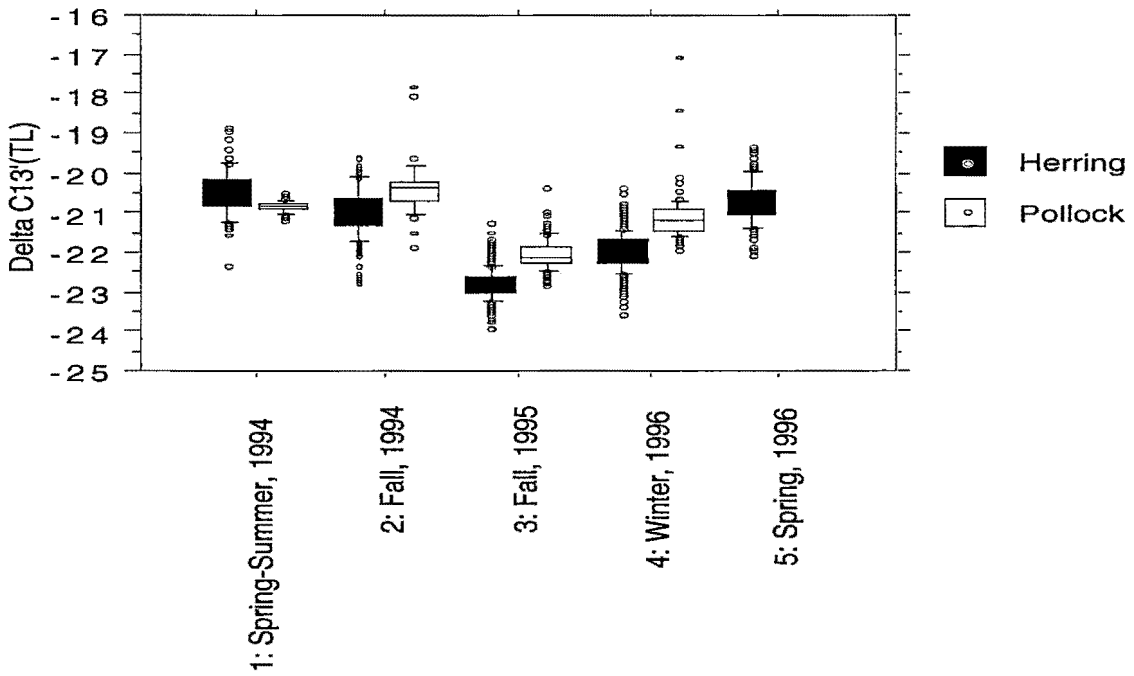

Figure 1. Shift in $\delta^{13}C$'TL and inferred change in Gulf of Alaska (GOA) vs. Prince William Sound (PWS) carbon dependency (see Kline 1998b, for explanation of delta notation and method of data interpretation) of juvenile herring (above) and pollock (below) in 1994 - 6 (from Kline 1998a). The distribution of values are shown as box and whisker plots that denote the 10th, 25th, 50th, 75th, and 90th percentiles; outliers are shown as symbols. There was a large shift to greater GOA carbon dependency in 1995 for both species as indicated by their very low $^{13}C/^{12}C$ values.

Project 311 is expanding the herring isotopic time series through to March 1998. Analysis is focused on four bays (Fig. 2) in order to provide greater temporal resolution than previously (Fig. 1). Samples that were archived at the PWSSC at the start of 311 were prepared for mass spectrometric analysis and sent to the University of Alaska Fairbanks Stable Isotope Facility (UAFSIF) in Jan 1998. These data correspond to the July to Dec 96 period. The results from these analyses are expected at about the start of FY99. A.J. Paul sent samples collected from Feb to Aug 97 to us in Jan 98. These samples are presently being sent to UAFSIF. Results from these are expected in early calendar year 1999 (Jan to Feb). A.J. Paul is presently completing analytical work on Fall 97 samples and will be sending those samples by FY99 as well as samples collected in March 98. We have also obtained extra samples from other projects from the Spring of 1995. This time corresponded to the period of biggest isotopic change observed thus far (Fig. 1). We will be analyzing ~ 150 of these fish to fill in the data gap presently existing between 1994 and 1995 (Fig. 1). From these data we will determine whether the shift occurred during the Summer of 1995, as conjectured by Kline (1998b), or earlier. Herring samples from two of the four bays were also provided to Jeff Short, Auke Bay Lab for pristane analysis.

Following our independent analyses we expect to integrate our findings into a collaborative paper.

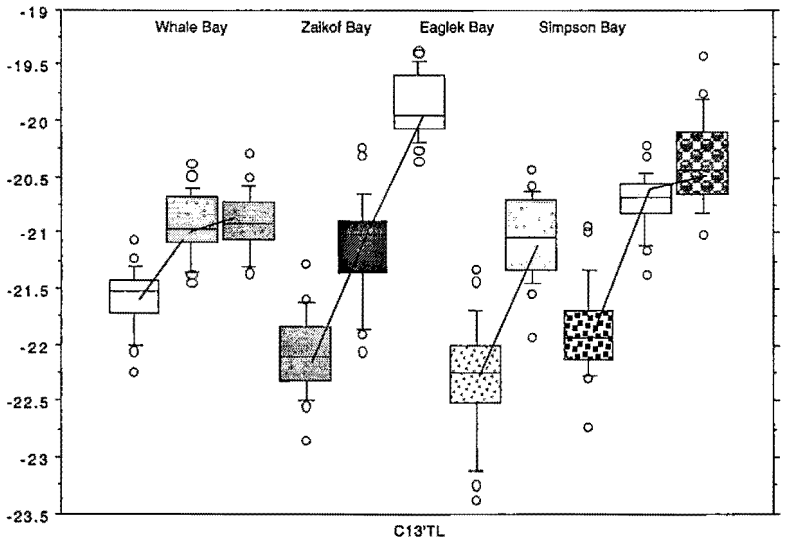

Figure 2. Preliminary results of four-bay time series showing box and whisker plots (as Fig. 1) of $^{13}C/^{12}C$ data of juvenile herring from March, May, and June 1996 (except Eaglek - May data not available). The greater shift in Zaikof probably reflects the proximity of this site to the GOA. The mean values for March (these bays plus others from the broad-scale survey) and for May-June are also shown in Fig. 1.

NEED FOR THE PROJECT

A. Statement of Problem

The Problem: Declining Production of Herring in PWS.

The availability of macrozooplankton forage for herring varies in space and time because of changes in physical processes in PWS. Results from the SEA project suggest that interannual differences can be quite large. These differences, in the SEA context, are due to postulated Lake/River processes. The data suggest that 1995 was more of a "river" year than 1994. In 1994, when Gulf of Alaska carbon was apparently not transported into PWS to the same extent, there was more spatial variability than 1995. Herring were energetically in better condition in 1994 (A.J. Paul, pers. comm.). The relative poor condition of herring when Gulf carbon dominates parallels the existing downturn in kittiwake productivity in the Gulf area (APEX project results) that may be related to a regime shift phenomenon. Accordingly, when production in the Gulf improves, herring production when principally dependent on Gulf carbon may also improve.

B. Rationale/Link to Restoration

This proposal was submitted under the New Projects: Distribution and Turnover in Juvenile Pacific Herring Populations initiative described on page ten of the Invitation to Submit Restoration Proposals for Federal Fiscal Year 1998 (*Exxon Valdez* Trustee Council 1997). A better understanding, particularly a quantitative understanding, is a prerequisite to determining protocols for restoration and recovery of these species. The shifts in carbon flow occurring as a result in variations in the physical environment represent fundamental changes in the way the PWS ecosystem supports commercially important species. Because a quantitative understanding of these phenomena is a prerequisite to determining protocols for restoration and recovery of these species, these results will have direct application to all future rehabilitation and restoration efforts. The stable isotope approach is unique in its ability to integrate time and spatial scales at mesoscale levels. No other technique currently available can generate such results. The natural tracer aspects of the approach emulates artificial tracer experiments without the burden of needing to generate signals or experimental artifacts. Tracking the effect of Gulf carbon inflow on herring production that appears to vary between years will be used to resolve the question of how oceanographic process affect herring recruitment. The results obtained thus far indicate important temporal shifts in carbon source dependency in herring and their probable principal competitor, juvenile pollock. The level of sampling will be improved to resolve finer temporal shifts than shown in Fig. 1. Fewer sites with more frequent sampling will resolve when shifts occur particularly in the late Summer to Fall period. Energetic data form A.J. Paul (pers. comm.) suggest the continuation of material uptake until at least December which may explain the large isotopic shift that occurred between November 1995 and March 1996 (Fig. 1).

C. Location

Prince William Sound

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Community involvement and traditional ecological knowledge was incorporated into the sampling regime developed by collaborator E. Brown used for acquisition of samples being analyzed in this work.

PROJECT DESIGN

Natural stable isotope abundances reflect (1) trophic level and (2) source of assimilated matter and are thus a proxy for the change in diet specified in the Lake/River and Predator/Prey Relationships hypotheses. Stable isotope ratios will thus be used as a biomonitor of herring production and shifts in predation as tests of the SEA hypotheses. Hypothesis tests using stable isotope data were presented in the SEA DPD and Kline (1998b). The proposed study will build upon our existing data base and add new data to construct and test conceptual food webs supporting herring (and other species dependent upon herring) in Prince William Sound. The goal is to determine the trophic positions and to define the natural history parameters accessible from isotope ratio data in light of the observed declines in their populations. These include changes in trophic level over the lives of herring, habitat dependencies, seasonal energetics and trophic dynamics relative to other community organisms. As part of this goal, we will integrate our analytical work with the field and laboratory studies of other investigators looking at food web structure, productivity of lower trophic levels, and provide validation data for assessment of conceptual and quantitative models.

A. Objectives

Original objectives from FY98 proposal:
1. Analysis of archived samples
2. Analysis of new as they become available following SEC determination by AJ Paul (nearly complete)
3. Data synthesis (also in FY99)
4. Disseminate results (also in FY99)

Additional objectives for this proposal:
1. Complete the analysis of herring sampled in four-bay time series (implied in original proposal).
2. Address "data gap" by analyzing samples collected in Spring 1995.

Objective details:
1. To determine the $^{15}N/^{14}N$ and $^{13}C/^{12}C$ of juvenile herring collected from the Prince William Sound, juvenile herring and pollock (when obtainable) will be matched with regional isotope abundances in zooplankton to allocate food sources and to assess trophic transfer efficiencies in specific areas of the sound.

A. Completion of analyses started in FY98: Those remaining consist of herring from the four-bay time series collected in Oct. 1997 and March 1998, for which energetic and AWL data are or will be available (AJ Paul, pers. comm.).

B. Analysis of herring from the Spring of 1995 to alleviate the large data gap described above.

Time series data obtained from these samples will be compared with our existing database which starts in 1994 and includes samples of opportunity collected in April, June, and October and as part of the Herring Group sampling in October-November 1995, March 1996 (shown in Fig. 1).

2. Synthesize the data obtained in context with conceptual food webs to validate feeding models and expand the natural history information.

3. Contribute stable isotope results to formal tests of the Lake/River-driven prey switching hypothesis developed by SEA to explain herring production trends, and the hypothesis given above through collaboration with A.J. Paul of the Herring Group.

B. Methods

Hypothesis:

Herring do better (i.e., have a higher somatic energy content and will more likely recruit to the fishery) when carbon source is ~50% from GOA and PWS (this is the case based upon data from 1994-5, discussed above).

New hypothesis regarding data gap:

A change occurred in 1994-1995 due to the influx of GOA zooplankton during the Summer of 1995, therefore the spring data will more closely resemble those from the Fall of 1994 (Fig. 1).

Isotopic methods and models are described in detail in Kline (1998b).

C. Cooperating Agencies, Contracts, and Other Agency Assistance

SCHEDULE

A. MEASURABLE PROJECT TASKS for FY 98 (October 1, 1997 - September 30, 1998)

Apr-Sept 1998:	Preparation of new samples for mass spectrometry as they become available following energetic determination by A.J. Paul
Oct-Dec 1998:	Data, receipt (from mass spect lab), integration and synthesis
Jan-Mar 1999:	Preparation for and dissemination of results at 10th Anniversary Symposium
Jan-Sept 1999:	Data synthesis and assessment, final report preparation

B. Project Milestones and Endpoints

April 1999:	Submit draft final report (in journal format)
April-Sept. 1999:	Revise final report, incorporate late data input
Sept. 1999	Final Report

C. Completion Date

September 1999

PUBLICATIONS AND REPORTS

The following manuscripts dealing with Pacific herring in Prince William Sound are planned in preparation:

Fall isotopic and somatic energy signatures of young of the year Pacific herring in Prince William Sound Alaska: Implications for trophic studies.
T. C. Kline and A. J. Paul
A revision of this MS is due in FY99

Interannual variability of the dependence of juvenile Pacific herring in Prince William Sound, Alaska on Gulf of Alaska shelf-derived secondary productivity
Kline, Planned publication in FY00 for International Herring Symposium

Relationship between feeding regime, inferred from natural stable isotope abundance, and whole body energetics of Pacific herring in PWS.
Kline & Paul
Outline conceptualized by authors FY00

PROFESSIONAL CONFERENCES

Travel is requested for the P.I. to present results at a national (or when appropriate, international) meeting such as AFS, ASLO or AGU and to attend workshops with collaborators. Travel to present project results at national meetings and to participate in collaborative workshops are essential to the project's success.

