(10812) 19.09.02

Exchange between Prince William Sound and the Gulf of Alaska. Submitted Under the Broad Agency Announcement.

Project Number:	O1552	
Restoration Category:	Research	
Proposer:	Prince William Sound Science Cer	nter
Sponsoring Agency:	NOAA	
Duration:	Three years	
Cost FY 00:	\$106.9 K	inni 1995 - Alexandri Maria (m. 1997) 1996 - Alexandri Maria (m. 1997)
Cost FY 01:	\$107.6 K	100
Cost FY 02:	\$ 95.9 K	AFK 1 3 2004
Cost FY 03:	\$0 K	المراجعة من المراجع المراجع . مراجع المراجع المراجع المراجع المراجع المراجع المراجع المراجع . مراجع المراجع ا
Cost FY 04:	\$0 K	
Geographic Area:	Prince William Sound	
Injured Resource/Service:	pink salmon. Pacific herring	

ABSTRACT

One of the least understood physical processes that influence the biological components of PWS is the exchange between the northern Gulf of Alaska (GOA) and Prince William Sound (PWS). The main objective of this proposal is to document the interannual variability in water mass exchange between PWS and the adjacent northern GOA at Hinchinbrook Entrance, and to identify mechanisms governing this exchange. Support is requested for continued deployment of an upward looking ADCP moorings in Hinchinbrook Entrance to create time series of velocities spanning three years. The mooring will be equipped with a CTD to create a time series of deep temperature (T) and salinity (S). To identify the dominant factors that govern PWS/GOA exchange, the mooring velocity and deep T/S time series will be combined with meteorological and physical data collected under other research programs in progress in PWS and the GOA.

INTRODUCTION

The Sound Ecosystem Assessment (SEA), funded by the EVOS Trustee Council from 1994 to 1999, was aimed at understanding physical and biological factors affecting pink salmon and Pacific herring survival on an ecosystem level. As part of the SEA study, an upward-looking acoustic Doppler current profiler (ADCP) mooring was deployed in Hinchinbrook Entrance from June through September 1995 and from September 1996 through May 1997. Time series of horizontal and vertical velocities were created for these two periods. The data were low-pass filtered (40 hour) to remove the tidal component.

At Hinchinbrook Entrance the summer and early fall months of 1995 (June through September) were characterized by outflow above about 150m and inflow below (Vaughan et al, 1999). Easterly offshore winds caused surface Ekman layer inflow, accompanied by deeper outflow. Except for the Ekman inflow, which reached speeds greater than 80 cm/sec, the magnitude of the flow seldom exceeded 20 cm/sec. In late September, at the very end of the 1995 time series, the pattern seemed to reverse to one of inflow above about 150m and outflow below.

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

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

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

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

FY00 through FY04. Process studies in the northern GOA are scheduled for FY01 and FY03. A GLOBEC survey line of particular interest is the trench on the southeastern side of Montague Island, which runs from the western side of Middleton Island to Hinchinbrook Entrance, and is almost certainly the conduit of any dense water entering PWS.

Anther project underway in PWS is the development of a near real-time nowcast/forecast (N/F) system, co-sponsored by the Oil Spill Recovery Institute (OSRI), the Alyeska Ship Escort and Response Vessel System (SERVS), and the PWS Region Citizens Advisory Council (PWS RCAC). The main objective of this project is to develop a prototype N/F circulation model that will be capable of calculating current velocity vector fields, particle trajectories, and the evolution of passive drifter concentrations. Current data are collected using a downward looking ADCP towed from one of the Alyeska SERVS vessels. East-west and north-south transects through central PWS, and repeated transects at Hinchinbrook Entrance (to eliminate the tidal contribution), were conducted in 1999. Funding has been secured to continue measurements in 2000.

NEED FOR THE PROJECT

A. Statement of the Problem

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

B. Rationale/Link to Restoration

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

C. Location

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

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

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

PROJECT DESIGN

A. Objectives

The main objective of this proposal is to document the interannual variability in water mass exchange between PWS and the northern GOA at Hinchinbrook Entrance, and to identify mechanisms governing this exchange. Funding is requested for continued deployment of an upward looking ADCP mooring in Hinchinbrook Entrance over the next two years. In addition to the ADCP velocity time series, time series of deep temperature (T) and salinity (S) will be collected by a CTD mounted on the mooring.

B. Methods

An upward-looking ADCP mooring (RDI 150 kHz broadband) will be deployed in the fall of each year (e.g., September) and retrieved in the spring or early summer (e.g., May). The approximate mooring location will be latitude 60 17.0', longitude 146 51.0', which is in the deepest part of Hinchinbrook Entrance at the northern end of the Montague Island trench. As configured, the ADCP will measure horizontal and vertical velocities from a few meters above the transducer faces to within roughly 45m of the surface in 8m bin depths.

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

In addition to the velocity data, T/S data will be collected by a SeaBird 16 CTD mounted on the mooring. The instrument has been equipped with a new pressure housing enabling it to function at the mooring depth. The data will be processed using standard SeaBird software. Density will be calculated from T and S. The first deployment took place in December 1999. Retrieval is scheduled for July 2000. The second deployment, funded under FY00 552 is scheduled for September 2000. Target cruise dates for the next two years are:

September 2000 - May 2001 September 2001 - May 2002

FY01 will include two mooring cruises (e.g., May 2001 and September 2001). FY02 will include one mooring cruise (e.g., May 2002) unless continued funding makes additional deployments possible. A vessel with a crane, A-frame, or other equipment suitable for mooring deployments will be required.

To identify the dominant factors that govern PWS/GOA exchange, the mooring velocity and deep T/S time series will be combined with additional data types collected under other programs. The time series obtained from the mooring will be supplemented by the velocity transects made with a downward-looking towed ADCP (funded under the OSRI N/F project). The repeated transects will capture the spatial variability of the Hinchinbrook Entrance flow patterns. T/S measurements on the SERVS cruises will be obtained using expendable CTDs (XCTDs). Conditions in the GOA, particularly in the trench southeast of Montague Island, will be documented by the GLOBEC group at the Institute of Marine Science (IMS) at the University of Alaska Fairbanks (UAF). Meteorological data are available from the NOAA C-MAN stations, particularly the Seal Rocks and Mid-Sound buoys, and from the station located on Middleton Island.

The mooring velocity time series coupled with the repeated ADCP transects over multiple years will show whether the baroclinic inflow/outflow structure that dominated the flow in summer 1995 and in fall through early winter 1996 (including the apparent September reversal and the 150m separation depth), as well as the transition from a baroclinic to barotropic structure in January 1997, is typical or anomalous. The mooring velocity time series coupled with time series of wind from the meteorological buoys will allow further investigation of surface Ekman layer inflow.

The T/S time series will signal the movement of any new deep water mass into or out of PWS. T/S observations from the GLOBEC cruises should reveal the source of deep water flowing into PWS, or the southern extent of deep water flowing out of PWS. Time series of GOA wind speed and direction (from the Middleton Island station) should indicate if large scale atmospheric forcing in the Gulf is responsible for the inflow/outflow patterns and transitions at Hinchinbrook Entrance, and for the variability in transports above and below 150m.

C. Cooperating Agencies, Contracts and Other Agency Assistance

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

SCHEDULE

A. Measurable Project Tasks

FY01:

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

FY02:

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

FY03:

April 15, 2003: FY02 Final Report due

B. Project Milestones and Endpoints

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

C. Completion Date

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

PUBLICATIONS AND REPORTS

Physical Processes Influencing the Pelagic Ecosystem of Prince William Sound, Fisheries Oceanography, October 2000.

PROFESSIONAL CONFERENCES

- -

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

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project will be coordinated with the efforts Dr. T. Weingartner and Dr. D. Musgrave, both of IMS/UAF (GLOBEC). This project will cooperate with other EVOS sponsored programs to provide the most efficient means for investigating biological and environmental factors common to all projects.

PROPOSED PRINCIPAL INVESTIGATOR

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

PRINCIPAL INVESTIGATOR

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

Education:

B.S., University of Miami, May 1981, Physics (major)/Mathmatics (minor)M.S., University of Miami, May 1986, PhysicsPh.D., University of Miami, Rosenstiel School of Marine and Atmospheric Science

(RSMAS), May 1993, Meteorology and Physical Oceanography (MPO), Kevin D. Leaman, advisor

Professional Experience (since 1986):

1986 - 1993: Research Assistant, University of Miami, RSMAS, MPO, Miami, Florida 1993 - 1995: Postdoctoral Associate, University of Miami, Cooperative Institute for Marine and Atmospheric Studies, a cooperative institute between RSMAS and NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML), Miami, Florida, Robert L. Molinari, supervisor

Sept. 1995 - present: Physical Oceanographer, Prince William Sound Science Center, Cordova, Alaska

Recent Refereed Journals:

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

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

Vaughan, S. L., C. N. K. Mooers, and S. M. Gay III, 2000: Physical Processes Influencing the Pelagic Ecosystem of Prince William Sound. J. Fish. Oceanogr. (submitted).

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

OTHER KEY PERSONNEL

Shelton M. Gay: cruise staging, instrument calibration and maintenance, data acquisition and analysis, contribute to journal publications.

LITERATURE CITED

Niebauer, H.J., T.C. Royer, and T.J. Weingartner, 1994: Circulation of Prince William Sound, Alaska. J. Geophys. Res., 99, C7, pp 14,113-14,126.

Vaughan, S.L., S.M. Gay, L.B. Tuttle, and K.E. Osgood, 1998: SEA: Observational Oceanography in Prince William Sound. Exxon Valdez Oil Spill Restoration Project Annual Report (Restoration Project 97320-M), Prince William Sound Science Center, Cordova, Alaska.

Vaughan, S.L., C.N.K. Mooers, J. Wang, S.M. Gay, and L.B. Tuttle, 1999: Physical Processes Influencing the Pelagic Ecosystem of Prince William Sound. Exxon Valdez Oil Spill Restoration Project Annual Report (Restoration Project 98320-M), Prince William Sound Science Center, Cordova, Alaska. 2000 EXXON VALDEZ TRUE LE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

	Authorized	Proposed	
Budget Category:	FY 2000	FY 2001	
Personnel		\$0.0	
Travel		\$0.0	
Contractual		\$107.6	
Commodities		<u>\$0.0</u>	
Equipment		\$0.0	LONG RANGE FUNDING REQUIREMENTS
Subtotal	\$0.0	\$107.6	
General Administration		\$7.5	
Project Total	\$0.0	\$115.1	
Full-time Equivalents (FTE)		0.7	
			Dollar amounts are shown in thousands of dollars.
Other Resources			
Comments:			
		<u></u>	
	Droject Ni	abor EEO	FORM 3A
FYU1	Project Title	: Exchange	e between PWS and the Gulf of Alaska
	Agency: NO	DAA	
Prepared:	L		

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

	Authorized	Broposod	
Budget Category	EV 2000	EV 2001	
	112000	112001	
Personnel	\$45.9	\$55.2	
Travel	\$7.0	\$5.3	
Contractual	\$28.6	\$20.2	
Commodities	\$4.0	\$3.0	
Equipment	\$0.0	\$0.0	LONG RANGE FUNDING REQUIREMENTS
Subtotal	\$85.5	\$83.7	Estimated
Indirect (28.6%)	\$21.4	\$23.9	FY 2002
Project Total	\$106.9	\$107.6	\$95.9
Full-time Equivalents (FTE)		0.7	
			Dollar amounts are shown in thousands of dollars.
Other Resources			
Comments:			
The federally negotiat	ted indirect cos	t rate for the I	Prince William Sound Science Center is 28.6%.
A total of \$482.00 is r	equested for a	ttendance at t	the annual EVOS Workshop in Anchorage.
r			
	Project Nu	mbor 550	
			a between DMC and the Culf of Alestra
FYUI	Project 111		e between PWS and the Guir of Alaska
	Name: Pri	nce William	Sound Science Center
Prepared:			

2000 EXXON VALDEZ TRUSTÉE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:				Months	Monthly		Proposed
IName	Position Description		-	Budgeted	Costs	Overtime	FY 2001
Shari Vaughan	Physical Oceanographer (PI)			4.0	7900.0		31.600.0
Shelton Gay	Physical Oceanographer			4.0	5900.0		23.600.0
	5						0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
					·		0.0
							0.0
							0.0
		Subtotal		8.0	13800.0	0.0	
	- Power				Per	sonnel Total	\$55.2
Travel Costs:			Ticket	Round	Total	Daily	Proposed
Description			Price	Trips	Days	Per Diem	FY 2001
EVOS Workshop - Anchor	age - January 2001		202.0	1	2	140.0	482.0
1 r/t Cordova-Fairbanks			440.0	1	3	140.0	860.0
1 r/t Cordova-Miami			960.0	1		0.0	960.0
2 r/t Miami-Cordova			960.0	2	8	140.0	3,040.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
						Traval Total	0.0
		······································			<u></u>	Travel Total	<u> </u>
							
	Project Number: 552						
EV01	Project Title: Exchange h	otwoon E	DWG and the		sko	ļĒ	Personnel
				- Guil OI Ala	Iona		& Travel
	Iname: Prince William Sol	und Scier	nce Center				DETAIL

Prepared:

2000 EXXON VALDEZ TRUS ZE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Contractual Costs:		: 	· · · · · · · · · · · · · · · · · · ·	Proposed
Description	<u> </u>	- <mark> Миника, к и жили каконо стан</mark> ика каконо стану, каконо каконо каконо каконо каконо каконо каконо каконо к -		FY 2001
Vessel Charter (2 cruises 2	2 days each @ \$3000 per day)			12.000.0
Equipment calibration/repai	ir			1,000.0
Network costs and mainten	ance (\$100/computer-month)			1,000.0
Professional service - moor	ring technician (\$2000 per cruise)			4 000 0
Phone fax conving	ing technician (42000 per cruise)			800.0
Mail freight shipping				800.0
Man, rreight, shipping				000.0
			Contractual Total	\$20.2
Commodities Costs:				Proposed
Description		· · · · · · · · · · · · · · · · · · ·		FY 2001
Office supplies				500.0
Computer supplies				500.0
Marine supplies				2,000.0
				1
			Commodities Total	\$3.0
	Farmer and the second s			
			F	ORM 4B
	Project Number: 552			ntractual &
FY01	Project Title: Exchange between PWS	S and the Gulf of Alaska		mmodities
	Name: Prince William Sound Science	e Center		
Prepared:		·		

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 2001
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0 0.0
			0.0 ^ ^
			0.0 0.0
Those purchases associated with replacement equipment should be indicated by placement of an B	New Equi	ipment Total	<u>\$0.0</u>
Existing Equipment Usage:		Number	
Description		of Units	l
FY01 Project Number: 552 Project Title: Exchange between PWS and the Gulf of Ala Name: Prince William Sound Science Center	ska	F	ORM 4B quipment DETAIL
Prepared:			



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DEVELOPMENT OF COMMUNITY-BASED MONITORING PROGRAMS FOR EVOS RESTORATION AND GEM (submitted under the BAA)

Project Number:	01554 - BAA	
Restoration Category:	Monitoring	
Proposer:	ECO Resource Group, LLP	
Lead Trustee Agency:		RECEIVED
Cooperating Agencies:		APR 1 4 2000
Alaska Sea Life Center:	No	EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
Duration:	FY 01, 1 st year, 2 year project	
Cost FY 01:	\$88.7k	
Cost FY 02:	\$105.0k	
Geographic Area:	Prince William Sound, Kodiak, Kenai	i Peninsula
Injured Resource/Service:		

ABSTRACT

This project will develop a framework for evaluating existing community-based monitoring efforts related to past and continuing restoration projects. A survey will be conducted of scientists, managers, and community members that have participated in the EVOS outreach and scientific studies to date. Three (3) workshops will then be held to strengthen alliances, define problems and opportunities, develop guidelines for a community-based monitoring program, and suggest pilot studies to solidify community-based monitoring for GEM during FY 02. A report will document the results of the survey and workshops and suggest a strategy for community-based monitoring efforts in the spill area.

INTRODUCTION

The Exxon Valdez oil spill has had a tremendous impact on people as well as natural resources in the spill area. Effects on commercial and subsistence fisheries, shellfish harvesting, marine mammal subsistence, and other resources have had serious cultural implications including physical dislocations and reduced ability to maintain traditional resource harvesting patterns. An important component of EVOS restoration activities over the last 11 years has been active two-way public involvement in defining restoration options. Ancillary to that effort is the involvement of local citizens, both Native and non-Native Alaskans, in scientific studies aimed at determining damages from the spill and subsequent cleanup.

Monitoring of environmental parameters by local citizens has become an important tool in public participation and habitat protection efforts worldwide. Whether known as citizen monitoring, volunteer monitoring, or community-based monitoring, data collection projects range from monitoring standard water quality parameters such as DO, salinity, and pH, to establishing baselines for nearshore habitat conditions, and monitoring fisheries as part of marine protected area programs, among many other examples. All of these efforts are aimed at broadening public understanding of the scientific issues involved in resource protection, and most participants and observers agree that community-based monitoring creates critical educational, environmental awareness, and public relations opportunities for resource management and science.

The data collection aspect and actual scientific value of citizen monitoring is less clear and is perceived differently by those involved. Many scientists are skeptical of the value of data collected by local groups of volunteers not highly trained in data collection methods, and citizen groups themselves often find themselves collecting data that are simply not used by agencies or other scientists, frustrating future efforts at involvement. Citizen groups often hold valuable information regarding local resources, whether the "data" is "stored" as anecdotes and stories, or as verifiable historical patterns. Recent efforts to incorporate Traditional Ecological Knowledge, or TEK, into Environmental Assessments have shown clearly that the information carried by traditional cultures has verifiable validity for resource management. Other developments in the evaluation of narrative and story are allowing the "extraction" of resource data that can be applied to policy development and management.

A number of issues need to be addressed in community-based monitoring efforts. Most importantly, the resources and parameters to be monitored define the level of involvement and training required of community members. What types of data will be collected and the level of detail (i.e., identifying organisms to family or species) will affect the level of training and effort. Quality assurance and quality control are the most significant areas of concern by the scientists managing the studies, and also relate to issues of documentation of results. How and where data will be entered and stored from community monitoring efforts will affect training, effort and funding. Effective monitoring programs will involve the communities in the study design, and will integrate Traditional Ecological Knowledge in the planning and reporting process, "triangulating" various methods of resource evaluation to assure an accurate balancing of

quantitative data and local knowledge.

The perceptual biases and practical problems that limit the use of community-based monitoring must continually be overcome by open dialogue between scientists, local citizens and resource managers to define appropriate uses for citizen data collection. An adaptive, evaluative process that constantly seeks to refine and oversee the data collection efforts can provide the greatest potential for an effective community-based monitoring program that maximizes education and public relations and enhances agency efforts to collect valid data for resource management, while providing local communities with the scientific training to enhance indigenous resource knowledge.

This proposal utilizes a strategic planning approach to maximize the understanding of lessons learned during the last 12 years of monitoring EVOS damages and restoration by providing an objective evaluation of community-based efforts to date, and providing guidelines for a prototype program based on these lessons and other community-based monitoring efforts. A strategic planning approach is proposed because the decisions regarding what will actually need to be monitored in future years have not yet been made, and because of what seem to be varying perspectives on the success and goals of EVOS community-based monitoring to-date. The objectives will be accomplished through (1) a survey, designed to elicit information and perceptions on what is positive and what can be improved about community-based monitoring related to EVOS; (2) three workshops that will provide opportunities for dialogue among scientists, managers, local citizens and others about issues raised during the survey, definition of ongoing or new projects that may be appropriate to maximize use of community-based monitors, development of guidelines that will assist in establishing future projects, and presentations of other community-based models by other experts in the field; and, (3) a strategy report that will present guidelines and a structure for future community-based monitoring based upon the information from the survey, workshops, and other comparable programs. Additionally, this proposal will provide a structure for continued community-based monitoring efforts by creating a position of Community-based Monitoring Coordinator and providing funding in FY 02 to begin to implement pilot projects and coordinate with scientists and citizen groups. This position would combine the existing positions of Area-wide Coordinator and TEK Specialist.

NEED FOR THE PROJECT

A. Statement of Problem

Much effort has been expended over the 11 years since the Exxon Valdez went aground to involve the public in the damage assessment and restoration science, and specifically to enable local participation through community-based monitoring, and requirements for scientific investigators to incorporate Traditional Ecological Knowledge into studies. Discussions with several current and former damage assessment and restoration scientists suggest problems common to the differences in perceptual and data collection perspectives mentioned above, and

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point to a need for an objective evaluation of existing community-based monitoring as a first step in developing future programs. Issues with Quality Assurance and Quality Control and consistency of data collection methods can provide grounds for lack of confidence in communitybased programs from the scientists' perspective. This lack of confidence can result in hesitancy to trust community-based efforts in future GEM studies. It will be important to expand community-based monitoring efforts in the future to maximize the use of indigenous knowledge while stretching limited funding. This proposal is intended to address problems inherent to community-based monitoring, while retaining and expanding the parts of the program that have shown great success in actively involving the public in the restoration science, such as *Protocols for Including Indigenous Science*, the Public Advisory Group, community facilitators, and existing projects partnering with local communities and schools.

B. Rationale/Link to Restoration

This proposal will assist ongoing restoration and GEM monitoring projects by providing a sound framework for future community-based monitoring that will support restoration and GEM science. It will strengthen the bond between the local inhabitants of the spill area and continued scientific efforts, while providing ongoing training for communities that may have to respond to another spill. Strengthening the connections between the public and science through ongoing dialogue and community-based monitoring will also support forums for management and policy decisions. The involvement of the Prince William Sound Regional Citizens Advisory Committee in support of the workshop in Valdez provides an opportunity to strengthen the relationship between EVOS restoration, GEM and ongoing monitoring and protection efforts directly related to the oil terminal at Valdez.

C. Location

The survey will include all of the spill area where community-based monitoring efforts have been utilized, while being inclusive of principal investigators, managers, agency personnel, and local citizens who have already been involved. The workshops will be held in Anchorage, Valdez, and Kodiak to provide opportunity for maximal participation by local residents. Pilot projects may be initiated in Prince William Sound, but will be designed to be applicable to other areas affected by the spill. Communities that may be affected by the project include Valdez, Cordova, Whittier, Tatitlek, Chenega Bay, Nanwalek, Ouzinkie, Port Graham, Seldovia, and Seward.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

Affected communities will be an integral part of the process of eliciting comments and information regarding the evaluation and development of community-based monitoring. Members of affected communities will be informed of the project through participation in the survey, newspaper announcements of the workshops, and availability of drafts of the final summary report for comments. Local input will be requested through participation in the

survey, involvement at the workshops, and participation in pilot projects. Local leaders will be utilized at the workshops as moderators where possible. Local knowledge will be incorporated into the workshops through the use of dialogue and story to elicit information, and any reports will integrate local stories and knowledge with scientific testimony. The project will coordinate with local liaisons, the Public Advisory Group and the TEK Specialist to assure that local needs are met during the survey and workshops, and during any pilot projects during FY 2002.

PROJECT DESIGN

A. Objectives

To develop conceptual prototypes of community-based marine monitoring programs applicable to the Exxon Valdez Restoration process and subsequent Gulf Environmental Monitoring projects. To accomplish this goal, it is necessary to follow several clearly delineated steps:

- 1. Evaluate existing community-based outreach efforts related to the spill to define what has worked and what hasn't and compare findings to community-based practices in other areas (such as Puget Sound and other National Estuaries);
- 2. Stimulate a dialogue among the parties (scientists, native groups, environmentalists, recreational users, local governments) regarding
 - what resources can realistically be committed to a community-based scientific monitoring program
 - who needs to participate
 - what needs to be monitored
 - how to monitor (protocols, methods, data storage, etc.)
- 3. Develop a strategy for community-based monitoring, and,
- 4. Develop several pilot projects that will incorporate these lessons and test methods of community-based monitoring.

B. Methods

FY01

1. Literature review of community-based monitoring in other places and consultations with participants in EVOS programs:

Prior to development of the survey, a literature review will be made to identify existing community-based monitoring programs and issues that can be addressed through questions on the survey. Results of the literature review will be included in the final project report (see below). Participants in existing projects will be canvassed to assure that the survey addresses any important issues.

2. Develop and implement a Survey of existing community-based efforts to assess monitoring needs and define lessons learned:

Develop and implement a survey instrument to assess the needs of scientific monitoring and community outreach. The survey will ask questions of local participants, scientists, native groups, and others that have been involved in EVOS community-based monitoring programs, and will be aimed at eliciting information on how to improve existing community-based monitoring programs to provide for the needs of science and community, such as, what needs to be improved, and the connections between community monitoring, and existing Restoration and future GEM monitoring and research. Researchers will interview approximately 30–40 respondents using a structured, open-ended telephone survey instrument. Respondents will include stakeholders and scientists who have participated in community-based monitoring projects, or who might participate in future projects. ECO will design and implement the survey, analyze the qualitative data, and summarize the results.

Products:

Survey instrument Summary of results

3. Design and facilitate 3 workshops

Design and facilitate a series of three (3) workshops that address the issues listed below as well as others raised by the survey and those which arise during the workshops. The workshops will take place in Anchorage, Valdez and Kodiak, and will include EVOS scientists, other PWS researchers, affected community leaders, environmental and tourism groups, local governments, and community-based monitoring experts from other locations such as Puget Sound or other National Estuary Program estuaries. The workshops will include discussions of local community-based monitoring projects, as well as projects that cover other parts of the spill area. The workshops will combine dialogue and other communication and meeting methods respectful of cultural differences. Training will be provided by facilitators as needed.

Items for initial discussions:

- what resources can be committed to a community-based science program
- · who needs to participate
- what needs to be monitored
- how to monitor (protocols, methods, data storage, etc.)
- possible organizational structures

Costs for these workshops may be defrayed through local in-kind contributions or from grants from local agencies or community-based monitoring or TEK funding sources. For example, the Valdez workshop is being fully supported by the prince William Sound Regional Citizens Advisory Council. Products:

Workshop notes

4. Develop Community-based Monitoring Strategy Report

A report will be developed that utilizes the results of the survey and the workshops, as well as a review of available literature, to provide recommendations on strategies to develop communitybased monitoring programs specifically structured for the transition from EVOS to GEM. The report will recommend guidelines for monitoring projects, and methods for coordinating between scientists and local communities, as well as an overall program structure.

Product:

Strategy Report

FY02:

Create position and hire Community-based Monitoring Coordinator

From the results of the Community-based Monitoring Strategy Report, create a position, develop job requirements and hire a person for the position of Community-based monitoring Coordinator. The position for FY02 will coordinate the implementation of any pilot projects appropriate for community-based monitoring and develop funding options for supporting training, organization, etc. The position could combine the existing positions of Area-wide Coordinator and TEK Specialist and continue funding.

Establish a Scientific Advisory Board (or combine with existing EVOS or GEM scientific review) to assure that projects follow the necessary guidelines and protocols. Community-based monitoring will be reviewed as part of technical proposals.

Develop several pilot projects to test the guidelines

Coordinate with several studies approved by EVOS Trustees or the GEM program to test the guidelines and efficacy of the community-based monitoring program. The Prince William Sound Regional Citizens Advisory Council has committed to provide support for projects that will initially focus in Port Valdez, but whose methods can be applied in other spill affected areas.

C. Cooperating Agencies, Contracts and Other Agency Assistance

During FY02, other government agencies or schools in the spill region may be contracted with for training of community-based monitors.

SCHEDULE

A. Measurable Project Tasks for FY01 (October 1, 2000 - September 30, 2001

November 1:	Complete design of survey instrument
February 30:	Complete Survey Summary Report
April 15:	First Workshop
May 15:	Second Workshop
June 15	Third Workshop
July 15:	Submit Workshop notes/summary
August 30	Submit Community-based Monitoring Strategy Report

B. Project Milestones and Endpoints

FY 01	
February 30	Evaluate existing community-based outreach efforts
June 15	Stimulate a dialogue among the stakeholders and develop guidelines
August 30	Develop a strategy for community-based monitoring
FY 02	
November 30	Hire Community-based Monitoring Coordinator
March 1	Promote several pilot projects to test the guidelines
August 30	Evaluate community-based monitoring pilot projects

C. Completion Date

FY 2002

PUBLICATIONS AND REPORTS

Community-based Monitoring Strategy Report in August 2001.

An Annual Report on the project will be submitted in April 2002 (and April 2003, if funded).

A paper on the project will be submitted to an appropriate journal related to Traditional Ecological Knowledge or Citizen Monitoring (to be identified later).

PROFESSIONAL CONFERENCES

Results of this project will be presented at an annual conference related to Traditional Ecological Knowledge or Citizen Monitoring (to be identified later).

NORMAL AGENCY MANAGEMENT

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project will be coordinated and integrated with other restoration efforts in several ways. First, Principal Investigator's (PI) and participants in previous, ongoing and proposed projects and studies will be surveyed and invited to participate in the workshops to share their experiences of community-based monitoring in restoration and other projects with which they have been involved. Secondly, the nature of this project is in sharing data collection and data management among local communities and restoration project agencies and PI's. Sponsors of this project have also been discussing the appropriateness of community-based monitoring related to a number of ongoing or proposed restoration studies, including a NMFS Intertidal monitoring proposal, and NMFS Auke Bay Laboratory's Pristane study, and a caged mussel study proposed through PWSRCAC by Applied Biomonitoring. This project has also been coordinating with, and would be complementary to, a proposal from the Alaska Wilderness Recreation and Tourism Association regarding educational awareness and developing a partnership with APU, Chugach Regional Resources Commission and tourism businesses for monitoring of tourism impacts. Additionally, the methods proposed in this project may be compatible for combination with aspects of a Community-based Monitoring Proposal by the Chugach Regional Resources Commission, though time has not allowed specific coordination between the two proposals.

Finally, the workshop and information gathering process described here will be coordinated with the workshops and other consultations of the GEM project, specifically the development of a monitoring plan or components of a plan, data management strategies, and public communications strategies.

The PWSRCAC has agreed in principle to provide funding for the Valdez workshop (see attached letter). Actual funding support is contingent on approval by the PWSRCAC board, but could include providing support for a pilot project. It is also expected that existing funded restoration projects using community-based monitoring will continue. This project also envisions that part of the Coordinators responsibilities will be in identifying other sources of funding for the project.

PROPOSED PRINCIPAL INVESTIGATOR

Name	David M. Sale
Affiliation	ECO Resource Group
Mailing Address	2536 Alki Ave. SW., #160
Phone Number	(206)937-6092
Fax Number	(206)937-9298

Prepared April 10, 2000

daves.eco@earthodysseys.com

PRINCIPAL INVESTIGATOR

David Sale

David Sale is a principal of the ECO Resource Group, an environmental, planning and organizational consulting firm. Mr. Sale is a marine ecologist and coastal planner who has extensive experience with the Exxon Valdez oil spill and Prince William Sound. Mr. Sale was a PI and author of a damage assessment study, Nearshore Transport of Hydrocarbons and Sediments Following the Exxon Valdez Oil Spill. In addition, he participated in other damage assessment studies on bivalve uptake, benthic community structure, and intertidal recolonization, response studies on shoreline geomorphology, and participated on 1990 SSAT and ASAP teams while working for ADEC. He has also guided and kayaked extensively in Prince William Sound and Resurrection Bay, consulted to National Geographic and KTOO (Juneau) in developing stories on the 10th anniversary of the spill, and is a member of the Alaska Wilderness Recreation and Tourism Association. Mr. Sale served as the Assistant Science Coordinator for the Puget Sound Water Quality Action Team in Washington, coordinating the activities of multiple state and federal agencies monitoring ambient conditions in Puget Sound and the Georgia Strait, including advising citizen groups on developing monitoring programs that would share data with government agencies, developing shared data management systems, and facilitating technical forums and dialogue on water quality issues. He is also active developing citizen monitoring and training programs, including diver monitoring, for the Puget Soundkeeper Alliance. Current work includes providing training on how to use Dialogue and Story to connect science and local knowledge for projects as diverse as responding to ESA listings, developing marine protected areas, and fisheries monitoring; developing public outreach and participation programs for disposing of contaminated sediments, watershed planning, growth management, environmental education, shoreline habitat and wetlands restoration; and reviewing and developing sustainable tourism projects.

OTHER KEY PERSONNEL

Greg Winter

Mr. Winter has over 15 years of experience in natural resource and environmental fields. Mr. Winter received a Bachelor of Science degree in Environmental Policy from Western Washington University and a Master of Science degree in Natural Resource Economics from Michigan State University. He worked on several Exxon Valdez oil spill Natural Resource Damage Assessment research projects while working as environmental specialist for the State of Alaska, Exxon Valdez Oil Spill Response Center, and later managed the Science and Data Management sections of that office. Mr. Winter also served as member and chair of the Prince William Sound Regional Citizens Advisory Council's Terminal Operations and Environmental Monitoring Committee. Currently, he is the Research Director of Paul Schissler Associates in Bellingham, Washington. Specialties of this firm include natural resource management and natural resource social research including

Prepared April 10, 2000

public participation and natural resource valuation. Mr. Winter's projects are concentrated in quantitative and qualitative social research in support of public policy, environmental planning and rural community development.

Sandra Davis

Ms. Davis is a principal of the ECO Resource Group with more than 20 years of experience related to natural resource, organization development and public outreach projects. Her expertise ranges from program development, facilitation and conflict resolution to planning, environmental analysis and design. Having developed and managed innovative programs for both private and public sector organizations, her work has focused on forwarding discussions and developing strategies to resolve complex environmental issues facing communities, governments, non-profit organizations and businesses. Her ability to be an effective bridge communicator has taken her into many forums requiring the bringing together of diverse constituencies towards a common goal. Ms. Davis has a Bachelor of Science Degree from the University of Pennsylvania in Environmental Science and a Masters of Science from Western Washington University in Regional Planning. She is a founding member and director of the Community Research Institute at Seattle Central Community College which houses three community based programs: research, community mediation and organization effectiveness, and a member of the Executive Board of the Planning Association of Washington, in addition to the association's liaison to the American Planning Association.

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

	Authorized	Proposed					
Budget Category:	FY 2000	FY 2001					
Porconnol		\$CD 4					
Travol		\$08.4 ¢15.0					
Contractual							
Commodition		<u>ቅን./</u> ቁሳ ፖ					
Equipment		<u>ቅሀ.7</u>					
Equipment		\$0.0					
Subtotal	\$0.0	\$88.7			Estimated		
					FY 2002		
Project Total	\$0.0	\$88.7			\$105.0		
· · · · · · · · · · · · · · · · · · ·							
Full-time Equivalents (FTE)	3.3					
	r		Dollar amounts are sh	own in thousands of	dollars.		
Other Resources		\$5.6		l			
Comments:							
funds to support possible Scientific Advisory Panel (\$20k). Other resources for FY 2002 may include funds to support local efforts from local entities or other citizen monitoring grants that will defray training and participation costs. For example, Prince William Regional Sound Citizens Advisory Council has expressed interest in such pilot projects, without actual committment. Other resources represent a cash contribution of \$5.6k to pay for support of the Valdez workshop by the Prince William Sound Regional Citizens Advisory Council. PWSRCAC is also pledging an in-kind contribution of \$3.6k to defray other costs of the workshop (that are included in personnel time and supplies). We hope to be able to identify sponsors to be able to defray costs of other workshops in the same manner from local contributions or grants to support citizen monitoring or TEK efforts, that could result in total in-cash and in-kind contributions in FY 2001 of approximately \$28k. Per diem billed at \$140/day. Spreadsheet only allows \$100 or \$200 (.1 or .2), so filled in at .2 to assure adequate cost coverage.							
	Project Num	ber: 0155	f-BAA				FORM 4A
FY01 Project Title: DEVELOPMENT OF COMMUNITY-BASED MONITORING Nor PROGRAMS FOR EVOS RESTORATION AND GEM SU Name: ECO Resource Group			Non-Trustee SUMMARY				
Prepared: 04/14/00							

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

Personne	el Costs:		:	Months	Monthly		Proposed
Nam	ne	Position Description		Budgeted	Costs	Overtime	FY 2001
Davi	id Sale	Principal Investigator		12.0	2.1		25.2
Greg	g Winter	Survey Design and implementation		4.0	4.8		19.2
Sand	dra Davis	Co-investigator and Facilitator		12.0	1.6	ĺ	· 19.2
Debl	bie Buxton	Administrative support		12.0	0.4		4.8
							0.0
							0.0
							0.0
							0.0
							0.0
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							0.0
	······································						0.0
		Subtotal	· · · ·	40.0	8.9	0.0	¢c0.4
				i	Pe	ersonner Total	
Travel Co	OSIS:		Ticket	Round	Total	Daily	Proposed
Desc	cription		Price	I rips	Days	Per Diem	FY 2001
Davi	id Sale travel to Anchora	age (meetings, EVOS Conference, workshop)	0.5	4	/	0.2	3.4
Davi	David Sale travel to Valdez (workshop)				2	0.2	1.2
Groat Winter travel to Anchorage (montings, EV/OS Conf.)			0.6	1	2	0.2	1.2 2 7
Greg winter travel to Anchorage (meetings, EVOS Cont.)			0.5	3	7	0.2	2.7
Sand	Sandra Davis travel to Anchorage (meetings, EVOS Cont., Workshop)			1	, 2	0.2	1.2
San	dra Davis travel to Kodi	ak (workshop)	0.0	1	2	0.2	1.2
Dave	e Sale travel to other co	nference	1.0	1	3	0.2	1.6
			1.0		0	01	0.0
							0.0
							0.0
							0.0
						Travel Total	\$15.9
		· · · · · · · · · · · · · · · · · · ·					
		Project Number					FORM 4B
EV					Personnel		
				VITORING	'	& Traval	
		PROGRAMS FOR EVOS RESTORA	TION AND G	аЕМ			
L	Name: ECO Resource Group						DETAIL
Prepared	l: 04/14/00		•				

2001 EXXON VALDEZ TRUS October 1, 2000 - September 30, 2001

Contractual Costs:		Proposed
Description		FY 2001
Room rental and support for v	workshops	3.0
Communications (phone cost	s for survey)	0.7
		¢0.7
		11 \$3.7 Dropood
Commodifies Costs:		
		PT 2001
various supplies for surveys,	workshops and reports	0.7
	Commodities Tota	I \$0.7
	Drojost Number	FORM 4B
		ontractual &
FY01	Project Title: DEVELOPMENT OF COMMUNITY-BASED MONITORING	ontractual d
	PROGRAMS FOR EVOS RESTORATION AND GEM	DETAIL
	Name: ECO Resource Group	DETAIL
Prepared: 04/14/00		
1000100.07/17/00		

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

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New Equipment P	Purchases:		Number	Unit	Proposed
Description			of Units	Price	FY 2001
					0.0
					0.0
					0.0
					0.0
					0.0
		•			0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
Those purchases a	associated with r	eplacement equipment should be indicated by placement of an R.	New Eq	uipment Total	\$0.0
Existing Equipmen	t Usage:			Number	
Description				of Units	
L				I	
	1				
		Project Number:			FORM 4B
EV01				E	Equipment
					DETAIL
Duan ava di	1		· · · · ·		
repared:				-	

 $(A_{1}) = (A_{1})^{-1} (A_{2})^{-1} (A_{2}$

4 of 4



Regional Citizens' Advisory Council / "Citizen> promoting environmentally safe operation of the Alyeska terminal and associated tankers."