NORMAL AGENCY MANAGEMENT

N/A

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Herring Group workshops and meetings with other EVOS P.I.s will be conducted to facilitate collaboration and to direct analysis efforts. Results of analyses will be exchanged at workshops and by telecommunications. Preliminary analysis from the integrated effort will be used to direct retrospective analysis of archived samples.

Collaboration with A.J. Paul will continue and facilitate relating carbon-source dependency with somatic energy content. Herring samples consisting of a time-series from two of the four bays (same fish that were analyzed for stable isotopes) were also provided to Jeff Short, Auke Bay Lab for pristane analysis - we expect to eventually integrate our results.

PROPOSED PRINCIPAL INVESTIGATOR

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PRINCIPALINVESTIGATOR

T. Kline has been actively involved in stable isotope research since 1985. His use of stable isotopes has been in fish ecology with emphasis on salmonid fishes in northern, western, south central and southeast Alaska. His innovative use of the techniques has allowed him to quantify the effect of salmon carcass nutrient input to juvenile sockeye salmon production. This research has been the first to provide direct evidence for the importance of salmon carcasses for juvenile salmon production. He has generated stable isotope models that enable the quantification of different sources of production important in salmon ecosystems. Dr. Kline also led an investigation relating feeding strategies to growth forms in North Slope salmonids. His on-going efforts include collaborations with ADF&G, the North Slope Borough, and BPX. The results of these projects have been presented in numerous scientific papers as well as in public forums (speaking to local groups and classes). T. Kline initiated project 320I which has been the first comprehensive project using natural stable isotopes in Prince William Sound. Through this project he has developed new models and application of natural stable isotope abundance methods. He was the first to provide direct evidence of the importance of carbon from the Gulf of Alaska in Prince William Sound.

OTHER KEY PERSONNEL

Fish Biologist: J. Williams. PWSSC. J. Williams received his Masters degree in Fisheries from Texas A&M University in 1995. While earning his degree, he spent one year conducting field research in a remote are of Venezuela, successfully incorporating native fishermen in his survey of reservoir fish populations. His research has been presented in a variety of forums and is currently under review for journal publication. J. Williams is a certified Rescue Diver, Divemaster and has eleven years of diving experience. He is currently fulfilling a diver-in-training program for cold water research diving to expand his knowledge of diving further. J. Williams is tasked with sample and data processing and data management for this project and will actively contribute to data synthesis.

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Exxon Valdez Trustee Council 1997. Invitation to Submit Restoration Proposals for Federal Fiscal Year 1998. *Exxon Valdez* Trustee Council, Anchorage, AK.

Fry, B. 1988. Food web structure on Georges Bank from stable C, N, and S isotopic compositions. Limnol. Oceanogr. 33:1182-1190.

Kline, T. 1997a. Sound Ecosystem Assessment: Confirming food web dependencies in the Prince William Sound Ecosystem using stable isotope tracers, *Exxon Valdez* Oil Spill Restoration Project Annual Report (Restoration Project 96320I), Prince William Sound Science Center, Cordova, Alaska.

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Minagawa, M., and E. Wada. 1984. Stepwise enrichment of ^{15}N along food chains: Further evidence and the relation between $\delta^{15}N$ and animal age. Geochim. Cosmochim. Acta 48:1135-1140.

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		$0.0
Travel		$0.0
Contractual		$97.7
Commodities		$0.0
Equipment		$0.0
Subtotal	$0.0	$97.7
General Administration		$6.8
Project Total	$0.0	$104.5
Full-time Equivalents (FTE)		10.0

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 2000	Estimated FY 2001	Estimated FY 2002
$0.0	$0.0	

Dollar amounts are shown in thousands of dollars.

Other Resources

Comments:

FY 99

Prepared:

Project Number:99311
Project Title: Pacific Herring Productivity Dependencies in the Prince William Sound Ecosystem Determined With Natural Stable Isotope Tracers
Name: Prince William Sound Science Center
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999						
Personnel		$67.0						
Travel		$4.7						
Contractual		$8.1						
Commodities		$1.6						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$81.4		Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
Indirect		$16.3						
Project Total	$0.0	$97.7		$0.0	$0.0			
Full-time Equivalents (FTE)		10.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

FY 99

Prepared:

Project Number:99311
Project Title: Pacific Herring Productivity Dependencies in the Prince William Sound Ecosystem Determined With Natural Stable Isotope Tracers
Name: Prince William Sound Science Center
Agency: ADFG

FORM 4A
Non-Trustee
SUMMARY

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 1999
T. Kline	P.I.		6.0	7.9		47.4
J. Williams	Biologist		4.0	4.9		19.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		10.0	12.8	0.0	
					Personnel Total	$67.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 1999
1 national meeting		0.8	1	7	0.1	1.5
3 workshops		0.2	3	9	0.1	1.5
meeting registraion		0.3	1			0.3
car rentals (total all travel)		0.1	14			1.4
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$4.7

FY 99

Prepared:

Project Number:99311
Project Title: Pacific Herring Productivity Dependencies in the Prince William Sound Ecosystem Determined With Natural Stable Isotope Tracers
Name: Prince William Sound Science Center
Agency: ADFG

FORM 4B
Personnel
& Travel
DETAIL

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed
Description	FY 1999
Stable isotope analyses (200)	5.0
Laboratory equipment use fee (200)	0.6
Photocopying	0.2
Shipping	0.2
Communications	0.5
PWSSC network charge	1.0
Publications	0.4
Poster	0.2
Contractual Total	$8.1

Commodities Costs:	Proposed
Description	FY 1999
Lab supplies miscl	0.3
Vials, chemicals, grinder blades, scalpels	0.3
Office supplies miscl.	0.3
Computer supplies and upgrades	0.5
Dyesub material	0.2
Commodities Total	$1.6

FY 99

Prepared:

Project Number:99311
Project Title: Pacific Herring Productivity Dependencies in the Prince William Sound Ecosystem Determined With Natural Stable Isotope Tracers
Name: Prince William Sound Science Center
Agency: ADFG

FORM 4B
Contractual & Commodities DETAIL

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1999
			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

FY 99

Prepared:

Project Number:99311
Project Title: Pacific Herring Productivity Dependencies in the Prince William Sound Ecosystem Determined With Natural Stable Isotope Tracers
Name: Prince William Sound Science Center
Agency: ADFG

FORM 4B
Equipment
DETAIL

99314

HOMER MARINER PARK HABITAT ASSESSMENT & RESTORATION DESIGN PROJECT

RECEIVED
APR 07 1998
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

Project Number:	99314
Restoration-Category:	Intertidal Community, Recreation and Tourism
Proposer:	City of Homer
Lead Trustee Agency:	Alaska Department of Natural Resources
Cooperating Agencies:	Alaska Department of Fish and Game Department of Interior, Fish and Wildlife Service
Alaska SeaLife Center:	No
Duration:	1 year
Cost FY 99:	$95,350
Geographic Area:	Kenai Peninsula, Homer
Injured Resource/Service:	Intertidal Organisms, Recreation and Tourism

ABSTRACT

In its present state, Mariner Park is a highly stressed marine habitat in decline. The area is experiencing a dramatic reduction in marine biota and shorebird population while incompatible and environmentally destructive human uses flourish. From the results of a comprehensive feasibility study that includes botanical, biological, and hydrological field studies coupled to community information it is possible to develop a comprehensive habitat restoration and enhancement plan. This plan will establish the optimal hands-on restoration program to increase and diversify the intertidal fauna; which, in turn, will benefit migrating shorebirds and promote recreationally compatible use of the area by residents and tourists.

INTRODUCTION

Kachemak Bay is the premier marine ecosystem in Cook Inlet. It is important for its fertile intertidal, nearshore, and subtidal waters. These estuarine areas support a richly diverse biosystem. In particular, the Bay nurtures a thriving marine bird habitat by providing important feeding, nesting, rearing, and migratory staging throughout the year. Central to this critical habitat, as an ecosystem and a destination for resident and non-resident recreational visitors, is Homer Spit.

Located at the base of the Spit and east of the Sterling Highway (Spit Road), is Mud Bay. This bountiful habitat is one of the most biologically diverse and active areas in the spectrum of northeast Pacific shallow-water estuaries, [Shimek 1979]. From a biological perspective, Mud Bay is a classical thriving northern mud flat site. It is home to a collection of worms, bivalves, crustaceans, and other intertidal life. These organisms are food for birds, crabs, and fish. Once an integral part of Mud Bay with all of the important habitat characteristics of its host ecosystem, the area west of the road, referred to in this proposal as Mariner Park redefined itself.

Mariner Park a 109 acre parcel of which 71 acres are owned by the Alaska Department of Natural Resources, 32 acres by the City of Homer, and 6 acres in private hands, faces west toward Cook Inlet. Approximately fifty years ago, prior to the construction of the Homer Spit Road and Airport, Mariner Park was contiguous with the habitat rich, Mud Bay. Today, Mud Bay, (a.k.a. Coal Bay), continues as a productive estuary, a fate not shared by its estranged neighbor, Mariner Park.

Once a mudflat, Mariner Park emerged as a sand beach ecosystem with a complex intertidal habitat. It consists of a high tide line saltwater wetlands, inshore tidal lagoon, and protective sand berm. Outer Kachemak Bay water enters the lagoon through a breach in the protective sand berm via a tidal stream. Since most of the lagoon area is relatively high, actual flooding occurs for short periods only during high tides; consequently, water exchanges are infrequent and the area is submerged only briefly. As a consequence Mariner Park has lost most of its diversity and density of infaunal organisms. It has become far less attractive for migratory shorebirds and folks who frequent the Spit to enjoy recreational opportunities. This decline in the vitality of the habitat was exasperated by protective actions taken in response to the *Exxon Balder* Oil Spill *(EVOS)* incident.

During the *Exxon Valdez* incident the tidal stream inlet to Mariner Park was raised to lessen the potential for oil to enter the habitat. The tidal stream, which supplied critical nutrients to the intertidal lagoon and marsh was, per governmental directive, dammed to protect the intertidal wetlands from oil. During the closure the wetlands dried and biota rich portions of the habitat were greatly reduced. With the inability of the intertidal community to sustain itself the area was unable to effectively support migrating shorebirds. Correlationally, the dry area attracted inappropriate use by residents and visitors. This human disturbance, which included trampling of vegetation by off-road vehicles, removing drift wood from the storm berm, and deforming the protective sand barrier, translated into a loss of nesting area for Common Eiders, harassment of shorebirds during migration, disturbance to shorebirds and sparrows nesting in the dunes area,

and the over-all degradation of the habitat. The effort encumbered in this proposal is to perform a feasibility study for a project to restore the intertidal community injured by *EVOS.* The study, in the form of a National Environmental Policy Act (NEPA)-Environmental Assessment (EA), will delineate the feasibility of a follow-on construction project to restore and enhance the intertidal wetland community in Mariner Park. With botanical, biological, and hydrological studies, coupled to community and historical information, providing the foundation of the EA, predictions are that a comprehensive restoration construction program will return the area to the rich wetland status it once was. The eventual enhancement potential is to provide, preserve, and protect intertidal feeding habitat for migrating shorebirds, which in turn will help restore recreation and tourism services injured by *EVOS.*

NEED FOR TIIE PROJECT

A. Statement of Problem

Historically, as the head of Mud Bay, Mariner Park was a classical northern mud flat. The contiguous area supported a diverse biomass with dominant organisms to include polychaete worms and small bivalves. The small organisms were food for larger, transient organisms: shorebirds, crabs, and fish. The density of infaunal organisms at this site was high; consequently, even a small portion of habitat was a productive location supporting a relatively large number of important organisms.

While Mud Bay continues to prosper in intertidal and avian diversity, Mariner Park has not Paired as well. With excavation of the area for fill used to construct the airport and the road segregating the area from its naturally connected ecosystem, Mariner Park's habitat has morphased into an intertidal area with complex sedimentary and biological relationships.

Mariner Park's sedimentary characteristics now resemble a sand beach versus mud flat ecosystem. Sediment carried via long-shore transport was deposited in the intermittently flooded lagoon area. Generally, the soil profile is sand, to a depth as shallow as four feet, over silty clay. Higher elevations have coarser sediment than lower areas. The subtidal cobble area is partially covered by moving patches of sand. The tidal stream habitat is composed of sandy gravel with cobbles and the saltwater marsh area, being farthest from the current flow, contains finer sediments. [USF&W, 1991 and Land Design North, 1980]

The site consists of a high tide line saltwater wetlands and lower inshore area which behaves as a tidal lagoon. The lagoon is separated from the outer Kachemak Bay by a storm berm. Historically, a tidal stream breaches the storm berm. Since most of the lagoon area is relatively high, it fills only at high tides, during which actual flooding occurs for short periods. Frequently, water becomes trapped in the lagoon area for long periods because the tidal stream channel is not sufficiently deep and the inshore lagoon too high to permit frequent exchange of water. The only remaining vegetation is located at the base of the bluff, which is primarily private property.

The areas above mean high tide line on both sides of the Spit Road are covered with grasses. These areas are interlaced with tidal channels and occasional tidal basins which are classified as

saltwater wetlands, [Kenai Peninsula Borough Coastal Management Program, 1990]. Vegetation of the small saltwater marshes at the base of the Spit are mainly Lyngbye sedge and arrow grass, with alkali grass at the lower tidal levels. These marshes are prime feeding habitats for the less common shorebirds as well as secondary feeding and loafing areas for the principal shorebird migrants. [ADF&G, 1992 and West, 1990]

Not only has natural sediment transport processes affected Mariner Park but consequences due to human use have depleted the habitat. As Homer grew the Spit became a very desirable recreation and tourist area. To address the demands for Spit development, in the late 1970's through the early 1990's, various proposals to address the ever growing need for campground and recreational areas on the Spit were written. It was the belief of various proposers, as a consequence of their site investigations, that the area at the base of the Spit and west of the road be partially filled and made into a park. The proposals suggested allowances be made to protect the saltwater lagoon and tidal stream. [Land Design North 1980, Dames & Moore 1981, and City of Homer 1984, 1990] ~

Responding to various ideas expressed in the proposals, in 1985, a phased development of a portion of the site was begun. Specifically, to support open space/recreational use, approximately. 20,000 cubic yards of fill material was placed in a 2.6 acre area south of the tidal stream by 1989. The area, Phase I of a three phase park concept, was partially filled, graded, and safety/sanitation upgrades made. It was during this period that Mariner Park got its name.

Concurrent with the Park's development, a chorus of concerned Homer residents voiced their opposition while extolling the virtues of habitat protection. In 1985 a petition against filling the area gathered 400 signatures. After the *Exxon Valdez* incident which caused the closure of the tidal lagoon, in 1990 the residents of property adjoining Mariner Park signed a joint letter to the US Army Corps of Engineers (COE) expressing their continued opposition to the development of Mariner Park and encouraging its prompt return to a natural habitat.

In response to the degraded habitat in Mariner Park, the City of Homer's Spit Campground Task Force, in 1990, revised the partially implemented 1984 park development plan. The Task Force proposed a scaled-down development plan that incorporated a lagoon flushing and enhancement program for the area. Further development of the area, to include the filling of an additional 2.0 acres adjacent to Phase I was withdrawn by the City of Homer. Subsequently, as a consequence of the *EVOS* incident, community sentiment, and concerns voiced by recreational users of the area to preserve and enhance the habitat, the COE denied a permit application to continue development of Mariner Park.

With the partial reopening of the breach in 1992, the tidal stream resumed transport, at lower levels, of nutrients into the intertidal lagoon. The refreshed lagoon and raised gravel plain attracted a small number of waterfowl and cranes. The breach was again closed in 1994 during a severe storm and was partially re-opened in 1996. As a consequence of the tidal stream closures, Mariner Park has experienced a noticeable increase in the rate of habitat degradation.

B. Rationale/Link to Restoration

As a protective measure against oil entering Mariner Park's wetlands during the *Exxon Valdez* incident, the tidal stream inlet was closed. The result of the closure was that critical nutrients were prevented from entering the intertidal lagoon. By cutting-off the stream from the outer bay and tides, the saltwater lagoon and marshes dried, thus, biologically rich portions of Manner Park were not able to sustain themselves.

With the inability of Mariner Park to sustain a vibrant intertidal community, the feeding habitat for shorebirds was injured. This transformed a once thriving habitat viewing area into an unattractive and unavailable tourist and recreation destination.

In addition to directly restoring the injury caused by the response to *EVOS* (i.e., closing the tidal stream inlet), this proposal is also justified as replacement for, and enhancement of, injured intertidal resources. Intertidal wetlands on the Homer Spit must be protected, as much as reasonably possible, if we are to maintain a healthy and productive ecosystem for populations of shorebirds and provide residents and tourists unique wildlife experiences.

C. Location

The environmental assessment project will be undertaken in Homer, Alaska. The flora, fauna, and hydrological studies will be conducted at the base of Homer Spit to include both sides of the Spit Road, (Mariner Park and the nearshore portions of Mud Bay).

The project will directly benefit the Homer area. Additionally, given the international interest in the ecosystem of Kachemak Bay, the environmental assessment will provide invaluable information to the scientific community on the integration of wetland restoration in high use areas. An eventual product of a restoration project is increased tourism to observe the unique habitat and shorebird migration. This will benefit the Cook Inlet region, specifically, and the State, generally.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

This project is a collaborative venture. Its success is predicated on a collegial relation where the interests of individuals, community groups, and governmental bodies are woven with scientific findings and Trustee Council concerns into tapestry for an optimal restoration outcome which is in the best interest of Homer and the environment. Frequent, open, and candid dialogue is the effective mechanism to achieve this goal.

While scientific information will shape the technical elements of the habitat restoration design, the program will only be effective if placed in a community context. It is incumbent and expected that the project will solicit community involvement and draw upon local resources for input to the planning, scheduling, assessment, and design efforts. A major objective of the project coordinator's scope of work is to communicate with residents, in non-technical terms, on all aspects of the project. It is the project's responsibility to establish and implement procedures

for collecting technical, local, and traditional ecological knowledge as well as investigating the issues and concerns raised by the public.

Homer is a community blessed with residents who possess a broad spectrum of knowledge and represent a myriad of talents. It is assumed the project will call on this talent to provide project support. For example, Homer is home to renowned biologists who have studied the intricacies of the big-diverse Kachemak Bay and the effects of change on ecosystems and habitats. These respected "birders" have intimate knowledge of the area, which translates into project effectiveness and cost savings. They are expected to be an integral component of the planning, assessment, and design team. As to the nuts 'n bolts issues of the project, depending on availability, the assessment team will use local labor and resources, such as equipment and vessels, to assist in collecting data.

PROJECT DESIGN

A. Objectives

The eventual restoration goal, for which this proposal is a critical element, is to restore the intertidal community. The principal objective of this project proposal is to develop a National Environmental Policy Act - Environmental Assessment that will provide a feasible project to restore the intertidal community of Mariner Park. In turn, the restoration project is to restore and rehabilitate the area in such a way as to increase, preserve, and protect a diverse feeding habitat for migrating shorebirds. Correspondingly, due to the fact that Mariner Park is on the flight approach to the airport, the plan will address the issue of how to discourage geese and cranes from frequenting the area, (i.e. inhibit the growth of submergent and emergent vegetation). Additionally, the plan establishes mechanisms to enhance the recreational use of the area in an environmentally compatible manner.

The restoration construction project, the topic of a follow-on proposal to the Trustee Council, is meant to enhance the spectacle of the spring shorebird migration. This translates into increased resident and tourist interest in the area especially during the annual Kachemak Bay Shorebird Festival. With the implementation of an optimal restoration design, Mariner Park will be a showcase of wetland rehabilitation in a high use area.

Concurrently with thisproject the City is proceeding with improvements to Mariner Park, including a windbreak and interpretive signage describing the Critical Habitat Area and shorebirds that flock to the Homer Spit.

To meet the proposal objectives, scientific and testimonial information is gathered to develop comprehensive restoration alternatives. These alternatives are compared and a preferred restoration alternative is tendered.

The objectives of the project are addressed by, but are not limited to, the tasks listed below.

1. Conduct a review of past documentation to establish an historical perspective for the comparison of past to present community related information and technical data.

2. Collect traditional and local information on prior and expected use of the area in relation to economic, social, and environmental issues. Solicit comments on issues and concerns relative to the impact on resources and services from a restoration project.

3. Measure the diversity, frequency, and abundance of flora and fauna in Mariner Park.

4. Determine the geophysical characteristics of Mariner Park and the head of Mud Bay.

5. Develop restoration design alternatives and conduct a comparative study to identify the preferred restoration project design.

6. Write a National Environmental Policy Act - Environmental Assessment.

B. Methods

The feasibility project being proposed involves collecting biological, botanical, hydrological, and community data that is used to produce an EA. Coordination and management of the project are the responsibilities of a representative for the City of Homer. Field, analytical, and formal EA efforts are to be developed and performed by consultant(s) hired by the City. The consultant(s) will formulate the details and methods for field studies. Generally, the elements of the project are as follows:

1. Research past biological, botanical, and hydrological studies of the area in order to develop a catalogue of historical data and information. !

2. Conduct field studies to catalogue the flora and fauna presently in Mariner Park. The data will establish a baseline for comparing historical data in an effort to delineate changes in the project area.

3. Conduct a hydrological study of Mariner Park and Mud Bay. Perform hydraulic, soil classification (test hole), and sediment transport studies.

The information acquired from the technical and community studies will provide the basis for determining the optimal restoration program. Production of the EA will follow NEPA guidelines.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

The City of Homer is the sponsoring, coordinating, and responsible agency for this project. The lead Trustee agency is the Alaska Department of Natural Resources (ADNR). Aside from providing technical expertise on environmental restoration issues, as property owner of a significant portion of the project area, the ADNR has land use interests in the Mariner Park.

Additionally, during discussions with ADNR and ADF&G it was suggested that the project may best be served if the agencies act in the role of co-lead Trustees. This is a viable option that would facilitate the efficient prosecution of the project.

A restoration project in Mariner Park directly impacts and interfaces with several state and federal agencies. Of the many agencies touched by the project, the primary Trustee cooperating agencies are the Alaska Department of Fish and Game (ADF&G) and the US Department of Interior, Fish and Wildlife Service (USF&WS). Both agencies have technical knowledge and vested interest in projects that purport to restore and protect habitat. By providing key insight on biological relationships, the agencies can provide valuable support during the analysis of field data, the developing of restoration alternatives, and the selection of the preferred alternative.

With respect to the USF&WS role, it is expected they will provide expertise and review functions during the environmental assessment phase of the project. The EA is the primary planning and permitting document for the project. As such, it is a primary tool for communicating the merits and options for follow-on restoration activities at the site and its consequence on neighboring facilities and habitats.

The Alaska Department of Transportation and Public Facilities (ADOT&PF), US Army Corps of Engineers (COE), and Federal Aviation Administration (FAA) possess significant technical knowledge of the area. Additionally, these agencies have vested interest in a Mariner Park restoration construction project because the area is in proximity to their spheres of influence and responsibility: the Homer Spit Road is an ADOT&PF facility, the airport is the privy of FAA, and the COE is a permitting agency representing coastal water concerns. Other agencies with peripheral interest are the Alaska Department of Environmental Conservation (ADEC - State Water Quality Certification) and the Alaska Office of Management and Budget: Division of Governmental Coordination (Certification of Consistency with the Alaska Coastal Management Program). In all cases, the EA will provide a basis for understanding the relationship of the project to the environment and be a mechanism to critique the potential of the project in meeting the established restoration goals.

When appropriate, the project will attempt to contract with local talent and resources for specific project services. In some cases experts from outside the Homer area may best meet the objectives of the project. Expectations are to contract with private consultants for biological, botanical, and hydrological studies.

SCHEDULE

A. Measurable Project Tasks for FY 99

October 1 - November 15:	Collect and review historic information and data. Develop contract proposals for consultant(s) effort, advertise for cost proposals, and evaluate proposals. Conduct community involvement, (education and information gathering), component of project.

December 10:	Award contracts.
December 11 - January 1:	Assist contractors in logistics for field efforts.
January 1 - March 27:	Assist with winter field surveys. Analyze historic information and data. Prepare portions of EA.
January 15 - January 24:	Attend Annual Restoration Workshop, (3-day workshop).
February 1 - March 15:	Conduct community involvement component of project.
March 16 - April 14:	Prepare annual report of activities to date.
April 15:	Submit annual report.
April 15 - September 30:	Consultant(s) conduct spring, summer, and fall field efforts and analyze data. Conduct formal community involvement component of project. Produce EA.

B. **Project Milestones and Endpoints**

December 1: Collect and analyze historic data.
January 15: Initiate EA process.
September 1: Complete EA field studies and analysis of data..
September 30: Submit EA and Report of Project to Trustee Council.

C. Completion Date

Substantial completion of the project is September 30, 1999. The principal objective to be completed by this date is the production of a NEPA-EA. Elements encumbered by this objective are historic and community perspectives, field studies, restoration design alternatives, no action alternative, comparative study of alternatives, preferred alternative, and final draft of the environmental assessment document.

PUBLICATIONS AND REPORTS

The project does not, at this writing, plan to submit manuscript(s) for peer-reviewed publication(s) in FY 99.

The project will submit to the Council an annual progress report on April 15, 1999 and a final project report on September 30, 1999.

PROFESSIONAL CONFERENCES

The project does not plan to present at professional conferences in FY 98.

NORMAL AGENCY MANAGEMENT

N/A

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The location and nature of this project requires close local, state, and federal agency coordination. During the formulation of this proposal substantive discussions have taken place with community organizations, local authorities, and state/federal agencies: ADNR, ADF&G, ADOT&PF, COE, USF&W, and FAA. As the project unfolds it is expected that the coordination effort will expand.

Interested parties from the public, private, and government sectors are encouraged to engage the project during planning, design, implementation, and review processes. Similarly, the project will share data from the field efforts and welcomes feedback on its analyses, conclusions, and recommendations.

At present, the project addressed by this proposal has not solicited matching funding. This does not preclude such; rather, it is expected the project will take advantage of complimentary work undertaken by other entities, (i.e. shorebird counts and COE projects scheduled for the Spit).

It is planned that the follow-on restoration construction project will vigorously seek matching funding from non-Trustee Council sources. Potential sources for matching funds are the COE "Project Modifications for Environmental Improvement, Section 1135" and ADNR restoration grants.

EXPLANATION OF CHANGES IN CONTINUING PROJECT

N/A

PROPOSED PRINCIPAL INVESTIGATOR

The City of Homer plans to employ a Project Coordinator to manage the EA process. At present, the City does not know who will fill the Coordinator position.