In Anchorage: 3709 Spenard Road / Anchorage, Alaska 99503 / (907) 277-7222 / FAX (907) 277-4523
In Valdez: 154 Fairbanks Dr. / P.O. Box 3089 / Valdez, Alaska 99686 / (907) 835-5957 / FAX (907) 835-5926

April 14, 2000

MEMBERS

Alaska State Chamber of Commerce

Alaska Wilderness Recreation & Tourism Association

> Glugach Alaska Garporutión

Gity of Cordava

City of Homer

City of Kochak

City of Seldovia

City of Seward

City of Vaidez

City of Whittier

Community of Chenega Bay

Community of Tatitics

Cordova District Fathermen United

> Kena: Peninsula Borougii

Kochak Island Borough

Kodiak Village Mayors Association

> Oit Spilt Region Environmental Continion

Prince William Sound Aquaculture Corporation Sandra Schubert Exxon Valdez Oil Spill Trustee Council Anchorage Restoration Office 645 "G" St., Suite 401 Anchorage, AK 99501

Dear Ms. Schubert:

We would like to express our support for a proposal titled "Development of Community-Based Monitoring Programs for EVOS Restoration and GEM," submitted to you by ECO Resource Group, LLP, for funding in the fiscal year beginning Oct. 1, 2000. We believe the program described in the proposal will be an important step in addressing the unfulfilled need for communitybased environmental monitoring in Port Valdez.

As you know, the port is a hub of industrial and commercial activity, containing the Valdez Marine Terminal (an oil loading facility), a petroleum refinery, a busy small boat harbor, a community of 4,400 people, and considerable traffic in oil tankers, cruise ships, and other vessels. At the same time, the port ecosystem supports important fisheries (subsistence, commercial and recreational), outstanding waterfowl habitat, and diverse biotic communities. The EVOS Trustee Council has shown its regard for this ecosystem by acquiring important habitat acreage on the Valdez Duck Flats.

Despite these values, community-based environmental monitoring in Port Valdez has been rare or non-existent to date. The proposal from ECO Resource Group, LLP, meshes well with the aspirations of this organization to initiate community-based monitoring within a framework of watershed management.

In the event the above proposal is accepted, our in-kind contribution would consist of approximately \$3,600 in assisting with a public workshop in Valdez. The purpose of the workshop would be to facilitate a dialogue among citizens, local decision-makers and scientists about the best way to develop community-based monitoring here. While the principals with ECO Resource Group, LLP, would conduct the workshop, we would provide the meeting space and audio-visual equipment, engage in preparation and public outreach prior to the workshop, make copies of meeting materials, and prepare notes of the meeting proceedings for distribution.

Page 1 of 2

To Sandra Schubert, EVOS T.C.

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4/14/00

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Our cash contribution would consist of approximately \$5,600 to defray the costs of travel, per diem and labor for the principals to visit Valdez and conduct the workshop.

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As workshop participants we also would present information about benthic chemistry and biological monitoring related to treated ballast water effluent from the Valdez Marine Terminal, conducted by UAF scientists, and past scientific studies sponsored by this organization in Port Valdez.

We look forward to participating in this program and hope the EVOS Trustee Council will give serious consideration to this proposal.

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- Maingun Allah mason - Miana anus Alailas

Thank you for your attention.

يتأوون فالكريب فمسهليت بمتعاقبه أترك Sincerely, Lynda Hyce, Deputy Director

CC: ECO Resource Group, LLP introf ampoint

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To Sandra Schubert, EVOS T.C.

Page 2 of 2

CAN STRESS HORMONES BE USED AS AN INDICATION OF FOOD AVAILABILITY AND REPRODUCTIVE PERFORMANCE? AN EXPERIMENTAL APPROACH.

Project Number:	01555	
Restoration Category:	Research (new)	
Proposed By:	DOI-USGS; University of Antw	werp, Belgium
Lead Trustee Agency:	DOI-USGS	
Cooperating Agencies:	N/A	
Alaska SeaLife Center:	No	RECEIVED
Duration:	1 st year, 1-year project	APR 1 4 2000
Cost FY 01:	\$18,900	EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL
Geographic Area:	Middleton Island	
Injured Resource:	Black-legged Kittiwake, Pelagi	c Cormorant

ABSTRACT

This study will complement and enhance an existing Exxon Valdez Oil Spill Trustee Council (EVOSTC) project (99479) that investigates how stress hormone levels (i.e., corticosterone) in adult seabirds relate to local food conditions and indicate the future reproductive health of a colony. This study will (1) test for differences in corticosterone levels between supplementally fed and unfed black-legged kittiwakes that are nesting at one colony, thereby removing any inherent environmental differences present when birds from two colonies are compared, (2) measure changes in corticosterone levels in adults throughout the breeding season including birds recently arriving from the wintering grounds, (3) explore the effects of adult gender on corticosterone levels, and (4) evaluate how corticosterone levels relate to the an individual's reproductive success and survival, as well as overall productivity of the colony. Results from a pilot study conducted in 1999 indicate the relationships among stress hormones, food availability, and reproduction may be more complex than previously suggested. A second year of data collection planned for the summer of 2000 will help elucidate these relationships. We are asking for minimal financial support to analyze plasma samples collected in 2000, and salary to complete and publish manuscripts. This study will assist other efforts to evaluate the efficacy of using corticosterone levels to assess the effects of fluctuations in food supply on the reproductive performance and survival of seabirds.

Project 01555
INTRODUCTION

In the Gulf of Alaska, some seabird and marine mammal species have experienced reduced productivity, increased mortality and resultant population declines during the past few decades (Hatch 1987, Merrick et al. 1987, Pitcher 1990, Hatch et al. 1993a, Byrd et al. 1999). Black-legged kittiwakes (Rissa tridactyla), for example, have failed to reproduce at many colonies in Alaska (Murphy et al. 1991, Hatch et al. 1993a, Irons 1996). Productivity in Alaska kittiwake colonies has declined from an average of about 0.6 young per nest in the 1960s and 1970s to less than 0.2 young per nest in the 1980s (Hatch et al. 1993a). Circumstantial evidence points to a deficient food supply as the cause of poor productivity in Alaskan kittiwakes and other seabirds (Hatch 1987, Hatch and Hatch 1990, Hatch et al. 1993a, Roberts and Hatch 1993, Piatt and Anderson 1996, Anderson and Piatt 1999). Depressed food supplies or other natural perturbations (called 'modifying factors') are thought to increase circulating levels of stress hormones (e.g., corticosteroids) in free-living animals (Wingfield et al. 1997), and cause these individuals to redirect their behavior away from reproduction towards survival (Silverin 1998). This stress response is thought to be an emergency reaction that promotes survival (e.g., through increased foraging) while temporarily suspending other unessential activities (Sapolsky 1987, Wingfield 1994).

The level of stress in an individual can be determined through measurements of circulating plasma levels of corticosterone in the peripheral system of most vertebrates (Wingfield et al. 1997). Recently, researchers have suggested using this "field endocrinology" approach to monitor the health of seabird populations (Wingfield et al. 1997; A. Kitaysky and J. Piatt, unpubl. proposal to the EVOSTC 1999). Indeed, these investigators suggest stress hormone levels can be used to assess the current health of a population (i.e., likelihood of successful reproduction) and to predict the vulnerability of the population to other deleterious events. They cite additional advantages to measuring stress hormones, including ease of obtaining samples, subject animals not being harmed, and the ability to collect incisive information in a few days. Traditional field methods, in contrast, may require weeks to collect alternative information, and enable biologists to recognize problems only after they have had an effect on a large number of individuals.

Despite the appeal of using corticosterone levels as predictors of individual or colony health, stress hormones have the disadvantage of being responsive to a variety of physical, seasonal and environmental factors. For example the adrenocortical response, which produces stress hormones, can be affected by an individual's body weight, body condition, and gender (Astheimer et al. 1995, Fowler et al. 1994, Holberton et al. 1996, Wingfield et al. 1994, 1997, 1999; Duffy and Belthoff 1997; Newman and Zinkl 2000). Stress hormone levels also may change within a breeding season (Wingfield et al. 1997) or within a breeding stage if food availability changes or the level of parental care changes. In species like black-legged kittiwakes, which provide biparental care, males and females within a pair might exhibit different corticosterone levels if they contribute unequally to parental care (K. O'Reilly, pers. comm.). Additional environmental factors that may affect corticosterone levels include pollution, habitat conditions (Marra et al. 1998), intraspecific competition for nest sites or mates, and predation. Indeed, any

stimulus that is perceived as imposing a threat, either real or anticipated, may cause a physiological response that results in increased stress hormone levels (Newman and Zinkl 2000). Consequently, care must be taken when cause and effect relationships that include corticosterone levels and other biological factors are investigated. Such care should include experimental manipulations that alter only the factor thought to increase stress hormone levels (e.g., food) while standardizing as many other factors as possible (e.g., habitat, predation, parental care needs).

To date, the relationship between food supply and corticosterone levels have been poorly investigated. A study on black-legged kittiwakes and common murres (*Uria aalge*) found that adults sampled at a food-rich colony had lower baseline levels of corticosterone compared to adults sampled at a food-poor colony (Kitaysky et al. 1999). Because stress hormone levels in these birds may have been caused by factors other than food (e.g., differences in predation levels or habitat characteristics between colonies or in the gender of sampled birds), these results provide only qualitative support for this relationship. A more controlled laboratory study found that black-legged kittiwake chicks, raised without parents, had elevated baseline levels of corticosterone when their diets were qualitatively and quantitatively restricted compared to chicks fed ad libitum (Kitaysky et al. 1999). No study to date has provided food to free-ranging adult seabirds at natural breeding colonies and tested for changes in corticosterone levels.

The relationship between stress hormone levels and reproduction has also been poorly investigated. Silverin (1986) found that male and female pied flycatchers (*Ficedula hypoleuca*) experimentally implanted with corticosterone decreased the frequency with which they fed their young and consequently had lower reproductive success. Similarly, black-legged kittiwake adults implanted with corticosterone brooded their young less and had lower inter-year return rates, although food provisioning to chicks by parents and chick fledging success was not lowered (Kitaysky et al. MS). Such changes in parental care suggest a negative relationship between elevated corticosterone levels and reproductive success. Unfortunately, sample sizes in these studies were low, and additional studies are needed to verify the reproductive consequences of elevated corticosterone levels.

A long-term decline in black-legged kittiwake numbers on Middleton Island (northcentral Gulf of Alaska) coupled with the development of a unique study colony on the island presents an exceptional opportunity to explore more fully the relationships between stress hormone levels, food availability, and reproduction. Formerly one of the largest aggregations of kittiwakes anywhere in the world, black-legged kittiwakes at Middleton have declined from 166,000 in 1981 to fewer than 16,000 today, an 85% decrease (Fig. 1). Mean productivity on Middleton from 1983 to 1999 has been 0.06 chicks per pair (S. Hatch and V. Gill, unpubl. data), with successful nests restricted to man-made structures such as an old radar tower on an abandoned Air Force base and portions of a World War II shipwreck. Nesting attempts on natural cliffs surrounding the island have decreased, and virtually no young have fledged from such sites since 1988 (S. Hatch and V. Gill, unpubl. data).

Project 01____

Between 1995 and 1999, biologists have enhanced the radar tower to promote nesting by kittiwakes, while simultaneously allowing experimentation and observation of birds. To determine if food was limiting the productivity of kittiwakes on Middleton, a supplemental feeding study was initiated on the tower in 1996. Over the next four years, reproductive data, collected on birds limited to natural food conditions and birds supplementally fed, confirmed that food was limiting the ability of birds to reproduce (see details below). In 1998, an effort was begun to understand the physiological aspects of food availability and reproduction. Adult and chick testosterone levels were measured and related to food availability, sibling aggression, and chick survival (Lanctot et al. in prep[a]). Corticosterone levels of supplementally fed and unfed adults were sampled in 1999 for the first time, providing the initial data on which we base this proposal. We propose conducting a second year of data collection in 2000.

Our goal is to investigate whether baseline levels of corticosterone in free-living blacklegged kittiwakes reflect stress associated with a deficient food supply, and to determine how corticosterone levels correlate with parental care, reproductive effort and success, and survival of individual black-legged kittiwakes. These relationships will be explored at the radar tower colony on Middleton Island, where food can be experimentally provided, adults can be observed and captured with ease, and corticosterone levels, reproductive performance, and survival of nesting individuals can be monitored accurately with minimal disturbance.

NEED FOR THE PROJECT

A. Statement of Problem

Biologists have actively monitored the status of seabird colonies in the North Pacific for more than 30 years (Hatch et al. 1994). A principal goal of these studies has been to understand the factors that regulate seabird populations and their ability to recover from natural and man-induced environmental perturbations (USFWS 1992). Most studies station personnel at seabird colonies where they monitor seabird breeding effort and reproductive success, and relate these parameters to local environmental conditions (Cairns 1987, Monaghan 1996). Given the expense and personnel time required to conduct such studies, researchers have searched for alternative ways to monitor seabird colonies that are inexpensive, practical, and applicable over a large geographic area. One such alternative is the measurement of stress hormones that may reflect local food conditions and the likelihood of successful breeding. In 1999, the EVOSTC funded project 99479 to investigate how corticosterone levels in adult seabirds relate to local food conditions and whether corticosterone levels can be used as an indicator of colony health. Preliminary comparisons between a food-rich (Gull Island) and a food-deprived (Chisik Island) seabird colony suggest that corticosterone levels in breeding adults reflect local food availability. Although these results seem promising, corticosterone measurements must be interpreted carefully. Stress hormones have the disadvantage of being responsive to a variety of physical, seasonal and environmental factors. This study will aid in the interpretation of project 99479 in four important ways. First, this study

will test for differences in corticosterone levels between food limited (natural foraging conditions) and food unlimited (supplementally fed) black-legged kittiwakes nesting at one colony. In this way, any confounding environmental differences, such as predation levels and habitat characteristics, present when comparing birds from two colonies will be removed. Second, this study will measure changes in stress hormones in adults throughout the breeding season, including birds that have recently arrived from the wintering grounds. Relatively little is known about how food conditions on the wintering grounds influences a bird's ability to reproduce in the subsequent summer, and whether local food conditions on the breeding grounds can alter this ability. Third, this study will explore the effects of adult gender on baseline levels of corticosterone. Because male and female kittiwakes may contribute unequally to the reproductive effort (e.g., only males feed females during courtship), we predict stress hormone levels of males to be more strongly affected by food availability, especially before the breeding season. Fourth, the unique colony of kittiwakes nesting on the abandoned radar tower on Middleton Island will allow the relationships between corticosterone, food availability and colony reproductive success to be studied accurately and with little disturbance. Nest site characteristics are virtually identical throughout the tower, there is no predation of eggs or chicks, and adults can be sampled for corticosterone within 2 minutes of initiating a capture. Taken together, these factors make the tower colony at Middleton Island an ideal setting to explore the physiological aspects between food availability, reproduction and survival.

B. Rationale/Link to Restoration

Efficient and reliable methods are needed to determine how seabird populations respond to natural and human-induced environmental perturbations. Indeed, little is known about how seabirds respond to such stressful conditions and whether such conditions influence reproduction and survival of birds. Recently, researchers have suggested using physiological parameters indicative of an individual bird's stress level as a measure of a bird's potential to reproduce and survive. Traditional methods for assessing seabirds do not evaluate the direct relationships between environmental conditions, adult physiology and reproduction; they simply monitor whether individuals breed and survive. To evaluate the relationships between environmental conditions, adult physiology, and reproduction requires a unique research facility where environmental conditions can be experimentally modified, adult physiology can be measured, and the resulting reproduction can be monitored. Such a setting occurs at Middleton Island where a wild population of black-legged kittiwakes nests on the sides of an abandoned radar tower. This study will complement and enhance project 99479 by allowing a thorough assessment of the use of a stress hormones as a tool for assessing the effects of fluctuations in food supply on the survival and reproductive performance of seabirds.

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C. Summary of Major Hypothesis

Ho: There are no significant differences in baseline levels of circulating corticosterone between black-legged kittiwakes that are supplementally fed and those relying solely on natural food conditions, after controlling for the effects of gender and breeding stage.

Ho: There is no significant relationship between natural forage fish conditions and baseline levels of circulating corticosterone in unfed black-legged kittiwakes.

Ho: There is no significant difference in parental care, breeding chronology, reproductive success, or over-winter survival between black-legged kittiwakes with elevated and depressed baseline levels of corticosterone, after controlling for the effects of gender, breeding stage, and food availability.

D. Location

The proposed field experiments will be conducted on Middleton Island (north-central Gulf of Alaska). Studies will be conducted at an abandoned radar tower that has been retrofitted to hold 210 nest sites equipped with supplemental feeding tubes and sliding glass windows. Among these sites, we have established two treatment groups to evaluate how stress hormone levels are affected by food provisioning, and to relate these levels to kittiwake reproduction and survival. Approximately 16,000 kittiwakes were counted on Middleton in 1999, of which 1,206 nested on the tower. An additional 100 nest sites are being prepared in April 2000 to support nesting of pelagic cormorants (*Phalacrocorax pelagicus*). See description of pelagic cormorant study below.

COMMUNITY INVOLVEMENT

Each year between four and six undergraduate and graduate students assist us in studying the seabirds on Middleton Island. These students learn not only about black-legged kittiwakes but also conduct studies on tufted puffins, rhinocerous auklets, glaucouswinged gulls and black oystercatchers. To date, two post-doctoral studies, three Master's theses, and one honor's thesis have been conducted on the seabirds at Middleton Island. These and other studies have involved collaboration among researchers from the University of Alaska Anchorage, Oregon State University, University of Antwerp (Belgium), Konrad Lorenz Institute for Comparative Ethology (Vienna), and the National Oceanic and Atmospheric Administration. In addition, numerous private groups visit the island each year to observe the large diversity of bird life that occurs on the island. For example, the Alaska state chapter of the Audubon Society is planning a field trip to Middleton in May. We typically invite these people to visit the tower and we explain our field research to them. The seabirds of Middleton Island were recently filmed by All Bird TV yielding a documentary entitled "Mysterious Middleton Island" that aired on the Animal Planet channel last fall.

The principal investigator will be available to present highlights of the research program to interested parties; and will provide information, photographs and articles for the Trustee Council newsletter if requested.

PROJECT DESIGN

A. Background and Results of Pilot Studies

Establishment of Tower Colony

Groundwork for this study has been laid by capitalizing on the fact that kittiwakes nest on an artificial structure on Middleton Island - an abandoned radar tower - which, with various enhancements has resulted in a colony that is uniquely accessible for observation and experimentation (Fig. 2a). As the exterior corrugated siding of this building was removed by high winds over the years, a limited number of horizontal ledges (2x4 cross members in the wall frame) became available to kittiwakes as nest sites. The first pair of kittiwakes nesting on the tower was noted in 1986, and numbers have steadily increased to the present level of 1200 pairs. In 1994, the tower walls were outfitted with 216 wooden ledges and the deteriorating inner wallboard was replaced with plywood paneling. Between 1995 and 1998, one-way sliding glass windows and feeding holes were installed behind 210 of these ledges (Fig. 2b-d). The feeding holes are designed so that plywood plugs can be inserted when pairs are not being fed. The one-way glass is virtually 100% effective, allowing feeding and observations of the birds to be conducted unobtrusively from inside the tower while the birds nest on ledges surrounding the tower. In 1996, a permanent AC power source was installed at the tower, enabling us to store large amounts of frozen fish on site in three chest freezers.

Supplemental Food Provisioning

Commercially available bait herring and capelin have been used to supplementally feed kittiwakes on the tower between 1996 and 1999. A recent analysis of kittiwake prey obtained in Prince William Sound indicated herring and capelin were at the high end of prey quality (Anthony and Roby 1997). Roughly, 4000 pounds of supplemental food were provided to kittiwake nest sites each year of our studies. Thiamine (vitamin B1) will be added to the capelin diet as a food supplement because this nutrient is known to be deficient in frozen fish (Altman et al. 1997, Crissey 1998). Members of each pair are fed individual items of food ad libitum each day in the morning and evening (and at mid-day during chick-rearing) by observers positioned inside of the building.

Capture and Measurement of Birds

In addition to the sliding one-way glass windows, narrow grooves have been cut in the plywood panels beneath each window at the height of the bird's tibio-tarsus (Fig. 2d). This groove allows researchers to slip coat hangers, whose ends are fashioned into small hooks, underneath adults and hook them by their feet. This method works so well that adults can be captured repeatedly within and between field seasons. P. Jodice and D.

Roby (unpubl. data) used this technique at the tower to capture 73 individuals twice during a 24-hr period for a doubly-labeled water study in 1998. The technique has the added advantage of catching birds quickly with no pre-capture disturbance that could artificially inflate baseline levels of corticosterone. Indeed, an initial analysis investigating how time from capture to blood sampling effects baseline corticosterone levels indicated a significant increase in corticosterone levels within as little as 2 min (Fig. 3). Previous researchers have noted a ten-fold or greater increase in plasma corticosterone levels measured within a few minutes of capturing and handling of a bird (Beuving and Vonder 1978, Harvey et al. 1980). Capturing of adult kittiwakes at natural cliffs with noosepoles in under 2 min is virtually impossible given the approach time needed to reach birds. Adults have been captured since 1995 at the tower, and virtually all adults nesting on the ledges are individually marked with a unique combination of color bands and USFWS rings. Unique markings allow us to follow individual birds throughout and across breeding seasons so as to monitor their breeding chronology, reproductive success and over-winter survival. The sex of most adults on the tower has been determined through a combination of morphological measurements, behavior, and genetics (Jodice et al., in press). Adult measurements also have proven useful for generating adult body condition indices which can be related to baseline levels of corticosterone.

Effects of Food Provisioning on Kittiwake Breeding Chronology and Reproduction

The easy viewing of kittiwake nest sites through the windows also allows nests to be monitored in detail. We can record easily the date when (1) adults begin to construct nests, (2) eggs are laid, lost or hatched, and (3) chicks are lost or fledged. The eggs and chicks residing in each nest can also be easily measured by simply opening the window behind each nest. For example, eggs can be individually measured for size, and then marked so that the emerging chick can be identified. This level of detail allows us to determine how food supplementation and egg order is related to egg size and chick sex (Lanctot et al. In prep [b]). Similarly, chicks can be measured at specific ages to determine growth, and blood samples can be taken periodically to determine changes in hormone concentrations. The one-way glass windows also allows the behavior of adults and their young to be observed easily. Depending on the parameter in question, up to 10 nests can be monitored simultaneously. During the past four years, we have measured adult attendance at nests, male and female feeding rates of young, chick begging rates (by first and second hatched chicks), and sibling aggression rates.

Results to date indicate unequivocally that supplementally feeding kittiwakes alters a variety of breeding parameters relative to kittiwakes subjected to natural food supplies (Gill 1999; Gill and Hatch, in prep.; Gill et al., in prep). During pre-egg laying, fed females begged food from their mates at significantly greater rates and attended their nests at lower rates than unfed females. During egg-laying and incubation, fed females initiated nests 3-4 days earlier and laid significantly larger second eggs than unfed females. During chick-rearing, fed pairs hatched their young earlier, had faster growing young, and had young that attained significantly heavier peak weights than unfed pairs. Further, parents at fed sites had significantly higher nest attendance during the second

half of brood-rearing than parents at unfed sites. On average, unfed chicks survived at significantly lower rates than fed chicks, primarily because of the extremely low survival rate of second hatched chicks in the unfed nests. These results suggest a strong relationship between food availability and kittiwake breeding success. If stress hormones in adults are related to food availability, then we would predict kittiwake adults that are supplementally fed to have lower baseline levels of corticosterone relative to unfed kittiwake pairs.

Pilot Study of Corticosterone Levels at the Middleton Kittiwake Colony

In 1999, we initiated a pilot study to investigate how baseline levels of corticosterone in adult kittiwakes relate to food supplementation and reproduction. We collected blood samples from 10 males and 10 females that were and were not supplementally fed during three reproductive stages (prior to egg-laying, incubation and brood-rearing). In addition, blood was sampled from 20 birds one day after their arrival at Middleton in early Aprilabout 1 ½ to 2 months prior to egg laying. Supplemental feeding began on 15 May in 1999, and pairs received food for about 26 days prior to the first eggs being laid. An analysis of corticosterone levels indicated kittiwakes that were supplementally fed had similar base-line levels of corticosterone as kittiwakes limited to natural food conditions during the pre-egg laying and incubation stages of reproduction (Fig. 4). This was not true during the chick-rearing stage, however, when supplementally fed kittiwakes had significantly lower levels of corticosterone (Fig. 4). Because we could not control the amount of food unfed kittiwakes obtained through natural foraging, these results appeared to indicate that unfed kittiwakes were able to obtain adequate amounts of natural food during pre-egg laying and incubation stages but not during brood-rearing (under the assumption that food availability is related to corticosterone levels). Our independent measures of food availability (quantity and type of food brought to nest sites by kittiwakes, rhinocerous auklets and tufted puffins) and reproductive success, however, did not support this supposition. Indeed, 1999 was a year with lower than normal food availability early in the season followed by an increase in food availability later in the season (S. Hatch and V. Gill, unpubl. data). Kittiwakes limited to natural food conditions also had poorer reproductive success than fed kittiwakes during pre-egg laying and incubation for most reproductive parameters (Table 1). During chick-rearing, there was no difference in fledging success (a key seabird monitoring variable) between fed and unfed kittiwakes despite significant differences in corticosterone levels (Table 1).

Taken together, these results suggest the relationships among adult base-line levels of corticosterone, local food conditions, and the reproductive success of a colony may be more complicated than previously thought. One factor that has been neglected is how the gender of a bird influences those parameters, though previous studies have identified gender as an important predictor of corticosterone levels (Duffy and Belthoff 1997, Wingfield et al. 1999). Further, an energetics study on the tower colony indicated male kittiwakes expend more energy in raising offspring than do females (P. Jodice and D. Roby, unpubl. data), suggesting females may be less stressed by deficient food supplies. Because most of the kittiwakes breeding on the tower had been previously marked and sexed (Jodice et al., in press), we investigated the effects of sex and food supplementation

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on corticosterone levels. Contrary to our expectations, we found no differences between males and females during pre-egg laying, incubation and chick-rearing stages (data not shown). There was, however, a tendency for females sampled during the pre-nesting stage to have higher levels of corticosterone if they did not subsequently breed at the tower colony (Fig. 5). No such pattern was found in males. Unfortunately, small sample sizes hamper a meaningful biological interpretation of the data from 1999.

We plan to explore these relationships further in 2000 by repeating this experimental design and supplementing our sample sizes during the pre-nesting stage.

B. Objectives

- 1. Determine whether male and female kittiwakes exhibit different baseline levels of corticosterone throughout the breeding season (i.e., pre-nesting, pre-egg laying, incubation, and brood-rearing) when they are and are not supplementally fed.
- 2. Determine whether baseline levels of corticosterone in unfed individual kittiwakes reflect local natural food conditions.
- 3. Determine whether parents with elevated levels of corticosterone provide lower levels of parental care (i.e., attendance during brood-rearing), have delayed breeding chronologies (i.e., laying, hatching and fledging dates), have lower reproductive success (i.e., egg laying success, hatching success, fledging success), and have lower over-winter survival.

C. Methods

The proposed research investigates wild birds nesting on the tower at Middleton Island. Field experiments will be conducted on birds marked in previous years to investigate the endocrinological characteristics of kittiwakes that have ad libitum food and those limited to natural forage conditions. Although we will focus on black-legged kittiwakes in this study, we also plan to begin testing methods for sampling pelagic cormorants that also breed on ledges of the tower (see below).

Corticosterone Sampling

To determine baseline levels of corticosterone, adult kittiwakes will be captured at the tower using hooked hangers (see above). Approximately 100-200 μ L of blood will be drawn from the basilic vein of the wing of each adult within 2 minutes after capture is initiated (i.e., the time between inserting the hooked hanger into the window and when the blood is successfully extracted). After sampling, birds will be released at the tower and their nest will be monitored to determine when they return. Field sampling in 1998 and 1999 indicated adult kittiwakes typically returned to their nests within 1 to 10 minutes and successfully incubated eggs and raised broods afterwards (R. Lanctot, V. Gill, and S. Hatch, pers. obs.). Blood samples will be centrifuged within 1 hour of collection and the separated plasma will be stored below freezing until it can be removed from the field and sent to the Laboratory of Immuno-Neuroendocrinology at the University of Leuven in Belgium. Laboratory technicians will determine corticosterone

levels blindly for each sample using radioimmuno-assay techniques (as described in Wingfield et al. 1992). This is the same technique being used by A. Kitaysky and J. Piatt in their corticosterone research on black-legged kittiwakes. Each sample will be measured in duplicate and intra- and inter-assay coefficients of variation will be calculated.

We anticipate sampling 40 birds (10 males and 10 females each from fed and unfed pairs) during each breeding stage (i.e., pre-egg laying, incubation and brood-rearing) in 2000. A larger sample of pre-nesting birds will be sampled within a few days after being first observed at the tower on Middleton. Blood will be collected from each bird only once during the breeding season to ensure samples from each stage are independent. Hormone levels within the pre-nesting birds may reflect their physiological response to prior winter conditions because the birds may not have been present in the local area sufficiently long to reflect local food conditions. Pre-egg laying birds will be sampled within 10 days of their first egg being laid. Ten days is the time it takes black-legged kittiwakes to form eggs (Neuman et al. 1998). Incubating birds will be sampled 14-16 days after their first egg is laid, and brood-rearing birds will be sampled 19-21 days after their first chick has hatched.

Natural Food Supply

The composition and seasonal changes in the natural food supply of kittiwakes will be determined three ways. First, we will collect regurgitated food samples from adults and chicks throughout the season. Adults and chicks instinctively regurgitate when captured. Emphasis will be placed on kittiwake pairs that are not being fed. Prey composition and biomass of collected regurgitations will be determined by laboratory analysis in the fall of 2000 through a contract with Falco Inc. (Alan Springer, pers. comm.). Second, we will conduct beach seining in the waters surrounding Middleton to monitor seabird prey. Third, we will collect food deliveries of adult tufted puffins and rhinocerous auklets to their young during brood-rearing. Although these species may use different forage fish as food, our long-term database (back to 1978) on food deliveries by these species allows the food availability within each year to be evaluated. These three sources of information will provide a crude but quantitative view of the natural food supply available to kittiwakes nesting at the tower. Based on the composition and quantity of forage fish, we will determine whether food (especially high caloric food) is lacking during each stage of reproduction. Here we would predict elevated corticosterone levels to be present in unfed kittiwakes during reproductive stages when the quantity or quality of food is limited. In contrast, kittiwakes that are supplementally fed should have consistently low baseline levels of corticosterone.

Corticosterone, Reproductive Success and Survival

To determine whether birds with elevated levels of corticosterone exhibit different life history tactics, we will contrast birds with elevated and depressed baseline levels of corticosterones with the level of parental care, breeding chronology, reproductive effort and success, and over-winter survival of individuals within the fed and unfed treatment

groups. Food supply has been shown to affect these parameters in previous studies (Gill 1999; V. Gill and S. Hatch, unpubl. data).

Parental Care

As an indication of parental care, we will measure adult attendance at nests during broodrearing. Previous research on Middleton indicated that adult attendance was highly sensitive to food availability and can have a strong effect on chick survival (in contrast to feeding rate which did not differ with food availability; see Gill 1999). Adult attendance will be quantified by recording the percentage of time each parent (male or female) is observed at its nest during incubation and chick-rearing.

Breeding Chronology

We will record two parameters that are indicative of breeding chronology. These will include laying date (date at which first egg of nest is laid) and hatching date (date at which first egg of nest hatches). These variables are extremely easy to record at the tower given our ability to approach nests without being seen.

Reproductive Effort

As a measure of reproductive effort, we will record the clutch size, egg size (egg length and width converted into egg volumes using Coulson's [1963] formulas), and egg weight (A and B eggs alone and together).

Reproductive Success

Measures of reproductive success will include egg laying success (whether pairs successfully laid at least one egg or not), hatching success (whether a pair successfully hatched at least one egg or not), fledging success (whether a pair successfully fledged at least one young or not). We will also determine the productivity (number of chicks fledged/nest) of fed and unfed treatment groups.

Over-winter Survival

Over-winter survival is relatively easy to determine in black-legged kittiwakes because adults exhibit strong nest site and mate fidelity across years (Coulson and Thomas 1985, Hatch et al. 1993b). For our purposes, over-winter survival will be the percentage of marked adults known to breed on the tower in one year that return to Middleton in a subsequent year. We conduct searches at all the Air Force buildings and natural cliffs to locate marked birds from previous years.

Statistical Analyses

For most analyzes, corticosterone levels will be compared and contrasted across food treatment groups (i.e., fed and unfed birds). We will attempt to reject the null hypothesis of no difference in baseline corticosterone levels (over all nest sites within a treatment group) between kittiwakes that are supplementally fed and those that are not. Similarly, we will test for differences in reproduction and survival between birds with high and low levels of corticosterone. Data will be normalized, if necessary and possible, and differences will be tested with parametric methods such as a one-way and multi-variate analysis of variance. Where data cannot be normalized, we will rank-transform data and/or use non-parametric methods such as the Kruskal-Wallis ANOVA to test for differences in results.

Pelagic Cormorant Pilot Study

Measuring baseline levels of corticosterone in pelagic cormorants has the potential to offer new insights into the physiological relationship between food availability and reproductive success. Cormorants, unlike black-legged kittiwakes, have the ability to dive for their food and may therefore have access to different (and additional) food resources. Several researchers have suggested that diving seabirds are able to buffer decreases in food availability better than surface feeders because they are not restricted to a two-dimensional feeding zone and have more flexible time budgets (i.e., time available to forage; Burger and Piatt 1990, Monaghan 1996). These differences might result in decreased corticosterone levels for these species. The development of a pelagic cormorant colony at the Middleton tower, along with the existing black-legged kittiwake colony, will facilitate an inter-species comparison that can investigate how foraging strategies interacts with food supply and reproductive performance.

In April 2000, we will begin testing protocols for capturing, banding, and sampling blood from pelagic cormorants using newly installed window sites on the tower. Adult pelagic cormorants are less tolerant to handling (R. Lanctot, pers. obs.) and frequently abandon nest sites after being captured. Consequently, we plan on using anesthetics (e.g., isoflurane) during capture to reduce abandonment. This technique has proven to be successful with other intolerant bird species (P. Flint, pers. comm.). If successful, we will sample up to five adults during each breeding stage in 2000. Cormorant chicks, in contrast, can be easily captured and sampled with little disturbance. We plan on measuring base-line levels of corticosterone from 10 nests (1 chick/nest) in 2000.

V. Cooperating Agencies, Contracts, and Other Agency Assistance

Seabird biologists Ms. Verena Gill and Dr. Scott Hatch of the US Geological Survey, with the assistance of five field assistants, will carry out the field component of this study. All field expenses associated with this project are borne by the Biological Resources Division of the US Geological Survey. Support is requested to provide salary to Dr. Richard Lanctot to analyze and write the reports and publications associated with this study. Dr. Marcel Eens of the University of Antwerp in Belgium will provide laboratory space at the Laboratory of Immuno-Neuroendocrinology in Leuven (through a collaboration with the University of Antwerp) and will coordinate the radioimmuno-assay analyses of plasma samples.

Permission to work on the tower and camp on Middleton Island has been received from Midico Corporation - a private consortium of business people who retained title of the land in the mid-1960s (Andy Milner, pers. comm.). The Federal Aviation Administration has also given us permission to land on the island runway and have access to water and electricity from their local facility. We have authorization from the Alaska Biological Science Center, Biological Resources Division of the U.S. Geological Survey and the State of Alaska to capture, band and sample blood from kittiwake adults and young. We have operated under similar permits since 1978 when field research began on the island.

SCHEDULE

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

Field work will be conducted by us during the summer of 2000. Funds are being sought to analyze plasma samples from this summer, and to analyze and write manuscripts describing our results from the 1999 and 2000 field seasons.

October – December:

January 16 – 26: February 11-14: January – April 15: April 15: corticosterone analyses, regurgitated food analysis, conduct preliminary analyses of 1999 data. Attend Annual Restoration Workshop Attend Pacific Seabird Group Meeting Analyze 2000 data and prepare manuscript Submit final report.

B. Project Milestones and Endpoints

A determination of how baseline levels of corticosterone in male and female kittiwakes are related to natural and experimental changes in food availability will require at least two years of field research. The first year of data was collected in 1999 and the second year will be collected this summer. Consequently this project milestone will have been accomplished prior to receiving funds from the EVOSTC. Smaller, but more significant, milestones include analyses of plasma samples for corticosterone due December 2000, and analyses and manuscript preparation due April 15, 2001.