PRINCIPAL INVESTIGATOR

Not Known

OTHER KEY PERSONNEL

Eileen R. Bechtol, Planning Director, City of Homer
Technical resource person and responsible party for City

Poppy Benson, U. S. Fish and Wildlife Service, Alaska Maritime National Wildlife Refuge
Technical resource person

Mike Bennet, Alaska Department of Natural Resources, Division of Lands
Technical resource person

Ruth Carter, Alaska Department of Transportation and Public Safety, Coastal and Harbor
Engineering Section, Hydrology and engineering resource person

Gino Del Frate, Alaska Department of Fish and Game, South-central District
Technical resource person

Larry Dugan, U.S. Fish and Wildlife Service, Ecological Services
Technical resource person

Ken Eises, U.S. Army Corps of Engineers, Coastal Engineering
Technical resource person on engineering design and hydrology issues

Dave Erikson
Biology resource person

William Hauser, Alaska Department of Fish and Game, Habitat Restoration Division
Representative of Cooperating Agency and technical resource person

Mac Humphrey, Federal Aviation Administration, Airports: Environmental Division
Technical resource person on FAA environmental concerns

Don McKay, Alaska Department of Fish and Game, Habitat Restoration Division
Representative of Lead Trustee Agency and technical resource

Mary Lynn Nation, U.S. Fish and Wildlife Service, Ecological Services
Representative of Cooperating Agency and technical support on NEPA-EA

Harvey Smith, Alaska Department of Transportation and Public Safety, Coastal and Harbor
Engineering Section, Hydrology and engineering resource person

Art Weiner, Alaska Department of Natural Resources, Wetlands Restoration
Representative of Lead Trustee Agency

George West, Birchside Studios
Biology resource person

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Shimek, R. L., 1979. Unpublished Report in the Addendum to Land Design North, 1980. The report is entitled Tidal Lagoon Feasibility: The Biological Perspective.

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West, G., 1990. Memorandum: Biological Impact of Filling in Existing Tidal Wetlands on the Homer Spit: Birds.

United States Department of Interior: Fish and Wildlife Service, M. R. North, 1991. Memorandum: Bird Use of Homer Spit and Beluga Slough, 30-April - 10 May, 1991.

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Spit Campground Task Force, 1990. Homer Spit Campgrounds Plan 1990.

Lentfer, J., Matthews, S., West, G., 1990. A Citizens' Alternative to the 1990 Homer Spit Campgrounds Plan.

FY 99 EXXON VALDEZ TRUS[illegible] COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		$14,400.0
Travel		$2,710.0
Contractual		$60,000.0
Commodities		$0.0
Equipment		$2,350.0
Subtotal	$0.0	$79,460.0
Indirect		$15,890.0
Project Total	$0.0	$95,350.0
Full-time Equivalents (FTE)		12.0

LONG RANGE FUNDING REQUIREMENTS					
	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		

Dollar amounts are shown in thousands of dollars.

Other Resources								

Comments:

The Indirect Cost multiplier for the project is 20%. The Indirects include, but are not limited to: utilitites, phones, copying, office supplies, administrative and finance functions, and mail service.

FY 99

Prepared:

Project Number: 99318
Project Title: Homer Mariner Park Habitat Assessment & Restoration Design Project
Name: City of Homer, Alaska

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 1999
Vacant	Project Coordinator		12.0	1200.0		14,400.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		12.0	1200.0	0.0	
					Personnel Total	$14,400.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 1999
Project Coordinator: meetings and research in Anchorage		130.0	3	8	100.0	1,190.0
Official(s) of the City of Homer: meetings in Anchorage		130.0	4	10	100.0	1,520.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$2,710.0

FY 99

Prepared:

Project Number: 99318
Project Name: Homer Mariner Park Habitat Assessment & Restoration Design Project
Name: City of Homer, Alaska

FORM 4B
Personnel & Travel DETAIL

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed
Description	FY 1999
Consultant(s) Firm to design and produce EA. Work includes biologic, botanical, and hydrologicl field studies	56,000.0
Survey	2,000.0
Printing and Photographs	2,000.0
Contractual Total	$60,000.0

Commodities Costs:	Proposed
Description	FY 1999
Cost associated with office materials, postage, utilties, etc. are addressed in the indirect rate.	
Commodities Total	$0.0

FY 99

Prepared:

Project Number: 99318
Project Title: Homer Mariner Park Habitat Assessment & Restoration Design Project
Name: City of Homer, Alaska

FORM 4B
Contractual & Commodities DETAIL

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 1999
Description			
Computer (IBM:price per COMP USA)			1,800.0
Fax/copier/printer (HP: price per COMP USA)			550.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$2,350.0

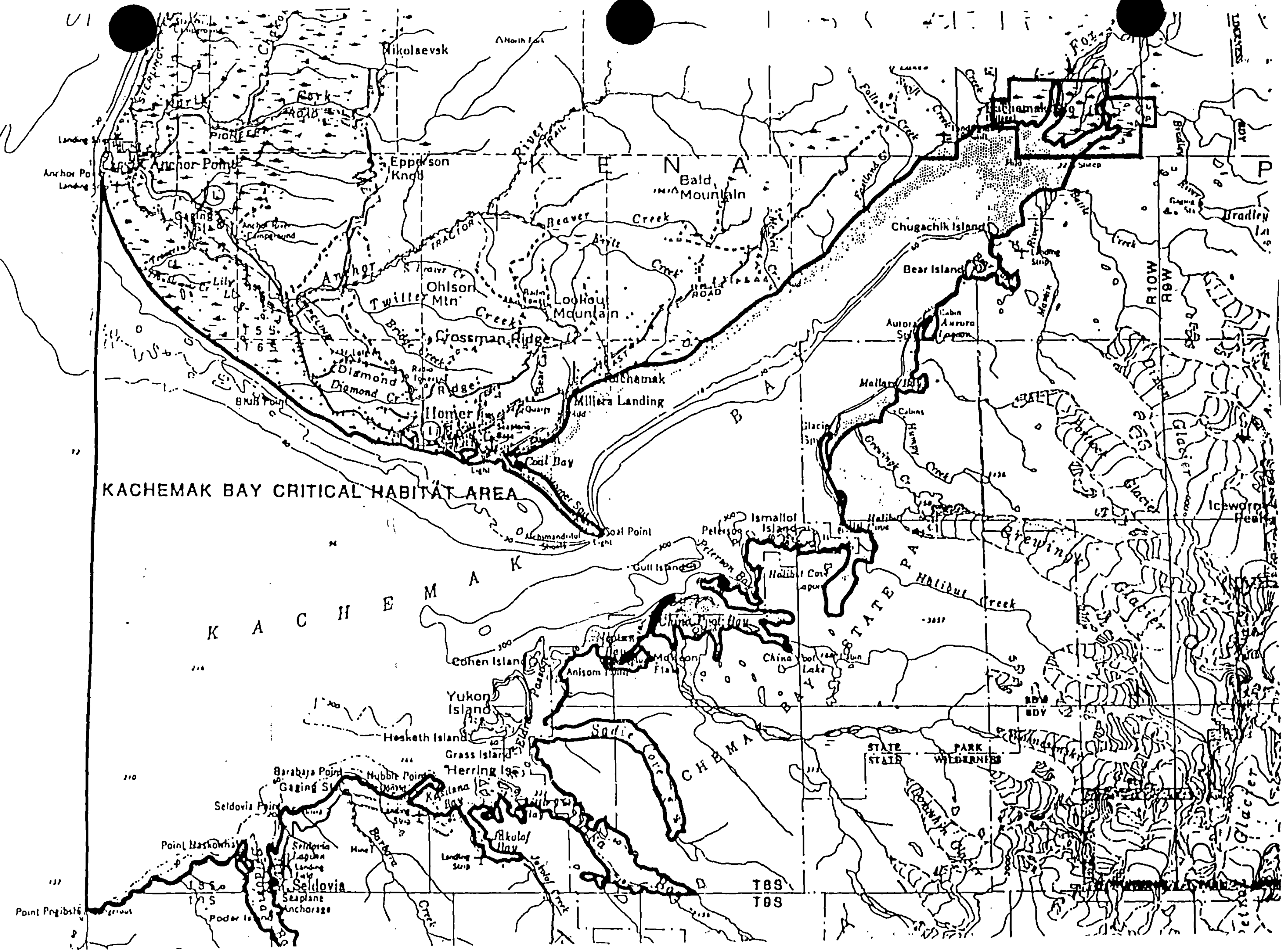
Existing Equipment Usage:	Number of Units
Description	

FY 99

Prepared:

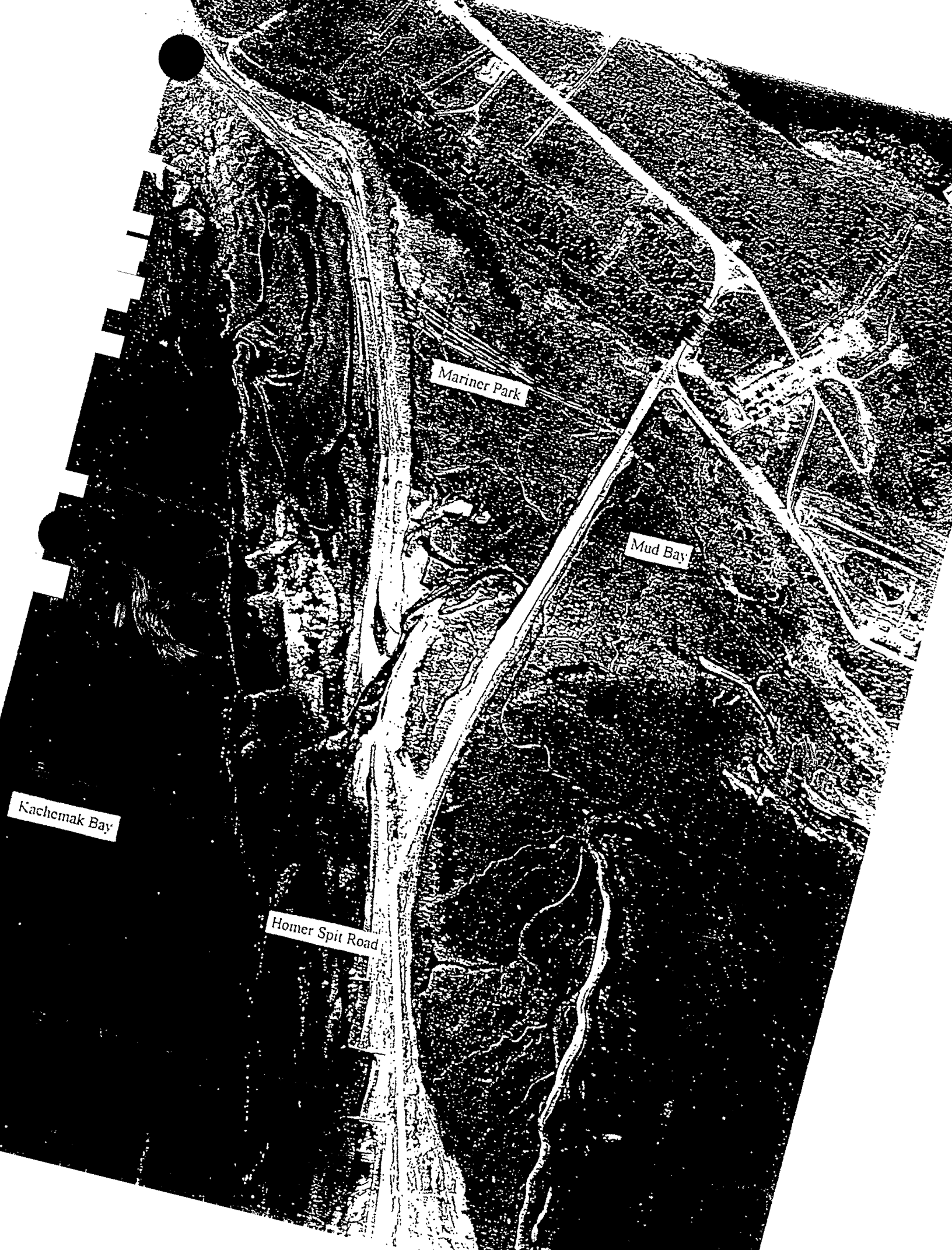
Project Number: 99318
Project Title: Homer Mariner Park Habitat Assessment & Restoration Design Project
Name: City of Homer, Alaska