C. Completion Date

The study will be completed by April 15, 2001.

PUBLICATIONS AND REPORTS

A final report, which will be in manuscript format, will be presented to the EVOSTC by April 15, 2001. Presently, we plan on submitting two manuscripts from this study. The

principal manuscript resulting from this study will be submitted to Hormones and Behavior and would be entitled "Effects of food availability on corticosterone levels and breeding success in male and female black-legged kittiwakes: an experimental study". A second paper, entitled "Effect of sampling time on the measurement of circulating levels of corticosterone in black-legged kittiwakes" will be submitted to Auk.

PROFESSIONAL CONFERENCES

We plan on presenting the results of this study at the Annual Restoration Workshop to be held in mid-January in Anchorage, and at the Pacific Seabird Group meeting to be held 11-14 February 2001 at Kauai, Hawaii. For both conferences, Dr. Lanctot, in collaboration with Ms. Gill, Dr. Hatch, and Dr. Eens, will present a talk describing how natural and experimental changes in food availability relate to corticosterone levels and reproductive success in male and female black-legged kittiwakes.

NORMAL AGENCY MANAGEMENT

The US Geological Survey would not normally conduct field endocrinology research. Blood sample collection equipment and laboratory analyses conducted to date have been funded by the Belgium Fund for Scientific Research (via a post-doctoral fellowship to Dr. Lanctot and a project grant to Dr. Marcel Eens). The post-doctoral fellowship ended in February 1999 and there is little money left in the project grant. Accordingly, no money is available to finance the plasma samples from 2000 or to pay Dr. Lanctot to complete the analysis and prepare manuscripts for this study.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This study tests an alternative endocrinology method for assessing forage availability at seabird colonies throughout the state of Alaska. The study complements and improves upon project 99479 that investigates similar concepts using two breeding islands that differ in natural forage availability. This study eliminates potential confounding problems associated with the breeding islands mentioned above, and investigates in more detail how baseline levels of corticosterone vary with food availability and breeding stage, and whether corticosterone levels are predictive of future reproduction and overwinter survival. Overall, this very controlled study will test the efficacy of using corticosterone to measure seabird responses to other environmental disasters.

PROPOSED PRINCIPAL INVESTIGATOR

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PRINCIPAL INVESTIGATORS

Principal Investigator and Project Leader – Dr. Richard Lanctot, Research Wildlife Biologist, Alaska Biological Science Center, Biological Resources Division, U.S. Geological Survey, Anchorage, Alaska. Obtained Ph.D. in Behavioral Ecology from Carleton University in Ottawa, Ontario in 1996. Since 1989, he has studied the breeding biology of seabirds and shorebirds throughout Alaska. His post-doctoral fellowship was on the effects of food supplementation on offspring sex ratio in black-legged kittiwakes, and how chick testosterone levels relate to sibling aggression and juvenile survival. He will be responsible for analyzing data and writing manuscripts.

Dr. Scott Hatch, Seabird Project Leader, Alaska Biological Science Center, Biological Resources Division, U.S. Geological Survey, Anchorage, Alaska. Obtained Ph.D. in Zoology from University of California, Berkeley in 1985. Since 1978, he has funded and led research studies on seabirds at Middleton Island. He has published extensively on seabird population trends in the North Pacific and is in charge of the North Pacific Seabird Monitoring Database. He will continue to supervise the research on Middleton in 2000.

Ms. Verena Gill, Seabird Wildlife Biologist, Alaska Biological Science Center, Biological Resources Division, U.S. Geological Survey, Anchorage, Alaska. Obtained M.S. in Biology from the University of Alaska Anchorage in 1999 (thesis topic was "Breeding performance of black-legged kittiwakes in relation to food availability: a controlled feeding experiment"). She has coordinated all aspects of field work at Middleton since 1993 and her thesis work laid the ground work for this study. She will continue to coordinate the field work on Middleton in 2000, and will be primarily responsible for the field collection of blood samples.

Dr. Marcel Eens, Professor in Biology at the University of Antwerp in Belgium. Obtained Ph.D. in Behavioral Ecology at the University of Antwerp in 1992, and has published extensively on hormone effects on behavior in a variety of species. He supervised Dr. Lanctot during his post-doctoral fellowship studies on hormones in kittiwakes. He will supervise the analysis of plasma samples at his laboratory in Belgium.

OTHER KEY PERSONNEL

Research Assistants – at least 4 volunteer biotechnicians and 1 biologist will be employed from May through August 2000 on Middleton Island.

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Figure 1. Population trend of black-legged kittiwakes on Middleton Island, 1974 - 1999 (Gill 1999).



Figure 2. (a) An abandoned radar tower on Middleton Island provides high quality nest sites for black-legged kittiwakes. (b) The interior of the building offers a laboratory-like setting in which to study wild, cliff-nesting birds. (c) Artificial nest sites backed by one-way mirror glass enable close observation and manipulation (glass removed from site at right). (d) A small tray slides through the wall at each site to facilitate supplemental feeding.



Figure 3. Base-line levels of corticosterone (mean +/- SE) from black-legged kittiwake adults in relation to time. Time refers to the duration between when a bird first became aware that a researcher was attempting to capture the bird and when blood was collected. One minute samples include those birds sampled in less than one minute (and so on). All adults regardless of feeding treatment, breeding stage (except pre-season), or gender are included in sample.



Figure 4. Base-line levels of corticosterone (mean +/- SE) from black-legged kittiwake adults that were supplementally fed (Fed) and limited to natural foraging conditions (Unfed) during three breeding stages at the Middleton Island tower colony in 1999. Males and females are combined within feeding treatments because there were no significant differences during any breeding stage (P>0.05).



Figure 5. Base-line levels of corticosterone (mean +/- SE) from male and female black-legged kittiwake adults sampled shortly after arriving at the Middleton colony tower in 1999 (about 60 days before fed birds laid eggs and 70 days before unfed birds laid eggs). Corticosterone levels of males that eventually paired up and laid eggs did not differ significantly from males who never bred. The same was true for females but the difference was nearly significant (despite low sample sizes). Table 1. Corticosterone levels and breeding parameters in black-legged kittiwakes (BLKI) in relation to supplemental feeding treatment, Middleton Island 1999. See methods for definition of parameters. Values are listed as mean \pm standard error where applicable, and samples sizes are shown in parentheses below each variable.

Breeding stage	Parameter	Fed BLKI		Unfed BLKI
Pre-egg laying	Corticosterone (ng/ml)	4.42±1.11 (21)	NS	4.98±0.99 (20)
	Laying success	92% (48)	P < 0.001	37% (178)
	Laying date	10 June ± 1.0 (44)	P < 0.001	18 June ± 0.6 (65)
	Clutch size	1.68±0.08 (44)	P < 0.001	1.14±0.04 (65)
Incubation	Corticosterone (ng/ml)	4.07±0.47 (21)	NS	5.36±0.87 (22)
	Hatching success	43% (76)	NS	56% (75)
	Shift length (hrs)	4.26 (29)	P < 0.001	11.95 (27)
	Egg volume (cc)	46.33±0.40 (73)	P = 0.033	45.00±0.50 (74)
Chick-rearing	Corticosterone (ng/ml)	1.75±0.14 (20)	P < 0.001	4.67±0.63 (22)
	Fledging success	82% (33)	NS	79% (42)
	A-Chick growth (g/day)	16.37±0.34 (22)	P = 0.004	14.87±0.34 (30)
	Adult attendance (% of both adults)	56.15±0.99 (21)	P < 0.001	41.83±0.81 (26)

	Authorized	Proposed	
Budget Category:	FY 2000	FY 2001	
Personnel		\$12,000.0	
Travel		\$1,500.0	
Contractual		\$2,100.0	
Commodities		\$1,400.0	
Equipment		\$0.0	LONG RANGE FUNDING REQUIREMENTS
Subtotal	\$0.0	\$17,000.0	Estimated
General Administration		\$1,854.5	, FY 2002
Project Total	\$0.0	\$18,854.5	\$0.0
Full-time Equivalents (FTE)		0.2	
			Dollar amounts are shown in thousands of dollars.
Other Resources	\$57,800.0	\$57,800.0	

Comments: The Alaska Biological Science Center, Biological Resources Division, DOI-USGS, is responsible for coordinating all aspects of this project. Responsibilities include field logistics, collection of data and blood samples, hormone and data analyses, report writing, and presentation and publication of results. One other non-trustee ageny, the University of Antwerp in Belgium, will coordinate hormone analyses.

We anticipate no expenses for NEPA compliance (assuming a categorical exclusion), annual restoration workshop attendance, or community involvement. \$1,700 has been budgeted to attend the Pacific Seabird Group Meeting in Hawaii, and \$1,000 has been budgeted for manuscript preparation and publication costs.

Accounting, personnel hiring, purchasing, secretarial assistance, computer equipment, and other office supplies will be provided by DOI-USGS. Other costs associated with project will be provided by DOI-USGS. These include \$13,300 for air charters to Middleton Island, \$2,800 for fish for feeding experiment, \$1,600 for tower expansion for pelagic cormorant work, \$200 for blood sampling supplies, \$4,000 for fish regurgitation identification, \$3,300 for four volunteers (travel and per diem), \$5,100 for food for volunteers and field leaders, \$24,500 for salary (1 month for Scott Hatch, 2 months for Verena Gill, 2 months for Charla Sterne), and \$3000 for miscellaneous expense. Total costs borne by DOI-USGS for FY2000 is \$57,800. A similar cost was expended by DOI-USGS in FY1999 to conduct the first year of this study.

Field work was conducted in 1999 and will be continued in summer of 2000. Final hormone and data analysis, and write-up will occur in 2001.



Project Number: 01555 Project Title: Can stress hormones be used as an indication of food availability and reproductive performance? An experimental approach. Agency: DOI-USGS



Prepared:10 April 2000

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

Personnel Costs:	GS/Range/	Months	Monthly		Proposed	
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2001
Dr. Richard Lanctot	Principal Investigator - manages project,	GS/11/2	2.5	4800.0		12,000.0
	analyzes data, presents information at					0.0
	meetings, and writes manuscripts					0.0
						0.0
						0.0
		,				0.0
						0.0
			л.,			0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.5	4800.0	0.0	
				Per	sonnel Total	\$12,000.0
Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 2001
Pacific Seabird Group Meeting i	n Hawaii	600.0	1			600.0
Housing				5	110.0	600.0
Food	· · · ·			5	50.0	300.0
·						0.0
						0.0
						0.0
		· ·				0.0
						0.0
						0.0
						0.0
						0.0
		I			Trough Total	0.0
					Travel Total	\$1,500.0
[]	Project Number	· · · · · · · · · · · · · · · · · · ·				
	Project Title: Can stress hormone	e he used os	on indicativ	on of food	F	ORM 3B
			annucau		P	ersonnel
	mance? An	experimenta	ai j		& Travel	
	approach.					DETAIL
Prepared: 10 April 2000	Agency: DOI-USGS				L	

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

Contractual Costs:	Proposed
Description	FY 2001
4A Linkage	2,100.0
When a non-trustee organization is used, the form 4A is required. Contractual Total	\$2,100.0
Commodities Costs:	Proposed
Description	FY 2001
Miscellaneous (federal express of plasma samples and other packages) Registration cost for Pacific Seabird Group Meeting	200.0 200.0
Commodities Total	\$1,400.0
FY01 Project Number: Project Title: Can stress hormones be used as an indication of food availability and reproductive performance? An experimental approach. Agency: DOI - USGS	DRM 3B tractual & nmodities DETAIL

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

New Equipment Purchases):	Number	Unit	Proposed
Description		of Units	Price	FY 2001
None				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
Those purchases associated	with replacement equipment should be indicated by placement of an R.	New Equ	ipment Total	\$0.0
Existing Equipment Usage			Number	Inventory
Description			of Units	Agency
Camp gear (tents, sleeping b	pags, cook kits, etc.)		1	DOI-USGS
Electric freezers			4	DOI-USGS
Propane stove and heaters			2	DOI-USGS
Inflatable boat and outboard	motor for collecting fish samples at sea		1	DOI-USGS
Float coats and basic surviva	al gear		3	DOI-USGS
Tower supplies (cleaning sol	utions, gloves, buckets, electric cords, etc.)		1	DOI-USGS
Banding supplies (bands, me	easuring equipment, etc.)		1	DOI-USGS
4-wheel ATVs and trailer			2	DOI-USGS
Computers - pentium 1 minin	num		2	DOI-USGS
Office supplies, copying, tele	phone, fax, postage, electronic mail		1	DOI-USGS
· · · · · · · · · · · · · · · · · · ·	Project Number			
	Project Title: Can stress hormones be used as an indicativ	on of food	F	ORM 3B
			F	quipment
Г І́́́ I				
	approach.			
	Agency: DOI-USGS		L	

Prepared: 10 April 2000

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

	Authorized	Proposed	
Budget Category:	FY 2000	FY 2001	
Personnel		\$0.0	
Travel		\$0.0	
Contractual		\$0,0	
Commodities		\$2,100.0	
Equipment		\$0,0	LONG RANGE FUNDING REQUIREMENTS
Subtotal	\$0.0	\$2,100.0	Estimated
Indirect			FY 2002
Project Total	\$0.0	\$2,100.0	\$0.0
-			
Full-time Equivalents (FTE)		0.0	
· · · ·			Dollar amounts are shown in thousands of dollars.
Other Resources	\$3,800.0	\$3,800.0	

Comments: Laboratory equipment, office supplies, computer equipment, and secretarial assistance will be provided through the University of Antwerp and the University of Leuven in Belgium.

Corticosterone analyses will be conducted at the Laboratory of Immuno-Neuroendocrinbology at the University of Leuven in Belgium, under the direction of Dr. Marcel Eens who resides at the University of Antwerp.

Salary support of \$3,800 was provided in FY2000 and will be provided in FY2001 by a grant from the Fund for Scientific Research-Flanders in Belgium to Dr. Marcel Eens. This consists of \$1,800 for a laboratory assistant and \$2000 for Dr. Eens salary.

No money is requested for report writing, NEPA compliance, annual restoration workshop attendance, community involvement, or indirect costs.

Program management will be conducted through the DOI-USGS lead agency.



Project Number:

Project Title: Can stress hormones be used as an indication of food availability and reproductive performance? An experimental approach. Name: University of Antwerp, Belgium FORM 4A Non-Trustee SUMMARY

Prepared: 10 April 2000

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

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Pers	onnel Costs:			Months	Monthly	· .	Proposed
	Name	Position Description		Budgeted	Costs	Overtime	FY 2001
	None						0.0
							0.0
							0.0
							0.0
							0.0
						· ·	0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		0.0	0.0	0.0	
					Per	sonnel Total	\$0.0
Trav	el Costs:		Ticket	Round	Total	Daily	Proposed
	Description		Price	Trips	Days	Per Diem	FY 2001
	None						0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
	······································					Travel Total	\$0.0
	·····						
		Project Number:				F	ORM 4B
		Project Title: Can stress hormone	s be used a	is an indicati	ion of food		ersonnel
	-YU1	availability and reproductive perfor	mance? An	experimenta	al	'	8. Troyot
		approach.		-		'	
		Name: University of Antwerp Belg	um		[DETAIL
Dron	ared: 10 April 2000	promotion of a second of a second promotion pr	Min I.				

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

G.

Contractual Costs:	Proposed
Description	FY 2001
None	
Contractual Total	\$0.0
Commodities Costs: Description Laboratory costs for corticosterone analyses (\$11.50 x 180 samples)	Proposed FY 2001 2,100.0
Commodities Total	\$2,100.0
FY01 Project Number: F Project Title: Can stress hormones be used as an indication of food availability and reproductive performance? An experimental approach. Control Prepared: 10 April 2000 Name: University of Antwerp, Belgium F	ORM 4B htractual & mmodities DETAIL

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

New Equipment Purchases:		Number	Unit	Proposed
Description		of Units	Price	FY 2001
none				0.0
				0.0
				0.0
		-		0.0
				0.0
				0.0
				0.0
			.	0.0
				0.0
				0.0
				0.0
				0.0
				0.0
Those purchases associated with repla	cement equipment should be indicated by placement of an R.	New Equ	ipment Total	\$0.0
Existing Equipment Usage:			Number	
Description			of Units	
Laboratory space and equipment to con	nduct corticosterone analyses		1	
Office supplies, copying, telephone, fax	<, postage, electronic mail		1	
FY01 Proje avail appr	ect Number: ect Title: Can stress hormones be used as an indicati ability and reproductive performance? An experiment oach.	on of food al	F	ORM 4B quipment DETAIL
Prepared: 10 April 2000				-

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Harbor Seal Recovery: Application of New Technologies for Monitoring Health

Project Number:	01558	
Restoration Category:	Research	
Proposer:	University of Alaska Fairb	anks
Lead Trustee Agency:	ADFG	
Alaska SeaLife Center:	YES	
Duration:	1st of a 3-year project	는 것
Cost FY 01:	\$160,403	ತಿಂತಿ 6 ಪು≦ಹಿಡಿ⊴್ರ.
Cost FY 02:	\$164,198	ارونه در این از به کمی افتاد به این از ای این به در این از به کمی این محمد میروند از این از
Geographic Area:	Alaska SeaLife Center, Gu	llf of Alaska
Injured Resource/Service:	Harbor seals	

ABSTRACT

This study will investigate the potential for new technologies to assess and monitor the endocrine and immune systems as diagnostic measures of the health of harbor seals. Analysis of thyroxine (T_4) , triiodothyronine (T_3) , and cortisol (primary metabolic and gluconeogenic hormones), and measurement of immunoglobulins (IgG, IgM and IgA) and the body burden of organochlorine contaminants will provide an assessment of both permanently captive seals as well as seals that are brought into the Alaska SeaLife Center (ASLC) for rehabilitation. The work will also employ community involvement through the Alaskan Native Harbor Seal Commission. Once the profiles of healthy seals and those 'failing to thrive' in their natural environment are assessed, these techniques will be evaluated for routine monitoring of free-ranging seals in an effort to restore this species.

INTRODUCTION

The potential exists for several environmental factors to impact the biology of harbor seals (Phoca vitulina), resulting in poor survival, recruitment and reproductive rates. While the leading hypothesis is that changes in the availability of high quality prey have reduced the carrying capacity of the Gulf of Alaska, a contributing factor to poor survival and reproduction may include exposure to organochlorine contaminants (OCs), with associated endocrine and immune system impairment (Addision, 1989; De Swart et al., 1994, 1996; Ross et al., 1995; Reijnders, 1986). OCs and their by-products are bioaccumulated, biomagnified and transferred through lactation from mother to pup (Beckmen et al., 1999; Gallenberg and Vodicnik, 1989; Vreel et al., 1996; Wagemann and Muir, 1984). These contaminants and by-products may continually affect a population of animals even though no major polluting event has occurred. The adverse effects on the physiology of the animal may be subtle or subclinical, or may manifest themselves with symptoms such as, 'failure to thrive' or 'failure to reproduce'. The systems that typically respond to environmental changes, including contamination or suitable prey, are the endocrine and immune systems. This proposed study will develop technologies to examine these two systems to be used to monitor the health of individuals and the well being of subpopulations.

The endocrine system is a complex system that integrates the environment in which an animal lives, with the physiology of that animal. As seasons, nutrition and other environmental parameters change, the neuroendocrine system is the first to work toward ensuring that the body can adapt to the changes. Many compounds in the environment are known to interfere with the endocrine systems of mammals and are often referred to as 'endocrine disrupting compounds' (EDCs). The most commonly known EDCs are the organochlorines, including polychlorinated biphenyls (PCBs), DDT and it's metabolites, as well as the phthalates. Some EDCs are known to bind with estrogen receptors (Katzenellenbogen, 1995), either mimicking or blocking the effects of estrogens. Extreme examples of the effects of OCs on reproductive function are the neoplastic occlusions of the uterus resulting in infertility and the development of hermaphroditic offspring (Helle et al., 1976; Baker, 1989; Reijnders, 1998). PCBs can also compete for binding sites on the transport proteins for the thyroid hormones, resulting in hypothyroid conditions that can affect early development or later reproductive performance (Brouwer, 1989). The results from these endocrine disruptions can be varied and also include suppression of the immune system (De Swart et al., 1996; Ross et al., 1995). Atkinson and Oki (2000) used thyroxine and cortisol concentrations along with several morphometric measurements to assess the well being of yearling Hawaiian monk seals that appeared to be malnourished. Their results suggest that a suite of measurements, including these hormones, provides a good indication of the physiology of a seal and its ability to adapt to suboptimal environments.

The immune system of marine vertebrates is a rapidly advancing area of interest, both in the basic components of the immune system as well as the development of immunodiagnostic reagents. Baseline information on the immune system of pinniped species is critical to any future field assessment of immunocompetence. The lack of baseline information on the immune system of the harbor seal population in Europe hindered assessment of the role of pollutioninduced immunosuppression in the phocid distemper virus outbreak of 1988 (Dietz et al., 1989a; Vos and Luster, 1989). Studies of levels of immunoglobulins and of isotypes of those immunoglobulins have been reported for a few species of pinnipeds. Cavagnolo and Vedros (1979) evaluated IgG, IgM and IgA levels in sera and colostrums of adult and immature northern fur seals (Callorhinus ursinus), finding low immunoglobulin levels in the sera of pups during the

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first four months of life. Baker (1984) found similar results for overall gamma globulin levels in grey seal (*Halichoreus grypus*) pups. Carter *et al.* (1990) measured specific immunoglobulin isotype levels in sera and colostrums of the grey seal. Ross *et al.* (1993) evaluated IgG levels in the harbor seal, and also evaluated lymphocyte function in this species by measuring responsiveness to a T-cell mitogen. A number of reports have appeared describing ELISA's or other immunoassays measuring pinniped antibody levels against canine distemper virus (e.g. Dietz, *et al.*, 1989b; Carter, *et al.*, 1990; Bengston, *et al.*, 1991; King, *et al.*, 1993). It is of note that some of the latter studies utilized antibodies specific for canine immunoglobulins to measure pinniped immunoglobulins, with which they cross-react. In assays such as the ELISA's mentioned above that require the use of anti-immunoglobulin indicator antibodies it is generally preferable to utilize species-specific antisera when available, but such antisera are not readily available for most species of pinnipeds.

This project will utilize our ability to montior several hormones and immunoglobulins, and relate their function to the body burden of contaminants and the overall health of individual seals. We propose to provide critical reagents and methodologies necessary for the assessment of several aspects of immunocompetence levels in the harbor seal, and to establish baseline data on these levels for the duration of the project in selected populations of harbor seals. The project will also result in the production of species-specific antisera for use in assays of immunoglobulin class specific antibody levels in the harbor seal population against pathogens, toxins, or other antigens of potential health importance. This project will also determine critical baseline concentrations of the thyroid hormones and cortisol of captive seals, housed in a stable environment with regular and balanced diets, to compare with free-ranging seals. In doing so, we can assess whether the seals in the Gulf of Alaska are being exposed to endocrine disrupting and/or immunosuppressive agents at level that are impacting their ability to survive, grow and reproduce. If contaminants are affecting the physiology of harbor seals, then we need to incorporate this into the working hypothesis under which this species is being managed. In addition, assessing the effects of environmental contaminants should be incorporated into any long-term plans for monitoring harbor seals. Monitoring endocrine and immune levels can also be used as indicators upon which parameters needed to model the population dynamics of harbor seals can be developed. This will become increasingly important if this species continues its population decline in the Gulf of Alaska.

NEED FOR PROJECT

A. Statement of Problem

Harbor seals were one of the resources that were injured by the 1989 *Exxon Valdez* oil spill (EVOS). To date this species is listed as 'not recovering'. Several studies have focused on the general health and metabolism of these seals as it relates to their diet, body condition and habitat (Projects 001, 341, 371, and 441). The proposed study will compliment these investigations as it will utilize new techniques to enhance our understanding of the health and physiology of the species and incorporate the possible affects of environmental organochlorine contaminants. If the techniques can be combined to develop a concise indicator of a given animal's health, then these techniques should be incorporated into the routine assessment and monitoring of harbor seals in the Gulf of Alaska.

B. Rationale/Link to Restoration

In order to recover any species whose population has experienced a major decline, it is necessary to fully understand the biology of the species. A few species of marine mammals have failed to recover with the enactment of the Marine Mammal Protection Act (e.g. Hawaiian monk seals and Steller sea lions). Other species have declined precipitously since the Marine Mammal Protection Act, with some subpopulations more affected than others (e.g. Alaskan harbor seals). The problems that these species face are multifaceted and complex. Many times a combination of factors will synergize to produce a devastating effect (such as the 1988 harbor seal epizootic in the North Sea), while either factor alone may not have had clinical effects. In understanding what the Alaskan harbor seals are experiencing, it is essential to know the degree to which they are being subjected to immunosuppressive or endocrine disrupting agents. Restoration of the species can only be successfully accomplished if the species is thoroughly understood. With this knowledge we can begin to predict the devastating effects of environmental changes and model the long-term population dynamics. In addition to predicting the impact of a given environment, we can also begin to manipulate animals and their environments to assist in their recovery.

The information gained from this study will enable us to assess two groups of animals, those that live in a stable, consistent environment (captivity), with those that experience the natural environment (rehab seals). Seals brought in for rehabilitation are generally young animals that are failing to thrive in their environment. They may not be able to naturally survive the weaning process due to a variety of factors, including immuno-incompetance or inadequate maternal investment (ie, poor milk quality or shorten lactation period). Through morphometric measurements, assessment of immune and endocrine function, and measurement of body contaminant levels, we can evaluate the degree to which these animals are adapting to a changing environment. Once these techniques have been perfected at the ASLC, we plan to test their application to a long-term, field-monitoring program. The ability of harbor seals to adapt to a changing environment is essential to the recovery of this species. Knowing what the animals are dealing with and their ability to adapt will enable resource managers to predict the recovery or mitigate the future decline of this species.

C. Location

Years 1 and 2 of this project will be undertaken at the ASLC using harbor seals that are currently resident and permitted for research under the Marine Mammal Protection Act for research. It will also utilize animals that will be brought in for rehabilitation under the terms of an existing letter of authorization, and through our collaboration with the Alaska Native Harbor Seal Commission. Year 3 of this work is proposed for free-ranging seals in Prince William Sound and areas near South Central Alaska.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

This project will involve a growing collaboration with the Alaska Native Harbor Seal Commission. In addition to the native communities, we propose working with coastal fishing communities to increase the awareness of the plight of this species. In working with community facilitators, we will request that nearby communities inform us of harbor seals needing rehabilitation, including orphaned pups. These animals provide a wealth of information as they

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have incorporated any environmental constraints into their physiology. As coastal communities come into contact with these animals more often than we know about, we propose working with these communities to increase our sample sizes. Through the development of brochures and speaking with local community groups, we will collaborate to ensure that seals requiring rehabilitation are brought to ASLC. Partnerships with the Civil Air Patrol and US Coast Guard will be sought to provide transportation of seals to ASLC from neighboring communities. During the rehabilitation process, these animals will be monitored for biochemical changes that indicate their ability to adapt.

This project will also coordinate with the existing volunteer and intern programs at ASLC to make opportunities available for spill-area residents who would like to spend time volunteering at ASLC. To a large extent this will increase our awareness of traditional and local knowledge of harbor seals as well as incorporate local expertise into the project. This project is budgeted for one graduate student and one research associate who will receive training to increase their level of expertise in marine mammal physiology as well as provide the necessary time to ensure that our community involvement is successful.

PROJECT DESIGN

A. Objectives

The overall goal of this project is to develop and test new methods of monitoring the physiology of harbor seals. In doing so the project has the following five objectives:

- 1. Determine seasonal and circadian patterns of total and free triiodothyronine (T_3) , thyroxine (T_4) , and cortisol in healthy captive harbor seals (Yr 1).
- 2. Develop new antibodies specific to harbor seal immunoglobulin classes IgG, IgM and IgA (Yr 1).
- 3. Determine seasonal patterns of IgG, IgM, and IgA, in healthy captive harbor seals (Yrs 1 and 2).
- 4. Determine endocrine and immunoglobulin profiles and measure organochlorine concentrations for rehabilitation seals periodically throughout the rehabilitation process (Yrs 1 and 2).
- 5. Assess endocrine and immunoglobulin profiles for free-ranging seals in Prince William Sound and in South Central Alaska (Yr 3).

B. Methods

Objective 1. Eight harbor seals (4 males, 4 females) housed at the ASLC will have monthly blood samples collected to assay for total and free T_4 , T_3 , and cortisol. In addition, circadian patterns of these hormones will be assessed from the eight seals during the seasonal extremes of the summer and winter solstices, with samples collected at 2 to 3 hourly intervals over a 24-hour period. A single blood and blubber sample will be collected for organochlorine analysis.

The analyses for these hormones have previously been validated for other pinniped species (Atkinson and Oki, 2000) and will be validated for harbor seals. Concentrations of cortisol will

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be measured in unextracted plasma using a single-antibody radioimmunoassay (Atkinson and Oki, 2000; Atkinson and Adams, 1988). The plasma will be heated at 60°C for 30 minutes to denature cortisol-binding proteins before assaying directly. Samples will be analyzed in batches to reduce inter-assay variation. Concentrations of total and free T_4 and T_3 will be measured in unextracted plasma using solid phase radioimmunoassays (Diagnostic Products Corporation, Los Angeles, CA) that are specific to either total or free, T_4 or T_3 (Atkinson and Oki, 2000). The standard curves of each assay will be log-logit transformed, enabling extrapolation of sample concentration (Robard, 1974). A profile of the variation in total and free T_4 and T_3 will be generated and analyzed.

Objective 2. The prerequisite for development of heavy chain specific antisera for the major immunoglobulin classes of the harbor seal is the production of purified preparations of each of these immunoglobulin classes. These purified immunoglobulin classes will be obtained from pooled sera from captive animals at ASLC and will be used as the source of the immunoglobulins to be purified. The first step toward purification of individual immunoglobulin isotypes (IgG, IgM, and IgA) from serum will be to remove non-immunoglobulin proteins, leaving a mixture of all immunoglobulin isotypes present. Serum samples will be centrifuged (five minutes at 10,000 rpm) to remove any large particulate matter present. The supernatant will then be filtered through a 0.45 µm and then a 0.2 µm filter to further remove any remaining particulates and/or aggregates. The next step involves separating serum proteins in the filtrate based on molecular weight. The serum will be placed in a Millipore UltraFree®-15 centrifugal filter device with a molecular weight cutoff of 100,000 daltons. During a thirty-minute centrifugation step (2000 x g) proteins less than 100,000 daltons pass through the filter, while those greater than 100,000 daltons are retained above the filter. Since the immunoglobulin isotypes being studied have molecular weights greater than 100,000 daltons, they will be retained in the fluid retained in the UltraFree®-15, and can be removed and kept available for use in further purification steps. This filtration technique has proven more satisfactory than techniques involving differential precipitation of serum proteins in saturated ammonium sulfate.

Aliquots of such partially purified and concentrated samples will then be applied to one of the types of chromatography columns for purification of a particular immunoglobulin isotype. Antiserum will be produced in rabbits against the precipitated immunoglobulins to permit preliminary analysis of the IgG, IgM, and IgA immunoglobulins in harbor seal serum. Grabar-Williams immunoelectrophoresis will be used in initial examination of harbor seal whole and precipitated serum for immunoglobulins.

In order to obtain immunogens suitable for production of heavy chain specific antisera for immunoglobulins of the harbor seal, purified immunoglobulins will first be enzymatically partially digested with papain to obtain the equivalent of Fab and Fc fragments for each isotype. Use of whole heavy chains as the immunogen produces antisera which include antibodies against the variable region of the heavy chain, which may cross-react with immunoglobulins of various isotypes. The Fc fragment contains only heavy chain constant regions and is more likely to induce isotype specific antisera if used as the immunogen. Purified "Fc" fragments of each isotype will be reduced with 2-mercaptoethanol and alkylated with iodoacetamide to break the disulfide bonds between the linked heavy chains. Chromatography using a Sephacryl S-400HR column will then be used to separate the heavy chain fragments from the other peptides which may be present (e.g. the J-chain of IgA or IgM). Once the purity of heavy chain preparations has been determined, they will be used to produce isotype-specific antisera that can be used to determine specific IgG, IgM, and IgA levels within a sample. Rabbits will be used to produce

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these antisera. The animals will be immunized by standard approved protocols. The titer and specificity of the antisera will be determined by (1) standard indirect ELISA (wells coated with purified harbor seal immunoglobulin heavy chain), followed by the rabbit anti-heavy chain antibody being tested, followed by enzyme-labeled anti-rabbit immunoglobulin, and finally by the indicator substrate) and (2) immunoelectrophoresis (IEP) methods including Grabar-Williams, Rocket IEP, Crossed IEP, and Tandem Crossed IEP. The antisera will be partially purified by use of the Millipore UltraFree®-15 centrifugal filter device followed by purification by Protein G Sepharose^R affinity chromatography to obtain the IgG fraction of this rabbit antisera. The purified antisera will be labeled with biotin or an enzyme (e.g. alkaline phosphatase or horseradish peroxidase) using standard labeling linkers (Pierce). The resulting antisera will be analyzed for specificity by several methods, including application of the antisera to Western blots of whole heavy chain preparations obtained by reduction/alkylation of the respective whole immunoglobulin isotype preparations.

Once the antisera for each immunoglobulin's heavy chain isotype has been made, it will be possible to regularly monitor immunoglobulin levels as an indicator of immune status of a population of harbor seals. It will also be possible to determine the level of each isotype present in, for example, samples obtained during a vaccination trial, at particular points in time of interest to a veterinarian or researcher (e.g. during pregnancy, drug therapy, maturation stage, etc.).

Objective 3. An ELISA protocol similar to that described by Suer *et al.* (1988) has been used to evaluate serum antibody levels in several species of marine mammals against several antigens (e.g. Patterson *et al.*, 1994). A "sandwich" ELISA protocol will be employed in an effort to determine general immunoglobulin levels in these samples. In the sandwich ELISA, a plastic solid phase matrix (polystyrene microwells) is coated with unlabeled antibodies against the antigen in question, i.e. in this case against on of the heavy chain isotypes (gamma, alpha, or mu for IgG, IgA, and IgM respectively) of immunoglobulins from the harbor seal (prepared via completion of Objective 2 above). The sandwich ELISA conducted in this manner will allow quantitation of general immunoglobulin levels in samples by comparison with a standard curve generated using preparations made with known concentrations of immunoglobulins purified from the harbor seal.

Blood samples will be collected on at least a monthly basis by project personnel based at the ASLC. Aliquots of each sample (and aliquots of other samples of harbor seal sera which become available) will be quantified for isotype levels using the ELISA described above in completion of Objective 2.

Objective 4. Using the previously described techniques, we will measure total and free T_3 , T_4 , cortisol, and IgG, IgM and IgA in harbor seals that are brought in for rehabilitation. ASLC has the ability to hold 10 seals for rehabilitation. An assessment of the level of contamination by organochlorines will also be performed from either blood or blubber samples. As these measurements will be diagnostic, the frequency of sampling will be based on the overall condition of the seals and not all of these animals will have the same numbers of samples collected. It is envisioned that samples will be collected upon entrance and before release of all seals. In addition, samples may be collected periodically to assess any effects of different milk formuli that are fed to very young seals as well as upon weaning when the diet and digestive efficiency of the animals is maturing. Experimental protocols are based on models using 10-12

harbor seals admitted for rehabilitation. These protocols will comply with the ASLC Institutional Animal Care and Use Committee (IACUC) and Marine Mammal Protection Act (MMPA) guidelines.

Seals admitted for rehabilitation at the SeaLife Center are held in quarantine and placed in individual holding tanks. Currently, the EVOS funded project Harbor Seal Recovery, Phase II, conducted by Dr. Mike Castellini, collects health data such as blood chemistry and morphometrics weekly from each harbor seal admitted for rehabilitation. Blood chemistry and hematology values are used in conjunction with body composition to detect significant changes in health status that might alter water balance, cause anemia, or compromise basic metabolic status (Castellini et al., 2000, 1993). Blood urea, nitrogen (BUN) ketone bodies, and free fatty acids, as well as hematocrit, hemoglobin, and erythrocyte sedimentation rate are measured.

Assimilation efficiencies will be determined for harbor seals prior to and during the weaning process, as well as once the animals are on a stable fish diet. Meal size and feeding frequency will be kept constant during the experimental period. Food digestibility in these seals will be determined using manganese (Mn^{++}) as an inassimilable dietary marker. Concentrations of Mn^{++} from subsamples of the food items fed to individual seals during the acclimation and collection periods, will be analyzed using atomic absorption spectrophotometry (Fadely et al. 1990). Feces will be collected during the course of the feeding trail to determine the clearance rate of food items and fecal Mn⁺⁺ concentrations. Differences in the Mn⁺⁺ concentrations between diet and feces will be used to calculate AE. In addition, diet and fecal samples will be freeze-dried and analyzed for energy (cal/g), nitrogen, total lipid, and ash as reported in Keiver et al (1984). To quantify the passage of digesta (mean retention time) and fecal Mn⁺⁺ concentrations, carmine red will be used as a marker to estimate emptying time of the stomach (Ashwell-Erikson and Elsner 1981).

Objective 5. The methodology of this objective will be developed over the first 1 to 2 years of the project. The feasibility of sampling as well as the necessities of sample processing will continually be evaluated with the goal of developing techniques that are feasible for field collections. It is hoped that Year 3 will be a collaborative effort with harbor seal researchers that regularly collect samples from free-ranging seals. The sites of collection, numbers of animals and the permits to cover the sampling of wild seals will be negotiated with other researchers who may be collecting samples concurrently. Discussions will also be held with the Alaska Native Harbor Seal Commission to assist with the planning of the field testing.

C. Cooperating Agencies, Contracts and Other Agency Assistance

This project will primarily be based at ASLC, with the National Marine Fisheries Service permits for the captive seals being held by ASLC with Dr. S. Atkinson serving as the Principal Investigator of that permit. Seals needing rehabilitation will be sought with the guidance of the Alaska Native Harbor Seal Commission. The letter of authorization for these seals is also held by ASLC, with Susan Inglis, Director of Research and Rehabilitation Operations serving as the PI.

The samples collected for endocrine evaluation will be analyzed in the Marine Mammal Endocrinology Lab of Dr. S. Atkinson, housed at ASLC. The samples for immune assessment will be analyzed by Dr. Bobby Middlebrooks, University of Southern Mississippi. A subcontract within this proposal has been negotiated. The samples for contaminant measurements will be

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analyzed by the Northwest Fisheries Science Center of the National Marine Fisheries Service. A subcontract for these samples has been negotiated with Dr. Peggy Khran.

SCHEDULE

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

October 2000:	Blood sampling commences on a monthly basis. In addition, single samples will be taken to initiate the hormone validations and immunoglobulin development
November 2000:	Blood and blubber samples from the captive seals will be sent for
	contaminant analysis.
December 2000:	Blood samples will be collected to assess circadian pattern of T_3 , T_4 and cortisol.
January 2001:	Endocrine assays will be undertaken with batches of samples to assist with quality control.
May-June 2001:	Seals collected for rehabilitation arrive at ASLC.
June 2001:	Circadian sampling will be performed.
June- September:	Endocrine and immunology samples analyzed.
September-October:	Rehabilitation seals released.

Depending on the age and health of these seals, they are typically kept until Most of the analyses will be accomplished by Sept 2001, although there will be some analyses to complete during FY 02.

B. Project Milestones and Endpoints for Year 1

1.

2.

3.

Establishment of baseline levels of total and free T_3 , T_4 and cortisol levels in the serum: The hormone concentrations from captive animals will serve as our baseline for both the rehabilitation seals and the free-ranging seals. Both circadian and seasonal baselines will be established. This will be completed during Year 1.

Development of species-specific antisera against immunoglobulins of the harbor seal: An important outcome of the proposed project will be the production of such antisera against immunoglobulin isotypes of the harbor seal. These antisera will be available for and of use in future studies involving immunoglobulins of this species. The antisera will also be available for use in ELISA's to measure immune response and immune levels against specific antigens of interest in the harbor seal population. For example, the antisera can be used in future studies involving use of ELISA's to measure antibody levels against selected viruses, toxins, or bacterial antigens of interest and importance in wild populations of the harbor seal. This will be completed during Year 1.

Establishment of baseline levels of immunoglobulin isotypes in serum and saliva: The sandwich ELISA (using the respective anti-isotype antisera as capture antibody) will provide data on general immunoglobulin levels in the harbor seal. This will be completed during Years 1 and 2.

C. Completion Date

The anticipated completion date of the captive portion of this project is October 2002. At this point we will hope to be able to recommend that these techniques be applied to a field-monitoring program. If this is accomplished the feasibility of field sampling will be determined by October 2003.

PUBLICATION AND REPORTS

It is anticipated that all of the work conducted under this proposal be published in peer-reviewed international journals. Potential journals include, General and Comparative Endocrinology, Comparative Biochemistry and Physiology, Marine Mammal Science, and Journal of Developmental and Comparative Immunology. In addition, any student projects will be presented in thesis or dissertation format as well as submitted for journal publication. The presentation of work at conferences and workshops will be encouraged. Such conferences may include, Society for Marine Mammalogy, International Association of Aquatic Animal Medicine, or any EVOS workshops.

PROFESSIONAL CONFERENCES

No professional conferences are requested for FY01. The PI will request to attend the Biennial Conference of the Biology of Marine Mammals in Vancouver, Canada in FY02.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The PI of this proposal also serves as the Science Director of the ASLC. Through this avenue, the PI holds regular discussions on the projects that are currently taking place at ASLC, and is already collaborating on the technical aspects of this study. This project will be using the same animals as have been used for projects 341, 371, and 441, and it is anticipated that discussions will be held whenever scientist are in Seward for sample collections. It is also anticipated that Year 3 samples will be collected from a shared field site, integrating existing field projects with our sample collections.

This project will benefit from new equipment that has recently been purchased by UAF and UAF Foundation in an effort to establish an endocrinology laboratory at ASLC. The lab will be regulated under the Nuclear Regulatory Commission License to UAF. It is in this lab that the students and research associate on this project will work.

PROPOSED PRINCIPAL INVESTIGATOR

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PRINCIPAL INVESTIGATOR (qualifications)

The PI of this project is a new professor at UAF, with half time duties to serve as the Science Director at ASLC. She has 18 years experience in analyzing body fluids for hormone concentrations. She has established and worked in two other endocrinology laboratories, one at Hawaii Institute of Marine Biology, University of Hawaii, and the other at Murdoch University in Western Australia. The PI also has extensive experience working with a variety of marine mammals, including the endangered Hawaiian monk seal, California harbor seals, northern elephant seals, Risso's, rough-toothed, white sided, and bottlenose dolphins, and, humpback, beluga, and false killer whales. The PI will be responsible for the completion of all project objectives. Her curriculum vitae is attached.

OTHER KEY PERSONNEL

Ms. Susan Inglis is the Director of Research and Rehabilitation Operations at ASLC. She has extensive experience in the rehabilitation of seals and birds. She has 15-year experience managing research projects, including numerous species of fish, sea birds and marine mammals. Her organizational and technical skills will be invaluable to this project. Her curriculum vitae is attached.

Dr. Bobby Middlebrooks is a Professor at the University of Southern Mississippi. He has an immunology laboratory that focuses on the basic components and functioning of the immune systems of marine vertebrates. He has developed immunodiagnostic assays for pinnipeds and is highly qualified to undertake the immunological aspects of this study. He will be responsible for the developing any specific reagents necessary to assay for immunoglobulins in harbor seals, as well as for performing and analyzing the results from those assays. His curriculum vitae is attached.

Salaries have been included for a research associate and a graduate student. The research associate will assist with the overall coordination of the sample collection from the captive seals as well as organize and coordinate sample collections from the rehabilitation seals. The research associate will also work with the community facilitators to increase the sample size of rehab seals entering ASLC. This will include collaborations with the Civil Air Patrol or Coast Guard to assist with transport of seals from nearby communities. In addition, the research associate will work in the endocrinology lab at ASLC and help to maintain quality control and assurance standards for the assays performed there.

The graduate student will be responsible for drafting the experimental designs and sampling protocols. They will assist with the sample collections and perform the laboratory work. With assistance from the PI, they will analyze the data and present them in graphical and tabular form. They will be responsible for the first draft of any manuscripts that arise from the work included in their thesis or dissertation.

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Education: Ph.D. Murdoch University, School of Veterinary Studies, 1985 M.Sc. University of Hawaii, Department of Animal Science, 1981 B.Sc. University of Hawaii, Department of Animal Science, 1978

Professional Experience

Professor, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks 2000-present Science Director, Alaska Sealife Center, Seward, AK 2000-present Associate Researcher, Hawaii Institute of Marine Biology, University of Hawaii 1991- present Affiliate Researcher, Hawaii Institute of Marine Biology, University of Hawaii 1989-1991 Experimental Scientist, Commonwealth Scientific and Industrial Research Organization (CSIRO), Division of Animal Production, Western Australia

Recent Research Projects:

- Reproduction and development of rough-touthed and bottlenose dolphins 1998-2001, NOAA/Seagrant
- Metabolism and reproduction in Hawaiian monk seals, 1998-2001
- Distribution and abundance of odontocetes around Oahu, Hawaii 1999-2001, NOAA/private foundation
- Feeding ecology of Hawaiian monk seals, 1994 to 1996, Waikoloa Marine Life Fund

Selected Relevant Publications:

- West, K.L., Atkinson, S., Carmichael, M.J., Sweeney, J.C., Krames, B. and J. Krames 2000. Concentrations of progesterone in milk from bottlenose dolphins during different reproductive states. *General and Comparative Endocrinology* 117(2):218-224.
- Atkinson S, Combelles C, Vincent D, Nachtigall P, Pawlowski J and Breese M (1999) Monitoring of progesterone in captive female false killer whales, *Pseudorca crassidens*. Gen. Comp. Endo. 115:323-332.
- Goodman-Lowe, G., Carpenter, J. and S. Atkinson 1999. Assimilation efficiency of prey in the Hawaiian monk seal (*Monachus schauinslandi*). Can. J. Zool. 77:653-660.

- Mazzuca, L., Atkinson, S., Keating, B. and E. Nitta 1999. Cetacean mass strandings in Hawaiian Archipelago 1957-1998. Aquatic Mamm. 25(2):105-114.
- Theodorou J and Atkinson S (1998) Monitoring of testosterone in the saliva of captive Hawaiian monk seals. Mar. Mamm. Sci. 14(2):304-310.
- Mazzuca L, Atkinson S and Nitta E (1998) Deaths and entanglements of humpback whales in the main Hawaiian Islands, 1973-1995. Pac. Sci. 52:1-13.
- Silvers LE, Atkinson S, Iwasa M, Combelles C and Salden D (1997) A large placenta encountered in the Hawaiian winter grounds of the humpback whale, Megaptera novaeangliae. Mar. Mamm. Sci. 13(4):711-716.
- Atkinson S (1997) Reproductive biology of seals: reproductive processes and events of phocid and otariid seals. Reviews of Reproduction. 2:175-194.
- Iwasa M, Atkinson S and Kamiya S (1997) Lipofuscin granular cells in regressing corpora lutea and corpora albicantia of ovaries from wild Hawaiian monk seals. Mar. Mamm. Sci. 13:326-332.
- Goodman-Lowe, G, Atkinson, S, and Carpenter, JR. (1997) Initial defecation time and rate of passage of digesta in adult Hawaiian monk seals. Can. J. Zool. 75:433-438.
- Iwasa, I and Atkinson, S. (1996) Analysis of corpora lutea to estimate reproductive cycles of wild Hawaiian monk seals (Monachus schauinslandi). Mar. Mamm. Sci. 12: 182-198.
- Atkinson, S., Becker, B.L., Johanos, T.C., Pietraszek, J.R. and Kuhn, B.C.S. (1994) Reproductive morphology and status of female Hawaiian monk seals (Monachus schauinslandi) fatally injured by adult male seals. J. Reprod. Fert. 100:225-230.
- Pietraszek JR & Atkinson, S. (1994) Concentration of oestrone sulfate and progesterone in plasma and saliva, vaginal cytology and bioelectric impedance during the oestrous cycle of the Hawaiian monk seal (Monachus schauinslandi). Mar. Mamm. Sci 10:430-441.
- Atkinson, S, Gilmartin, WG, & Lasley, BL (1993) Testosterone reduction after injection of gonadotropin releasing hormone in male Hawaiian monk seals. J Reprod Fert 97:35-38.
- Atkinson, S and Atkinson, MJ. (1992) Detection of estradiol-17ß during a mass coral spawning. Coral Reefs. 11:33-35.
- Atkinson, S & Gilmartin, WG (1992) Seasonal testosterone pattern in Hawaiian monk seals. J Reprod Fert 96: 35-39.

Atkinson, S and Atkinson, MJ. (1992) Detection of estradiol-17B during a mass coral spawning. Coral Reefs. 11:33-35.

Adams, NR, Atkinson, S, Hoskinson, RM, Abordi, JA, Briegel, JR, Jones, M and Sanders, MR (1990) Immunization of ovariectomized ewes against progesterone, oestrogen or cortisol to detect effects of adrenal steroids on reproduction. J. Reprod. Fert.89:477-483.

Curriculum Vitae (abbreviated)

NAME:

B. L. Middlebrooks

BUSINESS ADDRESS:

Department of Biological Sciences University of Southern Mississippi Box 5018 Southern Station Hattiesburg, Mississippi 39406

TELEPHONE:

Office --- (601) 266-4748 Fax --- (601) 266-5797

E-MAIL:

bobby.middlebrooks@usm.edu

DATE AND PLACE OF BIRTH: January 12, 1941, Greenville, Texas

SOCIAL SECURITY NUMBER: 456-68-8457

EDUCATION:

B.A. (1962) in Biology from Rice University, Houston, Texas M.A. (1964) and

Ph.D. (1966) in Microbiology from the University of Texas Southwestern Medical School, Dallas, Texas

Postdoctoral (1966-68) in Virology at Army Biological Research Laboratories, Ft. Detrick, Maryland

EXPERIENCE:

1974-present Professor (1982-present), Associate Professor (1977-1982), Assistant Professor (1974-1977), of Microbiology; Administrative positions held: Associate Provost (1998-1999), Assistant Vice President for Academic Affairs (1997-1998), Chair of Biological Sciences (1991-1997), Interim Dean of the Graduate School (1990-1991), University of Southern Mississippi, Hattiesburg, Mississippi

1972-1974 Assistant Professor of Biology, Plymouth State College of the University of New Hampshire, Plymouth, New Hampshire

1968-1972 Assistant Professor of Microbiology, University of Texas Medical Branch, Galveston, Texas

HONORS AND AWARDS:

Recipient of Outstanding Faculty Research Award at the University of Southern Mississippi (1988)

Prepared 4/12/2000

Co-recipient of Mississippi Innovation Advocate Award, presented by the Small Business Administration (1986)

O. B. Williams Award, Texas Branch, American Society for Microbiology (1964)

PUBLICATIONS AND PRESENTATIONS (Representative):

- Patterson, R.A. and B. L. Middlebrooks. 2000. Methods for purification and study of cetacean immunoglobulins, *in* Cell and Molecular Biology of Marine Mammals (in Press)
- Middlebrooks, B. L., J,C, Jones, and R. A. Patterson. 2000. Application of ELISA methodology for detection of *Erysipelothrix rhusiopathiae* antibody titers in cetaceans, *in* Cell and Molecular Biology of Marine Mammals (in Press)
- Jones, J. C., R. A. Patterson, and B. L. Middlebrooks. 1999. The antigenic components of a wild strain of *Erysipelothrix rhusiopathiae* determined by immunostaining of extracted bacterial surface components with serum from *Tursiops truncatus*, *Lagenorhynchus obliquidens*, and *Delphinapterus leucus*. p103 *In* Proceedings of the 29th Annual International Association of Aquatic Animal Medicine Conference
- Osgood, R, R. A. Patterson, and B. L. Middlebrooks 1999. Application of biochemical, immunochemical, and molecular analysis to comparison of *Erysipelothrix rhusiopathiae* isolates from two species of cetaceans to each other and to strains obtained from the American Type Culture Collection. p103 *In* Proceedings of the 30th Annual International Association of Aquatic Animal Medicine Conference
- Patterson, R.A. and B.L. Middlebrooks. 1998. The jacalin affinity chromatography column proves to be an effective method for purifying IgA from Atlantic bottlenose dolphin (<u>Tursiops truncatus</u>), beluga whale (<u>Delphinapterus leuca</u>), and Pacific whitesided dolphin (<u>Lagenorhynchus obliquidens</u> serum. p103 *In* Proceedings of the 30th Annual International Association of Aquatic Animal Medicine Conference.
- B. L. Middlebrooks, Yeuk-Mui Lee, Min Li, and R. D. Ellender. 1994. Effects of repeated immunization and wound trauma on changes in hemolymph agglutinin levels in brown shrimp (*Penaeus aztecus*). <u>Ann. N. Y. Acad. Sci.</u> 712:358-360.
- A.K. Najafabadi, R.D. Ellender, and B.L. Middlebrooks. 1993. Analysis of shrimp hemolymph and ionic modification of a <u>Penaeus</u> cell culture formulation. J. Aquatic Animal Health 4:143-148.
- R.D. Ellender, Ali Najafabadi, and B.L. Middlebrooks. 1992. Observations on the primary culture of <u>Penaeus hemocytes</u>. J. Crustacean Biology. 12:178-185.
- Middlebrooks, B.L., P.G. Voss, W.L. Douglas, and P.M. Toom. 1991. Procedure for selecting monoclonal antibodies for use in a ligand displacement assay of serum antibody levels. J. Immunoassay. 12:125-144.
- Middlebrooks, B.L., N.J. Brown-Peterson, P.M. Toom, and W.L. Douglas. 1988. Evaluation of specific binding affinity and biochemical properties of fish eye-lens reagents from seven teleost species. <u>Comp. Biochem. Physiol.</u> 90B:721-730.

Curriculum Vitae

NAME AND TITLE: Susan D. Inglis, Director of Research and Operations/Rehabilitation ADDRESS: Alaska SeaLife Center 301 Railway Ave., P.O. Box 1329, Seward, AK 99664

Prepared 4/12/2000

Telephone: (907) 224-6345 Fax: (907) 224-6360

EDUCATION

MSc. University of British Columbia, Vancouver, BC 1993 BSc. University of British Columbia, Vancouver, BC 1984

Dielement Deurfeld Menine Station Deurfeld DC 1095

Diploma: Bamfield Marine Station, Bamfield BC 1985

Diploma: Canadian Junior College, Marine Research Station.Carriacou, West Indies July-Sept. 1977 Certificates: Radionuclide Safety and Methodology, University Hospital, Vancouver, BC 1991

GIS-ARC/INFO Method Level 1, BC Institute of Technology, Vancouver BC 1996

ACADEMIC AWARDS:

Federal Industrial Research Assistance Program Award (IRAP)-1990 BC Student Challenge Awards- 1980, 81, 82, 83

PREVIOUS POSTITIONS:

Senior Fisheries Biologist, British Columbia Ministry of Environment, Vancouver BC-1994-96 Principal Investigator/Project Manager, SDI Consulting, Vancouver, BC-1987-94

Supervisor/Biochemist, West Van. Fish Nutrition Laboratory, Dept. of Fisheries and Oceans Vancouver, BC 1986-87

SELECTED PROJECTS:

- 2000. Co-investigator- Scoter life history and ecology: linking satellite telemetry with traditional ecological knowledge.
- 1998-2000. Co-investigator- Biological & behavioral impacts of radio-telemetry attachment on seabirds.
- 1998-2000. Co-investigator- Condition and health indices development for rehabilitated harbor seal pups at the ASLC.
- 1996. Technician-Nutritional analysis of samples for bioenergetic studies on herring, pollock and pink salmon in Prince William Sound.
- 1994. Co-investigator-Lower Fraser River white sturgeon population assessment through telemetry tracking and statistical analysis of angler fishery card data.
- 1994-5. Principal Investigator for 2 year biological and limnological study of Wahleach Reservoir.
- 1992-93. Principal Investigator for 2 year study of the distribution, behavior, and habitat requirements of two endangered fish species in BC.
- 1993. Principal Investigator to determine the impact of proposed summer cold water release from Kenney Dam on growth and behavior of fish populations in the upper Nechako River.

SELECTED PUBLICATIONS/REPORTS:

- Castellini, J.M., S.D Inglis, S. J. Trumble, and M.A.Castellini. 1999. Condition and Health Indices in Rehabilitated Harbor Seal Pups at the Alaska SeaLife Center. *Exxon Valdez* Oil Spill Restoration Project Report, University of Alaska, Fairbanks, Alaska.
- Newman, S. H, S.D. Inglis, and S. Hatch. 1999. Biological & behavioral impacts of radiotelemetry attachment on seabirds. OWCN Project Report, University of California, Davis.

- Castellini, J.M., **S.D Inglis**, S. J. Trumble, and M.A.Castellini. 1999. Condition and Health Indices in Rehabilitated Harbor Seal Pups at the Alaska SeaLife Center. Abstract submitted-13th Bi-annual Conference on the Biology of Marine Mammals, Maui, Nov. 1999.
- Inglis, S.D. 1995. Wahleach Reservoir Fertilization Project Final Pre-fertilization Assessment. BC Environment, Lands and Parks, Fish and Wildlife Management, Surrey, BC Regional Fisheries Report No.LM250
- Rosenau, M., and S.D.Inglis, 1994. Analysis of Lower Fraser River Sturgeon Population. BC Environment, Lands and Parks, Fish and Wildlife Management, Surrey, BC Regional Fisheries Report No.LM242.
- Inglis, S.D. and S.M. Pollard. 1994. Distribution and habitat of the Nooksack dace (*Rhinichthys* sp.) in Canada. BC Environment, Lands and Parks, Fish and Wildlife Management, Surrey, BC Regional Fisheries Report No. LM237.
- Inglis, S.D., Lorenz, A., and M.L. Rosenau. 1993. Distribution and habitat of the endangered Salish sucker (*Catostomus* sp.). BC Environment, Lands and Parks, Fish and Wildlife Management, Surrey, BC Regional Fisheries Report No. LM230.
- Inglis, S.D. and R.W. Blake. 1993. Impact of proposed summer cold water release from Kenney Dam on growth and behavior of fish populations in the upper Nechako River. For BC Ministry of Environment, Victoria, BC.
- Inglis, S.D. 1993. Growth, carcass composition and plasma growth hormone levels in cyclically fed rainbow trout, (*Oncorhynchus mykiss*). Master of Science thesis, University of British Columbia, Vancouver, BC, Canada.

Prepared 4/12/2000

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

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	Authorized	Proposed						e na senten er an
Budget Category:	FY 2000	FY 2001						
Personnel		\$0.0						
Travel		\$0.0						
Contractual		\$160.8						
Commodities		\$0.0	ntes de las		제 24. 10			
Equipment		\$0.0		LONG RA	ANGE FUNDIN	IG REQUIREN	MENTS	
Subtotal		\$160.8			Estimated	Estimated		
General Administration		\$11.3						
Project Total		\$172.1			\$175.0	\$202.0		
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Full-time Equivalents (FTE)		1.6						
			Dollar amount	ts are shown ir	n thousands of	dollars.		
Other Resources								
Comments:								
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	Project Nun	nber: 0155	8					FORM 3A
	Project Title	e Effect of (Dil Producte	on Endocrie	ne and Imm	une		TRUSTEE
FY01	Sveteme in	Harbor Soc						AGENCY
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2001 EXXON VALDEZ TRUST October 1, 2000 - September 30, 2001

	Authorized	Proposed	attenden and the		a deservations	Stea Constants (St.		
Budget Category:	FY 2000	FY 2001						
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Personnel		\$63.9						
Travel		\$4.0					14. ja 14. s. ja 1	
Contractual		\$57.8						ng yang kang dina sang dina sa Sang dina sang dina s
Commodities		\$3.0			e distant			
Equipment		\$0.0		LONG R	ANGE FUNDI	NG REQUIRE	MENTS	
Subtotal		\$128.7		· ·	Estimated	Estimated		
Indirect		\$32.1			2001	2002		
Project Total		\$160.8			\$175.0	\$202.0		
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Full-time Equivalents (FTE)		1.6			andrea Santa an Indea Mary			
			Dollar amount	s are shown ir	n thousands of	dollars.		
Other Resources								
Comments:								
The indirect rate is 25	% TDC, as ne	gotiated by the	e Exxon Valde.	z Oil Spill Trus	stee Council w	ith the Univers	ity of Alaska.	
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Student personnel cos	sts include resi	ident tuition of	\$3006 per yea	ar.				
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	Project Title	e: Effect of (Dil Products	on Endocri	ne and Imm	une		
FIUI	Systems in	Harbor Sea	als					on-Trustee
	Name: Sha	nnon Atkins	son				S	UMMARY
Prepared:							L_	
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2 of 5

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

Personnel Costs:		<u> </u>	Months	Monthly	1	Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2000
Shannon Atkinson	PI/Professor		1.0	10.5		10.5
ТВА	Research Associate		6.0	5.5	ļ	33.0
ТВА	M.S. Student		12.0	1.7		20.4
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Travel Costs:		Ticket	Round	lotal	Daily	Proposed
Description		Price		Days	Per Diem	FY 2000
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				L	Travel Total	\$4.0
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FY01	Project Title: Effect of Oil Products	s on Engochi	ne and immi	ine		
	Systems in Harbor Seals				·	
	Name: Shannon Atkinson				L	DETAIL
	I					

Prepared:



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

Contractual Costs:			Proposed
Description			FY 2000
Hormone analysis (228 Samp	les x5 Hormones @\$13/sample)		14.8
Blood chemistry and proximat	e analyses (ALSC)		8.0
Contaminant Analysis			10.0
Dr. Middlebrooks Subcontract			25.0
		Contractual Total	\$57.8
Commodities Costs:			Proposed
Description			FY 2000
Blood collecting supplies and	regeants		3.0
		Commodities Total	\$3.0
Lingen and consum const. "Several con-			<u> </u>
	Broingt Number 01559	1	OBM 4B
EY01	Project Title: Effect of Oil Products on Endocrine and Immune		
	Systems in Harbor Seals	Co	mmodities
	Name: Shannon Atkinson		DETAIL
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2001 EXXON VALDEZ TRUST OUNCIL PROJECT BUDGET October 1, 2000 - September 30, 2001

New Equipment	Purchases:	Number	Unit	Proposed
Description		of Units	Price	FY 2000
				0.0
				0.0
				0.0
				0.0
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I nose purchases	associated with replacement equipment should be indicated by placement of an R.		ipment i otai	\$0.0
Existing Equipme	ent Usage:		Number	
Description			of Units	
L			L	
	Project Number: 01558		F	ORM 4B
FY01	Project Title: Effect of Oil Products on Endocrine and Imm	une	E	quipment
1101	Systems in Harbor Seals			DETAIL
	Name: Shannon Atkinson			
repared:				5

UNIVERSITY OF ALASKA CASB BUDGET INFORMATION

The University of Alaska accounting system accumulates data according to an established system of accounts codes. This differs from the level or category of detail required on this proposal. Per the new Cost Accounting Standards Board (CASB) guidelines, costs are to be listed in a proposal only to the level of detail at which the subsequent expenditures may be tracked. Therefore, please note that supplies itemized on the budget form may be tracked to UA accounting system categories such as the following examples: 1) project supplies; 2) professional, technical and scientific supplies; 3) field camp supplies; and 4) hazardous materials. Service listings are also broad, but include specific categories such as duplicating, postage, toll charges, and software licensing. A complete list of University of Alaska Accounts Codes is available upon request.

The University of Alaska separates employee fringe benefits into two major categories — Leave Benefits (LB) and Staff Benefits (SB) — with varying rates for each category which are dependent upon job classification as follows for FY 00:

Faculty (LB – 1.3% of salary, SB – 29.2% of salary + LB), Exempt Staff (LB – 19.8% of salary, SB – 26.2% of salary + LB), Non-exempt Staff (LB – 21.1% of salary, SB – 34.4% of salary + LB), Extended Temporary Staff (LB – 15.9% of salary, SB – 34.4% of salary + LB), Temporary Staff (SB – 8.4% of salary), and Student (no benefits). The Leave Benefits have been included with salary in the Salaries and Wages category on your agency budget form; however, the person months shown reflect the actual work time only. Staff Benefits are entered in the Fringe Benefits category.



THE UNIVERSITY OF SOUTHERN MISSISSIPPI

CENTER FOR MOLECULAR AND CELLULAR BIOSCIENCES

Dr. Al Geist EVOS Proposal Coordinator University of Alaska Fairbanks Fairbanks, Alaska

Dear Dr. Geist:

Please accept this letter of intent concerning a proposed collaborative project in which my laboratory at the University of Southern Mississippi would be responsible for portions of an EVOS proposal being submitted by Dr. Shannon Atkinson, Science Director of the Alaska Sealife Center. The proposal will deal with the effects of persistent oil (or oil by-products) on the immune and endocrine systems. Those portions of the project to be carried out by this laboratory are specified in the proposal, with a proposed budget of \$25,000. I have discussed this proposal with our Of fice of Research and Sponsored Programs, and we are in agreement that the portion of the work to be done here will be conducted as a subcontract to be completed if the proposal is recommended for funding and when the final budget for the proposal is established. Thank you for your assistance in this matter. Please feel free to contact me by e-mail or call me at (601) 266-4748 should you need additional information or clarification.

Sincerely,

BLAND

Bobby Middlebrooks, Ph.D. Professor of Biological Sciences

Southern Station

Box 5153

Hattleeburg, Mississippi

39406-5153

(601) 266-4748

(601) 266-4701

Subject: Date: Tue, 11 Apr 2000 14:59:32 -0500 From: Bobby Middlebrooks <bobby.middlebrooks@usm.edu> To: algeist@sfos.uaf.edu CC: shannon_atkinson@alaskasealife.org

Dr. Al Geist EVOS Proposal Coordinator University of Alaska Fairbanks Fairbanks, Alaska

Dear Dr. Geist:

Please accept this letter of intent concerning a proposed collaborative project in which my laboratory at the University of Southern Mississippi would be responsible for portions of an EVOS proposal being submitted by Dr. Shannon Atkinson, Science Director of the Alaska Sealife Center. The proposal will deal with the effects of persistent oil (or oil by-products) on the immune and endocrine systems. Those portions of the project to be carried out by this laboratory are specified in the proposal, with a proposed budget of \$25,000. I have discussed this proposal with our Office of Research and Sponsored Programs, and we are in agreement that the portion of the work to be done here will be conducted as a subcontract to be completed if the proposal is recommended for funding and when the final budget for the proposal is established. Thank you for your assistance in this matter. Please feel free to contact me by e-mail or call me at (601) 266-4748 should you need additional information or clarification.

Sincerely,

Bobby Middlebrooks, Ph.D. Professor of Biological Sciences

	Name:	letter.pdf
 letter.pdf	Type:	Acrobat (application/pdf)
	Encoding :	base64

Correction Factors for Harbor Seal Surveys Using Photo-ID

Project Number:	01560	
Restoration Category:	Research/Monitoring	
Proposer:	Joint from University of Alask	a Fairbanks and ADF&G
Lead Trustee Agency:	ADF&G	
Cooperating Agencies:	none	ana An an an taobha a Anaphagasan an tao
Alaska Sea Life Center:	No	
Duration:	1 st year, 2-year project	APR 1 3 2000
Cost FY 01:	\$64,500	المان المراجع المحكم المراجع المراجع المحكم المراجع المحكم المحكم المحكم المحكم المحكم المحكم المحكم المحكم الم المراجع المحكمة المحكمة المحكمة المحكم الم المحكم المحكمة المحكمة المحكمة المحكم الم
Cost FY 02:	\$57,500	
Geographic Area:	Kodiak	
Injured Resource/Service:	harbor seal	

ABSTRACT

Aerial counts of harbor seals count only those animals on the beach. The fraction of the population on the beach varies by date and with environmental factors such as time of day, stage of tide, etc. Inferring abundance and trends in abundance from counts depends upon correction factors that are subject to uncertainty. Recently developed techniques for photographic identification of individual seals allow a large fraction of a population to be 'marked.' We propose to design and implement mark-recapture experiments to provide substantially improved and integrated estimates of correction factors used to infer abundance and trends of harbor seals.

INTRODUCTION

Harbor seals in the Gulf of Alaska and the Bering Sea declined substantially between the early 1970s and early 1990s (Johnson 1976; Hoover 1983; Pitcher 1990; Jemison 1996; Withrow and Loughlin 1996a; Frost et al. 1999). Within Prince William Sound, harbor seal numbers decreased 62% between 1984 and 1996 with part of that decline attributed to the 1989 *Exxon Valdez* oil spill (Frost *et al.* 1996). However, seal numbers in the Kodiak Archipelago have increased 3% per year since 1993 (Small et al. 1999).

The status of these populations is primarily assessed from aerial counts of animals hauled out of the water. Counts underestimate a population's abundance, as some animals are always in the water. The National Marine Fisheries Service (NMFS) and the Alaska Department of Fish and Game (ADF&G) have differing objectives (estimating abundance and estimating trends, respectively) and consequently use two different methods to "correct" these count data (Frost et al. 1999; Withrow and Loughlin 1995). We will use newly developed photo-ID techniques (Hiby 1990) in an intensive, ground-based mark-recapture study to obtain accurate estimates of the relationship between counts and abundance, and of the influence of various environmental factors. This project will produce better correction factors and will reconcile the two approaches.

NEED FOR THE PROJECT

A. Statement of Problem

Harbor seal abundance and trends in abundance are primarily assessed using aerial counts. However, there are difficulties in inferring harbor seal abundance and population trends from aerial counts. It is possible to obtain fairly precise counts of animals on the beach by making repeated passes over the beach, taking photographs that are later scrutinized in the lab, etc. However, not all animals are on the beach at any one time. Further, the fraction on the beach varies by date, time of day, stage of the tide, etc. (Frost et al. 1999, Small et al. 1999). It is not always possible to count animals under consistent conditions. Logistical or weather-related difficulties may affect when counts can be taken, and some factors such as tidal stage and time of day vary asynchronously (Frost et al. 1999).

In order to monitor trends in the population, the Alaska Department of Fish & Game (ADF&G) annually counts seals on a consistent set of trend sites (Frost et al. 1999; Small et al. 1999). They have used sophisticated statistical methodologies to standardize these counts to common units by estimating the effects of covariates such as date, stage of tide, time of day, etc. on the number of animals seen (Frost et al. 1999; Small et al. 1999; Jay ver Hoef personal communication). This attempt at standardization may suffer from being based on observational rather than experimental data. In at least one instance, counts had been made progressively earlier in the year. This could lead to potentially confounding the effect of date on the fraction of the population on the beach with the underlying true trend in the population (Small et al. 1998). ADF&G does not attempt to convert their standardized counts to an estimate of absolute abundance.

NMFS, mandated by the Marine Mammal Protection Act (MMPA) to estimate absolute abundance, periodically counts seals over their entire range in Alaska. They've used markrecapture data and applied VHF radios to animals to estimate the fraction in the water (Huber

Prepared April 12, 2000

Project 01560

1995; Withrow and Loughlin 1995, 1996b; Loughlin et al. 1992). Based on this fraction, they have applied a single correction factor to their counts and have not attempted to account for variation due to date, tidal height, etc. However, the correction factor that should be applied necessarily varies with the state of the covariates that affect the fraction of the population hauled out (see Figure 1).

Recent work has revealed an additional difficulty. Animals of different sexes and ages differ in the timing of their use of haulouts (Thompson and Rothery 1987; Jemison et al. 1998; Harkonen et al. 1999; Daniel et al. 1999). Thus, depending upon when aerial counts are obtained, the fraction of the animals on the beach and the representativeness of the animals on the beach may vary. A correction factor that does not take these phenomena into account may result in severe biases.

Photographic identification (photo-ID) techniques recently developed by UAF and ADF&G allow mark-recapture studies to be undertaken with a very high rate of 'marking' (Hiby 1990, Crowley et al. 1999, Hastings et al. 1999). This high marking rate allows very precise estimates of abundance (Seber 1982). ADF&G initiated an intensive mark-recapture study using photo-ID at Tugidak Island in 1998, a haul-out in the Gulf of Alaska. We propose to expand this study cooperatively with ADF&G, with increased 'marking' throughout the entire molting season to (1) precisely estimate the fraction of the population in the water at any one time, (2) determine how this fraction varies with date, time of day, and tidal height, and (3) estimate the rates of immigration and emigration of components of the population as the season progresses.

ADF&G has dedicated personnel and financial support to the design and abundance estimation work in their current mark-recapture study. Trustee Council funds are requested for the UAF component of this work: estimation of correction factors for converting aerial counts into absolute abundance estimates, taking environmental covariates into account. This work will constitute a Master's thesis for a UAF student. The study design will be coordinated to accomplish all project objectives. The data collected in this study will be of great value for future NMFS & ADF&G studies of harbor seal demography vital to assessing population status.

B. Rationale/Link to Restoration

Detecting changes in trends or differences in trends among areas through counts obtained during aerial surveys is critical to understanding population status. Accurate abundance estimates are needed in order to monitor the potential recovery of harbor seals, and are required to determine the significance of mortality levels on stock status. This study aims to improve our ability to estimate harbor seal population abundance and trends from aerial count data. This will improve future surveys and allow more reliable inferences to be made from historical counts.

C. Location

All work will be undertaken at Tugidak Island, one of the Trinity Islands in the Kodiak Archipelago in the Gulf of Alaska. Tugidak Island is ideally suited for ground-based studies, because seals are concentrated on a beach directly beneath 15 - 30 m high, vertical cliffs. It has been demonstrated that harbor seals hauled out on Tugidak Island can be photographically 'marked' as individuals through the pelage patterns on their ventral surface. Subsequent 'recaptures' by visually matching photographs categorized by a relational database have been successful (Crowley et al. 1999; Hastings et al. 1999). Tugidak Island has two major harbor seal

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haulouts below high bluffs that permit an excellent vantage point for photography with little potential for disturbance. Additionally, the extensive historical data on harbor seals (Mathisen and Lopp 1963; Bishop 1967; Johnson 1976; Kelly 1979, 1981, Pitcher and McAllister 1981; Pitcher 1990, 1991; Jemison and Kelly 1995, 1996, 1997, in prep.; Jemison 1996, 1997; Jemison et al. 1998) in the area makes Tugidak Island an ideal location to initiate this type of study.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

The co-P.I. serves as a scientific consultant for the Alaska Native Harbor Seal Commission (ANHSC), a non-profit organization formed to increase the role of Alaskan Native resource policy in affecting harbor seals and their uses. One the organization's major goals is to encourage Native peoples to become more involved in research programs through the activities of subsistence hunters and students familiar with, or interested in, harbor seal ecology. This project employs a recently developed approach (Crowley et al. 1999; Hastings et al. 1999) to enumerating harbor seals. As a long-term monitoring tool, the application of the method could be expanded if photographs were obtained by local people over wide regions. Through the P.I.'s work with the ANHSC, we will seek to develop future work in a way that would lend itself to collecting data in collaboration with the ANHSC.

Local people could participate by (1) photographically "capturing" seals, (2) participating in ground-based surveys during pupping and molting, (3) distinguishing color phases, molt phases, age, and gender of harbor seals, and (4) analyzing population data using mark-recapture techniques.