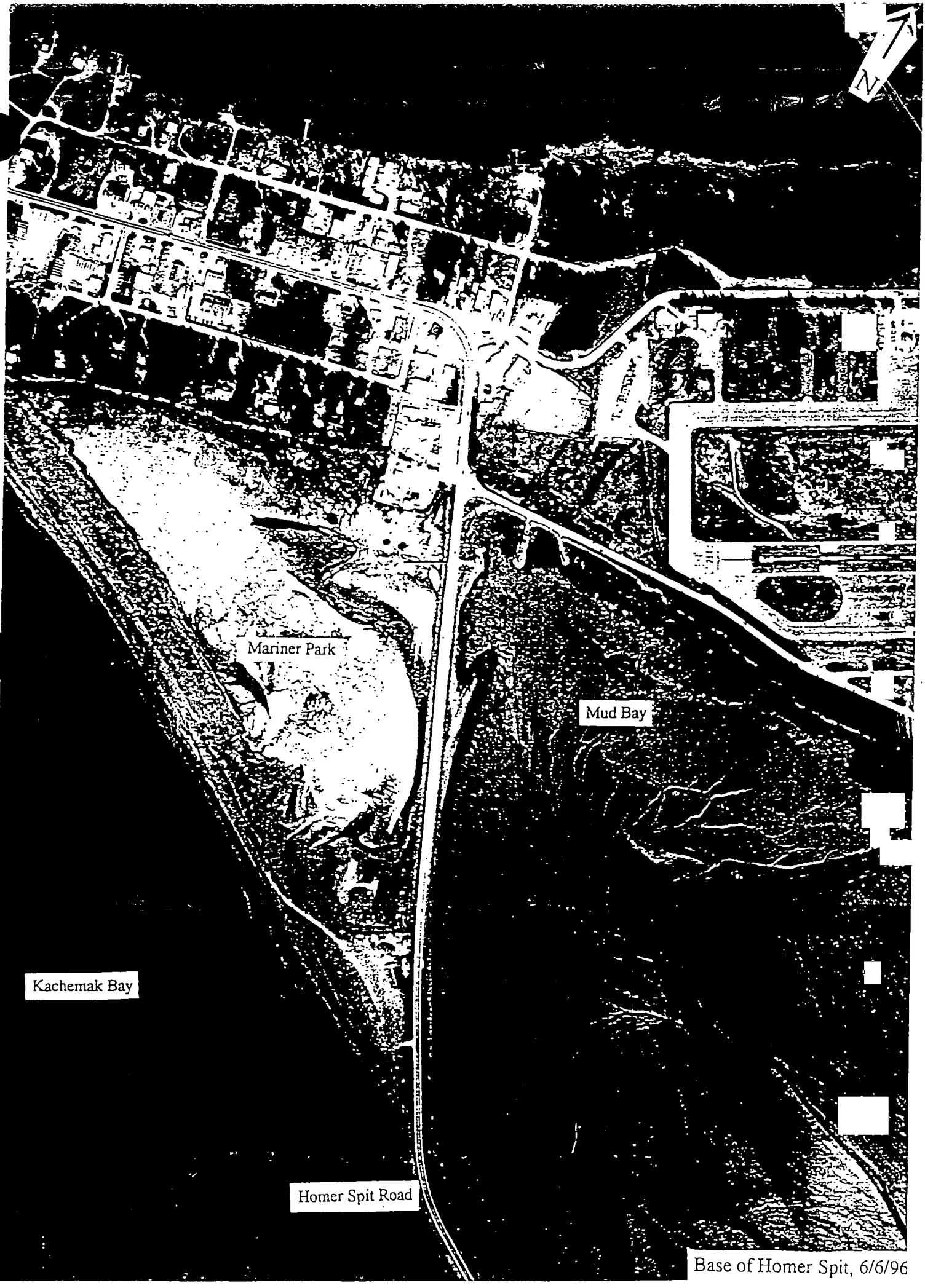
FORM 4B
Equipment
DETAIL



KACHEMAK BAY CRITICAL HABITAT AREA
K E N A I
K A C H E M A K
B A Y
KACHEMAK BAY STATE PARK
STATE PARK WILDERNESS
Nikolaevsk
Anchor Point
Eppcrson Knob
Bald Mountain
Chugachik Island
Bear Island
Ohlson Mtn
Lookout Mountain
Crossman Ridge
Diamond Ridge
Homer
Millers Landing
Coal Bay
Coal Point
Bluff Point
Ismailof Island
Gull Island
Halibut Cove
Halibut Creek
China Poot Bay
Cohen Island
Anisom Point
Yukon Island
Hesketh Island
Grass Island
Herring Isl
Barabara Point
Hubble Point
Seldovia Point
Point Naskowhak
Seldovia
Seaplane Anchorage
Point Pogibshi
Sadie Cove
Iceworm Peak
Beaver Creek
Fritz Creek
Twitter Creek
R10W
R9W
T8S
T9S

Base of the Homer Spit, 1944


Mariner Park
Mud Bay
Kachemak Bay
Homer Spit Road



Base of Homer Spit, 6/6/96

99320 (SEA)

Sound Ecosystem Assessment (SEA)

FY99 Proposal

Letters of Submittal

FY99 Single Integrated Detailed Project Description (DPD)

Appendix I. Sound Ecosystem Assessment (SEA) Individual Project Budgets

Submitted under the NOAA BAA

99320-Y	Bird Predation on Salmon Fry
99329-Z-2	Sea Synthesis and Integration

Submitted to Alaska Department of Fish and Game

99320-E	Salmon Predation
99320-G	Phytoplankton and Nutrients
99320-H	The Role of Zooplankton
99320-R	Biophysical Modeling
99320-T	Juvenile Herring Growth and Habitats
99320-T (supp)	Herring Traditional Ecological Knowledge
99320-U	Somatic Energetics
99320-Z-1	Sea Synthesis and Integration

Submitted to the U.S. Forest Service

99320-Q	Bird Predation on Herring Spawn

Sound Ecosystem Assessment (SEA): An Integrated Science Plan for the Restoration of Injured Species in Prince William Sound, Alaska "Submitted (in part) under the Broad Agency Announcement"

Project Number:	99320
Restoration Category:	Research
Proposer:	Alaska Department of Fish and Game University of Alaska Fairbanks Prince William Sound Science Center U.S. Forest Service
Lead Trustee Agency:	ADFG
Cooperating Agencies:	NOAA
Alaska SeaLife Center:	no
Duration:	6th year, 6-year project
Cost FY 99:	$689,000
Cost FY 00:	$15,000
Geographic Area:	Prince William Sound
Injured Resource/Service:	Pink Salmon and Pacific Herring

RECEIVED
APR 13 1998
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

ABSTRACT

Project 320 is an integrated, multi-component study of processes influencing the annual survival of juvenile pink salmon and herring rearing in Prince William Sound. Support in FY99 provides the means to close out the program. Program close-out includes the submission of a single, integrated Final Report, and a SEA synthesis volume written as a single journal volume for the journal, Fisheries Oceanography. Project support will also provide the means for individual Principal Investigators to address revisions to reports and manuscripts in FY99. A nominal amount is signaled to the Trustees for clean up of revisions, and page charges that hang over into FY00. These tasks will be supervised by an in-house SEA editor and the SEA Lead Scientist.

INTRODUCTION

The SEA program (320) was designed in 1993 and funded in April 1994, as a five-year, multi-project investigation of factors influencing the production of pink salmon and herring in Prince William Sound, Alaska. The herring and salmon literature suggested at the time that most of the mortality occurs in the earliest life stages of these species, the larval and juvenile forms. During this critical time, both species are resident in the region, are sustained primarily by energy arising from plankton populations, and are believed to undergo high rates of loss associated primarily with predation and starvation. SEA argued that any understanding of the dynamics of recovery for these important commercial and ecological components of the Prince William Sound ecosystem must account for the combined affects of oil-induced change and limits placed on production by oceanographic and other natural variability in the marine environment. In the absence of any substantial knowledge about how historical trends in pink salmon and herring production reflect environmental limitation, SEA developed a multi-year program of study to define the process of loss in juvenile populations of pink salmon and herring. The intent of the research has been to provide information about these processes so that Alaska Department of Fish and Game might better enhance, manage or otherwise restore pink salmon and herring production in the region.

After five years of intense field and modeling activity, the SEA program is being closed out in FY99. This primarily writing activity will produce a single, integrated Final Report of all results obtained by each individual project in the multi-year study. In addition to the Final Report, SEA investigators will also produce a bundle of professional manuscripts for a single volume of the prestigious journal, Fisheries Oceanography. The report and synthesis volume will document project results relative to the major hypotheses guiding the field and modeling studies, and will describe potential management applications for pink salmon and herring populations in Prince William Sound. The numerical products developed by SEA will also be documented in these reports and manuscripts.

NEED FOR THE PROJECT

A. Statement of Problem

Injured and non-recovering pink salmon and herring populations in 1993 suggested that something other than oil might be constraining their recovery. SEA proposed that some aspect of ocean climate, perhaps temperature and/or food for juveniles might be responsible for the perceived limitation, or that an oil-induced shift or other change in the composition of large fish predators was the cause for reduced production. These conditions can only be examined comprehensively within the framework of a multi-disciplinary program designed specifically to define the processes of loss to juvenile pink salmon and herring populations in relation to bottom-up (oceanographic) and top-down (predation) control each year.

A vast amount of information has been gathered by the SEA program since its initiation in the spring of 1994. This information has been reported in previous annual reports of the investigators (the SEA single, integrated annual report series), and is now entering the peer-reviewed literature. The information to date is primarily that arising from the individual projects. A SEA synthesis volume has been designed specifically as the appropriate vehicle to integrate selected

results across the boundaries of the individual projects, particularly where results have bearing on complex hypothesis testing and model development and validation. As such, preparation of the SEA synthesis volume is central to the orderly close-out of SEA and the products that it has been developing since 1994.

B. Rationale/Link to Restoration

The SEA approach to pink salmon and herring restoration is to formulate a series of interacting numerical models designed to simulate the dynamic processes influencing the survival of juvenile pink salmon and herring rearing in Prince William Sound each year. Because pink salmon and herring populations are managed for a commercial fishery, there is a mandated means for manipulating stock size each year in response to levels of production and the commercial, sport and subsistence needs of the region. SEA models will ultimately assist the managers of these important fisheries to understand how environmental factors affect production from year to year and possibly on longer decadal-level time scales. Because they encompass both food-web dynamics and atmospherically forced ocean physics, these simulations will also allow retrospective analyses of past stock performance, now-casting (current status of juveniles in the system), and improved forecasting. By more fully understanding the factors that regulate juvenile herring and pink salmon survival, appropriate levels of harvest can be applied to allow stock response in the face of continually changing natural conditions in the region—some minor, some major.

The final step in the maturation of the SEA program is the assembly of results in forms that can be accessible to the Trustees and their agencies, to the academic marine science community, and to the general public, particularly the users of pink salmon and herring resources. In this regard, the close-out activities planned by SEA will ensure documentation of the results in reports and scientific papers available to resource users and managers.

C. Location

The SEA program has been conducted in Prince William Sound and adjacent shelf and ocean waters.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Program 320 grew out of active regional community involvement which continues to the present time. Part of the study originates from the Prince William Sound Science Center, Cordova, Alaska and requires local services in that community. Prince William Sound vessels and aircraft have been routinely chartered for much of the SEA research. Each year SEA provides the citizens of the region with an update of research findings and current and planned studies. During the first two years of the program, SEA circulated a newsletter of accomplishments. Commercial fishermen in the region also learn about SEA results through a lecture series sponsored by the Prince William Sound Science Center. In FY97, SEA expanded the herring work to include incorporation of traditional ecological knowledge for this species (97320-T supplement). A most recent annual report of SEA progress was presented to the Prince William Sound Aquaculture Corporation and the public at the PWSAC spring meeting, March 1998, in Cordova.

PROJECT DESIGN

A. Objectives

1. Produce a single, integrated Final Report of SEA accomplishments following the format established for this purpose. This report will document all progress by individual projects in SEA toward goals established by the multi-disciplinary program. The single, integrated volume will be prepared by the Lead Scientist and will be submitted as the final volume of the report series from SEA (previous volumes include SEA94, SEA95, SEA96 and SEA97). All previous results, and results from FY98 will be included in this volume. However, unlike the previous series, there will be no extensive "synthesis chapter" in this document. That information is the subject of a second volume—a series of scientific manuscripts being submitted as a single journal volume to Fisheries Oceanography (see 2 below).

2. Produce an integrated series of synthesis papers for the journal, Fisheries Oceanography and the Trustee Council. These co-authored manuscripts will present multi-disciplinary assessments of factors influencing the survival of juvenile pink salmon and herring in Prince William Sound, will document tests of hypotheses that have guided SEA research, and will suggest ways in which the observed and modeled results can be used to manage these valuable resources in the region.

B. Methods

Report writing and synthesis activities leading to the preparation of close-out documentation of SEA results will proceed along several tracks. First, individual investigators are responsible for publishing results that apply to their projects alone. Priority is given to results that have bearing on the broader issues in SEA. These activities are presently underway. Secondly, small subgroups, focused by synthesis manuscript titles and authorship, will collaborate through data sharing and writing tasks to produce drafts of all papers destined for the journal volume. These papers will be distributed and read internally, then returned for revisions before becoming bundled in the submission package for Fisheries Oceanography and the Trustee Council in April 1999. The SEA Lead Scientist will be responsible for assuring that the SEA Final Report is prepared and submitted as a single, integrated document at that time as well. A SEA in-house editor will be responsible (in consultation with the Lead Scientist) for tracking, assembling, and submitting the synthesis bundle to Fisheries Oceanography. This individual will also be responsible for seeing that future revisions are addressed and that (possibly in FY00) page charges are cleared and the volume is published.

Close-out activities will be facilitated by small-group workshops, by meetings of all SEA investigators, by conference calls, by e-mail and by web tools designed for the purpose of sharing manuscripts and data. Project Z-1 will provide travel for investigators to most workshops/meetings. However, each project is also budgeting travel for one small-group workshop. These activities have been refined within the SEA workgroups and proven to work. Alaska Department of Fish and Game personnel outside of SEA have been invited to participate as co-authors on manuscripts in their areas of speciality. Two SEA investigators who concluded their work prior to FY98 are being invited to participate in the synthesis activities to strengthen the perspective of the overall team (M. A. Bishop and D. Scheel).

C. Cooperating Agencies, Contracts, and Other Agency Assistance

Program 98320 is one of three ecosystem approaches sponsored by the EVOS Trustee Council in Prince William Sound. The integrated SEA study is administered by two agencies - ADF&G for projects housed at the University of Alaska Fairbanks and within ADF&G, and NOAA for projects conducted from the Prince William Sound Science Center, Cordova, Alaska, and at the Copper River Delta Institute (U.S. Forest Service).

SCHEDULE

A. Measurable project tasks for FY 99 (October 1, 1999 – September 30, 1999)

October:	SEA synthesis workshop – rough drafts of all papers
January:	SEA synthesis workshop – second drafts of all papers
January–March 20:	Papers and Final Reports prepared in final form
March 24-27:	Synthesis presented at the EVOS public workshop (SEA technical session)
April 15:	Submit the SEA Final Report and SEA synthesis volume to the Trustees and Fisheries Oceanography
April 15–September 30:	Respond to revisions to the Final Report and SEA synthesis volume

B. Project Milestones and Endpoints

April 15:	Submit the SEA Final Report
April 15:	Submit the SEA synthesis volume

After the submission of these documents, SEA investigators will respond to revisions. It is intended that these revisions will be completed in FY99, but that cannot be guaranteed. Nominal funds are signaled for FY00 in budget 99320-Z-2 for publication tasks that extend into that year.

C. Completion Date

The SEA program will close out in FY99. To the extent possible, all revisions to reports and manuscripts will be addressed in FY99. However, it seems unlikely that all responses can be addressed by September 30. We are therefore proposing a small close-out fund for a designated in-house SEA editor (Project Z-2) to facilitate cleaning up any report and manuscript business hanging over into FY00. Editorial activity will include tracking the status of papers/reports, routing revisions and galleys, and paying page charges. Most individuals who have been associated with SEA will be available locally to interact with the in-house editor to expedite these tasks, but we feel it is necessary to have an identified person on site to guide this effort. The SEA Lead Scientist expects to retire from the University in the summer of 1999, and will reside outside Alaska after that. Dr. Cooney will remain associated with the project through the FY99 funding year, and will be available for assistance with the final close-out tasks as needed in FY00.

PUBLICATIONS AND REPORTS

As its close-out package, SEA will submit two (2) volumes: 1) the single, integrated Final Reports of all the projects assembled in the manner of previous SEA annual reports by the Lead Scientist; 2) a bundle of manuscripts prepared as a single journal volume for both the Trustees and Fisheries Oceanography (series of synthesis papers for the reviewed literature).

At present, the synthesis volume features the following manuscripts (exact titles and authorship subject to change). These manuscripts were agreed upon at a meeting of all project investigators in September 1997, in Valdez:

1. Introduction: What is SEA? (Cooney, et al.)

2. SEA Summary: What have we learned about the survival of pink salmon and herring? (SEA executive committee and others as invited)

3. The observed and modeled physical oceanography in Prince William Sound (Vaughan, et al.)

4. The response of plant and animal communities to physical conditions in Prince William Sound (Eslinger, et al.)

5. Physical and biological factors influencing juvenile pink salmon survival in Prince William Sound (Willette, et al.)

6. Physical and biological factors influencing the herring life cycle in Prince William Sound (Norcross, et al.)

7. The role of pollock in the Prince William Sound ecosystem (Stokesbury, et al.)

8. Linked physical–plankton–nekton models for Prince William Sound (Patrick, et al.)

9. Information services and numerical products supporting SEA research in Prince William Sound (Allen, et al.).

10. Management implications for SEA results in Prince William Sound (ADF&G designee, et al.)

This volume is intended to serve as the synthesis chapter to the SEA Final Report. It will be submitted to the Trustee Council at the same time it is also submitted for review to Fisheries Oceanography. Co-authors expect to respond to critical reviews from journal and EVOS peer reviewers.

PROFESSIONAL CONFERENCES

SEA will participate in the March 1999 EVOS public workshop. We expect to present the results of the SEA synthesis volume in a special technical session devoted to our ecosystem approach. Individual authors will also present the results of their projects at other national meetings in

FY99. In some cases, Principal Investigators have requested funds to allow additional participation at national meetings. Some are requesting that graduate students and research staff be permitted to present papers or posters at conferences, such as those for the American Fisheries Society, American Society of Limnology and Oceanography, and the American Geophysical Union. All requests for travel are for presenters of results. There are no requests to merely support observers at these meeting. Much of the work of SEA has been undertaken and completed by young professionals seeking careers in the marine and fisheries sciences. Their presentations at national meetings will provide additional exposure for SEA results.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

SEA program efforts are coordinated by a Lead Scientist (Ted Cooney) with assistance from an executive committee composed of David Eslinger, Vince Patrick, Mark Willette and Brenda Norcross (Kevin Stokesbury substituting for Norcross in 1997/98). Each of the SEA modeling subgroups is chaired by a Principal Investigator with responsibility for coordination and integration within and between subgroups. SEA interacts with other EVOS-sponsored studies through collaborative research and analysis of data arranged primarily at the investigator level. To assist with close-out activities, SEA is proposing to appoint a senior staff person to serve as an on-site editor to see that the synthesis volume is competed in a timely manner. Dr. Jennifer Allen at the Prince William Sound Science Center has agreed to serve in this capacity.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

The work proposed by SEA for FY99 is specifically for the purpose of bringing the SEA program to an orderly close. The level of this activity has been negotiated with the EVOS Science Coordinator and SEA program managers.

PROPOSED PRINCIPAL INVESTIGATOR

R. Ted Cooney
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School of Fisheries and Ocean Sciences
Fairbanks, AK 99775-7220
Phone: 907-474-7407
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PRINCIPAL INVESTIGATOR

Robert (Ted) Cooney serves as the Lead Scientist for SEA. Dr. Cooney has extensive experience with zooplankton in the Gulf of Alaska and Prince William Sound. His studies began in 1976 in response to questions from the local aquaculture corporation about the carrying capacity of the region to support enhanced populations of pink and other salmon species in the region. He initiated a program of Cooperative Fisheries and Oceanographic Studies (CFOS) prior to the *Exxon Valdez* oil spill that yielded important information to initiate SEA studies of juvenile pink salmon survival. Dr. Cooney is professor of marine science at the University of Alaska Fairbanks, and an affiliated scientist with the Prince William Sound Science Center, Cordova.

OTHER KEY PERSONNEL

The interdisciplinary aspects of the FY98 SEA program are led by the following Principal Investigators:

Mark Willette	Alaska Department of Fish and Game, Cordova
Peter McRoy	Institute of Marine Science, University of Alaska Fairbanks
Ted Cooney	Institute of Marine Science, University of Alaska Fairbanks
Brenda Norcross	Institute of Marine Science, University of Alaska Fairbanks
David Eslinger	Institute of Marine Science, University of Alaska Fairbanks
A. J. Paul	Institute of Marine Science, University of Alaska Fairbanks, Seward
Vince Patrick	Prince William Sound Science Center, Cordova
Gary Thomas	Prince William Sound Science Center, Cordova
Thomas Kline	Prince William Sound Science Center, Cordova
Shari Vaughan	Prince William Sound Science Center, Cordova
Jennifer Allen	Prince William Sound Science Center, Cordova

These investigators are assisted by staff and students in Fairbanks, Cordova, and Seward, and at several institutions outside Alaska. The investigators will be joined by Mary Anne Bishop and David Scheel (former SEA investigators) to assist with the SEA synthesis.

LITERATURE CITED

None

APPENDIX I

Sound Ecosystem Assessment (SEA): Individual Project Budgets

A. Individual project budgets being submitted under the NOAA Broad Agency Announcement

Prince William Sound Science Center

99320-Y	Bird Predation on Salmon Fry
99329-Z-2	Sea Synthesis and Integration

B. Individual project budgets being submitted to Alaska Department of Fish and Game

Alaska Department of Fish and Game

99320-E	Salmon Predation

University of Alaska Fairbanks

99320-E	Salmon Predation
99320-G	Phytoplankton and Nutrients
99320-H	The Role of Zooplankton
99320-R	Biophysical Modeling
99320-T	Juvenile Herring Growth and Habitats
99320-T (supp)	Herring Traditional Ecological Knowledge
99320-U	Somatic Energetics
99320-Z-1	Sea Synthesis and Integration

C. Individual projects being submitted to the U.S. Forest Service

Copper River Delta Institute

99320-Q	Bird Predation on Herring Spawn

APPENDIX I-A

Individual project budgets being submitted under the NOAA BAA

99320-Y

Bird Predation on Salmon Fry

Prince William Sound Science Center, Cordova, Alaska

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

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		
Travel		
Contractual	$0.0	$15.0
Commodities		
Equipment		
Subtotal	$0.0	$15.0
General Administration	$0.0	$1.1
Project Total	$0.0	$16.1
Full-time Equivalents (FTE)	0.0	0.2
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
	$0.0	$0.0	$0.0		

Dollar amounts are shown in thousands of dollars.

Comments:

FY 99

Project Number: 99320-Y
Project Title: Bird Predation on Salmon Fry
Agency: NOAA

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: 4/11/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		$11.3
Travel		$1.0
Contractual		$0.2
Commodities		
Equipment		
Subtotal	$0.0	$12.5
Indirect		$2.5
Project Total	$0.0	$15.0
Full-time Equivalents (FTE)		0.2
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		

Dollar amounts are shown in thousands of dollars.

Comments:

FY 99

Project Number: 99320-Y
Project Title: Bird Predation on Salmon Fry
Name: Prince William Sound Science Center
Agency: NOAA

FORM 4A
Non-Trustee
SUMMARY

Prepared: 4/11/98

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

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 1999
	Scheel, D.	Co-author	1.75	6.44		11.3
		Subtotal	1.8	6.4	0.0	
					Personnel Total	$11.3

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 1999
	Ogdensburg, NY to Anchorage, AK – EVOS meeting/SEA synthesis	1.0	1	3		1.0
					Travel Total	$1.0

FY 99

Project Number: 99320-Y
Project Title: Bird Predation on Salmon Fry
Name: Prince William Sound Science Center
Agency: NOAA

FORM 4B
Personnel
& Travel
DETAIL

Prepared: 4/11/98

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

Contractual Costs:	Proposed
Description	FY 1999
Services (photocopies, phone, mail, etc).	0.2
Contractual Total	$0.2

Commodities Costs:	Proposed
Description	FY 1999
Commodities Total	$0.0

FY 99

Project Number: 99320-Y
Project Title: Bird Predation on Salmon Fry
Name: Prince William Sound Science Center
Agency: NOAA

FORM 4B
Contractual & Commodities DETAIL

Prepared: 4/11/98

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

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 1999
Those purchases associated with replacement equipment should be indicated by placement with an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number	
Description	of Units	

FY 99

Project Number: 99320-Y
Project Title: Bird Predation on Salmon Fry
Name: Prince William Sound Science Center
Agency: NOAA

FORM 4B
Equipment
DETAIL

Prepared: 4/11/98

99320-Z-2

SEA Synthesis and Integration

Prince William Sound Science Center, Cordova, Alaska

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		
Travel		
Contractual	$0.0	$35.0
Commodities		
Equipment		
Subtotal	$0.0	$35.0
General Administration	$0.0	$2.5
Project Total	$0.0	$37.5
Full-time Equivalents (FTE)	0.0	0.5
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
	$15.0	$0.0	$0.0		

Dollar amounts are shown in thousands of dollars.

Comments:

FY 99

Project Number: 99320-Z-2
Project Title: SEA Synthesis and Integration (Editor)
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: 4/11/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		$25.8
Travel		$1.7
Contractual		$1.6
Commodities		$0.1
Equipment		
Subtotal	$0.0	$29.2
Indirect		$5.8
Project Total	$0.0	$35.0
Full-time Equivalents (FTE)		0.5
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
	$15.0				

Dollar amounts are shown in thousands of dollars.

Comments:

FY 99

Project Number: 99320-Z-2
Project Title: SEA Synthesis and Integration (Editor)
Name: Prince William Sound Science Center
Agency: ADFG

FORM 4A
Non-Trustee
SUMMARY

Prepared: 4/11/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Personnel Costs: Name	Position Description		Months Budgeted	Monthly Costs	Overtime	Proposed FY 1999
Allen, J.	Synthesis Editor		3.0	6.0		18.0
TBN	Clerical Assistant		2.8	2.8		7.8
	Subtotal		5.8	8.8	0.0	
					Personnel Total	$25.8

Travel Costs: Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 1999
Cordova to Fairbanks – meet with SEA Lead Scientist	0.35	2	10	0.1	1.7
				Travel Total	$1.7

FY 99

Project Number: 99320-Z-2
Project Title: SEA Synthesis and Integration (Editor)
Name: Prince William Sound Science Center
Agency: ADFG

FORM 4B
Personnel
& Travel
DETAIL

Prepared: 4/11/98

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

Contractual Costs:	Proposed FY 1999
Description	
Postage	0.4
Telephone	1.0
Photocopying	0.2
Contractual Total	$1.6

Commodities Costs:	Proposed FY 1999
Description	
Office supplies	0.1
Commodities Total	$0.1

FY 99

Project Number: 99320-Z-2
Project Title: SEA Synthesis and Integration (Editor)
Name: Prince William Sound Science Center
Agency: ADFG

FORM 4B
Contractual & Commodities DETAIL

Prepared: 4/11/98

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1999
None			
Those purchases associated with replacement equipment should be indicated by placement with an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units
Prince William Sound Science Center network, workstation, personal computer and associated hardware	1

FY 99

Project Number: 99320-Z-2
Project Title: SEA Synthesis and Integration (Editor)
Name: Prince William Sound Science Center
Agency: ADFG

FORM 4B
Equipment
DETAIL

Prepared: 4/11/98

APPENDIX I-B

Individual projects being submitted to Alaska Department of Fish and Game

98230-E

Salmon Predation

Alaska Department of Fish and Game

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel	$244.1	$77.8
Travel	$3.1	$1.0
Contractual	$20.0	$1.0
Commodities	$14.9	$0.2
Equipment		
Subtotal	$282.1	$80.0
General Administration		$11.7
Project Total	$282.1	$91.7
Full-time Equivalents (FTE)	4.0	1.1

LONG RANGE FUNDING REQUIREMENTS					
	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
	$0.0	$0.0	$0.0		

Dollar amounts are shown in thousands of dollars.