Integrating subsistence hunters and users into research would accomplish several objectives. It promotes (1) a greater understanding of the results of scientific studies, (2) greater stewardship of resources, (3) the opportunity for the incorporation of local and traditional knowledge in the interpretation of results, and (4) the establishment of a trained, local work force able to cost-effectively continue studies as research funds decline.

PROJECT DESIGN

D. Objectives

- 1. Reconcile and integrate the aerial count correction factors used in <u>NMFS</u>'s harbor seal abundance estimates with the covariate (e.g., tide, time of day, date) adjustment approach used by ADF&G for trend estimates.
- 2. Use a quasi-experimental approach to validate some of the covariate adjustments for aerial counts.

E. Methods

Related work by ADF&G: photo-ID methodology.- Seals are not physically captured and marked; rather, all captures and recaptures are done photographically in a manner similar to the methods

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used in mark-recapture studies of other marine mammals (Katona et al. 1979, Hiby and Lovell 1990, 1997; Langtimm et al. 1998, Forcada et al. 1999). Since 1998, harbor seals on Tugidak have been photographed during the breeding (May-June) and molting seasons (July-September; n > 1,500 seals photographed). Individuals are marked and identified by their unique pelage patterns (Kelly 1981, Yochem et al. 1990, Olesiuk et al. 1996, P. Thompson and S. Middlemass, pers. comm.). Short-term studies (1 to 3 years) demonstrated pelage patterns are retained from one year to the next (Kelly 1981, P. Olesiuk pers. comm.). The persistence of pelage patterns throughout the life of the animal is currently being tested by following over several years, seals tagged as pups on Tugidak and captive harbor seals (ages ranging from pup to 18 years) at several aquaria. The use of photo-id to identify individual harbor seals by their natural markings has been used successfully on small (<100) populations in British Columbia (Olesiuk et al. 1996) and California (Yochem et al. 1990). Photo-ID techniques to mark animals presents a unique opportunity to mark a large fraction of the population without disturbance to animals.

The ventral surface of the seal or the side of the head is photographed using a 35mm or digital camera and a Schmidt-Cassegrain telescope (40x). Seals are "marked" when first photographed and "recaptured" when photographed in subsequent samples. Photographs of seals are sent to Conservation Research Ltd. (Cambridge, UK) to be cataloged and matched following the method of Hiby and Lovell (1990). In this method, one to two of the best photos of each seal possessing good photographs and pattern, are selected for "fingerprinting". When fingerprinting, the 3-D model of the head or ventrum is first applied to each photo to compensate for posture and viewpoint, and then the pelage pattern within standardized fingerprint regions is extracted and gray-scale intensities at each coordinate in the region described numerically. This numerical description or "mark" is entered into an ACCESS database, to be used for subsequent matching analyses of other marks. After reading marks from photographs, marks are compared with others of the same view in the database using software developed by CRL. Each comparison generates a standardized similarity score that allows identification of matches for fingerprint pairs with high scores (scores above 2.0). This matching software performs well; comparison of multiple photos of the same seal shows a 2-3% error rate in failing to identify an individual in the database ("false negative"). All matches determined by the software are checked manually to produce a zero probability of a false match. Performance of matching software is continually evaluated to quantify the probability of generating a false negative (using data from tagged seals and from multiple photos of the same seal on the same day).

F. Related work by ADF&G: survey design and estimation of life-history parameters.- Design of a long-term mark-recapture study consisting of multiple systematic surveys (or "photo sessions") is being developed by ADF&G to allow estimation of abundance for both the breeding and molting seasons, as well as annual survival, reproduction, and movement probabilities for the Tugidak Island population. Several designs are being explored through simulation including: open and closed population models (Seber 1982), the robust design (Pollock 1982, Kendall and Pollock 1992) and multi-state designs to estimate movement and breeding probabilities (Nichols et al. 1995). Data will be collected concerning covariates that may reduce heterogeneity in the data and/or be of biological interest, including: age or age-class, sex, molt stage, reproductive status, and variables associated with the photo matching process rather than the biology of the animals (photo quality, pattern quality, color phase, and number of images available for comparison in the database). Priority will be given to photographing pups, yearlings and tagged seals, to increase the known-age and juvenile sample and to test for age-related changes in pelage patterns. The study design and models chosen will address complications unique to using photographs to mark and resight seals, including: "apparent" immigration and emigration of seals over the course of a season due to molt status, and variation in photo and pelage "quality" among individuals and photographs. Simulations will be conducted to evaluate effects of "false negatives" (failing to find a match in the database) on parameter estimates and their standard errors. An initial study design will be finalized by May 2000; evaluation of the design and modifications if necessary, will be completed by May 2001. These studies will produce seasonal abundance estimates for use by the UAF studies outlined below.

This study: estimating correction factors. - Intensive mark-recapture efforts will be undertaken to obtain precise abundance estimates for several dates spread throughout the molting season. One of these dates will coincide with the date of the aerial survey. On these dates, we will make multiple counts of the number of seals hauled out. Counts will be taken at differing stages of tide and time of day.

We will not be able to completely control the variables of interest, so some confounding of date, time of day, and stage of tide is unavoidable. However, to the extent possible we will time our counts to maximize the contrast in conditions. For instance, the time of day when different tidal stages occur depends on the date. Since the same tidal state occurs approximately an hour later each day, counts taken two days apart will encompass different combinations of time of day and tidal stage on a similar date. By carefully selecting the periods of observation, we will be able to separate the influence of each factor on the fraction of seals hauled out.

We will model the effects of environmental covariates on the fraction of the seals hauled out using a modification of the framework employed by Small et al. (1998) and Frost et al. (1999). The count of animals observed on any given day will be a (most likely overdispersed) binomial random variable such that:

$$C \sim binom(N, p)$$
$$\ln(p) = b_0 + \sum b_i x_i$$

C = animals hauled out on the beach

- N = either the total number of animals present (some fraction of which are in the water) at the time of the count or the total number of animals that will use the haulout over the course of the molt. In the latter case, some animal may no longer be in the vicinity of the island and some may have yet to arrive.
- p = the probability an animal is on the beach given the values of the covariates (x's).
- x_i = the value of the covariate *i* (e.g., date, time of day, stage of tide, etc.) standardized to a mean of zero and variance of 1.
- b_i = the strength of the effect of the covariate *i* on the probability of an animal being on the beach. b_0 = the probability of an animal being on the beach under average conditions, i.e., $1/b_0$ is an average correction from counts to absolute abundance.

In addition to linear effects, we will also explore other functional forms (e.g., quadratic) and interactions between covariates. We will validate the significance of each putative covariate using likelihood-based tests that are robust to the phenomenon of overdispersion (e.g., the QAICc of Burnham and Anderson 1998) or resampling-based model selection methods (Manly 1997, Adkison and Peterman 2000). Maximum likelihood estimates of the effect of each remaining

covariate will then be calculated. Bootstrap methodologies (Efron and Tibshirani 1993, Manly 1997) will be used to calculate confidence intervals and the amount of residual variance.

Based on our results, we will convert historical aerial counts of harbor seals on Tugidak Island to estimates of historical abundance and temporal trends. We will compare the results we obtained (estimates of abundance, trends, and the effects of covariates on counts) using our intensive quasiexperimental approach to previous estimates using other, less powerful methods.

G. Cooperating Agencies, Contracts, and Other Agency Assistance

The bulk of this study will be contracted to the University of Alaska Fairbanks, who will provide personnel, supervision, and scientific oversight in design and analysis of this project. The Alaska Department of Fish and Game will assist with logistical support and collaborate on analyses. UAF and ADF&G will coordinate image collection and analyses of this project with ongoing ADF&G studies on abundance estimation.

SCHEDULE

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

(Sep. 1, 2000: Preliminary fieldwork completed - supported by ADF&G)

Jan. 1:	Image analysis of preliminary fieldwork completed
Jul. 1:	Complete development of models and methodology, analysis of first year's data,
•	experimental design for summer 2001 season
Sep. 1:	Fieldwork completed
Sep. 30:	Year-end report submitted

B. Project Milestones and Endpoints

(Sep. 1, 2000: Preliminary field work completed - supported by ADF&G)

FY 2000

Jan. 1:	Image analysis of preliminary fieldwork completed
Jan. ?:	Attend Annual Restoration Workshop
Jul. 1:	Complete development of models and methodology, analysis of first year's data, experimental design for summer 2001 season
Sep. 1:	Field work completed
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Sep. 30: Year-end report submitted

<u>FY 2001</u>

Jan.	1:	Image analysis of 2000) fiel	ldwork	completed

- Jan. ?: Attend Annual Restoration Workshop
- Jun. 1: Data analysis complete, draft manuscript prepared, M.Sc. thesis defense
- Sep. 1: Manuscript submitted to journal
- Sep. 30: Final report submitted
C. Completion Date

September 30, 2002.

PUBLICATIONS AND REPORTS

Results of these studies will be published in refereed scientific journals.

PROFESSIONAL CONFERENCES

Results of these studies will be presented at EVOS meetings and other scientific symposia.

NORMAL AGENCY MANAGEMENT

Funds are requested only for the UAF portion of these studies.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Data collection will be coordinated between UAF and ADF&G investigators to satisfy the several objectives of the joint studies. The University subcontractor and the ADF&G have been collaborating on population studies at Tugidak Island for over 20 years, and they will continue to coordinate research efforts and share camp facilities, equipment, and technical staff. Extensive consultation between personnel is anticipated, as well as joint authorship of some reports and manuscripts. Representatives of <u>NMFS</u>'s National Marine Mammal Laboratory (e.g., Dr. Peter Boveng, Dr. John Bengston) have expressed interest in this project and will be consulted about methodology and analyses. The Alaska Native Harbor Seal Commission will be similarly consulted.

PROPOSED PRINCIPAL INVESTIGATORS

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PRINCIPAL INVESTIGATORS

Milo Adkison is an Assistant Professor of Fisheries at the Juneau Center, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks. Dr. Adkison will assist in design, statistical analysis and interpretation of the UAF studies and be jointly responsible (with Dr. Kelly) for the supervision of the graduate research project and reporting.

Brendan P. Kelly is an Assistant Professor of Biology and Program Coordinator at the University of Alaska Southeast and of Fisheries at the Juneau Center, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks. He also serves as an advisor to the Alaska Native Harbor Seal Commission. Dr. Kelly will assist in design, fieldwork, image analyses, and biological interpretation and be jointly responsible (with Dr. Adkison) for the supervision of the graduate research project and reporting.

Robert Small is principal investigator of the ADF&G statewide harbor seal research program. Dr. Small will oversee the ADF&G research study with Kelly Hastings.

OTHER KEY PERSONNEL

Terry Quinn is a Professor of Fisheries at the Juneau Center, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks. Dr. Quinn will assist in design and statistical analysis of the UAF studies.

John Moran is a graduate student at the Juneau Center, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks. Mr. Moran will perform the bulk of the design, fieldwork, photo-ID, and analyses of the UAF studies under the supervision of Drs. Kelly and Adkison.

Kelly Hastings is a wildlife biologist with the ADF&G statewide harbor seal research program. Ms. Hastings is responsible for survey design, data analysis, and coordination of the on-going ADF&G photo-id project on Tugidak Island.

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Figure 1. The fraction of seals hauled out as a function of a hypothetical covariate (e.g. tide). The vertical bars illustrate the differing amount of correction necessary to calculate absolute abundance from counts for different states of the covariate.

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

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Personnel		\$33.6						
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Contractual		\$0.7						
Commodities		\$5.0						
Equipment		\$5.0	: .	LON	G RANGE FUND	ING REQUIREM	ENTS	
Subtotal		\$48.3		<i>y</i> 1300	Estimated	Estimated		
Indirect		\$12.0		-	2002			
Project Total		\$60.3			\$53.7			
Full-time Equivalents (FTE)		1.1						
			Dollar amounts	are shown	in thousands of	dollars.		
Other Resources				: 				
Comments:								
			x					
[]	······································						<u>г</u>	
FY01Project Number: 01560 Project Title: Correction Factors for Harbor Seal Surveys Using Photo-ID Name: Milo D. Adkison/Brendan P. KellyFS						FORM 4A Non-Trustee SUMMARY		
Prepared:	L			<u> </u>				2 of 5

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

Pers	onnel Costs:	· · · · · · · · · · · · · · · · · · ·		Months	Monthly		Proposed
10000	Name	Position Description	ante, monte de la marca de la mandada de la mandada de la marca de la marca de la marca de la marca de la marc	Budgeted	Costs	Overtime	FY 2000
	Milo Adkison	PI/Assistant Professor		0.5	7.6		3.8
	Brendan Kelly	Associate Professor		0.5	6.3		3.2
	ТВА	M.S. Student		12.0	1.8		21.3
	Terrance Quinn II	Professor		0.5	10.5		5.3
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
				10.5			0.0
		Subtotal		13.5	20.2	U.U	622.6
			ⁱ T !-14	Daviad	<u> </u>	Personnel Total	ş33.0
Trav	el Costs:		LICKET	Round	Total	Daily Day Diam	Proposed
	beschption		FICE		Days	Per Diem	FT 2000
	Juneau to Nodiak		550.0				0.6
	Kodiak to Tugidak (Charter)	maating	2400.0			101.0	2.4
	Juneau to Anchorage (EVUS	meeting)	250.0	2	4	121.0	1.0
							0.0
			-				0.0
			`;				0.0
		and the second					0.0
							0.0
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							0.0
1000000000000					· · · · · · · · · · · · · · · · · · ·	Travel Total	\$4.0
<u> </u>						[
		Project Number: 01560					
	FY01 Project Title: Correction Factors for Harbor Seal Surveys Using Photo-ID						rersonnel
		Name: Mile D. Adkiegen/Brender B. I		a voyo ooniy			& Travel
	i l	Indine. Willo D. Aukison/Dieliuan P. I	Celly				DETAIL
Prep	ared:					L	

3 of 5



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

Contractual Costs:		Prop	osed
Description		FY 2	2000
Communications			0.1
Duplication			0.1
Publication			0.5
î :			
1			
	C	ontractual Total	0.7
Commodities Costs:		Prop	osed
Description		FY 2	2000
Project supplies			0.5
Food			0.7
Basic field gear			1.0
Binocular or spotting scope			0.8
Film, processing, transfer to C	D Construction of the second		2.0
	Com	modities Total	\$5.0
i]	
		FORM 4B	
	Project Number: 01560	Contractual	8.
FY01	Project Title: Correction Factors for Harbor Seal Surveys Using Photo-ID	Contractaal	α
	Name: Mile D. Adkison/Brendan P. Kelly	Commoditie	es
	Name. Willo D. Aukison/Dienuali F. Nelly	DETAIL	
Prepared:			
		4 - 4 5	

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

New E	quipment Purchases:		Number	Unit	Proposed
Descri	ption		of Units	Price	FY 2000
С	amera (with backup camera	body, lens, case, tripod)			5.0
					0.0
1					0.0
					0.0
					0.0
1					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
Those	purchases associated with	replacement equipment should be indicated by placement of an B	New Fr	uinment Total	\$5.0
Evistin	a Fauinment Usade:			Number	+0.0
Descri	otion			of Units	
1	•				
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		Project Number: 01560		F	ORM 4B
F	Y01	Project Title: Correction Factors for Harbor Seal Surveys Using	Photo-ID	E	quipment
. .		Nome, Mile D. Addison/Prender D. Kelly			DETAIL
		INAINE: WIND D. ADKISON/Brendan P. Kelly			
Prepar	red:				
•					5 0T 5

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USING PREDATORY FISH TO SAMPLE FORAGE FISH

Project Number:	01163K 01561						
Restoration Category:	Monitoring						
Proposer:	DOI-FWS						
Lead Trustee Agency:	USFWS						
Cooperating Agencies:	USGSBRD, ADF&G	RECEIVED					
Duration:	3.5 years (FY 01 - FY 04)	APR 1 4 2000					
Cost FY 01:	\$82.2K	EXXON VALDEZ OIL SPILL					
Cost FY 02:	\$116.5K	TRUSTEE COUNCIL					
Cost FY 03:	\$134.5K						
Cost FY 04:	\$26.5K (estimated cost of final repor	rt)					
Geographic Area FY 01:	Kachemak Bay - Cook Inlet (includit lower Resurrection Bay - Chiswell Is	ng the Barren Islands), and slands					
Geographic Area FY 02:	Kachemak Bay - Cook Inlet (includi Resurrection Bay - Chiswell Islands,	Kachemak Bay - Cook Inlet (including the Barren Islands), lower Resurrection Bay - Chiswell Islands, and Prince William Sound					
Geographic Area FY 03:	Kachemak Bay - Cook Inlet (includi Resurrection Bay - Chiswell Islands, Kodiak Island area	ng the Barren Islands), lower Prince William Sound, and the					
Injured Resource/Service:	Common murres; other seabird speci by the T/V <i>Exxon Valdez</i> oil spill	es injured					

ABSTRACT

This proposed multiyear transition project is based on recently completed APEX projects 95163K, 97163K, 98163K, and 99163K. It is designed to develop a strong, cost-effective, communitybased program to monitor long-term trends in capelin, sand lance, and other forage fish stocks in the northern Gulf of Alaska for the upcoming EVOS-sponsored GEM program. The proposed project takes into account the need for meaningful public involvement and participation in long-term EVOS-funded research and monitoring studies. The study establishes a network of partnerships among AMNWR, USGS-BRD, and ADF&G biologists; students and teachers in EVOS-sponsored Youth Area Watch programs; village and tribal council facilitators and resource specialists; and subsistence, sport, and commercial fishermen, and it directly involves residents of oil spill communities and students participating in local Youth Area Watch programs in data collection and monitoring tasks.

INTRODUCTION

Evaluating the influence of fluctuating prey populations (e.g., forage fish) is critical to understanding the recovery of many species injured by the T/V *Exxon Valdez* oil spill; however, it is expensive to conduct annual hydroacoustic and trawl surveys to assess forage fish stocks over broad regions. This proposed project is designed to develop a strong, cost-effective, communitybased program to monitor forage fish populations in the northern Gulf of Alaska by analyzing stomach contents from subsistence- and sport-caught predatory fish, including Pacific halibut (*Hippoglossus stenolepis*), Pacific cod (*Gadus macrocephalus*), lingcod (*Ophiodon elongatus*), and rockfish (*Sebastes* spp.). After the community-based program is established, it can be integrated into the Gulf Ecosystem Monitoring (GEM) plan.

As part of the 1995 APEX project, we began a study to test the feasibility and effectiveness of using stomachs from sport-caught halibut to obtain spatial and temporal data on capelin (*Mallotus villosus*) and Pacific sand lance (*Ammodytes hexapterus*), two forage fish important to piscivorous seabirds (Project 95163K; see Roseneau and Byrd 1996, 1997). Because these initial efforts demonstrated that valuable information could be obtained on the target species by this method, additional data were collected in 1996-1999 (APEX Projects 97163K, 98163K, and 99163K; see Roseneau and Byrd 1998, 1999, 2000).

Results from the 1995-1998 studies provided evidence that analyzing the stomach contents of predatory fish could supply low-cost geographic and relative abundance information on forage fish that could be used to identify seasonal and interannual variations in capelin and sand lance stocks. For example, these data indicated that capelin stocks declined during 1995-1997 and then rose in 1998, while populations of sand lance increased over the 1995-1997 interval and then remained relatively stable in 1998 (see Roseneau and Byrd 1999; based on total numbers of fish, capelin dropped from 60% in 1995 to 49% in 1996 and 19% in 1997, and then increased to 46% in 1998, and sand lance rose from 23% in 1995 to over 40% 1997 and 1998). Data from these studies also indicated that one sampling area (Area 6 - Point Adam) continued to support relatively large stocks of capelin during the same period of time (74%, 65%, 47%, and 61%, in 1995, 1996, 1997, and 1998, respectively). Preliminary results from 1996-1999 Kachemak Bay - lower Cook Inlet beach seine data supported these observations (M. Robards, pers. comm.). Also, the apparent declines observed in capelin populations and increases in sand lance stocks during 1995-1998 were supported by Barren Islands kittiwake chick diet data (capelin = 64%, 28%, 14%, and 32%, and sand lance = 13%, 53%, 63%, and 50% by weight in 1995, 1996, 1997, and 1998, respectively; see Roseneau and Byrd 1999; based on preliminary analyses, 1999 data follow a similar pattern).

Based on the results of the 1995-1999 APEX studies, it appears that analyzing stomach contents from predatory fish can provide valuable spatial and temporal information on forage fish populations (e.g., presence-absence, relative abundance) that would be useful during the EVOS-sponsored long-term GEM program. Therefore, we designed a 3-year-long transition study that will develop a strong, cost-effective, community-based program to monitor long-term trends in capelin, sand lance, and other forage fish stocks in the northern Gulf of Alaska for GEM. The proposed project takes into account the need for meaningful public involvement and participation in long-term EVOS-sponsored research and monitoring work. The study establishes a network of partnerships among AMNWR, USGS-BRD, and ADF&G biologists; students and teachers in EVOS-sponsored Youth Area Watch programs; village and tribal council facilitators and resource specialists; and subsistence, sport, and commercial fishermen. The study plan for the proposed FY 01 – FY 03 work is described below.

NEED FOR THE PROJECT

A. Statement of Problem

Monitoring forage fish stocks during the EVOS-sponsored GEM program would provide valuable information on the long-term status of species important to a variety of northern Gulf of Alaska seabird, marine mammal, and fish populations (e.g., common murres, *Uria aalge*; black-legged kittiwakes, *Rissa tridactyla*; harbor seals, *Phoca vitulina*; northern sea lions, *Eumetopias jubatus*; salmon, *Oncorhynchus* spp.; halibut). It would also provide information on spatial and temporal fluctuations in two key forage fish species (e.g., capelin, sand lance) that may help explain changes that might occur in northern Gulf of Alaska seabird, marine mammal, and fish populations important to subsistence-dependant communities, and subsistence, commercial, and sport fishermen. However, it can be prohibitorily expensive to monitor forage fish over broad regions and long periods of time using standard fisheries techniques, including hydroacoustic, trawl, and beach seine surveys. Furthermore, even if it was feasible to use some combination of these methods to track changes in forage fish populations, past experience strongly suggests that it is unlikely that results from the work would be transmitted to local and regional resource users in timely and easily understandable formats.

B. Rationale/Link to Restoration

The proposed study is designed to develop a strong, cost-effective, community-based monitoring program to monitor long-term spatial and temporal trends in capelin, sand lance, and other forage fish populations in four areas of the northern Gulf of Alaska that will be useful during the GEM program. Data collected by a community-oriented monitoring program will provide valuable information on long-term spatial and temporal changes in forage fish stocks across a broad region that may help explain trends in the abundance and productivity of other Gulf of Alaska species (e.g., seabirds, marine mammals, and fish important to subsistence, commercial, and sport fisheries). The project is a transition study that will be implemented in three stages over a 3-year period (FY 01 - FY 03), and if successful, it will have potential to play an important role in the long-term EVOS GEM program. The proposed work is based on a series of feasibility studies conducted during the recently completed 5-year-long 1995-1999 EVOS-sponsored Alaska Predator Ecosystem Experiment (APEX; see APEX Projects 95163K, 97163K, 98163K, and 99163K, and Roseneau and Byrd 1996, 1997, 1998, 1999, and 2000). However, the scope of the study has been expanded to include collecting data from the lower Resurrection Bay - Chiswell Islands, Prince William Sound, and Kodiak Island areas, in addition to Kachemak Bay - lower Cook Inlet. It has also been expanded to include collecting stomach samples from a variety of subsistencecaught fish, in addition to sport-caught halibut, and to <u>directly</u> involve residents of oil spill communities and students participating in local Youth Area Watch programs in data collection and monitoring tasks. Community and student involvement are important aspects of the proposed project, because it allows data to obtained over a large part of the northern Gulf of Alaska at reasonable cost. It also make it possible to collect information from some locations year-around (few winter data are available on capelin and sand lance, and stomachs from predatory fish caught by subsistence fishermen during winter months may provide new information on these important species). Furthermore, the direct participation of oil spill communities will allow local residents and students to have important stakeholder roles in EVOS-sponsored research and the upcoming GEM program. It will also help encourage and maintain long-term community interest in resource management, and help ensure that results from the work are transmitted to local resource users in a timely and understandable manner.

C. Location

The project will be directed from Homer, Alaska, and the study area will expand over a 3-year period. During the first year of work in FY 01, data will be collected in Kachemak Bay - lower Cook Inlet and the lower Resurrection Bay - Chiswell Islands area. During the second and third years of study in FY 02 and FY 03, samples will also be obtained from Prince William Sound and the Kodiak Island area, respectively (i.e., by the end of FY 03, the first year of the GEM program, the project will be established and functioning in all four of these northern Gulf of Alaska study areas). Communities involved in the study will include Homer, Seldovia, Port Graham, Nanwalek, Seward, Valdez, Cordova, Chenega Bay, Tatitlek, Kodiak, Ouzinkie, and possibly other villages in the Kodiak archipelago. All of these communities will benefit from the proposed project.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Community involvement is an important aspect of the proposed project, and residents from 12 different oil spill communities in four separate areas of the northern Gulf of Alaska will be <u>directly</u> involved in it by FY 03 (see Location above). People participating in the work will include village and tribal council facilitators and resource specialists; Youth Area Watch high school students; subsistence, sport, and commercial fishermen; and school teachers involved in community Youth Area Watch programs. The study will also utilize local knowledge of fishing areas and subsistence species, and observations of forage fish schools by commercial, sport, and subsistence fishermen. Color posters summarizing annual results will be prepared and submitted to the Trustee Council for public display each year after data have been analyzed. Posters will also be supplied to participating community councils and schools, and smaller versions will be printed and handed out at public meetings. The posters and abstracts summarizing annual findings will be available on-disk for inclusion in any on-line products that the Trustee Council may develop for public display. Copies of annual and final reports will be available to the public in Homer and Anchorage. Study results will also be presented at public meetings and workshops, and published in scientific journals. Supplies and services will be purchased locally, whenever possible.

PROJECT DESIGN

A. Objectives

The objectives of the project are to: 1) first develop a strong, cost-effective, community-based monitoring program to track long-term spatial and temporal changes in capelin, sand lance, and other forage fish stocks in the northern Gulf of Alaska that can be used during the GEM program; and 2) then use the forage fish information to help understand and explain changes that might occur in the abundance and productivity of northern Gulf of Alaska seabird, marine mammal, and fish populations important to subsistence-dependent communities, and commercial, subsistence, and sport fishermen.

B. Methods

The project will be directed from AMNWR headquarters in Homer, Alaska, and data will be collected and analyzed by the same basic methods used during APEX Projects 95163K, 97163K, 98163K, and 99163K (see Roseneau and Byrd 1996, 1997, 1998, 1999, 2000). However, the scope of the study has been expanded to include collecting data from the lower Resurrection Bay - Chiswell Islands, Prince William Sound, and Kodiak Island areas, in addition to Kachemak Bay -

lower Cook Inlet. It has also been expanded to include collecting stomach samples from subsistence-caught fish (e.g., halibut, Pacific cod, lingcod, rockfish), in addition to sport-caught halibut, and to <u>directly</u> involve residents of oil spill communities and students participating in local Youth Area Watch programs in the data collection and monitoring tasks (by FY 03, participating communities will include Homer, Seldovia, Port Graham, Nanwalek, Seward, Valdez, Cordova, Chenega Bay, Tatitlek, Kodiak, and Ouzinkie; see below). Methods used by the transition project are summarized below (also see Roseneau and Byrd 1996, 1997, 1998, 1999, 2000).

Data Collection

During the first year of the proposed project in FY 01, data will be collected in the Kachemak Bay – lower Cook Inlet and lower Resurrection Bay - Chiswell Islands areas using the designated data collection sites of Homer, Seldovia, Nanwalek, Port Graham, and Seward. The study will expand to Prince William Sound and the communities of Valdez, Cordova, Chenega Bay, and Tatitlek in FY 02, and to Kodiak Island and the communities of Kodiak and Ouzinkie in FY 03.

The principal investigator will visit participating communities several times every year to provide information on the project to local teachers, community facilitators, and resource specialists, and train participating adults and students. During these trips, information on the study will also be presented to local village, tribal, and IRA councils, and the general public.

Halibut, Pacific cod, lingcod, and rockfish stomachs will be obtained from subsistence and sport fishermen, and charter boat operators in the participating communities during January–March and June-August. The stomachs will be collected by high school students participating the EVOS-sponsored Youth Area Watch projects (e.g., see Projects 00210 and 00610). Students participating in the forage fish sampling project will receive assistance from a variety of sources, including the principal investigator, local teachers, and community facilitators and resource specialists. All students and adults involved in the study will receive comprehensive briefings on the project, including information on sampling strategies and methods for collecting data and identifying key forage fish species (i.e., capelin, sand lance). They will also be supplied with fish identification guides and copies of relevant reports (e.g., Roseneau and Byrd 2000, Roseneau *et al.* 2000, Yang 1990).

The January-March stomach collections will serve as hands-on training sessions for students in local community Youth Area Watch programs. Students involved in the winter data collection efforts will be trained on how to collect and record scientific data, and they will be given a variety of information via lectures and presentations on the role forage fish play in the Gulf of Alaska ecosystem and their potential value for long-term monitoring efforts (e.g., the GEM monitoring program). These students will also receive classroom credit for their work on the forage fish sampling project.

The June-August stomach collections will provide most of the long-term information on forage fish stocks. These samples will be collected by students recruited through local Youth Area Watch programs and participating teachers, community facilitators, and resource specialists. Students selected for these summer jobs will receive small monthly stipends via professional services contacts issued and administered by AMNWR. They will also gain valuable on-the-job experience and training that may lead to future opportunities and career choices in the fields of biology and resource management. *Note: Summer jobs for high school students are scarce in many of the smaller northern Gulf of Alaska communities, and jobs providing experience and training in biological sciences are particularly rare.*

Baseball caps or T-shirts with project logos will be purchased and given to all students, teachers, community facilitators, and resource specialists participating in the project. Students will also

hand out baseball caps and T-shirts to local fishermen contributing some set number of stomach samples to the study (e.g., for 20 stomachs or more; the specific number of samples will be determined at a later date with the help of Youth Area Watch students and teachers). The caps and shirts will help advertise the project, and they will also serve as tokens of appreciation for participating in the forage fish monitoring project.

Alaska Department of Fish and Game (ADF&G) biologists will also collect some stomachs from sport- and subsistence-caught halibut in the Deep Creek and Ninilchik vicinities of Cook Inlet during June-August FY 01, FY 02, and FY 03, as they did in 1996-1999. ADF&G personnel may also help collect stomach samples in Seward.

The halibut, Pacific cod, lingcod, and rockfish stomachs will be labeled, frozen, and shipped to Homer, where contents will be identified by M. Robards, USGS-BRD, using taxonomic keys, photographs, and voucher specimens. Data, including catch dates and locations, will be entered stomach-by-stomach into Excel spreadsheets where the information can be easily sorted by dates, areas, species, and several basic categories of fish and invertebrates (e.g., fish, invertebrates, capelin, sand lance, other forage fish, nonforage fish, flatfish, sculpin, cod, other fish, crabs, shrimp, squid, octopus, mollusks, other invertebrates; see Roseneau and Byrd 1996, 1997, 1998, 1999, 2000).

Data Analysis

Data will be analyzed by first eliminating all potential bait items from the data base (e.g., cod and salmon heads; hook-marked and cut herring) and then calculating numbers and frequencies of occurrence of fish and invertebrates in different geographic areas and time periods (see Roseneau and Byrd 1996, 1997, 1998,1999, 2000). Appropriate statistical tests will be used to check for differences among years and sampling areas (tests will be determined in consultation with biostatisticians).

C. Cooperating Agencies, Contracts, and Other Agency Assistance

Homer based ADF&G fisheries biologists (S. Meyer and W. Dunn) will participate in the proposed study by collecting stomachs from sport- and subsistence-caught halibut in the Deep Creek and Ninilchik vicinities of Cook Inlet during June-August FY 01, FY 02, and FY 03, as they did in 1996-1999 (ADF&G personnel may also help collect samples in Seward). M. Robards, USGS-BRD, will be contracted to identify prey items in stomach samples (Mr. Robards identified all prey items collected during the 1997-1999 APEX projects—see Roseneau and Byrd 1998, 1999, 2000—and he has agreed to continue working in this capacity during this study). AMNWR will provide office, warehouse, lab, and freezer space needed for the project, and will also provide two computers for entering and analyzing data, and donate up to 1 month of the project manager's time (G.V. Byrd) to the study.

SCHEDULE

A. Measurable Project Tasks for FY 01 (1 October 2000 – 30 September 2001), FY 02 (1 October 2001 – 30 September 2002), FY 03 (1 October 2002 – 30 September 2003), and FY 04 (1 October 2003 – 30 September 2004)

<u>FY 01</u>

1 Oct - 31 Dec 2000:

Coordinate FY 01 study plans with community resource specialists, facilitators, and volunteers in participating communities (Seldovia,

Nanwalek, Port Graham, Seward, Homer); visit communities to meet participants and present information on the project to the public and village, tribal, and IRA councils; develop and finalize lines of communication and partnerships with community facilitators and resource personnel; provide Youth Area Watch coordinators with information on the project, and develop and finalize lines of communication and partnerships with these and other Project 01210 personnel. 1 Jan - 31 Mar 2001: Continue coordinating study with community resource specialists, facilitators, and Youth Area Watch personnel in participating communities; train participating Youth Area Watch students and teachers, and community resource specialists in data collection procedures; initiate winter sampling programs to introduce data collection procedures to participating community fishermen, and give Youth Area Watch students hands-on training in interacting with fishermen and collecting, labeling, shipping stomach samples. 1 Apr – 25 May 2001: Hire and train student assistants in participating communities; arrange for adult members of communities to be available to help and guide students in data collection activities; analyze data from winter sampling programs. 26-31 May 2001: Begin summer data collection activities with student assistants in participating communities (i.e., Seldovia, Nanwalek, Port Graham, Seward, Homer). 1 Jun – 31 August 2001: Collect data in participating communities. 1-5 Sep 2001: End summer data collection activities in participating communities. 6-30 Sep 2001: Begin analyzing data collected during June-August. FY 02 1 Oct - 31 Dec 2001: Finish analyzing FY 01 data and prepare poster of results for workshops and meetings; coordinate FY 02 study plans with community resource specialists, facilitators, and volunteers in participating communities (Seldovia, Nanwalek, Port Graham, Seward, Homer, Valdez, Cordova, Chenega Bay, Tatitlek); visit communities to meet participants and present information on the project to the public and village, tribal, and IRA councils; develop and finalize lines of communication and partnerships with

1 Jan – 31 Mar 2002:

Prepared 04/12/00

Project 01163K

other Project 02210 personnel.

community facilitators and resource personnel; provide Youth Area Watch coordinators with information on the project, and develop and finalize lines of communication and partnerships with these and

Compile annual report of FY 01 activities; continue coordinating study with community resource specialists, facilitators, and Youth

community resource specialists in data collection procedures; initiate

Area Watch personnel in participating communities; train participating Youth Area Watch students and teachers, and

winter sampling programs to introduce data collection procedures to participating community fishermen, and give Youth Area Watch students hands-on training in interacting with fishermen and collecting, labeling, shipping stomach samples.

1 Apr – 25 May 2002:

26-31 May 2002:

1 Jun – 31 August 2002:

1-5 Sep 2002:

6-30 Sep 2002:

<u>FY 03</u>

1 Oct - 31 Dec 2003:

1 Jan – 31 Mar 2003:

1 Apr – 25 May 2003:

Finalize and submit annual report of FY 01 activities to Chief Scientist for peer-review by 15 April; hire and train student assistants in participating communities; arrange for adult members of communities to be available to help and guide students in data collection activities; analyze data from winter sampling programs.

Begin summer data collection activities with student assistants in participating communities (i.e., Seldovia, Nanwalek, Port Graham, Seward, Homer, Valdez, Cordova, Chenega Bay, Tatitlek).

Collect data in participating communities.

End summer data collection activities in participating communities.

Begin analyzing data collected during June-August.

Finish analyzing FY 02 data and prepare poster of results for workshops and meetings; coordinate FY 03 study plans with community resource specialists, facilitators, and volunteers in participating communities (Seldovia, Nanwalek, Port Graham, Seward, Homer, Valdez, Cordova, Chenega Bay, Tatitlek, Kodiak, Ouzinkie); visit communities to present information on the project to the public and village, tribal, and IRA councils; develop and finalize lines of communication and partnerships with community facilitators and resource personnel; provide Youth Area Watch coordinators with information on the project, and develop and finalize lines of communication and partnerships with these and other Project 03210 and 03610 personnel.

Compile annual report of FY 02 activities; continue coordinating study with community resource specialists, facilitators, and Youth Area Watch personnel in participating communities; train participating Youth Area Watch students and teachers, and community resource specialists in data collection procedures; initiate winter sampling programs to introduce data collection procedures to participating community fishermen, and give Youth Area Watch students hands-on training in interacting with fishermen and collecting, labeling, shipping stomach samples.

Finalize and submit annual report of FY 02 activities to Chief Scientist for peer-review by 15 April; hire and train student assistants in participating communities; arrange for adult members of communities to be available to help and guide students in data collection activities; analyze data from winter sampling programs.

	26-31 May 2003:	Begin summer data collection activities with student assistants in participating communities (i.e., Seldovia, Nanwalek, Port Graham, Seward, Homer, Valdez, Cordova, Chenega Bay, Tatitlek, Kodiak, Ouzinkie).
	1 Jun – 31 August 2003:	Collect data in participating communities.
	1-5 Sep 2003:	End summer data collection activities in participating communities.
	6-30 Sep 2003:	Begin analyzing data collected during June-August.
	<u>FY 04</u>	
	1 Oct - 31 Dec 2004:	Finish analyzing FY 03 data and prepare poster of results for workshops and meetings.
	1 Jan – 31 Mar 2004:	Compile annual report of FY 03 activities.
•	1-15 Apr 2004:	Finalize and submit annual report of FY 02 activities to Chief Scientist for peer-review by 15 April.
	B . Project Milestones a	nd Endpoints
	December 2000	Complete introducing FY 01 study plans to participating communities and finalize communications and working arrangements with community facilitators, resource specialists, and Youth Area Watch personnel.

students in participating communities.

participating communities.