Other Resources

Comments:

At a Sea Grant workshop on Ecosystems Considerations in Fisheries Management a paper entitled, "An Evaluation of Some Factors Affecting Mortality of Juvenile Fish During the Spring Bloom in Prince William Sound, Alaska" will be presented.

FY 99

Project Number: 99320-E
Project Title: SEA: Salmon Predation
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: 4/11/98

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

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 1999
	Name	Position Description					
	Willette, M.	Fishery Biologist III	18F	5.0	6.6		33.0
	Clapsadl, M.	Fishery Biologist II	16E	4.0	5.6		22.4
	Hyer, K.	Biometrician I	17C	4.0	5.6		22.4
		Subtotal		13.0	17.8	0.0	
						Personnel Total	$77.8

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 1999
	Description					
	Cordova to Anchorage – Attend annual EVOS workshop	0.2	1	3	0.1	0.5
	Cordova to Anchorage – Attend Sea Grant workshop on Ecosystem Considerations in Fisheries Management	0.2	1	3	0.1	0.5
					Travel Total	$1.0

FY 99

Project Number: 99320-E
Project Title: SEA: Salmon Predation
Agency: ADFG

FORM 3B
Personnel
& Travel
DETAIL

Prepared: 4/11/98

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

Contractual Costs:	Proposed FY 1999
Description	
Publication costs	1.0
Contractual Total	$1.0

Commodities Costs:	Proposed FY 1999
Description	
Office and computer supplies	0.2
Commodities Total	$0.2

FY 99

Project Number: 99320-E
Project Title: SEA: Salmon Predation
Agency: ADFG

FORM 3B
Contractual & Commodities DETAIL

Prepared: 4/11/98

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

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 1999
Indicate replacement equipment purchases with an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number
Description	of Units

FY 99

Project Number: 99320-E
Project Title: SEA: Salmon Predation
Agency: ADFG

FORM 3B
Equipment
DETAIL

Prepared: 4/11/98

99320-G

Phytoplankton and Nutrients

University of Alaska Fairbanks

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		
Travel		
Contractual	$99.7	$70.0
Commodities		
Equipment		
Subtotal	$99.7	$70.0
General Administration	$7.0	$4.9
Project Total	$106.7	$74.9
Full-time Equivalents (FTE)	2.6	2.1

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 2000	Estimated FY 2001	Estimated FY 2002
$0.0	$0.0	$0.0

Dollar amounts are shown in thousands of dollars.

Other Resources

Comments:

FY 99

Project Number: 99320-G
Project Title: SEA Plankton Dynamics: Phytoplankton and Nutrients
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: 4/11/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel	$67.5	$47.3
Travel	$5.1	$6.7
Contractual	$0.9	$1.2
Commodities	$2.1	$0.8
Equipment	$4.2	
Subtotal	$79.8	$56.0
Indirect	$19.9	$14.0
Project Total	$99.7	$70.0
Full-time Equivalents (FTE)	2.6	2.1
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		

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.

Personnel costs for P. Simpson include two semesters of resident tuition ($2,916).
Personnel costs for K. Tamburello include two semesters of non-resident tuition ($5,616).

FY 99

Project Number: 99320-G
Project Title: SEA Plankton Dynamics: Phytoplankton and Nutrients
Name: University of Alaska Fairbanks

FORM 4A
Non-Trustee
SUMMARY

Prepared: 4/11/98

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

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 1999
	McRoy, C. P.	Principal Investigator/Professor	1.0	12.3		12.3
	Simpson, P.	Ph.D. Student	12.0	1.4		16.8
	Tamburello, K.	M.S. Student	12.0	1.5		18.0
		Adjustment to recognize rounding				0.2
		Subtotal	25.0	15.2	0.0	
					Personnel Total	$47.3

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 1999
	Fairbanks to Anchorage – EVOS annual meeting	0.2	3	15	0.1	2.1
	Fairbanks to Cordova – SEA synthesis	0.3	3	15	0.1	2.4
	Fairbanks to Santa Fe – presenters at ASLO meeting in February	0.7	2	6	0.1	2.0
	Adjustment to recognize rounding					0.2
					Travel Total	$6.7

FY 99

Project Number: 99320-G
Project Title: SEA Plankton Dynamics: Phytoplankton and Nutrients
Name: University of Alaska Fairbanks

FORM 4B
Personnel
& Travel
DETAIL

Prepared: 4/11/98

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

Contractual Costs:	Proposed FY 1999
Description	
Publication costs	1.0
Communications	0.2
Contractual Total	$1.2

Commodities Costs:	Proposed FY 1999
Description	
Project supplies (computer disks, laboratory supplies and chemicals)	0.8
Commodities Total	$0.8

FY 99

Project Number: 99320-G
Project Title: SEA Plankton Dynamics: Phytoplankton and Nutrients
Name: University of Alaska Fairbanks

FORM 4B
Contractual & Commodities DETAIL

Prepared: 4/11/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 1999
Those purchases associated with replacement equipment should be indicated by placement with an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number	
Description	of Units	

FY 99

Project Number: 99320-G
Project Title: SEA Plankton Dynamics: Phytoplankton and Nutrients
Name: University of Alaska Fairbanks

FORM 4B
Equipment
DETAIL

Prepared: 4/11/98

99320-H

The Role of Zooplankton

University of Alaska Fairbanks

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		
Travel		
Contractual	$99.2	$70.0
Commodities		
Equipment		
Subtotal	$99.2	$70.0
General Administration	$6.9	$4.9
Project Total	$106.1	$74.9
Full-time Equivalents (FTE)	1.0	0.5
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Dollar amounts are shown in thousands of dollars.

Estimated FY 2000	Estimated FY 2001	Estimated FY 2002
$0.0	$0.0	$0.0

Comments:

FY 99

Project Number: 99320-H
Project Title: The Role of Zooplankton in the Prince William Sound Ecosystem
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: 4/11/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel	$69.6	$50.1
Travel	$5.4	$3.3
Contractual	$2.9	$2.6
Commodities	$1.5	
Equipment		
Subtotal	$79.4	$56.0
Indirect	$19.8	$14.0
Project Total	$99.2	$70.0
Full-time Equivalents (FTE)	1.0	0.5
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Dollar amounts are shown in thousands of dollars.

	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		

Comments:

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

FY 99

Project Number: 99320-H
Project Title: The Role of Zooplankton in the Prince William Sound Ecosystem
Name: University of Alaska Fairbanks

FORM 4A
Non-Trustee
SUMMARY

Prepared: 4/11/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Personnel Costs: Name	Position Description		Months Budgeted	Monthly Costs	Overtime	Proposed FY 1999
Cooney, R. T.	Principal Investigator/Professor		3.1	11.7		36.3
Coyle, K.	Research Associate		2.5	5.5		13.8
	Subtotal		5.6	17.2	0.0	
					Personnel Total	$50.1

Travel Costs: Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 1999
Fairbanks to Anchorage – SEA workshop	0.3	1	5	0.1	0.8
Fairbanks to Anchorage – EVOS annual meeting	0.3	1	5	0.1	0.8
Fairbanks to Cordova – synthesis organization	0.4	2	10	0.1	1.8
Adjustment to recognize rounding					-0.1
				Travel Total	$3.3

FY 99

Project Number: 99320-H
Project Title: The Role of Zooplankton in the Prince William Sound Ecosystem
Name: University of Alaska Fairbanks

FORM 4B
Personnel
& Travel
DETAIL

Prepared: 4/11/98

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

Contractual Costs:	Proposed FY 1999
Description	
Publication page charges	1.0
Academic Services – manuscript preparation (30 hr @ $40/hr)	1.2
Communications – phone, mail	0.4
Contractual Total	$2.6

Commodities Costs:	Proposed FY 1999
Description	
Commodities Total	$0.0

FY 99

Project Number: 99320-H
Project Title: The Role of Zooplankton in the Prince William Sound Ecosystem
Name: University of Alaska Fairbanks

FORM 4B
Contractual & Commodities DETAIL

Prepared: 4/11/98

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

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 1999
Description			
Those purchases associated with replacement equipment should be indicated by placement with an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number of Units	
Description		

FY 99

Project Number: 99320-H
Project Title: The Role of Zooplankton in the Prince William Sound Ecosystem
Name: University of Alaska Fairbanks

FORM 4B
Equipment
DETAIL

Prepared: 4/11/98

99320-R

Biophysical Modeling and Remote Sensing

University of Alaska Fairbanks

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		
Travel		
Contractual	$150.0	$70.0
Commodities		
Equipment		
Subtotal	$150.0	$70.0
General Administration	$10.5	$4.9
Project Total	$160.5	$74.9
Full-time Equivalents (FTE)	2.6	0.4
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
	$0.0	$0.0	$0.0		

Dollar amounts are shown in thousands of dollars.

Comments:

FY 99

Project Number: 99320-R
Project Title: SEA Trophodynamic Modeling and Remote Sensing
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: 4/11/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel	$81.5	$33.7
Travel	$12.2	$9.9
Contractual	$24.0	$10.9
Commodities	$2.3	$1.5
Equipment		
Subtotal	$120.0	$56.0
Indirect	$30.0	$14.0
Project Total	$150.0	$70.0
Full-time Equivalents (FTE)	2.6	0.4
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		

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.

The purpose of the second trip to Cordova is to recover the C-LAB mooring and includes truck rental ($1,000).
Per diem for Anchorage includes car rental ($261).
Per diem for national meetings includes car rental ($261) and registration for two meetings ($600).

FY 99

Project Number: 99320-R
Project Title: SEA Trophodynamic Modeling and Remote Sensing
Name: University of Alaska Fairbanks

FORM 4A
Non-Trustee
SUMMARY

Prepared: 4/11/98

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

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 1999
Eslinger, D.	Principal Investigator/Assist. Professor		3.5	7.4		25.9
Allen, D.	Marine Technician		1.0	4.6		4.6
Chu, C.	Programmer		0.6	5.4		3.2
	Adjustment to recognize rounding					
	Subtotal		5.1	17.4	0.0	
					Personnel Total	$33.7

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 1999
Fairbanks to Cordova – SEA synthesis meeting		0.4	1	7	0.1	1.1
Fairbanks to Cordova – recover C-LAB mooring		0.4	1	7	0.2	1.8
Fairbanks to Anchorage – EVOS meeting		0.3	3	15	0.1	2.4
Fairbanks to Lower 48 – presenter at national meetings (ERIM Coastal Remote Sensing and AGU)		0.9	2	10	0.2	3.8
	Adjustment to recognize rounding					0.8
					Travel Total	$9.9

FY 99

Project Number: 99320-R
Project Title: SEA Trophodynamic Modeling and Remote Sensing
Name: University of Alaska Fairbanks

FORM 4B
Personnel
& Travel
DETAIL

Prepared: 4/11/98

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

Contractual Costs:	Proposed
Description	FY 1999
Communications	0.5
Publishing/page charges for two papers	1.0
ARGOS servicing	3.5
Ship time	2.5
Shipping	3.4
Contractual Total	$10.9

Commodities Costs:	Proposed
Description	FY 1999
Project supplies – diskettes, DAT tapes, software upgrades	0.5
Color printing supplies	1.0
Commodities Total	$1.5

FY 99

Project Number: 99320-R
Project Title: SEA Trophodynamic Modeling and Remote Sensing
Name: University of Alaska Fairbanks

FORM 4B
Contractual &
Commodities
DETAIL

Prepared: 4/11/98

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

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 1999
Description			
Those purchases associated with replacement equipment should be indicated by placement with an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number of Units	
Description		

FY 99

Project Number: 99320-R
Project Title: SEA Trophodynamic Modeling and Remote Sensing
Name: University of Alaska Fairbanks

FORM 4B
Equipment
DETAIL

Prepared: 4/11/98

99320-T

Juvenile Herring Growth and Habitats

University of Alaska Fairbanks

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		
Travel		
Contractual	$523.7	$150.0
Commodities		
Equipment		
Subtotal	$523.7	$150.0
General Administration	$23.0	$10.5
Project Total	$546.7	$160.5
Full-time Equivalents (FTE)	9.6	2.2
Other Resources		

LONG RANGE FUNDING REQUIREMENTS			
	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002
	$0.0	$0.0	$0.0

Dollar amounts are shown in thousands of dollars.

Comments:

FY 99

Project Number: 99320-T
Project Title: Juvenile Herring Distribution and Habitats
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: 4/11/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel	$354.4	$101.1
Travel	$19.0	$10.6
Contractual	$35.0	$5.4
Commodities	$10.5	$2.9
Equipment		
Subtotal	$418.9	$120.0
Indirect	$104.8	$30.0
Project Total	$523.7	$150.0
Full-time Equivalents (FTE)	9.6	2.2
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		

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.

Personnel costs for R. Foy include two semesters of resident tuition ($2,916).