Youth Area Watch personnel.

communities.

January 2001

June 2001

September 2001

December 2001

January 2002

April 2002

June 2002

Begin FY 02 winter sampling programs with Youth Area Watch students in participating communities.

arrangements with community facilitators, resource specialists, and

Begin FY 01 winter sampling programs with Youth Area Watch

Begin FY 01 summer sampling programs with student assistants in

Submit annual report of FY 01 activities to Chief Scientist.

End FY 01 summer sampling programs in participating

Complete introducing FY 02 study plans to participating communities and finalize communications and working

Begin FY 02 summer sampling programs with student assistants in participating communities.

End FY 02 summer sampling programs in participating communities.

Prepared 04/12/00

September 2002

Project 01163K

December 2002	Complete introducing FY 03 study plans to participating communities and finalize communications and working arrangements with community facilitators, resource specialists, and Youth Area Watch personnel.
January 2003	Begin FY 03 winter sampling programs with Youth Area Watch students in participating communities.
April 2003	Submit annual report of FY 02 activities to Chief Scientist.
June 2003	Begin FY 03 summer sampling programs with student assistants in participating communities.
September 2003	End FY 03 summer sampling programs in participating communities.
April 2004	Submit annual report of FY 03 activities to Chief Scientist.

C. Completion Date

The FY 01 component of the project will be completed on 15 April 2002, when the annual report of FY 01 field activities is submitted to the Chief Scientist. The FY 02 and FY 03 study components will be finished on 15 April 2003 and 15 April 2004, respectively, when annual reports of these activities are sent to the Chief Scientist.

PUBLICATIONS AND REPORTS

The proposed project is part of a multiyear transition study. If funded, annual reports of FY 01 and FY 02 activities will be submitted to the Chief Scientist by 15 April 2002 and 15 April 2003, and a more comprehensive final report summarizing combined FY 01 – FY 03 results will be completed by 15 April 2004 (see above). One paper, based on FY 95 APEX Project 95163K work, has already been published in the Lowell Wakefield Fisheries Symposium series (see Roseneau and Byrd 1997), and a second manuscript discussing the FY 95 – FY 99 APEX studies is being prepared for publication and will be completed after the 5-year data set has been fully analyzed (a final report summarizing the results of the 1995-1999 studies is currently being written and will be submitted to the Chief Scientist by 30 September 2000). After the proposed FY 01-FY 03 studies are completed, another paper will be written that will discuss the role of local communities in long-term monitoring work (tentatively, we plan to submit the above manuscripts to the Lowell Wakefield Fisheries Symposium series; a related manuscript comparing 1995-1999 results with seabird diets may also be prepared and submitted to an ornithological journal (e.g., Auk, Condor, Ibis).

PROFESSIONAL CONFERENCES

The proposed study is part of a multiyear transition project. Results of the FY 01 - FY 03 work will be presented and evaluated at annual Trustee Council-sponsored workshops. After these presentations and evaluations have been completed, project results will be presented at other appropriate professional conferences and meetings (e.g., Lowell Wakefield fisheries symposiums, Pacific Seabird Group conferences).

NORMAL AGENCY MANAGEMENT

The proposed project is not something that AMNWR or the FWS are required to do by statute or regulation. Furthermore, the types of data that will be collected during the study are not part of the standard AMNWR resource monitoring protocols. The project could not be conducted without support from the EVOS Trustee Council.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The FY 01 component of the predatory fish as forage fish samplers project has already been discussed in detail with Nancy Yeaton (Natural Resources Specialist and Community Facilitator, Nanwalek IRA Council), Edgar Otis (Natural Resources Specialist, Port Graham Village Council), and Lillian Elvsaas (Community Facilitator, Seldovia Village Tribe), and will be closely coordinated with these community representatives (similar discussions will be held with a representative of the Qutekcak Native Tribe in Seward in the near future (i.e., Carl Wassilie or his replacement; in FY 02 and FY 03, the study will also be closely coordinated with appropriate community representatives in the Prince William Sound and Kodiak Island regions). The FY 01 project component will also be closely coordinated with EVOS-sponsored Youth Area Watch programs in Homer, Seldovia, Port Graham, Nanwalek, and Seward (Project 01210; see Methods above—participation by students from these communities has been discussed with Joshua Hall, Anchorage School District). Coordination will be expanded to include Youth Area Watch programs in the Prince William Sound and Kodiak areas in FY 02 and FY 03, respectively. Annual study components will also be coordinated with ADF&G fisheries biologists in Homer. ADF&G personnel will participate in the study by collecting stomachs from sport- and subsistence-caught halibut in the Ninilchik and Deep Creek vicinities of Cook Inlet in FY 01 - FY 03, as they did in 1996-1999 (they may also help collect samples in Seward). Data collected during all phases of the project will be shared with ADF&G fisheries biologists, because these data can be used for fisheries management purposes. Note: All discussions held to date with community facilitators, resource specialists, and Youth Area Watch program personnel about the proposed project have been productive and very positive.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

This is a new transition project. Basic study design, including methods and schedules, are similar those used by previously approved APEX Projects 95163K, 97163K, 98163K, and 99163K (see Roseneau and Byrd 1996, 1997, 1998, 1999, 2000). However, the scope of the study has been expanded to include: 1) collecting data from the lower Resurrection Bay - Chiswell Islands, Prince William Sound, and Kodiak Island areas, in addition to Kachemak Bay - lower Cook Inlet; 2) collecting stomach samples from subsistence-caught halibut and cod, in addition to sport-caught fish; and 3) directly involving oil spill communities and students associated with Youth Area Watch programs in the data collection and monitoring work. These changes were made to develop a long-term, cost-effective, community-based program to monitor capelin, sand lance, and other forage fish populations over a large part of the northern Gulf of Alaska. They were also made to help ensure that residents of oil spill communities become directly involved in long-term EVOS-sponsored research and monitoring work (e.g., the upcoming GEM program).

PROPOSED PRINCIPAL INVESTIGATOR

Name: David G. Roseneau Affiliation: Alaska Maritime National Wildlife Refuge Mailing address: 2355 Kachemak Bay Drive (Suite 101), Homer, Alaska 99603-8021 Phone number: (907) 235-6546 Fax number: (907) 235-7783 E-mail address: dave_roseneau@fws.gov

PRINCIPAL INVESTIGATOR

1. David G. Roseneau (Co-Principal Investigator)

Mr. Roseneau will be responsible for the overall day-to-day operation of the project in both the field and the office. He will supervise project personnel, review and approve expenditures, and ensure that work stays on schedule and is coordinated with all participants. He will also be in charge of overall data analysis and interpretation, preparing posters and presentations for scientific conferences and meetings, and writing annual and final reports and manuscripts for publication. Mr. Roseneau received his B.S. degree in wildlife management and M.S. degree in biology from the University of Alaska - Fairbanks in 1967 and 1972, respectively. His thesis research was on the numbers and distribution of gyrfalcons, Falco rusticolus on the Seward Peninsula, Alaska. He joined the U.S. Fish and Wildlife Service in January 1993, and was project leader for EVOSsponsored common murre restoration studies at the Barren Islands during 1993-1994 (Projects 93049 and 94039). Mr. Roseneau was also principal investigator of the 1995-1999 APEX Barren Islands seabird and large fish as samplers studies (Projects 95163J, 95163K, 96163J, 97163J, 97163K, 98163J, 98163K, 99163J, and 99163K), and the 1996-1997 and 1999 Barren Islands and 1998 Chiswell Islands common murre population monitoring projects (Projects 96144, 97144, 98144, and 99144). Currently, he is principal investigator of the 2000 APEX Barren Islands seabird and large fish as samplers studies (Projects 00163J and 00163K) and the 2000 Barren Islands common murre population monitoring project (Project 00144). Prior to 1993, Mr. Roseneau worked as a consulting biologist for over 20 years. During that time, he conducted and managed marine bird, raptor, and large mammal projects in Alaska and Canada for government agencies and private-sector clients, and he also participated in several large-scale murre (Uria spp.) monitoring projects. In 1976-1983, as co-principal investigator of NOAA/OCSEAP Research Unit 460, he conducted monitoring studies of murres and black-legged kittiwakes (Rissa tridactyla) at capes Lisburne, Lewis, and Thompson in the Chukchi Sea, and St. Lawrence, St. Matthew, and Hall islands in the Bering Sea. He also studied auklets (Aethia spp.) at St. Lawrence and St. Matthew islands, and participated in murre and kittiwake projects at Bluff in Norton Sound. During 1984-1986, he also participated in monitoring studies of murres and kittiwakes in the northeastern Chukchi Sea, and in 1987-1988, 1991-1992, and 1995-1999, he conducted additional murre and kittiwake monitoring work at capes Lisburne and Thompson, and Chamisso and Puffin islands. Mr. Roseneau is experienced in collecting and analyzing data on numbers, productivity, and food habits of seabirds; relating trends in numbers and productivity to changes in food webs and environmental parameters (e.g., air and sea temperatures, current patterns); and assessing potential impacts of petroleum exploration and development on nesting and foraging marine birds. He has broad knowledge of rock climbing techniques and has operated inflatable rafts and other outboard-powered boats in the Bering, Chukchi, and Beaufort seas and on various Alaskan rivers in excess of 3,000 hrs. He has also accrued several hundred additional hours operating time in small boats and larger, more powerful vessels (e.g. 25 ft, 300-400 hp HydroSports and Boston Whalers) in Kachemak Bay, Prince William Sound, and Kenai Peninsula and Barren Island waters. During his career, Mr. Roseneau has authored and co-authored over 80 reports and publications, including about 30 on Alaskan seabirds.

Selected Publications

- Roseneau, D.G. and G.V. Byrd. 1997. Using Pacific halibut to sample the availability of forage fishes to seabirds. Pp. 231-241 *in* Forage Fishes in Marine Ecosystems, Proceedings of the International Symposium on the Role of Forage Fishes in Marine Ecosystems, University of Alaska Sea Grant College Program Report No. 97-01, University of Alaska-Fairbanks, Fairbanks, Alaska.
- Murphy, E.C., A.M. Springer, and D.G. Roseneau. 1991. High annual variability in reproductive success of kittiwakes (Rissa tridactyla L.) at a colony in western Alaska. J. Anim. Ecol. 60: 515-534.
- Springer, A.M., E.C. Murphy, D.G. Roseneau, C.P. McRoy, and B.A. Cooper. 1987. Paradox of pelagic food webs in the northern Bering Sea I. Seabird food habits. Cont. Shelf Res. 7: 895-911.
- Murphy, E.C., A.M. Springer, and D.G. Roseneau. 1986. Population status of *Uria aalge* at a colony in western Alaska: results and simulations. Ibis 128: 348-363.
- Springer, A.M., D.G. Roseneau, D.S. Lloyd, C.P. McRoy, and E.C. Murphy. 1986. Seabird responses to fluctuating prey availability in the eastern Bering Sea. Marine Ecol. Prog. Ser. 32: 1-12.
- Springer, A.M. and D.G. Roseneau. 1985. Copepod-based food webs: auklets and oceanography in the Bering Sea. Marine Ecol. Prog. Ser. 21: 229-237.
- Murphy, E.C., D.G. Roseneau, and P.J. Bente. 1984. An inland nest record for the Kittlitz's murrelet. Condor 86: 218.
- Springer, A.M., D.G. Roseneau, E.C. Murphy, and M.I. Springer. 1984. Environmental controls of marine food webs: food habits of seabirds in the eastern Chukchi Sea. Can. J. Fish Aquat. Sci. 41: 1202-1215.

OTHER KEY PERSONNEL

1. G. Vernon Byrd (Project Manager)

Mr. Byrd will supply overall guidance to the project, including providing advice during data analysis and report writing. He will also review reports and presentations as needed, and help prepare manuscripts for publication. Mr. Byrd received a B.S. degree in wildlife management from the University of Georgia in 1968, did post-graduate studies in wildlife biology at the University of Alaska-Fairbanks in 1975, and completed his M.S. degree in wildlife resources management at the University of Idaho in 1989. His thesis, entitled "Seabirds in the Pribilof Islands, Alaska: Trends and monitoring methods", explored statistical procedures for analyzing kittiwake (Rissa spp.) and murre (Uria spp.) population data. Mr. Byrd has worked for the U.S. Fish and Wildlife Service for over 20 years, focusing on studies of marine birds in Alaska and Hawaii. His major interests center around monitoring long-term trends in seabird populations, including numbers of birds and reproductive performance, and he has worked at murre colonies in the Aleutian Islands, the Bering and Chukchi seas, and western Gulf of Alaska. Mr. Byrd was a co-author of the final T/V Exxon Valdez oil spill damage assessment report for murres. Also, he was project manager of the 1993-1994 Barren Islands common murre restoration monitoring projects (Projects 93049 and 94039), the 1995-1999 APEX Barren Islands seabird and large fish as samplers studies (Projects 95163J, 95163K, 96163J, 97163J, 97163K, 98163J, 98163K, 99163J, and 99163K), the 1996-1997 and 1999 Barren Islands and 1998 Chiswell Islands common murre population monitoring projects (Project 96144, 97144, and 98144), and EVOSsponsored work designed to remove predators from seabird nesting habitats (Projects 94041 and 95041). Currently, Mr. Byrd is project manager of the 2000 APEX Barren Islands seabird and large fish as samplers studies (Projects 00163J and 00163K) and the 2000 Barren Islands common murre population monitoring project (Project 00144). He has authored and co-authored over 50

scientific papers and 70 U.S. Fish and Wildlife Service reports on field studies, and has made about 35 presentations on seabirds at scientific conferences and meetings. Mr. Byrd is the supervisory wildlife biologist at the Alaska Maritime National Wildlife Refuge, the premier seabird nesting area in the national public land system.

Selected Publications

- Roseneau, D.G. and G.V. Byrd. 1997. Using Pacific halibut to sample the availability of forage fishes to seabirds. Pp. 231-241 *in* Forage Fishes in Marine Ecosystems, Proceedings of the International Symposium on the Role of Forage Fishes in Marine Ecosystems, University of Alaska Sea Grant College Program Report No. 97-01, University of Alaska-Fairbanks, Fairbanks, Alaska.
- Byrd, G.V., E.C. Murphy, G.W. Kaiser, A.J. Kondratyev, and Y.V. Shibaev. 1993. Status and ecology of offshore fish-feeding alcids (murres and puffins) in the North Pacific Ocean. Proceedings of "Symposium on the Status, Ecology, and Conservation of Marine Birds of the Temperate North Pacific". Canadian Wildlife Service, Ottawa.
- Byrd, G.V., and J.C. Williams. Whiskered Auklet. 1993. A chapter describing the biology of the species in The birds of North America, No. 76 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia PA, and the American Ornithologists' Union, Washington, D.C. 12 pp.
- Byrd, G.V., and J.C. Williams. Red-legged Kittiwake. 1993. A chapter describing the biology of the species in The birds of North America No. 60 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia PA, and the American Ornithologists' Union, Washington, D.C. 12 pp.
- Springer, A.M. and G.V. Byrd. 1989. Seabird dependence on walleye pollock in the southeastern Bering Sea. Pages 667-677 in Proceedings of the International Symposium on the Biology and Management of Walleye Pollock. Alaska Sea Grant Rep. No. 89-1, Univ. of Alaska-Fairbanks, Fairbanks, ALaska.

LITERATURE CITED

- Roseneau, D.G, and G.V. Byrd. 1996. Using predatory fish to sample forage fishes, 1995. Appendix K (13 pp.) *in* APEX: Alaska Predator Ecosystem Experiment (D.C. Duffy, Compiler), *Exxon Valdez* Oil Spill Restoration Proj. Annual rept. (Restoration Proj. 95163), Alaska Natural Heritage Program, Univ. of Alaska - Anchorage, Anchorage, Alaska.
 - _____. 1997. Using Pacific halibut to sample the availability of forage fishes to seabirds. Pp. 231-241 *in* Forage Fishes in Marine Ecosystems, Proceedings of the International Symposium on the Role of Forage Fishes in Marine Ecosystems, University of Alaska Sea Grant College Program Report No. 97-01, University of Alaska-Fairbanks, Fairbanks, Alaska.
 - ____. 1998. Using predatory fish to sample forage fishes, 1997. Appendix K *in* APEX: Alaska Predator Ecosystem Experiment (D.C. Duffy, Compiler), *Exxon Valdez* Oil Spill Restoration Proj. Annual rept. (Restoration Proj. 97163), Alaska Natural Heritage Program, Univ. of Alaska - Anchorage, Anchorage, Alaska.

_____. 1999. Using predatory fish to sample forage fishes, 1998. Appendix K *in* APEX: Alaska Predator Ecosystem Experiment (D.C. Duffy, Compiler), *Exxon Valdez* Oil Spill Restoration Proj. Annual rept. (Restoration Proj. 98163), Alaska Natural Heritage Program, Univ. of Alaska - Anchorage, Anchorage, Alaska.

Project 01163K

_____. 2000. Using predatory fish to sample forage fishes, 1999. *In preparation*. Appendix K *in* APEX: Alaska Predator Ecosystem Experiment (D.C. Duffy, Compiler), *Exxon Valdez* Oil Spill Restoration Proj. Annual rept. (Restoration Proj. 99163), Alaska Natural Heritage Program, Univ. of Alaska - Anchorage, Anchorage, Alaska.

Roseneau, D.G., A. B. Kettle, and G. V. Byrd. 2000. Barren Islands seabird studies, 1999. Appendix J in Apex: Alaska Predator Ecosystem Experiment (D.C. Duffy, Compiler), Exxon Valdez Oil Spill Restoration Proj. Annual rept. (Restoration Proj. 990163), Alaska Natural Heritage Program, Univ. of Alaska, Anchorage, Alaska.

Yang, M-S. 1990. Food habits of the commercially important groundfishes in the Gulf of Alaska in 1990. NOAA Tech. Memorandum NMFS-AFSC-22, NTIS, Springfield, VA.

2001 EXXON VALDEZ TRUST

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FFY 2000	Proposed FFY 2001			a an			
Personnel	\$12.2	\$32.4						
Travel	\$0.6	\$20.1						
Contractual	\$0.0	\$15.8				an teas	en la sur se	and the second second
Commodities	\$2.4	\$7.9						
Equipment	\$0.0	\$0.0		LONG F	ANGE FUNDIN	IG REQUIREM	ENTS	:
Subtotal		\$76.2	Estimated	Estimated	Estimated	Estimated	Estimated	Estimated
General Administration	\$1.8	\$6.0	FFY 2002	FFY 2003	FFY 2004	FFY 2005	FFY 2006	FFY 2007
Project Total	\$17.0	\$82.2	\$116.5	\$134.5	\$26.5			
Full-time Equivalents (FTE)	0.2	0.5					The second second	
			Dollar amou	nts are shown i	n thousands of	dollars.		•
Other Resources								

Comments: This proposed transition project is a new study designed to monitor forage fish populations in the northern Gulf of Alaska. It is based on previously approved APEX Projects 95163K, 97163K, 98163K, and 99163K; however, the 1995-1999 APEX study plan has been modified to include collecting data from the lower Resurrection Bay - Chiswell Islands, Prince William Sound, and Kodiak Island areas, in addition to Kachemak Bay - lower Cook Inlet. It has also been modified to include collecting stomach samples from subsistence-caught halibut and cod, in addition to sport-caught fish, and to directly involve local communities and students associated with Youth Area Watch programs directly in the data collection and monitoring process. This transition project has been designed to be implemented over a 3-year period (FY 01 - FY 03; funds estimated for FY 04 are for analyzing FY 03 data and writing a final report of FY 01 - FY 03 activities), and if successful, will have the potential to play an important role in the long-term EVOS GEM program.

Travel costs for workshops in Anchorage are included in the budget. The Alaska Maritime National Wildlife Refuge is donating up to 1 month of the project manager's time to the project. They are also providing computers, and office, warehouse, lab, and freezer space at no additional cost to the study.

Funds authorized for FFY 2000 (\$17.0K) are for close-out of the 5-year APEX study (final report due 30 September 2000).

2001	Project Number: @#1984 01561 Project Title: Large Predatory Fish as Samplers Agency: DOI-FWS	FORM 3A TRUSTEE AGENCY SUMMARY	
Prepared: 04/10/00			
1 of 4		6/12/9	7

2001 EXXON VALDEZ TRUS

October 1, 2000 - September 30, 2001

			1 .					
Personnel Costs:			GS/Ran	ge/	Months	Monthly		Proposed
Name		Position Description	S	tep	Budgeted	Costs	Overtime	FFY 2001
David G. Roseneau	1	Project Leader (Principal Investigator)	GS11/6		6.0	5.4	0.0	32.4
G. Vernon Byrd		Project Manager	GS13/1		1.0	0.0	0.0	0.0
C. Berg		Program Manager	GS12		0.5	0.0	0.0	0.0
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		÷						
		Subtota			7.5	5.4	0.0	
			·······			Pe	ersonnel Total	\$32.4
Travel Costs:			Tic	ket	Round	Total	Daily	Proposed
Description	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	Pr	rice	Trips	Days	Per Diem	FFY 2001
Travel to Anchorag	e EVOS worksh	nop (1 person)		0.3	1	3	0.2	0.9
Travel to Anchorag	e to coordinate	with Youth Area Watch staff (1 person)		0.3	4	6	0.2	2.4
Travel to Seldovia	to give presenta	tions, train & meet students & facilitators,						
coordinate work wit	th community fa	cilitators & Youth Area Watch personnel		0.1	8	16	0.2	4.0
Travel to Nanwalek	to give present	tations, train & meet students & facilitators,						
coordinate work wit	th community fa	cilitators & Youth Area Watch personnel		0.1	8	16	0.2	4.0
Travel to Port Grah	am to give pres	entations, train & meet students & facilitators	,		-	-		
coordinate work wit	th community fa	cilitators & Youth Area Watch personnel		0.1	8	16	0.2	4.0
Travel to Seward to	give presentat	ions, train & meet with students & facilitators.						
coordinate work wit	th community fa	cilitators & Youth Area Watch personnel		0.2	8	16	0.2	4.8
	- y	• • • • • • • • •						
							Travel Total	\$20.1
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		Project Number: 01163K						
2001		Project Title: Large Predatory Fish a	s Samplers	\$				ersonnei
		Agency: DOI-FWS		-				& I ravel
								DETAIL

Prepared: 04/10/00

6/12/97

2001 EXXON VALDEZ TRUS

October 1, 2000 - September 30, 2001

Contractual Costs:					
Description	FFY 2001				
Contract M. Robards, USGS-BRD, to identify samples and enter data (1.0 month @ \$3.8K/mo = \$3.8K)					
Contract 1 student to collect & label samples in Homer (1 student x 3 months @ $0.8K/mo = 2.4K$)					
Contract 1 student to collect & label samples in Seldovia (1 student x 3 months @ \$0.8K/mo = \$2.4K)					
Contract 1 student to collect & label samples in Nariwalek (1 student x 3 months @ $$0.8K/mo = $2.4K$)					
Contract 1 student to collect & label samples in Port Granam (1 student x 3 months $@$ \$0.8K/mo = \$2.4K)					
Contract 1 student to collect & label samples in Seward (1 student x 3 months @ \$0.8K/mo = \$2.4K)					
When a non-trustee organization is used, the form 4A is required.	\$15.8				
Commodities Costs:	Proposed				
Description	FFY 2001				
Maps, tags, labels, waterproof notebooks and markers, pencils, ziplock bags, other plastic sample bags, wet-lock boxes, plastic buckets, filet knives, measuring tapes, fish identification guides (estimate \$0.5K per community) Incentive items for students & community members who contribute to the project (project baseball caps & t-shirts) (100 items x \$10.00 each) Freight charges for shipping frozen samples from Seldovia, Nanwalek, Port Graham, and Seward to Homer (estimate \$0.8K per community) Costs of copying reports & producing & printing color posters of results for schools, adult volunteers, community centers, and public display [Note: FWS will furnish additional office supplies; office, warehouse, lab, and freezer space; and telephone and postage costs]					
Commodities Total	\$70				
	ψη.9				
2001 Project Number: 01163K Project Title: Large Predatory Fish as Samplers Agency: DOI-FWS	FORM 3B ontractual & ommodities DETAIL				

2001 EXXON VALDEZ TRUS

October 1, 2000 - September 30, 2001

New Equipment Purchases: Numb			Number	Unit	Proposed		
Description of		of Units	Price	FFY 2001			
	No equipment is needed for	or the project			0.0		
76		verlessment success the sold has indicated by placement of our D	No				
Those purchases associated with replacement equipment should be indicated by placement of an R. New Eq					\$0.0		
Existing Equipment Usage:			of Unite				
Dest	лрион				Agency		
Freezers				2	FWS		
Computers				2	FWS		
	·						
[Note: The FWS will also supply office, warehouse, and lab space to the project]							
			· · · · · · · · · · · · · · · · · · ·				
	2001	Project Number: 01163K Project Title: Large Predatory Fish as Samplers Agency: DOI-FWS		F	FORM 3B quipment DETAIL		
Prepared: 04/10/00							
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PROJECT TITLE: "GEM NEWS"

THE GULF ECOSYSTEM MONITORING NEWS BULLETIN: AN ON-LINE MARINE ENVIRONMENTAL QUALITY REPORT

"Submitted Under the BAA"

Project Number:

01566 -BAA

Restoration Category: Ecosystem Synthesis/GEM Transition

Proposer: Intermountain Communications Bill Crampton, owner 60968 Onyx St. Bend, OR 97702 Voice: 541-312-8860 Fax: 541-312-2806 E-mail: intercom@ucinet.com

Lead Trustee Agency:

Cooperating Agencies:

Alaska Sea Life Center: No

Duration: 1st year, 1-year project - pilot.

Cost FY 01: \$117,750

Cost FY 02:

Geographic Area:

Injured Resource/Service:

ABSTRACT

GEM News, an e-mail newsletter, will provide information coordination and news dissemination that meets the information needs identified by the restoration process and the GEM program. The Trustees have indicated they intend to provide leadership in coordinating agency programs and getting information about the Gulf of Alaska to the public. This e-mail and web newsletter is ideal for this purpose. Readership will include agency staff, tribes, commercial fishermen, school districts, local governments, researchers, media and other interested partices.

RECEIVED APR 1 4 2000 EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL

INTRODUCTION

GEM News will enhance stakeholder and public understanding of the restoration process, GEM, and other coastal marine environment issues by providing -- in a weekly electronic mail format -regularly delivered, objective, summary information about policies, proceedings, research and other relevant events and developments related to the Gulf ecosystem. It will enhance information dissemination, public involvement and cooperation among all parties involved in efforts in ensure the long-term health and conservation of the spill-affected marine ecosystem.

A model for *GEM News* will be the highly successful *Columbia Basin Bulletin (CBB): Weekly Fish and Wildlife News*, also produced by project sponsor, Intermountain Communications, and supported with Bonneville Power Administration fish and wildlife mitigation funds. (Many Alaskans use the CBB to track Basin issues related to Alaska fisheries issues.)

The *CBB* keeps policymakers and the public posted on the most significant developments related to fish and wildlife policy activities in the Basin and directs them to websites, documents and email addresses offering more information on specific topics. In addition, the *Columbia Basin Bulletin* responds to the need of federal and state agencies to involve the public in the various processes related to fish and wildlife restoration. The CBB keeps policymakers, stakeholders, and the public aware of regional hearings and information meetings, public comment periods, congressional hearings, conferences, workshops and other public activities.

GEM News will do much the same thing for those working on Gulf of Alaska ecosystem issues. Methods used to gather information will include attendance at meetings and conferences, hearings, telephone interviews, and face-to-face interviews. GEM writers will also utilize research reports (and comments on those reports), studies, press releases, meeting announcements, policy letters, memoranda and other documents as information sources.

GEM News will provide readers: an understanding of the scope of technical information used in policy decisions; an understanding of the multiple perspectives included in decision-making; a presentation of various positions addressed in the decision process; and a presentation of the political and technical constraints incorporated in decisions. The electronic newsletter provides effective dissemination of information for policymakers and the public.

Intermountain Communications is proposing the GEM News be funded as a pilot project so Trustees can gauge its usefulness for the restoration process and GEM.

NEED FOR THE PROJECT

A. Statement of the Problem

Efforts to assess, restore, protect and enhance the Gulf of Alaska coastal marine environment in the wake of the oil spill involves complex policy initiatives and restoration activities that policymakers, stakeholders and the interested public find difficult to track. Yet, because of the inter-relationships and interactions of management actions throughout the Gulf, it's vital that policymakers, stakeholders, and the interested public are able to keep up with the range of meetings, policies, and materials related to restoration, GEM and other Gulf issues. Effective information dissemination plays a key role in the coordination and success of fish and wildlife

Date Propared: 4/11/2000

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restoration efforts. The production of an electronic newsletter to provide summary information about fish and wildlife issues important to the restoration process and GEM meets this need.

B. Rationale/Link to Restoration

GEM News is a logical component of the Trustees' mandate to provide information that facilitates public involvement and improves dissemination and coordination of information. With GEM News, policymakers and the public are kept posted on the most significant developments related to Gulf restoration and protection activities and directed to websites, documents and cmail addresses offering more information on specific topics.

In addition, *GEM News* responds to the need of federal and state agencies to involve the public in the various processes related to restoration. *GEM News* will keep policymakers, stakeholders, and the public aware of regional hearings and information meetings, public comment periods, congressional hearings, conferences, workshops and other public activities.

C. Location

Writers for *GEM News* will be located in Anchorage and coastal communities. Supervising editor Bill Crampton, owner of Intermountain Communications, is located in Bend, Oregon. Intermountain Communication will consider an Anchorage office, but today's technology makes it possible to gather information and distribute it without a central office, as has been shown by the CBB. All communities in the oil spill area will benefit by *GEM News*' distribution of vital news and information.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

GEM News will seek correspondents among residents of spill-area communities to assist in information gathering and will consider working with school districts in using *GEM News* as a training tool for those interested in journalism, information technology, and science. *GEM News* will assist the Trustee Council in its concerted effort to increase communication with spill-area residents about restoration efforts. It will play a key role in communicating in non-technical language to local communities research findings and other information. Intermountain Communications will consider a fax version of *GEM News* for those without access to the Internet.

PROJECT DESIGN

A. Objectives

The objectives of GEM News are:

- 1) Provide timely, objective, summary information related to the restoration process and GEM, using an e-mail delivery system.
- 2) Provide quality customer service to subscribers and interested individuals.
- 3) Market the newsletter to increase circulation.

Date Prepared: 4/11/2000

B. Methods

For each edition, the editor will discuss with *GEM News* writers throughout the oil-spill area key events and information that need to be covered and make a decision on how best to use reporting, writing, and editing resources. As much as possible the editor will aim for *GEM News*' content to reflect the geographic diversity and scope of issues which makes up the restoration efforts in the Gulf.

Because the newsletter will be supported with public funds, every effort will be made by the editor and writers to ensure fairness of coverage and avoid bias and the perception of bias.

- 1. a.) Reporters will use traditional journalistic methods of gathering information. Reporters will attend meetings, conduct telephone and face-to-face interviews, and read and summarize reports and other documents.
 - b.) Reporters must be responsible for coverage of the following:
 - Cover key Council meetings and activities.
 - Cover federal, state, local meetings related to the restoration efforts and GEM.
 - Cover congressional and Administration activities related to restoration efforts and other relevant marine environment developments.
 - Cover relevant conferences, workshops, key personnel changes, reports, studies, memoranda, letters, legislation, fisherics, projects and programs, and research.
 - c.) Reporters must:
 - Accurately portray positions discussed at meetings.
 - Include in coverage diverse reactions to documents, policy initiatives and other items covered.
- 2. a.) GEM News will provide quality customer service in the following ways:
 - Provide a "feedback" feature allowing readers to respond to content.
 - Provide names and contact information for sources used in preparing cach edition.
 - Respond positively to subscribers seeking more information about topics covered.
 - Provide assistance to subscribers having technical difficulties with e-mail delivery (which is rare).
 - · Conduct readership survey to monitor customer satisfaction with content and

Date Prepared: 4/11/2000
delivery methods and assess usefulness of information.

- 3. Market the newsletter to reach readers both inside and outside restoration policy circles by:
 - a.) sending press releases about *GEM News*, making phone contacts, and placing notices in journals, other publications, and on the Internet;
 - b.) encourage subscribers to forward GEM News to other potential interested párties.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

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SCHEDULE

A. Measurable Project Tasks for FY01

October 1-31:	Preparation, contract with writers
November 1-30:	Begin production and distribution bi-weekly
January 16-26	Attend Annual Restoration Workshop
February 1-28:	Survey users
August 1-31:	Second survey of users
September 15:	Submit year-end report

B. Project Milestones and Endpoints

The objectives listed above will be met with the production and distribution of *GEM News* throughout the fiscal year.

C. Completion Date

During the fiscal year all of the project's objectives will have been met.

PUBLICATIONS AND REPORTS

In the Fall of 2001, Intermountain Communications owner, Bill Crampton, will write either an op-ed or article to be submitted to media trade journals and other publications which will discuss the success of the e-mail newsletter approach as a way to coordinate and communicate important information about major environmental restoration efforts. The article will use *GEM News* as example of a successful application of this approach.

PROFESSIONAL CONFERENCES

There are no plans to attend professional conferences to present project results. However, if asked, Bill Crampton, owner of Intermountain Communications, would be willing to attend conferences to explain the principles and successes of *GEM News*.

Date Prepared: 4/11/2000

NORMAL AGENCY MANAGEMENT

NA

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

GEM News will work closely with others involved in the restoration and GEM to ensure relevant, accurate, timely information is disseminated to agency staff, tribes, commercial fishermen, school districts, local governments, researchers, media and other interested parties. In October, Bill Crampton, owner of Intermountain Communications, will work with Council staff in contacting key personnel and offices to inform them about GEM News and to explain how to get information into the Bulletin.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

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PROPOSED PRINCIPAL INVESTIGATOR

Bill Crampton Owner, Intermountain Communications 60968 Onyx St. 541-312-8860 Fax: 541-312-2806 E-mail: Intercom@ucinct.com

PRINCIPAL INVESTIGATOR

Bill Crampton has a bachelor's degree in journalism from the University of Washington and a master's degree in American History from Washington State University. For 20 years he worked as an award winning reporter and editor for Northwest newspapers, including three years as a reporter for the Fairbanks Daily News Miner. In 1997, he founded Intermountain Communications, which launched the print newsletter *The Northwest Salmon Recovery Report* In 1998, he launched the on-line news report *The Columbia Basin Bulletin: Weekly Fish and Wildlife News.* Crampton will be responsible for supervising the set up and production of *GEM News.*

OTHER KEY PERSONNEL

Barry Espenson, editor and senior reporter for *The Columbia Basin Bulletin* will assist Crampton in the set up and production of *GEM News*. Espenson has a bachelor's degree in journalism from the University of Oregon and has worked as reporter and editor for Northwest newspapers for 20 years.

LITERATURE CITED

The Columbia Basin Bulletin: Weekly Fish and Wildlife News

Date Prepared: 4/11/2000

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October 1, 2000 - September 30, 2001

	Authorized	Proposed	
Budget Category:	FY 2000	FY 2001	
Personnel		\$73.5	
Travel		\$12.0	
Contractual		\$6.0	
Commodities		\$0.0	
Equipment		\$2.1	LONG RANGE FUNDING REQUIREMENTS
Subtotal	\$0.0	\$93.6	Estimated
Indirect		\$24.2	FY 2002
Project Total	\$0.0	\$117.8	
		· · · · · · · · · · · · · · · · · · ·	
Full-time Equivalents (FTE)		4.0	
1			Dollar amounts are shown in thousands of dollars.
Other Resources			
Comments:		-	
If the Trustees and Staff are in	terested in cons	idening this p	project, Intermountain Communications would like to work with Staff in refining the

numbers so it meets both the financial and information needs of the Council and Stakeholders.