FY 99

Project Number: 99320-T
Project Title: Juvenile Herring Distribution and Habitats
Name: University of Alaska Fairbanks

FORM 4A
Non-Trustee
SUMMARY

Prepared: 4/11/98

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

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 1999
	Norcross, B.	Principal Investigator/Assoc. Professor	3.0	8.5		25.5
	Stokesbury, K.	Co-Principal Investigator/Res. Assoc.	3.5	5.2		18.2
	Brown, E.	Program Manager	0.5	6.1		3.1
	Frandsen, M.	Laboratory Technician	3.5	5.1		17.9
	Vallarino, M.	Programmer	3.5	5.1		17.9
	Foy, R.	Ph.D. Student	12.0	1.6		19.2
		Adjustment to recognize rounding				-0.7
		Subtotal	26.0	31.6	0.0	
					Personnel Total	$101.1

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 1999
	Fairbanks to Anchorage – EVOS meeting	0.3	4	20	0.1	3.2
	Fairbanks to Anchorage – technical review session	0.3	4	8	0.1	2.0
	Fairbanks to Lower 48 – presenters at AFS meeting (location TBN)	0.7	4	16	0.1	4.4
	Adjustment to recognize rounding					1.0
					Travel Total	$10.6

FY 99

Project Number: 99320-T
Project Title: Juvenile Herring Distribution and Habitats
Name: University of Alaska Fairbanks

FORM 4B
Personnel
& Travel
DETAIL

Prepared: 4/11/98

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

Contractual Costs:	Proposed FY 1999
Description	
Reprint charges for published manuscripts	2.0
Communications	1.0
Copying and duplicating	1.0
Page charge for publication of research results	1.0
Postage and shipping for samples and data	0.4
Contractual Total	$5.4

Commodities Costs:	Proposed FY 1999
Description	
Presentation supplies – slides, overheads, video tape, poster supplies, etc.	1.3
Project supplies – laboratory supplies and chemicals, shipping supplies	0.6
Computer supplies – disks, software upgrades	1.0
Commodities Total	$2.9

FY 99

Project Number: 99320-T
Project Title: Juvenile Herring Distribution and Habitats
Name: University of Alaska Fairbanks

FORM 4B
Contractual & Commodities DETAIL

Prepared: 4/11/98

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

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 1999
Those purchases associated with replacement equipment should be indicated by placement with an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number	
Description	of Units	

FY 99

Project Number: 99320-T
Project Title: Juvenile Herring Distribution and Habitats
Name: University of Alaska Fairbanks

FORM 4B
Equipment
DETAIL

Prepared: 4/11/98

99320-T Supplement

Herring Traditional Ecological Knowledge

University of Alaska Fairbanks

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		
Travel		
Contractual	$71.0	$30.0
Commodities		
Equipment		
Subtotal	$71.0	$30.0
General Administration	$5.0	$2.1
Project Total	$76.0	$32.1
Full-time Equivalents (FTE)	1.0	0.3
Other Resources		

LONG RANGE FUNDING REQUIREMENTS			
	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002
	$0.0	$0.0	$0.0

Dollar amounts are shown in thousands of dollars.

Comments:

FY 99

Project Number: 99320-T Supplement
Project Title: Documenting Forage Fish Natural History through Local and Traditional Ecological Knowledge
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: 4/11/98

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

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel	$38.0	$15.4
Travel	$12.0	$2.0
Contractual	$5.6	$6.5
Commodities	$1.2	$0.1
Equipment		
Subtotal	$56.8	$24.0
Indirect	$14.2	$6.0
Project Total	$71.0	$30.0
Full-time Equivalents (FTE)	1.0	0.3
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		

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.

Personnel costs for J. Seitz are actually 5 hours per day for 3 months.

FY 99

Project Number: 99320-T Supplement
Project Title: Documenting Forage Fish Natural History through Local and Traditional Ecological Knowledge
Name: University of Alaska Fairbanks

FORM 4A
Non-Trustee
SUMMARY

Prepared: 4/11/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Personnel Costs: Name	Position Description		Months Budgeted	Monthly Costs	Overtime	Proposed FY 1999
Brown, E.	Principal Investigator/Program Manager		0.5	6.1		3.1
Seitz, J.	Technician		1.9	4.6		8.7
TBN	GIS Technician		1.0	2.5		2.5
Frandsen, M.	Laboratory Technician		0.3	5.1		1.5
	Adjustment to recognize rounding					-0.4
	Subtotal		3.7	18.3	0.0	
					Personnel Total	$15.4

Travel Costs: Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 1999
Cordova to Anchorage – EVOS annual meeting	0.2	1	5	0.1	0.7
Cordova to Anchorage – SEA synthesis or TEK meeting	0.2	1	4	0.1	0.6
Fairbanks to Anchorage – SEA synthesis or TEK meeting	0.2	1	4	0.1	0.6
Adjustment to recognize rounding					0.1
				Travel Total	$2.0

FY 99

Project Number: 99320-T Supplement
Project Title: Documenting Forage Fish Natural History through Local and Traditional Ecological Knowledge
Name: University of Alaska Fairbanks

FORM 4B
Personnel
& Travel
DETAIL

Prepared: 4/11/98

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

Contractual Costs:	Proposed FY 1999
Description	
Communications	0.2
Contractual services – anthropologist/sociologist to assist with data analysis and publications	6.0
Publication costs	0.3
Contractual Total	$6.5

Commodities Costs:	Proposed FY 1999
Description	
Project supplies – disks, software upgrades	0.1
Commodities Total	$0.1

FY 99

Project Number: 99320-T Supplement
Project Title: Documenting Forage Fish Natural History through Local and Traditional Ecological Knowledge
Name: University of Alaska Fairbanks

FORM 4B
Contractual & Commodities
DETAIL

Prepared: 4/11/98

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

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 1999
Those purchases associated with replacement equipment should be indicated by placement with an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number	
Description	of Units	

FY 99

Project Number: 99320-T Supplement
Project Title: Documenting Forage Fish Natural History through Local and Traditional Ecological Knowledge
Name: University of Alaska Fairbanks

FORM 4B
Equipment
DETAIL

Prepared: 4/11/98

98320-U

Somatic Energetics

University of Alaska Fairbanks

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		
Travel		
Contractual	$98.9	$70.0
Commodities		
Equipment		
Subtotal	$98.9	$70.0
General Administration	$6.9	$4.9
Project Total	$105.8	$74.9
Full-time Equivalents (FTE)	1.3	0.7
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 2000	Estimated FY 2001	Estimated FY 2002
$0.0	$0.0	$0.0

Dollar amounts are shown in thousands of dollars.

Comments:

FY 99

Project Number: 99320-U
Project Title: Fish Energetics
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: 4/11/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel	$75.0	$53.6
Travel	$2.1	$1.8
Contractual	$1.2	$0.4
Commodities	$0.8	$0.2
Equipment		
Subtotal	$79.1	$56.0
Indirect	$19.8	$14.0
Project Total	$98.9	$70.0
Full-time Equivalents (FTE)	1.3	0.7
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		

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.

Travel to Anchorage is by personal vehicle at the UAF rate of $0.31 per mile.

FY 99

Project Number: 99320-U
Project Title: Fish Energetics
Name: University of Alaska Fairbanks

FORM 4A
Non-Trustee
SUMMARY

Prepared: 4/11/98

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

Personnel Costs: Name	Position Description		Months Budgeted	Monthly Costs	Overtime	Proposed FY 1999
Paul, A. J.	Principal Investigator/Assoc. Professor		2.7	8.6		23.2
McDonald, J.	Technician		6.0	5.1		30.6
	Adjustment to recognize rounding					-0.2
	Subtotal		8.7	13.7	0.0	
					Personnel Total	$53.6

Travel Costs: Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 1999
Seward to Anchorage – EVOS annual meeting	0.1	1	5	0.2	1.1
Seward to Anchorage – SEA synthesis meeting	0.1	1	5	0.2	1.1
Adjustment to recognize rounding					-0.4
				Travel Total	$1.8

FY 99

Project Number: 99320-U
Project Title: Fish Energetics
Name: University of Alaska Fairbanks

FORM 4B
Personnel
& Travel
DETAIL

Prepared: 4/11/98

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

Contractual Costs:	Proposed FY 1999
Description	
Communications	0.4
Contractual Total	$0.4

Commodities Costs:	Proposed FY 1999
Description	
Project supplies (laboratory supplies, computer disks)	0.2
Commodities Total	$0.2

FY 99

Project Number: 99320-U
Project Title: Fish Energetics
Name: University of Alaska Fairbanks

FORM 4B
Contractual & Commodities DETAIL

Prepared: 4/11/98

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

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 1999
Those purchases associated with replacement equipment should be indicated by placement with an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number	
Description	of Units	

FY 99

Project Number: 99320-U
Project Title: Fish Energetics
Name: University of Alaska Fairbanks

FORM 4B
Equipment
DETAIL

Prepared: 4/11/98

99320-Z-1

SEA Synthesis and Integration

University of Alaska Fairbanks

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		
Travel		
Contractual	$59.8	$84.0
Commodities		
Equipment		
Subtotal	$59.8	$84.0
General Administration	$4.2	$5.9
Project Total	$64.0	$89.9
Full-time Equivalents (FTE)	0.2	0.3
Other Resources		

LONG RANGE FUNDING REQUIREMENTS			
Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
$0.0	$0.0	$0.0	

Dollar amounts are shown in thousands of dollars.

Comments:

FY 99

Project Number: 99320-Z-1
Project Title: Sound Ecosystem Assessment (SEA): Synthesis and Integration
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: 4/11/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel	$28.7	$35.1
Travel	$15.0	$29.6
Contractual	$4.1	$2.5
Commodities		
Equipment		
Subtotal	$47.8	$67.2
Indirect	$12.0	$16.8
Project Total	$59.8	$84.0
Full-time Equivalents (FTE)	0.2	0.3
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		

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.

FY 99

Project Number: 99320-Z-1
Project Title: Sound Ecosystem Assessment (SEA): Synthesis and Integration
Name: University of Alaska Fairbanks

FORM 4A
Non-Trustee
SUMMARY

Prepared: 4/11/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Personnel Costs: Name	Position Description		Months Budgeted	Monthly Costs	Overtime	Proposed FY 1999
Cooney, R. T.	Principal Investigator/Professor		3.0	11.7		35.1
	Subtotal		3.0	11.7	0.0	
					Personnel Total	$35.1

Travel Costs: Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 1999
All travel is for SEA synthesis workshops.					
Fairbanks to Cordova	0.4	10	50	0.1	9.0
Fairbanks to Anchorage	0.3	10	50	0.1	8.0
Miami to Fairbanks	1.2	2	10	0.1	3.4
Cordova to Anchorage	0.1	10	50	0.1	6.0
Charleston to Anchorage	1.1	2	10	0.1	3.2
				Travel Total	$29.6

FY 99

Project Number: 99320-Z-1
Project Title: Sound Ecosystem Assessment (SEA): Synthesis and Integration
Name: University of Alaska Fairbanks

FORM 4B Personnel & Travel DETAIL

Prepared: 4/11/98

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

Contractual Costs:	Proposed FY 1999
Description	
Communications – mail, conference call	1.1
Document copying	0.6
Academic Services – manuscript preparation (20 hr @ $40/hr)	0.8
Contractual Total	$2.5

Commodities Costs:	Proposed FY 1999
Description	
Commodities Total	$0.0

FY 99

Project Number: 99320-Z-1
Project Title: Sound Ecosystem Assessment (SEA): Synthesis and Integration
Name: University of Alaska Fairbanks

FORM 4B
Contractual & Commodities DETAIL

Prepared: 4/11/98

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

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 1999
Description			
Those purchases associated with replacement equipment should be indicated by placement with an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number of Units	
Description		

FY 99

Project Number: 99320-Z-1
Project Title: Sound Ecosystem Assessment (SEA): Synthesis and Integration
Name: University of Alaska Fairbanks

FORM 4B
Equipment
DETAIL

Prepared: 4/11/98

APPENDIX I-C

Individual projects being submitted to the U.S. Forest Service

99320-Q

Bird Predation on Herring Spawn

Copper River Delta Institute, Cordova, Alaska

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		$13.3
Travel		$1.4
Contractual		
Commodities		$0.3
Equipment		
Subtotal	$0.0	$15.0
General Administration		$2.0
Project Total	$0.0	$17.0
Full-time Equivalents (FTE)		0.2
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
	$0.0	$0.0	$0.0		

Dollar amounts are shown in thousands of dollars.

Comments:

Prepare publications including synthesis papers for SEA close-out.

FY 99

Project Number: 99320-Q
Project Title: SEA–Avian Predation on Herring Spawn
Agency: USFS–Pacific Northwest Research Station

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: 4/11/98

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

Personnel Costs: Name	Position Description	GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 1999
Bishop, M.	Principal Investigator	GS-12-02	2.1	5.7		12.0
Meyers, P.	Biologist/Statistician	GS-09-01	0.4	3.2		1.3
	Subtotal		2.5	8.9	0.0	
					Personnel Total	$13.3

Travel Costs: Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 1999
Cordova to Anchorage – EVOS Workshop – March 1999	0.3	1	5	0.1	0.8
Cordova to Fairbanks – SEA, small group synthesis workshop	0.3	1	3	0.1	0.6
				Travel Total	$1.4

FY 99

Project Number: 99320-Q
Project Title: SEA–Avian Predation on Herring Spawn
Agency: USFS–Pacific Northwest Research Station

FORM 3B
Personnel
& Travel
DETAIL

Prepared: 4/11/98

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

Contractual Costs:	Proposed FY 1999
Description	
Contractual Total	$0.0

Commodities Costs:	Proposed FY 1999
Description	
Poster materials	0.2
Computer-generated slides (20 @ $5)	0.1
Commodities Total	$0.3

FY 99

Project Number: 99320-Q
Project Title: SEA–Avian Predation on Herring Spawn
Agency: USFS–Pacific Northwest Research Station

FORM 3B
Contractual & Commodities DETAIL

Prepared: 4/11/98

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

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 1999
Indicate replacement equipment purchases with an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number	
Description	of Units	

FY 99

Project Number: 99320-Q
Project Title: SEA–Avian Predation on Herring Spawn
Agency: USFS–Pacific Northwest Research Station

FORM 3B
Equipment
DETAIL

Prepared: 4/11/98