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FY01		Project Number: 0(566-BAA) Project Title: GEM News		FORM 4A Non-Trustee
		Name: Intermountain Communications	,	SUMMARY
Prepared:	•	•		1 of

October 1, 2000 - September 30, 2001

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Personnel Costs:			Months	Monthly	1	Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2001
Bill Crampton	Project Manager		12 months	1.0 per mont	No overtime	12.0
Barry Espenson	Senior Editor		12 months	1.0 per mont	No overtime	12.0
To be hired	Senior Reporter - Anchorage based		11 months	2.5 per mont	No overtime	27.5
To be hired	Correspondents - Gulf based		11 months	2.0 per mont	No overtime	22.0
					1	0.0
						0.0
						0.0
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						0.0
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	Subtotal		36.0	6.5	0.0	
		-		۲e	rsonnel lotal	\$73.5
Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Drem	FY 2001
Decland to Anchorean h	ampton and Barry Espenson traveling from		l		1	12.0
Coursell staff and most w	with writers. Other travel will be on on an engine		·		ľ	0.0
hasis and he determined	the the locations of bearings, meetings	j				
conferences and other in	mortant events to be coved red by Gem			l		
News writers All travel	will require pre-amproval by Project Manager					0.0
Bill Crampton	wii require pre appreter by rieject manager		1			
						0.0
	<i>,</i>					
]		0.0
			ſ	1	1	0.0
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				4	Travel Total	\$12.0
					1	
						FORM 4B
EVOA	Project Number:					Derconnel
	Project Title: GEM News					
	Name: Intermountain Communice	tions				
		ang no				DETAIL
Prepared:					j	2 0

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 October 1, 2000 - September 30, 2001

Contractual Costs:			Proposed
Description			FY 2001
Telephone		ł	4.0
Distribution and Web	Posting		2.0
		Contractual Total	\$6.0
Commodities Costs:			Proposed
Description			FY 2001
			·
		-	
	•		
		Commodities Total	\$0.0
			ORM 4B
EV04	Project Number:	Con	itractual &
FTUI	Project Title: GEM News	Cor	nmodities
	Name: Intermountain Communications		TAH
L			
Prepared:		· · ·	· ·

3 of 4

October 1, 2003 - September 30, 2001

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 2001
O ne Lap top computer and software	1	2100.0	2,100.0
			0.0
			0.0
			0.0
			0.0
		-	0.0
		i	. 0.0
			0.0
			0.0
			0.0
			. 0.0
			0.0
These purchases appainted with real generation and should be indicated by algorithment of an D	Nou Eau	inment Total	0.0
Evipting Environment liegge	NEW EQU	Number	φ2,100.0
Description		of Unite	
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]
Project Number		F	ORM 4B
FY01 Project Title: GEM Nows		E	quipment
Name: Informeustain Communications			DETAIL
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Book on EVOS science for general readers

Project Number:	01570
Restoration Category:	Public Information
Proposer:	Shana Loshbaugh
Lead Trustee Agency:	REEFFED
Cooperating Agencies:	APR 1 4 2000
Alaska SeaLife Center:	no EXXON VALDEZ OIL SPILL
Duration:	1st year, 1-year project
Cost FY01:	\$43,900
Cost FY02:	none
Geographic Area:	Prince William Sound, Kenai Peninsula, Anchorage and Fairbanks
Injured Resource/Service:	Lost and reduced human services (indirectly)

ABSTRACT

The project will produce a publication-ready, book-length manuscript about the scientific and restoration projects following the EVOS. Written for the intelligent lay reader, it will emphasize the cutting-edge quality, adventurous experiences, ethical issues and lucid, non-technical explanations of findings. Based on interviews, symposium presentations and review of the technical literature, it will include discussions of scientists' personal motivations, partnerships between Western and indigenous knowledge systems, legal entanglements, technical advances, the interdisciplinary ecosystem approach and the implications both process and findings hold for future research design, science in the public arena, and the environment.

INTRODUCTION

The project being proposed is the research and writing of a manuscript to bring the scientific results and restoration efforts of EVOS Trustee Council to a broader audience beyond the circle of scientists and resource managers.

The proposal is new.

It is linked to all the projects that have gone before, in that it synthesizes their results and presents them to the public in a new -- hopefully appealing and enduring -- form. Its source materials will be reports on other projects, publications in the peer-reviewed scientific literature, interviews with investigators and regional stakeholders, and the presentations at the 1993 and 1999 symposia.

NEED FOR THE PROJECT

A. Statement of Problem

Professionals involved in the restoration process have expressed concern that the significance of their findings has only reached a small audience.

At the end of *Legacy of an Oil Spill*, the 1999 symposium commemorating the 10th anniversary of the *Exxon Valdez* oil spill, EVOS Trustee Council Director Molly McCammon addressed a conference room filled with scientists.

"There is still a disconnect between the scientists and the public," she said.

Scientist Charles "Peter" Peterson urged those present to bring the cutting-edge research and its findings' implications to a broader audience.

"We know about it," he said. "We've seen it here. Now we need to make sure it leaves this room."

The majority of findings from restoration projects have been published in technical periodicals or reports that are not readily accessible to the general reader. Popular publications (such as newspapers and magazines), with the notable exceptions of the "Restoration Notebook" and "Alaska Coastal Currents" series, have provided limited coverage on the major findings, technical advances and implications from EVOS-related science.

B. Rationale/Link to Restoration

This book would enhance the value of all the other restoration and research that preceded it. Disseminating results of the entire decade's work to a wider audience would have advantages including (but not limited to):

Helping people in the spill area and other concerned citizens understand and feel connected
to what happened in 1989 and is happening now;

Prepared 4/12/00

Project 01

- Dispelling myths that science is a dull and detached pursuit;
- Moving the general public toward a more sophisticated understanding of environmental problems;
- Inspiring educators and students, especially in Alaska, to examine vital, contemporary science; and
- Building a constituency that appreciates the relevance, stature and attraction of this type of scientific endeavor.

A book for general readers would find a place in public library shelves, offices, homes and classrooms. Motivated students, concerned residents, elected officials and researchers from other disciplines easily could pick it up and come away with insight into why the EVOS Trustee Council's projects have been significant.

By including the human drama and wilderness adventure involved with the efforts, the book will remain relevant and interesting long after more technical publications become dated.

C. Location

Most of the project's work would consist of reading and writing – portable pursuits that can be done nearly anywhere. I intend to do most of this book project out of my home office.

To enhance accuracy and impact, some excursions to field and research sites in the spill area are necessary. These will be arranged with scientists being interviewed.

Library research and interviews also will necessitate infrequent trips to Anchorage and Fairbanks.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

People from affected communities will be included in the interview process.

The partnership developed between scientists and Native villagers to assist each other in understanding spill effects is one major topic to be included in the book.

Communicating findings and other project information to local communities in non-technical language is the main point of this entire project.

PROJECT DESIGN

A. Objectives

The prime objective of the project is to produce a manuscript of 200 to 400 pages by the report deadline ready for publication.

Prepared 4/12/00

Project 01

The secondary objective is to arrange for a publisher to print and distribute the work.

B. Methods

The project would consist of three major phases: research, writing and marketing.

The research phase would begin with a thorough reading of final project reports, symposium proceedings and review publications from EVOS Trustee Council and Exxon science projects. It would continue with interviews of people affected by the spill or involved in damage assessment or restoration research. The interviews would include discussions about attitudes toward the spill and the scientific work it generated; evaluation of findings investigators consider most significant; their impressions of the overall course of the restoration project; memorable experiences they encountered in the course of their work and their concerns about the future of Alaska's coastal areas, ecological research, and the environment. The research phase also would include reading of selected articles from the EVOS technical literature and study of how other popular books on science present their subject matter.

The writing phase would overlap the research. It begins with a general outline and detailed field and interview notes. Sections would be roughed out, then combined into a whole. Along the way, arrangements would be made for photographic and graphic illustrations. The draft text would be subjected to several revisions, including review by interview subjects, people knowledgeable about the history of the EVOS Trustee Council restoration efforts and professional editors.

The third phase would involve locating a publisher to print and distribute the completed book. (See below.)

C. Cooperating Agencies, Contracts and Other Agency Assistance

This project is, by its nature, inclusive and independent. No agency involvement -- in the conventional sense -- is needed.

However, publication requires assistance. To that end, I already have entered into preliminary discussions with the University of Alaska Press.

SCHEDULE

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

October 1 - December 31:	Complete identification of source literature; complete review of
	half of basic review literature; identify preliminary interview list
	and complete preliminary outline.
January 16-26:	Attend Annual Restoration Workshop
January 1 - March 31:	Complete basic literature review; complete first round of
	interviews; complete intermediate outline; identify potential

Project 01

	illustrations and begin drafting text based on literature review and preliminary interviews
March 10 - 31:	Complete and submit book proposal
April 1 - June 30:	Conduct secondary interviews and secondary literature search; arrange summer field visits; complete detailed outline; complete bulk of rough draft and revise early sections
July 1 - August 30:	Conduct summer field visits and final interviews; complete rough draft and preliminary revisions
September 1-30:	Undergo peer review of text sections and professional editorial review of draft; complete revisions of manuscript

B. Project Milestones and Endpoints

March 31:	Submit book proposal to potential publisher
September 30:	Submit manuscript to potential publisher

C. Completion Date

The manuscript will be completed at the end of FY01. Actual publication date will be determined by the publisher. Some revision will be undertaken in FY02 in collaboration with the publisher.

PUBLICATIONS AND REPORTS

Submit a book, tentatively titled *E.V.O.S.: the Alaska Oil Spill and the Frontiers of Environmental Science*, to the University of Alaska Press by September 30, 2001.

Other publications, based on excerpts of the book, may be submitted to mass market Alaska newspapers or magazines during the year of the project. Brief excerpts from the book will be available for posting on Internet sites describing EVOS Trustee Council restoration projects.

The annual report, to be completed by April 15, 2002, will include information about the completed manuscript and its status on the road to publication.

PROFESSIONAL CONFERENCES

Presenting this type of project at professional conferences is not appropriate. However, I may attend conferences on an *ad hoc* basis as an observer and distribute fliers describing the forthcoming book to conference participants.

NORMAL AGENCY MANAGEMENT

Not applicable.

Prepared 4/12/00

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project will integrate with nearly all other restoration efforts from an observer's point of view. The starting point will be meeting with Trustee Council staff and the Chief Scientist for recommendations and an overview of the entire research effort.

The interview phase and secondary literature search will require cooperation with individual investigators, including visits to laboratories and field sites for first-hand information about the day-to-day realities of their work. Interview subjects and leaders of major restoration projects will have opportunities to review sections of the draft manuscript referring to their own work.

The publication of the completed manuscript requires involvement of a publisher. The University of Alaska Press seems most appropriate for this task. They cannot commit to the publication until they see a detailed proposal; I cannot give them a detailed proposal until I have secured funding for the research and writing phase.

Following is the text of an e-mail from the press dated March 20, 2000:

Dear Ms. Loshbaugh:

A book on the results of scientific research on the effects of the Exxon Valdez oil spill sounds like a worthy project, and one we would be pleased to consider. With more information at this development stage, the Press could lend its support in the form of a letter expressing interest; we could not enter into an agreement to publish a work without more about the book, a prospectus that includes an overview of the book's subject, contents, length, photographs, other illustrations, chapter by chapter narrative outline, potential audience and market for the book, and author's CV. A final decision by our editorial board is based on peer review of a complete manuscript.

I shared your letter with our managing editor Carla Helfferich. She will contact you directly.

Thank you for thinking of the UA Press.

Sincerely,

Pam Odom

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

Not applicable.

PROPOSED PRINCIPAL INVESTIGATOR, IF KNOWN

Shana Loshbaugh Doug and Shana Loshbaugh, Freelance Writing P.O. Box 1165 Soldotna AK 99669 (907) 262-3126 or 398-8956 fax (907) 262-6176 mutski@alaska.net

PRINCIPAL INVESTIGATOR

Shana Loshbaugh is a professional journalist with a background in science.

She holds a B.A. degree in biology from Carleton College and an M.S. degree in Animal Science from the University of Minnesota. She has lived in Alaska since 1981 and has worked in Homer, Soldotna, Valdez, Seward, Cordova, Anchorage and Dillingham.

During the 1989 oil spill, she worked for the sea otter rehabilitation project, becoming the documentation supervisor and serving the second longest of any employee on the project. She subsequently worked for the U.S. Fish and Wildlife Service on the 1990 Sea Otter Symposium, serving as a presenter, section editor and technical editor of the published proceedings. She remains involved with organizations that grew out of that experience, serving as a member of International Wildlife Research, Inc. and the Marine Wildlife Rescue Team.

She has worked as a journalist since 1991, for the Homer News, freelancing, and, most recently, for the Peninsula Clarion. Her work has appeared in the *Peninsula Clarion*, the *Homer News*, the *Anchorage Daily News*, the Associated Press wire service; *Alaska* magazine, *National Fisherman*, *Outdoor America*, *Senior Voice*, *Business News Alaska* and others. In 1998 and 1999 she single-handedly researched, wrote and published *The Cook Inlet and Kenai Peninsula Science Newsletter*. Among other subjects, she has reported on science, the environment and the 1993 and 1999 EVOS symposia.

Her writing awards include first place in the open nonfiction category of the Anchorage Daily News/University of Alaska Creative Writing Contest in 1992 for a natural history essay and the 1999 award for best reporting on the environment in a daily paper from the Alaska Press Club.

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OTHER KEY PERSONNEL

Not applicable.

LITERATURE CITED

Appended are copies of samples from my writing portfolio. Also contributed to:

Bayha, K. and J. Kormendy, editors. Sea Otter Symposium: Proceedings of a Symposium to Evaluate the Response Effort on Behalf of Sea Otters After the T/V Exxon Valdez Oil Spill Into Prince William Sound, Anchorage, Alaska, 1990. U.S. Fish and Wildlife Service Biological Report 90 (12).

Williams, T. M. and R.W. Davis, editors. *Emergency Care and Rehabilitation of Oiled Sea Otters: A Guide for Oil Spills Involving Fur-bearing Marine Mammals*, University of Alaska Press, Fairbanks, AK. 1995.

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October 1, 2000 - September 30, 2001

	Authorized	Proposed	
Budget Category:	FY 2000	FY 2001	
Personnel		\$38.0	
Travel		\$4.1	
Contractual		\$0.8	
Commodities		\$1.0	
Equipment		\$0.0	LONG RANGE FUNDING REQUIREMENTS
Subtotal	\$0.0	\$43.9	Estimated
Indirect		·	FY 2002
Project Total	\$0.0	\$43.9	
Full-time Equivalents (FTE)		1.0	
			Dollar amounts are shown in thousands of dollars.
Other Resources	<u> </u>		
Comments:			
New, one-year project	. •		
	F		
The second secon	FORM 4A		
Project Title: Book on EVOS science for general readers			VOS science for general readers Non-Trustee
Name: Shana Loshbaugh			igh SUMMARY
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2001 EXXON VALDEZ TRUSTEE UNCIL PROJECT BUDGET October 1, 2000 - September 30, 2001

Per	onnel Costs:			Months	Monthly		Proposed
	Name	Position Description		Budgeted	Costs	Overtime	FY 2001
	Loshbaugh, Shana	Author		12.0	3162.5	0.0	37,950.0
							0.0
							0.0
							0.0
							0.0
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		Subtotal		12.0	3162.5	0.0	£27.050.0
			T:		Per	sonnet i otar	\$37,950.0
l ra	/el Costs:			Rouna	i otai	Dally	Proposed
2450F#5	Description		Price	l rips	Days	Per Diem	FY 2001
	Anchorage, via auto		90.0	3	10	150.0	870.0
rairpanks, via airpiane and rentai car		102,0	2	5	150.0	1,014.0	
Condexe, via airplane and rental car			300.0	1	4	150.0	900.0
	Cordova and Tattlek via te	rry out of Seward	100.0	1	4	100.0	490.0
	Fort Granam and Ivanware	k via airpiane of boat via nomer	120.0	4	4	30.0	400.0
	FIEID SILES IN FINICE WINIA	I Sound via Doal via Seward of Winkier	120.0	1	10	30.0	420.0
							0.0
					· · · ·		0.0
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		·		·····		Travel Total	\$4,100.0
		[*************************************					
							OBM AB
		Project Number:					
		Project Title: Book on EVOS science	e for general	readers		r	
		Name: Shana Loshbaugh					
L]						DETAIL
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October 1, 2000 - September 30, 2001

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Contractual Costs:									Proposed
Description									FY 2001
Independent manuscript re	eview								800.0
						•			
								[
		4							
·····							Con	tractual Total	\$800 0
Commodities Costs:		<u></u>							Propose
Description									FY 200
Office supplies (mainly pri	inter ink & paper &	postage)		:			· · · · · · · · · · · · · · · · · · ·		350.
Phone bills									500.
Camping provisions (for fi	eld camps)								200.
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2001 EXXON VALDEZ TRUSTE JUNCIL PROJECT BUDGET October 1, 2000 - September 30, 2001

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 2001
			0.0
None existing equipment should be adequate			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	Tan R. New Equ	ipment i otal	\$0.0
Existing Equipment Usage:		number	
Computer		or Umis	
Printer		2	
22-foot skiff			
25-foot sailboat		4	
		1	
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			auinment
Project Litle: Book on EVUS science for general reade	rs		
Name: Shana Loshbaugh			DETAIL
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Photo by M. Scott Moon

Rutted tracks fan out from a point near the Caribou Hills, as seen from a Kenai National Wildlife Refuge airplane flying overhead.

Users, land managers debate impact of ATVs

By SHANA LOSHBAUGH Peninsula Clarion

From the air, the wetlands of the Kenai Peninsula look like velvet — green and gold in the autumn sunlight.

But over another ridge the scenery takes a dramatic turn for the worse. Dark lines gouge the landscape into parallel ruts and muddy quagmires, as if an angry cat had shredded the velvet.

Such tracks of all-terrain vehicles are more and more common in the backcountry, although they remain out of sight and out of mind for most peninsula residents.

Snowniachines and logging get more attention. But many familiar with the Kenai wilderness see the ATVs' impact on the landscape as a growing issue — an issue on which user groups remain poles apart and land managers stay uninvolved.

The bird's eye view

Rick Johnston has been flying over the Kenai backcountry for decades. As a pilot and ranger for the Kenai National Wildlife Refuge, he keeps a close eye on the wilderness terrain few people ever see. His territory stretches from near Point Possession north of Nikiski to the boundary of Kachemak Bay State Park east of Homer.

Johnston has seen a growth in backcountry traffic and environmental degradation starting around 1980 and dramatically increasing since 1990.

The areas most affected, he said, have been boggy areas near residential development — Funny River Road, north of the Kenai Airport, the uplands east of Ninilchik, off Homer's East End Road and



Photo by M Scott Moon Refuge ranger/pilot Rick Johnston speaks about ATV tracks during a flight over the refuge.

near Caribou Lake between Lake Tustumena and the head of Kachemak Bay.

When ATVs cross muskeg, they tend to break through the mat of moss and herbs, opening a muddy cut. To avoid the mud, subsequent riders go around the holes. They start new holes and set in motion a cycle of widening damage.

Wetlands affected crisscross a patchwork of private, state, borough and Native property.

The wildlife refuge is federal land and completely bans ATVs. In many places, tracks come right up to the refuge boundary and stop. Most people using off-road vehicles. Johnston said, respect the refuge boundaries and rules

"The refuge has been pretty successful in preventing damage," he said

For the refuge, the issue is straightforward, its employees have a mandate to protect the wilderness and wildlife. They also have the power to ticket violators. But for other land managers, handling ATVs is complicated by remoteness, competing interests and multiple uses, he said.

Is ATV damage significant?

Some think ATVs are fairly harmless.

Doug Blossom has spent 50 years living in the Ninilchik area and thinks four-wheelers are getting blamed for damage by other vehicle types. Now the president of the Caribou Hills Cabin Hoppers, a nonprofit group with about 450 members specializing in snowmachine recreation, he thinks ATV track problems are mostly cosmetic.

"We've discussed it lots," he said.

ATVs and track vehicles leave impressions, but are lightweight and don't tear the sod, he said. Fourwheel drive pickups make a bigger mess, and logging vehicles do the most damage of all, he said. And yet loggers need to tear up the ground to help young trees take root.

Blossom said accelerated logging is necessary to prevent fire hazards, and population pressures are part of progress. His group doesn't see any problems with ATVs and doesn't favor any type of limitations, he said.

Biologists, environmentalists and even urban officials in other states see ATVs differently.

In Baltimore, for example, the city recreation and parks department estimated ATVs cause more than \$100.000 in damage to the city's parks each year.

Studies on their ecological costs are few but alarming.

ATVs scare away wildlife, disrupt nesting birds, See ATV, page A-13 The exacts estigation added sides hand curve æ Nissan left the Troopers de belt because s

Enr falls pro

By HEATHER A. Peninsula Clanor

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after the whol He said leswas budgeted ion the impact

Assembly may see shifting ideological base



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Continued from page A-1

promote erosion and use fuel inefficiently, researchers say.

In wetlands, impacts are more severe. Besides creating quagmires, ATVs can drive frost deep into the ground, change drainage patterns and leave scars that endure for decades.

A 1991 study in the wetlands of Nova Scotia found ATVs killed half the vegetation with as few as 10 passes over an area, and that after 40 ATVs passed over a bog trail all plants were killed. The Canadian scientists concluded that ATV traffic caused more damage than logging or mining and recommended ATVs should be prohibited from all bogs and wetlands in the Cape Breton Highlands." They also noted that the terrain they studied resembled Alaska's.

But no one has specifically stud-ied the effects of ATV use on the Kenai Peninsula's wildlife.

'I don't think there's enough information on the table to say it causes ecological damage," said refuge ranger Johnston. "But it looks nasiv.

Management obstacles

The wildlife refuge has a policy for dealing with ATVs, but other government agencies managing public land on the peninsula lack a consensus on whether ATVs are a problem. Public comments indicate more concern about maintaining access than about damage from traffic.

"ATV use hasn't come up," said Kenai Peninsula Borough Planning Director Lisa Parker. "We haven't gotten any complaints about damage to the terrain.

Down the hall the borough's land management agent. Roy Dudley, had a different viewpoint. "It's a big issue," he said.

Not many years ago, the peninsula had a really low population and people could do a lot of things with minimal effects, Dudley said. Now the population has increased and so has the impact. All problems tie directly to the boom in use, in his opinion.

The borough code specifically allows "casual use of borough land. he said. Casual use includes ATVs on "established trails" as long as it's "nonconsistent." Anyone driving an ATV on a borough trail to commute or for a commercial purpose such as guiding is supposed to get a permit. he said

However, people haven't applied for permits. Instead, the borough works with remote residents and sets up access easements across borough land.

To remain legal, ATV use can't cause more than "minimal distur-bance." If someone brought an ATV damage problem to the borough's attention. "we would probably have to deal with it." Dudley said.

lenge for the borough, especially in view of the voters' rejection of Proposition No. 1 on trails powers in the Oct. 6 election.

"It is difficult for us to put up signs or manage a trail." Parker said. "because we don't have the authority.'

The state also maintains a de facto hands-off policy on ATV use. "Yeah, there's damage." said

Rick Thompson, the state Department of Natural Resources regional manager for Southcentral Alaska. "It looks like a snake with a big rat in the middle. On the Kenai Peninsula you can always see tracks. I know the use is increasing.

"In general, it's probably not a big problem statewide," he said. "It's one of the things people like to do and can do on state land.

His office is concerned about heavy usage, as population growth makes resource use more intense and complicated. But one of its priorities is keeping access routes open to people, he said.

The pending Kenai Area Plan is too general to deal with ATVs directly, explained Bruce Talbot, the DNR project manager in charge of the plan. At meetings on the Kenai, ATV damage has been discussed, but it's been overshadowed by other concerns, he said.

DNR investigates complaints about environmental damage caused by off-road vehicles, but nearly all involve collapsed banks of anadromous fish streams and get the Alaska Department of Fish and Game involved, Thompson said.

With a staff of 22 responsible for more than 50 million acres of state land, his office is spread too thin to keep track of ATVs, he said.

We don't have the staff to get out there," Talbot said. "And furthermore, we don't have citation powers." On state land, only park rangers or fish and game enforcement officers have any policing powers, he explained.

DNR lacks funding to maintain trails or conduct public education. And Thompson doesn't foresee any changes in its management of ATV issues.

"We're not equipped to step in and make everyone happy." he said.

A spreading problem

The wildlife refuge has kept ATVs at bay, but encroachment is a growing problem even on their lands. Johnston said.

He attributes the increased pressure on the land to the burgeoning peninsula population, enhanced technology allowing ATVs to reach farther into the wilderness, more access (through logging roads and Native land subdivisions), and to land-change status.

The refuge's problems have been associated with easemen's, inholdings and Native claims, he said. Ambiguities lead to inadvertent and intentional trespass. Many offending drivers, he said, are just youngsters who don't know the rules.

"It really adds to confusion." he

are less obvious and the status blurs.

Utility corridors, such as powerline cuts, create unnatural routes into wild areas. The refuge and Homer Electric Association work to keep ATVs off powerline tracks that cross the refuge. It's a challenge because the refuge wants to leave access open for legal snowmachine use in winter, Johnston said.

HEA's policy is that powerline easements are not for public access unless the surrounding landowner gives permission. ATV regulation is up to the owner, too.

"Individuals must first check with property owners if they wish to travel on easements or else it will be considered trespassing on private property," said spokesman Sandra Ghormley, 'Generally HEA does not erect restriction or trespassing signs on utility easements or rightsof-way because HEA does not own the property.

State efforts to serve the public have sometimes clashed with fragile environments.

Access to public land is a priority, said DNR's Talbot, but beyond a

point people can "access it to death. The state sold remote parcels by Caribou Lake and the Fox River on the southern peninsula into private hands. But some of those parcels can only be accessed across wetlands.

'Some of that country can't stand up to that kind of use," Talbot admitted.

Options

In other states, ATV problems have produced lawsuits, rees and regulations which Alaskans would prefer to avoid.

In contrast, the Nova Scotta study recommended an integrated management option. Laws and regulations would be less efficient, it argued, than a coordinated effort of designated public trails, recreational planning, training programs taigeted at middle and high school sudents, and limited legislated contra-

ATV technology itself may help Some machines with less weight and bigger tires distribute weight in a manner that leaves less of a footprint on the land.

Borough and DNR officials said people who note damage on public lands should report a. They also urged people to step forward and contribute suggestions on the Kenai Area Plan, which is open for comment until Nov. 2.

The snowmachine group from the Caribou Hills has organized a letter drive associated with the plan and has made lots of good suggestions. said DNR's Alison Arians, a landuse planner working on the Kenai plan. Topics under discussion include off-road weight restrictions that could keep prejup trucks out of the backcountry, she said

"We're very interested in public comments," she stressed.





Alaska scientists challenge Exxon findings

y SHANA LOSHBAUGH eninsula Clarion

New studies from the National farine Fisheries Service dealing ith the 1989 Exxon Valdez oil spill ontradict Exxon reports and may ave major implications for the oil idustry and fisheries in Alaska.

Results suggest that oil has more mg-term toxic effects on fish than reviously suspected, that Alaska's outpentral coast was more pristine rior to the spill than Exxon has dmitted and that oil industry studis contain serious flaws. If the new indings are accurate, fishing and oil evelopment may be less compatile over the long term than previous nucles suggested

Chemists and biologists affiliat-

ed with the NMFS Auke Bay Laboratory for fisheries science near Juneau are releasing findings this fall in two major areas. One set deals with the reactions of salmon and hering fry to trace pollution. The other deals with the source of

and herring fry to trace pollution The other deals with the source of natural background chemicals that resemble oil in the sea. Both sets of NMFS studies couclude that oil spills, including small

chronic leaks, may damage fish and other marine wildlife more than previously believed. The scientists involved say current water quality standards may be too lax to effectively protect the resources. **Fish fry vulnerable Fish fry vulnerable Construction Participants convened a panel discussion to debate the ments of the studies. They kind of duked it out,** said **Stan Senner, the science coordinator** for the **Exxon Valdez** Oil Spill **Trustee Council, which funded the** NMFS research.

Fish fry vulnerable

The fish studies conclude that some ingredients found in weath-

ered Alaska North Stope crude oil are so poisonous that even amounts below one part per billion can damage salmon eggs and young fish. Jeff Short from NMFS presented

dling rather than oil. But NMFS has studies of herring as well as salmon to back up its claims.

The NMFS researchers repeated the experiment three times and got the same results with a high level of statistical significance. Short said.

dies. "This conclusion is controversial "They kind of duked it out," said in Senner, the science coordinator the Exxon Valdez Oil Spill ustee Council, which funded the UFS research. Panelist Al Maki, spokesman for

See SPILL, back page

Massive scientific initiative spawned by 1989 oil spill

By SHANA LOSHBAUGH

Peninsula Clarion

As the 10th anniversary approaches of the 1989 Exxon Valdez oil spill in Prince William Sound, the EVOS Trustee Council and Exxon are taking stock of the enormous research effort the spill, spawned. The public has the opportunity to hear what they've learned at an anniversary meeting in March.

The trustees, funded by money the courts took from the oil industry grant, have spent about \$165 million so far on research and monitoring, said Stan Senner, the council's science director. Exxon officials, asked about their expenditures on EVOS stud-

See EVOS, back page



Exxon's scientific research in Prince

Bounty hunters

eninsula Clarion, November 22, 1998

....Spill

Continued from page A-1

Exxon has challenged the coordinations with data presented in one publication. The trustee conclusions are based on seven different publications involving 17 independent researchers representing five different agencies — including Exxon." they wrote,

The trustee council requested the studies after pink salmon spawning in intertidal areas orled in 1989 tailed to produce normal offspring as late as the summer of 1993.

The lingering effects surprised scientists, Senner said, and the trustees wanted to find out why recovery was so slow.

They set up experiments in the laboratory to numic what had happened in the sound, exposing eggs and fry to seawater percolated through gravel sprayed with oil.

Eggs hatched prematurely, and fry showed abnormally high birth defects, including stunting, twisted backbones, swollen egg sacs, deformed jaws and microscopic evidence of genetic mutations. Malformations resembled those seen in studies with dioxin, a dangerous industrial pollutant.

Before these findings, most scientists believed that the volatile chemical fraction of crude oil that evaporates readily was the most toxic and that oil in the environment became less dangerous as it aged. The new results suggest that pockets of residual weathered oil from spills can cause localized problems for many years.

They may not kill adult fish or eggs outfight, but cause "sub-lethal" damage that weakens and stunts fry. Because salmon and herring reacted the same way, the biologists suspect all fish are susceptible.

Coal threatens to souttle Exxon assertion

Last week, NMFS and Exxon scientists squared off again at the annual meeting of The Society of Environmental Toxicology and Chemistry in Charlotte, N.C.

The technical debating question was whether natural oil seeps or coal deposits produced background chemicals detected in Prince William Sound that resemble those from spilled Exxon Valdez crude. Discussions focused on technical details about hydrocarbons, a large family of molccules found in petroleum, burned material, plants and a variety of other sources.

But the underlying questions deal with whether or not Prince Wilham Sound was pristine before the tanker hit Bligh Reef, whether or not manne wildhife had previous adaptations to endure trace oil, and whether lingering terminants from the spill still dam

age the consystem.

The big difference between seep oil and coal is that the oil would affect the environment the same way as man-made pollution, but the same chemicals in coal cannot get into the tood chain.

They are just not bio-available," said Susan Saupe, the science director for the Cook Infer Regional Citizens Advisory Council (CIRCAC) in Kenai, which sponsors similar research in Cook Infer, "They are kind of stuck, embedded in a crystal matrix.

Studies Exconstanded suggest spilled crude demaded and diluted quickly and got lost in the chemical background noise of natural hydrocarbons.

"By 1990, Exxon Valdez crude was generally a small merement on the natural background — " according to a 1996 report in the journal "Environmental Toxicology and Chemistry."

Geochemists read an area's geologic history through chemical clues. They sample water, oil, soil and sea floor sediments and analyze them for traces of the complex soup of hydrocarbons that occur in petroleum products

State-of-the-art chemical "fingerprinting" lets scientists trace the origin of petroleum (natural or artificial), somewhat like genetic testing belps forensic laboratories trace crommals from minute bits of hair or blood left at crime scenes.

In the case of marine oil, geochemists look in the relative amounts of dozens of hydrocarbons with jaw-breaker names and formulas that look like chicken wire. They take into account factors such as weathering, bacterial digestion and how the petroleum sticks to water-borne silt particles.

Using such techniques, a research team Exxon hired led by David Page, a chemist from Bowdoin College, and Paul Boehm, a specialist in petroleum fingerprinting from the international consulting firm Arthur D. Little Inc., traced background hydrocarbons in the sound to natural oil seeps at Katalla (near the Bering River) and Yakataga, along the Gulf of Alaska coast east of the Copper River.

The Alaska Department of Natural Resources Oil and Gas Division has no information on seep volumes and no leases scheduled in the area at this time. Oil drilling at Katalla closed down about 60 years ago.

Details on the seeps are sketchy, because current technology cannot measure them directly

Exon's scientists estimated that 2,500 to 8,400 burnels of oil per year — as much as 1,200 tons or more — seep naturally out of the ground and sea floor at those sites, and that a substantial portion travels in the Alaska constal superior to Prince William

Sound and other points west,

Teaspoons rather than tons would be closer to reality. Short said. He characterized the seeps as "pathetically small."

Instead, he and his colleagues at NMES see coal as the obvious source for the back ground hydrocarbons.

Two 1996 reports sponsored by Exxon said no coal deposits have been reported to the east of the Copper and Bering rivers.

Short criticizes Exxon studies as having gone to "astonishing lengths" to avoid investigating the coal contribution. In his presentation at the conference last week, he discussed coal formations and showed slides of black coal dust on beaches in the area.

The coast near Katalla contains "several thousand tons of coad" and when analyzed it gave "an identical chemical signal to what is in the bottom of Prince William Sound," Short said last week, "I think it's odd for them to just overlook that,"

Jousting geochemists

"We're not discounting coal," Bochm responded from his office in Cambridge, Mass.

The Exxon researchers didn't analyze coal because they don't have maps at the time that showed coal in the area, and felt that all chemical evidence pointed to the oil seeps.

Short sent a letter to the journal that published Page's and Boehm's study.

"Coal was emoneously dismissed as an alternative source," he wrote, pointing out the available coal beds in the area.

In their written response, the scientists for Excon acknowledged they hadn't known about the coal in the area, and also admitted new chemical analyses that seem to rule out the Katalla oil seep as a source.

They stuck with seeps from the sea floor near Yakataga as the source for all of the sound's hydrocarbon background, and printed a graph of chemical ratios to illustrate the relationship.

"The Bering River coal fields east of Prince William Sound cannot be the dominant source of this hydrocarbon background," Boehm said via e-mail. "The fingerprint of the (petroleum chemistry) in Prince William Sound sediments closely matches that of Yakataga oil and is very different from Bering River coals, based on the use of very stable marker compounds."

Short's letter and a written rebuttal to it from Page, Bochm and their colleagues appeared in the September issue of the journal.

But when Short studied what the Exxon scientists had written, he discovered that the points on their graph didn't match the original data. They omitted some points, included other samples that didn't contain enough

oil to show anything and mislabeled a sample from a coal beach as "shoreline/lake sedment"

Shon contends the real data, if put onto Exxon's graph, reverses its meaning and supports his conclusions.

"This is a highly irregular event," he said. "I've never seen anything like this."

He was upset enough by the turn of events to pass out copies of both versions of the graph at the environmental toxicology and chemistry meeting on Wednesday.

T m not sure what Dr Short is saying here." Boehm responded.

He examined both figures and admitted his team had made errors. But the chemical fingerprints for the coal don't match no matter which labels are used, he said.

The revisions to the graph don't alter the results. Boehm said, and he is still convinced that seep oil is the most important background source.

We have a lot of data," he said.

Bochm cautioned that items presented at meetings are often preliminary, haven't been scrutimized by the peer review process and should not carry the weight of results published in the technical journals

The coal versus seep oil issue is interesting, he said, and seems to have generated some jousting.

Saupe was the only person from the Kenai Peninsula at the meeting in North Carolina.

After seeing Short's presentation, she is convinced his premise about coal being the main source is correct and Boehm's group is off track.

"His argument is real strong," she said, "There is just no way seeps can account for all that. I believe what Jeff Short's data show."

She prefers to view the scientists' disagreement as "two different interpretations of the same data" rather than "taking sides," she suid.

The errors the Exxon scientists have published are substantial, but she doesn't attribute any ulterior motives to the situation.

"It's too obvious," she said. "I think it was an honest mistake."

Major implications

The NMFS studies have "huge implications" for Southcentral Alaska, Saupe said.

The NMFS work on coal challenges a dogma about scep oil, and is likely to prompt even more interest in Alaska coal studies, she said

Coal studies were listed as a research priority at CIRCAC's workshop in Kenai in October, which Saupe organized CIRCAC wants to identify natural hydrocarbons in Cook Infectio monitor effects of the orlindus

am-try.

The federal Minerals Management Service also is examining sediments in Lower Cook lulet and Shelikof Straits as part of its studies for offshore oil lease sales.

Boohm and other Arthur D. Little scientists have beaded Cook Inlet studies, including coal analysis, for both CIRCAC and MMS.

In one sense, the background hydrocarbon issue plays a secondary role to spilled oil from the Exxon Valdez. But it may have legal and scientific ramifications.

Some animals in Prince William Sound are still having touble nine years after the oil spill. When petroleum gets in the food chain it changes, so scientists can't fingerprint oil tovins in animals.

"We continue to see biochemical evidence of exposure to hydrocarbons," said Senner from the oil spill trustees' office, "in samples such as sea otter blood."

Background oil from seeps could explain that, offering Exxon a biochemical alibit against accusations of long-term effects.

But if the natural hydrocarbons in the sound do come from coal, the evidence would suggest long-term pollution from the spill.

The studies of toxic effects on fish may have even bigger implications.

The state of Alaska has some of the most stringent water quality standards in the world. Its threshold level for polynuclear aromatic hydrocarbons (PAHs), the petroleum compounds of the highest concern, is 10 parts per billion.

The U.S. Environmental Protection Agency's acute water quality criterion is 300 parts per billion.

The new studies imply that even Alaska's tough standards are not stringent enough, Short said, to sustain fish and shellfish for future generations.

"We think it will probably have to be lowered by a factor of 100 or 1,000," he said.

If borne out, the results apply not just to Prince William Sound, but to Cook Inlet, all of Alaska's coast and, indeed, the world.

Tougher standards could affect industry activities such as discharge permits, ballast water treatment and offshore oil platforms.

"This is really interesting," said the state water quality standards coordinator, Katy McKerney from the Alaska Department of Environmental Conservation.

She noted that industry groups have criticized the state government for setting such high water quality standards in the past, and predicted the offindustry in particular would react strongly to any proposed changes.

"But our mission is to protect the resources," she suid. "If the science is solid we would definitely consider changing the standards."

...EVOS

Continued from page A-1

ies, said their intent is to never release that information.

Studies have involved federal and state agencies, private science consultants and oil industry employees. The scope of the endeavor has greatly increased the amount known about the behavior of spilled oil, wildlife genetics and the marine ecosystem of Southcentral Alaska.

Studies conducted by agencies are public. Some Exxon studies are proprietary; others have been published in scientific journals and other places.

"They only release the information they choose to release," Senner said.

Exxon's science spokesman, Al Maki, was traveling and unavailable for comment.

The U.S. Fish and Wildlife Service sponsored a symposium on Anchorage in 1990 to review be sea offer rehabilitation effort, whe trustees sponsored one to review preliminary damage ossessment studies in 1993.

Exponseience contractors took part in the sea otter symposium but, not the damage assessment meeting. They chose to present their

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findings at a meeting of a technical society on the East Coast.

The trustees' council is now organizing another symposium, titled "Legacy of an Oil Spill: 10 Years After Exxon Valdez."

Exxon scientists were invited to participate, but none signed on to make presentations, Senner said.

"They pick their forums carefully," he noted.

The trustees' anniversary symposium will be March 23-26 at the Egan Convention Center in Anchorage.

Topics will include the status of injured resources, recovery, lingering effects, gains from efforts to restore natural resources and human services, and lessons learned about spill prevention and response.

Fees will be \$15 for the first day

overview, \$70 for full registration before March 1, and \$100 for registration after March 1.

Valdez will host two days of events beforehand, March 21-22, focusing on spill prevention and response.

The Alaska Wildlife Response Center will hold a reception in Anchorage for participants on March 25.

Symposium organizers have also arranged a trip to Seward on March 27 with tours of the Alaska SeaLife Center and a gray whale watch voyage.

Registration forms for the anniversary symposium are available by calling the EVOS Trustee Council Restoration Office at 278-8012, e-mailing them at restoration@oilspill.state.ak.us or on their web site at www.oilspill.state.ak.us ...RDC

Continued from page A

long term.

For instance. McC would be dangerous to programs and progra with child abuse a because that would ser the prison population

"Prisons are full c have been neglected, a at a seventh-grade edu McConnell said. "Ig problem now will cost future."

News did not get afternoon keynote a two-day RDC confe was attended by 20-Alaskans from acroincluding resource j



STFOCUS

MAY 1993 NATIONAL FISHERMAN Wrath of the Exxon Valdez spill is still taking its toll on fisheries

By Shana Loshbaugh

he Exxon Valdez oil spill is four years old, and long-term effects are just now becoming apparent. Oil affected fish more than anticipated, says Chuck Meachum, deputy commissioner of the Alaska Department of Fish and Game (ADFG). Herring and wild pink salmon eggs are dying, and the red salmon fishery in Cook Inlet is in trouble.

To discuss these and other issues, hundreds of people met in Anchorage Feb. 2-5 for the Exxon Valdez Oil Spill Symposium. Alaska and federal agencies presented 101 damage assessment reports, many on fish. "In oil impacted areas, fisheries are probably the single most important industry," Meachum stated.

Pink Salmon

Two ages of pinks hit oil in 1989 in Prince William Sound (PWS). The 1988 fry migrated through fouled waters; the 1989 brood year was spawned in polluted areas. ADFG estimates that 75% of wild PWS pinks spawn intertidally and that 213 streams. were oiled. Researchers found that fry in 1989 did eat and assimilate oil. Schools were in unusual places and grew more slowly than normal. Hatchery fish fared better because of protection in 1989. Hatchery returns in 1990 and 1991 were robust in numbers, but plagued by late arrivals, low prices and problems deflecting fishing pressure off faktering wild stocks. In 1990, egg hatches began dropping, with twice the normal rate dying in 1991. Biologists don't know if nature will compensate by permitting more fry to survive to adulthood if fewer eggs hatch. The 1992 run was "disastrous," according to ADFG, and the slide of egg survival continues. Oiling immature pinks may cause genetic damage leading to "functional sterility," the department's Brian Bueb said. Biologists don't know if the problem will worsen or resolve itself. Meanwhile, weak wild runs mean ADFG will favor terminal fisheries near hatcheries, despite tradeoffs of poorer quality catch.

Red Salmon

"We will almost certainly have a complete collapse of the Cook Inlet fishery," warned Dana Schmidt, who is with ADFG in Soldotna. Problems for reds stem from three years of over-escapement into the Kenai River. Oil closed the 1989 Cook Inlet harvest, which would have been a bumper year. A smaller spill had closed the 1987 season, and 1988, too, saw over-escapement. The third year overtaxed the system, and production of sockeye smolts plummeted.

Schmidt believes that lack of food seems to be the problem. Young fish starve over winter in nursery lakes. His studies suggest that the copepods comprising their main diet didn't disappear but learned to avoid salmon. If the change has evolved permanently, lakes will recover productivity r slowly. If not, recovery should begin after several weak years of reds, he said. ADFG forecasts "way less than a million fish" in the Kenai and possible shutdowns in 1994 and 1995 for commercial and sport fisheries. Kodiak reds will also be depressed.

Herring

. . .

The spill hit as the largest PWS herring population in over a decade gathered to breed. But sampling of adults in 1992 indicated the 1989 year class will be one of the smallest ever. Spawning in 1989 peaked just after the spill, with oil on 40% of spawning beds and in 90% of rearing areas. ADFG reported. Oiled eggs produced larvae with genetic damage, deformities and decreased growth and survival. Effects will

Valdez

(Continued from WCF Page 1) not be clear for several years because 1989 fish are just now maturing. Cordova biologist Evelyn Biggs-Brown estimated 96% of 1989 herring were lost and projected a 12% loss of mature fish by the mid-1990s. And the 1988 year class, the largest in the sound's current herring population, may have reproductive problems. Eggs from 4year-olds in formerly oiled areas failed at twice the normal rate in 1992. ADFG's Fritz Funk expected the biomass to peak in 1993, based mainly on the 1988 cohort. and then decline. Closures may be needed to compensate for poor egg survival, they suggested.

Other Fish

Some rockfish were killed directly by oil and, as of 1991, still others had liver



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damage. Their sensitivity to pollutants and slow population recovery concern biologists. Pollock showed internal oil from PWS to Shelikof Strait - 400 miles from the original spill --- in 1989. By 1990, they were normal again. Damage to pollock was not conclusive, and studies were halted. Shrimp and crab stocks in PWS were depleted before the spill. Scientists couldn't study oil's effects on crab because they only found one Dungeness in affected areas. Cutthroat trout and dolly varden char showed decreased growth and survival in oiled areas. ADFG estimated recovery of these sport fish will take six to 12 years.

Most of the 11 million gals. of crude dumped into the sound are gone now. The National Oceanic and Atmospheric Administration (NOAA) reported it has biodegraded, evaporated or become inert. Skimming and clean-up removed only 14% and may have damaged intertidal areas. Oil levels in the water and fish dropped after 1989, but toxins linger. The most dangerous oil is in a few mussel beds, where it enters the food chain via shellfish and is protected from weathering. Oil seeping from beaches is moving into deeper sediments. Most benthic oil is probably harmless, NOAA said:

Effects on bottomfish are unknown. Oil seems to fertilize some nearshore environments, spurring plankton blooms and increasing food for juvenile cod. No one knows if currents that brought oil to areas also concentrate plankton and nutrients in the same places.

The Oil Spill Trustee Council, the University of Alaska Sea Grant College Program and the Alaska Chapter of the American Fisheries Society sponsored the symposium. Exxon chose not to participate. On the last day of the meeting, it issued a press release. "Exxon strongly disagrees with the characterizations of the current state of the environment in PWS presented by many Trustee scientists," it said. Exxon will discuss its own studies in April at the "Symposium of Environmental Toxicology and Risk Assessment" for the American Society of Testing and Materials in Atlanta, Ga.

By S.F. Loshbauch

The Monarchs

A monarch butterfly — orange as fire, veined in black flickered in the air and floated on sunbeams in a desultory trajectory that took it, as if by chance, to a large milkweed plant overtopping the meadow grass.

The time was early morning in late spring; the dew hung heavy on the soft blades of yellow-green grass and soaked my jeans as I brushed past. I was 11 years old, taking the meadow short-cut to my best friend's house.

The butterfly rose in a slow spiral and then sank, fluttering to another milkweed stalk. Clutching at the edge of a leaf with its spindly legs, it bent its abdomen under the leaf before flying away again.

Returning home later, I examined the milkweed leaf where the insect had stopped. Underneath, protruding from the pale fuzz, was the object I sought. It was a striated, bullet shape, pale, scarcely 2 millimeters tall.

On impulse, I picked the entire plant and examined the other milkweeds in the meadow. By the time I returned home, I had a bouquet of green stalks and butterfly eggs.

My mother — my wonderfully tolerant mother — put them in a large vase on the dining room table. And we waited.

The hatchlings were so small they were nearly invisible. Their heads were black dots no larger than the period ending this sentence. Their bodies were pale threads. They munched their own eggshells and then grazed upon the fuzz and tender cells of the leaves' bottom sides.

They grew apace, migrated to the tops of the leaves, and riddled them with ever-larger holes. They became clownish caterpillars, clad in cheerful stripes of black, white and chartreuse, with pairs of false antennae both fore and aft. They trundled about the plants on their stubby legs until they ate the leaves down to the stems.

One morning, they were gone. The milk weed stems were picked bare and deserted. We found the larvae inching along the carpet, scaling the couch, under the piano — questing for milk weed throughout the dining and living rooms.

After that, I never let them run out of food. I searched for milkweed myself, through the meadows and unmown margins, to satisfy their burgeoning appetites. I learned to appreciate milkweed plants myself. There were two kinds in our neighborhood: the gaudy, orange-blossomed butterfly weed, and the plain milkweed; although I no longer thought of it as plain, but loved its thick, creamy, pink flowers with their intricate shape and delicate perfume.

Summer wore on. One morning, most of the caterpillars were gone again. This time was different; plenty of leaves remained. The few left behind acted strangely, so we settled in to watch.

On a sturdy stalk, one fussed over a spot on the underside. The jaws, ravenous so long, did not bite but wove a silken knob. The insect worked it over and over until some instinct was satisfied, then turned and clamped its rear legs firmly onto the button.

Releasing the stem with its front limbs, it swung loose and hung down in a "J" shape. Pulling itself shorter and thicker, it undulated and squirmed until it split open behind its head. The bulge grew until the caterpillar skin sloughed off the head and slid up the fattening body. Minutes later, the old garb crumpled into a scab and fell away.

The creature that remained bore no visible resemblance to the larva it had been. It pulsated a few times, then grew still. Its surface hardened into a waxy skin.

A chrysalis is an astonishing creation. It is an animal that does not move. It is a box in which nature's sorcery transforms the monarch. And it is a thing of extraordinary beauty, a pendant jewel. The new creation dangled before my eyes, sea green with gleaming knobs of enamel black and metallic gold. We searched for the missing monarchs,

We searched for the missing monarchs, and found several pupating in awkward locations. One was behind the piano; another hung from a stack of books; and one dangled from the textured wallpaper next to the table, perfectly situated to be a topic of dinner conversation.

We watched the color change in each pupa during the next few weeks. Orange and black replaced the lovely green; the outer skin became transparent as glass, keeping only the black and gold knobs. The shapes of tiny wings wrapped like a shawl around the stout black creature within.

Summer was nearly over when the first emerged. There was a tiny jiggle, then more vigorous movements, until the shell split open — once again behind the head. A strangely shaped butterfly wriggled free. Obese and soggy, it hung trembling from the shreds of the chrysalis.

At first tentatively, it spread crumpled wings and began to pump them. The black struits straightened and strengthened. The saturated orange lost its intensity as the surface flattened and dried. The bulging abdomen shrank and the six legs gripped more surely.

When the creature began to flutter, I carried it on my finger to the door and proudly watched it sail away into the deep blue sky.

Others came out, here and there, within a day or so. Even the chrysalis on the wallpaper hung empty. One evening, after we thought they were all gone, I came into the living room to find a butterfly forlornly flying from window to window. I put up the sash and set it free. Summer was ending.

Years later and far away, the monarchs royally repaid me for my hospitality.

It was one of those autumn days when the world has a golden aura and the sky seems bottomless. I was riding my horse, a spirited little mare, across the Midwestern countryside. I was 16. The dirt lane snaked between a forest and a comfield. On the left, the trees shed their multicolored leaves; on the right, tall stalks stood ripe for harvest. The horse began to canter faster and faster, delighting in speed.

We came around a bend — suddenly, there they were, monarchs by the hundreds, hanging from trees and clinging to constalks as they paused on their migration. In all the years we lived there, I never saw them before or after.

The mare pricked her ears forward and accelerated. We whirled around the next bend. Now there were thousands of monarchs. The horse passed them like a hurricane and the butterfiles rose up like leaves in a whirlwind. She plunged on, as if intoxicated by the spectacle. A great orange vortex spun over us, drawing us on.

We were flying; we all had wings. The horse seemed to leave the ground — Pegasus aflame with orange and bronze, carrying me in a cloud of butterflies to reach the sky, to reach a heaven of orangeand black-winged angels, to reach one moment of crystal joy.



Open Non-fiction Winner

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me to the Kenar P a on turday when a delegat flee ators from the Sakhalin region of 2 Russian Far East spent a day on a central peninsula. The Russian at focused on legislative aspects. developing and regulating offore oil production

Originally, the group included gislators from the Russian, deration State Duma - equivant of the U.S. Congress. But the iv after they arrived in Alaska," e lawmakers were summoned ome by the Moscow government

The 1989 Exxon Valdez oil spill

eft a wake of devastation, but fund-

ng from spill litigation has created

a valuable legacy of scientific

or generations to come, said orga-

nizers of a four-day symposium in

Anchorage, "Legacy of an Oil

Spill 10 Years After Exxon

anderstanding of 'Alaska's waters.

they said, with implications for oil-

spill prevention and response poli-

cy, fisheries management, environ-

mental safety regulations and the

future of the world's oceans and

long term oil toxicity than previ-

Wilding is more sensitive to

people while depend on them

Findings are revolutionizing our

The research will pay dividends

V SHANA LOSHBAUGH

eninsula Clainon

esearch

Valdez."

levis at Sakhalin, an island north of Japan, reacted differently Luboy Shubina, trist deputy

chairman of the Sakhalin Legislature, told Alaskans at a press conference Thursday in Joneau that making war was the prerogative of the tederal governments, but regional officials were more interested in making friends. Hosts and guests agreed they did not want events in the Balkans to interfere with relations in the North Pacific, Alaska officials said. See RUSSIAN, back page



Line dance

driveway last week.

Compare transformers in south Same in Industry asses ration would have to fund at least 40 percent of its marketing contract with the state. Within three years, it would have to fund at least 60 percent

Elton, though, would fund his marketing corporation with bed taxes on cruise ship passengers and customers of lodges, hotels and bed-and-breakfasts. A quarter of those taxes would go back to the communities in which they were collected, and 2 percent would fund grants to help communities plan tourism development and mitigate effects. He estimates the new taxes would generate \$14.5 million per year by fiscal 2002.

Both bills aim to consolidate Alaska's generic marketing effort and inject new funding.

At present, the Division of Tourism markets Alaska as a destination overseas, while ATMC, a quasi-government organization, markets Alaska to Canada and the Lower 48. The Alaska Visitors Association, an industry group, also conducts marketing. AVA funds about a third of ATMC's budget. The state funds the rest.

But state funding for tourism marketing has slipped from \$15 million in fiscal 1990 to \$6.7 miltion in fiscal 1999.

"If we don't do something, the state will keep slashing its contribution until there's nothing left." said Kathy Tarr, executive director of the Kenai Visitors & Convention Bureau, and a member of the AVA board.

The AVA board meets in Juneau this week, and the industry plans a

See TOURISM, back page

Exxon disputes trustee council findings

By SHANA LOSHBAUGH Peninsula Clarion

Scientists working for Exxon were invited to participate in last week's symposium on oil spill research, but declined, said Stan Senner, research coordinator for the Exxon Valdez Oil Spill Trustee Council.

Exxon also declined to take part in the 1993. Anchorage symposium and has presented results only in technical meetings outside of Alaska. The

ously believed, said scientists working with the Exxon Valdez Oil Spill Trustee Council, which organized the conference with help from the University of Alaska and the Prince William Sound Regional

Dave Barry C-5

Crossword: C-5

Mini Page Section D

Classifieds Section D

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sessione Clanon

encounters to readers to

Citizens Advisory Council. Oil damage adds to other factors, such as climate shifts, to spur complex cascades of effects throughout the larger ecosystem.

The post-spill coordinated

not to publish.

research effort, which has spanned nearly a decade and cost almost \$200 million, has made major strides toward understanding how the sound's ecosysten, works

See DISPUTE, page A-3

Interdisciplinary teams tackled

tes and by Youth so got its shift in-

1996 after Harris was hired in 1995

technologies for biochemical testing, genetic analysis, satellite tracking and computer modeling. they pioneered new levels of understanding. Factors such as water chemistry, temperature and currents were traced up the food chain from plankton all the way to whales and people. This is a change from the approach used in the first few years.

big questions about ecosystem

functions. Using sophisticated new

after the spill, when government and trustee council scientists focused on documenting damage to individual species for the court case against Exxon. After the settlement, the information was released to the public and, in 1993, the council held a public symposium on damage assessment study results.

Stan Sennet, science coordina-See SPILL, page A-3

Inside today Peninsula Life Section C Cloudy Dear Abby C-5

35/21



For complete weather, see page A-2

, I.			
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World	Ă-7		
Sports	Section B	To subscrip	el cal 235-755*

Camp SWAMPY seeking adult, teen participants

By HEATHER A. RESZ

Peninsula Clarino

Adults and teens interested in participating in Camp SWAMPY this summer are encouraged to sign up. Space is lumited to a maximum of 30 teens and a minimum of 16 Each teen who plans to attend is

responsible for earning the \$150 cost of camp, something SWAMPY organizer Panicla Harris said is an interventions list the" important part of the experience

"Camp is going to offer them a wonderful experience, but the biggoal is to have them working for

'Camp is going to be a wonderful experience. but the big goal is to have them working for what they want. That's how life is. Isn't it?'

> -Pamela Harris SWAMPY organizer

what mey want," she said. "That's at Skyview High School as the first intervention specialist in the Kenai SWAMPY -- Self Worth Pennsula Borough School District. Assertiveness Motivation Project

She said students banging out in her room before and after school decided they wantact to meet outside

of school to go camping together And SWAMPY was born. The program operates under the umbrella of Bridges There is no limit to the number of adults needed to help with the three five-day camps, Camps are June 19 to 13, July 15 to 19 and Aug 8 to 12 at the Outdoor Education Center at the Kenai National Wildlike Refuge.

Harris said she can find a sport planning or presenting the camp for any adult with an interest in working with at rask teens.

> "You and need to have a desire to See CAMP, back page

A TANK AND A

Hope offered, concerns raised at spill symposium

corporation has not revealed how much it has spent

on studies or how many studies it funded but chose

10th anniversary observances of the Alaska oil spill

pendent scientists - that there are no species in

Prince William Sound in trouble due to the impact

of the 1989 oil spill," their statement read in part

Exxon released a statement commenting on the

"It is Exxon's position - and that of many inde-

"Certainly there were severe short-term impacts

Rachel McCartan dances over tangled lines as she tries to walk Fluffy. Buddy and Miko in her Kenai

sity the traffic Enforcement (nam activities at the following times and locations Monday

7108a.m., Sterling Highway between Devin and Boundry

8 to 9 a.m., Binkley between Wilson and Marvdale

310.5 p.m., all of Redoubt, Kobuk and Binkley Wednesday

3 to 5 p.m., the Kenai Spur Highway from Sterling Highway to Knight, and Marydale from the Spur to Soldotna High School Thursday

7 to 8 a.m., Kalifornsky Beach Road

8 to 9 a.m., Sterling Highway between the Kenai

Spor Highway and the Soldoma Bridge Friday

7to8a.m., Sterling Highway between Devin and Boundry

8 to 9 a.m., Redoubt and Binkley

Saturday

5 to 7 p.m., The Kenai Spur Highway, Sterling Highway and Kalifornsky Beach Road

The grant, \$15,000 in federal money and \$2,000 in matching funds from the City of Soldotna, is intended to reduce traffic accidents in Soldotna by putting more officers in the field at key locations. such as schools and the Sterling and Spur highways. The money buys 12 extra hours of traffic enforcement each week and pays for educational outreach efforts to enlist the community in the safety effort.

Era having another community forum

Era Aviation is holding a second community forum in Homer and Kenai this week. The Homer meeting is Tuesday, 6:30 to 8:30 p.m. in the Homer City Council Chambers. The Kenai meeting will be Wednesday, 6:30 to 8:30 p.m. at the Kenai Merit Inn. The public is welcome to attend and participate.

Nominations being taken

..Dispute

Run Errands

What don't you feel like doing today?

Grocery Shopping - Banking Post Office - Pharmacy

otna Area 262-55

Business

Home or

Continued from page A-1

for family physician of the year

The Alaska Academy of Family Physicians is seeking nominations for the 1999 Family Physician of the Year. Each year the Alaska Academy awards one family physician the award on the basis of out-

their physician should receive the award. The family physician of the year in Alaska will be nominated for the Family Physicians' Nation Mamily Physician of the Year award. The Al hinner will be honored during the Academy's Annual Scientific Assembly, June 17-20 in Valdez,

Nominations are due no later than April 30. Nominations can be submitted to Alaska Academy of Family Physicians, P.O. Box 231793. Anchorage, AK 99523, or fax to 258-9584, or email to akafp@alaska.net

Fish and Wildlife having public

meeting Tuesday

The U.S. Fish and Wildlife Service will hold a public meeting Tuesday, from 7 to 10 p.m., at the Soldotna Senior Center, located at 197 W. Park Avenue in Soldotna. The meeting will have a discussion about the scope of the Wolf Lake Environmental Impact Statement for the construction of about 5.5 miles of natural gas pipeline and production facilities in the Kenai National Wildlife Refuge. The proposed project would be located in the northwest section of the Kenai Peninsula, between the existing Beaver Creek gas field and Swanson River Road,

For more information, call Brian Anderson, USFWS realty section at (907) 786-3379.

Free divorce clinic happening in Kenai

A free divorce and custody clinic is being held at the Public Assistance Office in the Old Carrs Mall in Kenai, Tuesday from 1 to 3:30 p.m. A representative from Alaska Legal Services Corporation will be doing the clinic. Participants must be on time and prepared to stay for the entire two-and-a-half-hour clinic.

ALSC representatives will be meeting by appointment with individuals wishing to discuss their legal problems Tuesday at the Women's Resource and Crisis Center in Kenai.

ALSC is a nonprofit agency that provides divorce, custody, public benefits and housing legal assistance to low income people.

For more information, call the ALSC office at (800) 478-9431.

Clarion

classifieds work.

283-7551, 262-6009

Homer city offices and branches of hirst commedias a result of the bory shart split over the Interstate Bank, National Bank of Alaska and Key Bank will he closed.

Schools on the Kenai Peninsula are closed --- not for Seward's Day, but for spring break - and will reopen April 5. However, the school district's central office will be open Monday.

The state holiday carries the name of William Henry Seward, who as Secretary of State negotiated the 1867 treaty with Russia for the purchase of Alaska for \$7.2 million.

Other events in Seward's life include --

....Spill

Continued from page A-1

tor for the trustee council, said that, in 1994, the council changed its focus to broader ecosystem studies that resource managers and oil spill response planners could use

Five years of those results were presented last week. The first day of the symposium, Tuesday, was a report on the status of Prince William Sound's recovery. On Wednesday, Thursday and Friday, scientists, officials and community leaders presented about 150 talks on biology, fisheries, oceanography, restoration projects, prevention and response networks and social impacts.

About 600 people attended.

Acute reactions to the oil spill faded after two or three years, but chronic effects linger in some areas, the speakers at the trustee council symposium said.

Humans in the spill region --which stretched from Prince William Sound west to the eastern coast of the Alaska Peninsula --- still experience spill-related stresses. Native villagers remain leery of subsistence foods on which they rely, and fishing families are still embroiled in prolonged litigation with Exxon.

Some wild animals, such as eagles and river otters, are doing well in Prince William Sound, But

Medium

Commercial +

OTR

others, such as sea otters, harlequin ducks and herring remain impaired. Biologists still find signs of oillinked poisoning in blood samples and body parts in some species in some areas of the spill zone, they said, mingled with signs of robust recovery in others, Studies from the National Marine Fisheries Service in Juncau found that minute traces of oil can damage salmon eggs years after a spill.

Senner said the findings are troubling.

"It re-emphasizes for me," he said, "the concern we have about possible effects of oil that remains on the shore. And the continuing impact on people is something that cannot be taken lightly."

Studies hint at broader changes in the North Pacific.

Overall productivity of the North Pacific, traced through biochemical records in baleen, has declined 40 percent since 1965. Other studies suggested 30-year cycles in fish populations and provided hope that seals, declining along the Gulf of Alaska coast since before the spill, may have bottomed out and begun a recovery.

•Easter treats!-

chocolate bunnies & halibut • unusual eggs • bright candles cards • tiny basket items • paper napkins • peter rabbit things linens • cookie cutters • stickers Northcountry open Mon-Sat 10-6 Fail 35082 Spur Hwy • Soldotna • 262-7715 283-2270 Formert Kena: He New Owner • Fresh Attitude 🐲 Fully Equipped Gym . Indoor Track Tanning Bods with New Bulbs Personal Trainer Available Circuit Classes • Tai Chi Ch'aun Classes

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by the spilled oil. The ecosystem in Prince William Sound is healthy, robust and thriving. This level of recovery conforms to the well established on many species due to the spilled record of recovery documented by oil and they suffered damages. But, the scientific community following based on the studies of many scienmany other oil spills around the tists who have worked extensively in Prince William Sound, there has been no long-term damage caused 1989."



Theaters_K-Beach Cinemas



· lavery issue:

Elected Governor of Work from 1839 to 1843:

nelected U.S. Senator from New York from 1849 10 1861:

■appointed U.S. Secretary of State 1861 to 1869; seriously wounded in the Lincoln assassination conspiracy;

retired from public life upon Ulysses Grant's election to the presidency:

died in Washington, D.C. on October 10, 1872.

The keynole speaker, marine

biology professor and National

Science Foundation hoard member

Jane Lubchenco, stressed the global

context of the oil spill. Although it

remains the worst environmental

disaster in the United States, spill

damage is just a small fraction of the

disturbing news scientists are glean-

She and others urged the scien-

Spill research will continue

Senner said the trustee council's

approval earlier this month of an

ongoing restoration reserve will pro-

vide science funding far into the next

century. The council plans to man-

age it like an endowment and make

evolve, they said, expanding to

include more areas around the Gulf

the ocean, we need to know a heck

of a lot more about what is going on

inside it," trustee council director

Molly McCammon said during the

concluding remarks.

The effort will continue to

"If people are going to be using

research a high priority, they said.

tists to continue their quest for infor-

mation and to take their new knowl

ing from the world's oceans.

edge to the public.

of Alaska.

Use of Stable Isotopes to Identify Food Web Dependencies and Nutrient Sources for Breeding Seabirds, Submitted Under the BAA

Project Number:	01572				
Restoration Category:	Research				
Proposer:	U.S. Fish and Wildlife Service				
Lead Trustee Agency:	DOI				
Cooperating Agencies:	Prince William Sound Scien Canada	nce Center, Environment			
Alaska SeaLife Center:	No				
Duration:	2 year	RECEIVED			
Cost FY 01:	\$116.4K	APR 1 3 2000			
Cost FY 02:	\$70.0K	EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL			
Geographic Area:	Prince William Sound				
Injured Resource/Service:	seabirds				

ABSTRACT

Prince William Sound (PWS) is connected to the Gulf of Alaska (GOA) by physical processes that are dynamic in nature and thereby strongly influence biological productivity in the Sound. This biophysical coupling between PWS and the GOA has been investigated by researchers with the Sound Ecosystem Assessment (SEA) project using natural stable isotopes. SEA investigators have demonstrated that biological production in PWS can be dependent upon the influx of carbon from the GOA, which is highly variable among years. How might these processes affect reproduction and population dynamics of upper trophic level predators? We propose to use stable isotope analysis to investigate possible linkages between the reproductive success of a piscivorous seabird, the black-legged kittiwake, and the source of nutrients in their diet (PWS vs. GOA). We collected feather samples from kittiwake nestlings throughout the Sound in addition to zooplankton samples from the Sound and adjacent GOA waters. Samples were collected during two years when breeding conditions varied considerably. By comparing contrasting conditions between years, we seek to gain new insight into food web dynamics affecting seabird reproductive success. This information will be valuable in identifying conditions necessary for recovery of piscivorous seabirds injured during the *T/V Exxon Valdez* oil spill.

Prepared 4/12/00

Project 01572

INTRODUCTION

Stable isotopes that occur naturally in the environment can be used to trace energy flow through complex physical and biological systems. Use of these natural tracers involves measuring differing ratios of two stable forms of carbon ($^{13}C/^{12}C$) and of nitrogen ($^{15}N/^{14}N$). Depicted in delta notation relative to international standards, values of $\delta^{15}N$ permit determination of food chain length, whereas $\delta^{13}C$ values identify sources of primary production. This technique has been successfully applied to determine the trophic position of forage fishes (Kline 1997, 1999) as well as numerous species of seabirds (Hobson 1990, 1993, Hobson and Welch 1992, Hobson et al. 1994) Through stable isotope analysis of zooplankton, investigators have also defined spatial patterns and isotopic gradients within coastal marine systems of the north Pacific Ocean (Wu et al. 1997, Kline 1999) as well as the Bering, Chukchi, and Beaufort Seas (Schell et al. 1998). By combining isotope analysis of organisms at upper and lower trophic levels, researchers have been able to identify the sources of food for upper trophic level predators (e.g. freshwater vs marine [Hobson 1990] and inshore vs. offshore feeding [Hobson 1993, Hobson et al. 1994]).

Recent investigators with the Sound Ecosystem Assessment (SEA) project have demonstrated that naturally occurring stable isotopes can be used to identify Prince William Sound (PWS) or Gulf of Alaska derived nutrients within the food web. Based on samples of herbivorous zoooplankton (*Neocalanus cristatus*), Kline (1999) described an isotopic gradient occurring between PWS and the Gulf of Alaska that varies seasonally and annually. By identifying spatial and temporal variation in isotope signatures at the base of the food web (e.g. sampling herbivorous zooplankton), it is possible to trace energy flow to to higher trophic levels (Fry 1988, Dunton et al. 1989). To date, SEA investigators have used stable isotopes to trace PWS and Gulf of Alaska derived nutrients through the food wed to Pacific herring (*Clupea pallasi*; trophic level 3). We propose to extend this analysis one more trophic level to an apex marine predator, the black-legged kittiwake (*Rissa tridactyla*), a piscivorous seabird.

Similar to spatial and temporal variation in the origins of nutrients in the PWS food web, kittiwakes nesting in PWS exhibit marked regional and annual differences in diets and reproductive parameters. For example, kittiwakes nesting in "northern" PWS (i.e. farther from

the Gulf of Alaska) tend have greater reproductive success than those nesting in "southern" PWS (i.e. closer to the Gulf of Alaska; Fig. 1). However, even within these northern colonies, there is considerable annual variation in reproductive parameters. Can the energy source of local food webs (PWS vs. GOA) explain these regional trends and annual fluctuations in repoductive success?



Figure 1. Long-term trends in kittivake reproductive success (fledglings/pair) showing that colonies located farther inside Prince William Sound (northern) have consistently produced more chicks than those closer to the Gulf of Alaska (southern).

During 1997 and 1998 we collected (nonlethally) tissue samples from black-kittiwake nestlings (feathers) and zooplankton (whole organisms from SEA and GLOBEC stations, see methods) to

2

Prepared <u>4/12/00</u>

evaluate whether the above question can be addressed. Admittedly, the scale of the question is considerably larger than our data set, however, the two years of data collection do provide striking contrasts in the regional production of forage fishes and kittiwakes. In 1997, prey abundance (primarily juvenile herring) and relative reproductive success of kittiwakes was greatest at the northern APEX study colony (Shoup Bay) compared to the southern colony (N. Icy Bay). In contrast, during 1998 the trend was reversed with the southern colony having greater prey abundance and greater relative reproductive success than the northern colony (Fig. 2). Interestingly, preliminary isotope data of kittiwake nestlings from colonies in northern, central, and southern PWS show a gradient in δ^{13} C between colonies far inside PWS and those near the Gulf of Alaska (Fig. 3). Given the reversal of breeding conditions between northern and southern PWS in 1998, we may observe a greater range or reversal of isotopic signatures that correlate with the overall productivity of a given region. Such contrasting conditions between years may also help us to identify how nutrients derived from PWS or GOA most benefit reproduction in a piscivorous seabird. Hence, by narrowing our focus to these two years of differing breeding conditions between northern and southern



Figure 2. Breeding conditions for black-legged kittiwake study colonies in northern (Shoup Bay) and southern (N. Icey Bay) Prince William Sound exhibited reversed trends between 1997 and 1998. Repreductive success is reported as deviations from a 15-yr average at each colony, thereby standardizing for differences in reproductive success that may inherently occur between large and small colonies.



Figure 3. Stable isotope values from feather samples of kittiwakes nestlings show regional differences in nutrient sources responsible for their development. Preliminary isotope data from 1997.

PWS, we can obtain new insight into food web dynamics affecting seabird reproductive success.

We will address two primary hypotheses:

Once corrected for trophic level (using measures of δ¹⁵N), δ¹³C values in tissues of an apex predator reflect δ¹³C values of lower trophic level organisms (herbivorous zooplankton, *Neocalanus cristatus*, in this case) within their foraging range.
δ¹³C values representing the source of energy for the prev of breeding kittiwakes will

 δ^{13} C values representing the source of energy for the prey of breeding kittiwakes will vary with annual changes in prey abundance and reproductive success.

Based on the results of 1997 and 1998, we can pose additional hypotheses and conduct retrospective analyses of regional food web dynamics and kittiwake reproductive parameters based on data previously collected by investigators with SEA, APEX, and the U.S. Fish and Wildlife Service. Results of our study may prove this technique to be a valuable and cost effective, long-term tool for monitoring and modeling ecosystem processes affecting reproductive success and population trends of apex predators.

NEED FOR THE PROJECT

Prepared <u>4/12/00</u>

Project 01_

A. Statement of Problem

Prince William Sound is a diverse marine environment with aquatic habitats that include estuarine, fjordic, and oceanic conditions. Oceanographic processes within these habitats are influenced locally by freshwater runoff and wind mixing and externally by the Alaska Coastal Current (ACC) which transports nutrients from the Gulf of Alaska into PWS. The strength of the ACC and associated influence of Gulf of Alaska waters within PWS varies seasonally and annually (Niebauer et al. 1994). Congruent with the physical exchange of water masses, stable isotope abundance data indicate that productivity derived from the Gulf of Alaska can influence biological production in Prince William Sound (Kline 1999). The proposed mechanism is an influx of carbon into GOA coastal regions, and eventually PWS, in the form oceanic zooplankton which are transported onto the continental shelf during the summer (Cooney 1988). Therefore, large-scale changes in marine productivity within the North Pacific Ocean (e.g. Brodeur and Ware 1992) can have profound, but measureable, biological effects in PWS.

Biological effects of changes in marine productivity within PWS and adjacent waters may be particularly evident in upper trophic level predators, such as piscivorous seabirds. For example fish eating birds were a feeding guild identified as declining in PWS (Agler et al. 1999) during a period coincident with a proposed regime shift and associated declines in piscivorous seabirds in the Gulf of Alaska (Piatt and Anderson 1996). During the same period, the distribution of black-legged kittiwakes breeding in PWS has changed from a majority of birds nesting at colonies closest to the Gulf of Alaska to a majority now at colonies farther inside of PWS (Suryan and Irons in review). Since 1984 most colonies nearest the GOA have exhibited poor

reproductive success and declining population numbers, whereas those colonies farther inside the Sound have increased in size and have been more successful than other colonies in PWS or the Gulf of Alaska (Suryan and Irons in review). Evidence indicates that these regional differences are at least partly a result of differences in prey availability, particularly access to juvenile Pacific herring in the northern bays of PWS (Suryan et al. 2000). However, after 1989 reproductive success at the "northern" colonies declined markedly and appears to be related to decreased availability of



1-yr-old herring (Fig. 4). Contrastingly, in recent years, reproductive success at some of the "southern" colonies have improved slightly (Fig. 1; Suryan and Irons unpubl. data). Kittiwakes, therefore, appear to be responding to regional changes in marine productivity that is occurring over years and decades within PWS.

B. Rationale/Link to Restoration

Black-legged kittiwakes can be used as a model for other species of piscivorous seabirds in PWS. Our data suggest that overall breeding conditions have declined during the past 10 years and that regional changes in conditions may be occurring. All six of the seabird species listed as injured

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Project 01

by the *T/V Exxon Valdez* oil spill are piscivores. Therefore determining linkages between physical processes and marine productivity affecting upper trophic level predators, can provide valuable information for anticipating or determining recovery of injured species.

Avian samples used in our proposed study can be collected nonlethally from nestlings of any seabird species whose nest is accessible to investigators. Therefore, the methods that we are developing and testing could easily be applied to other marine bird species or among feeding guilds.

C. Location

Feather samples for this project were collected from kittiwake nestlings at colonies throughout PWS during the summer of 1997 and 1998. Zooplankton samples were collected in PWS and nearby continental shelf regions during the spring and summer as part of restoration projects 311 in 1997 and from GLOBEC cruises in 1998.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

This project is primarily laboratory analysis and does include direct involvement by community members. However, pertinent information obtained during this study will be incorporated into information sheets about seabirds in Prince William Sound that are being produced and distributed by the U.S. Fish and Wildlife Service. We also would be pleased to meet and discuss our work and findings of this and other studies with community members within the spill region.

PROJECT DESIGN

A. Objectives

- 1. Measure naturally occurring isotopes of ¹³C/¹²C and ¹⁵N/¹⁴N in samples of zooplankton collected in PWS and adjacent waters
- 2. Measure naturally occurring isotopes of ¹³C/¹²C and ¹⁵N/¹⁴N in feather samples from kittiwake nestlings (a record of summertime nutrient sources for breeding birds) collected nonlethally at colonies throughout PWS.
- 3. From zooplankton samples, determine δ^{13} C gradients in water masses identifying PWS and Gulf of Alaska derived nutrients.
- 4. From kittiwake feather samples, determine δ^{13} C values and possible regional gradients (as in preliminary data from 1997) among colonies in PWS (northern vs. central vs. southern colonies) to identify differences in nutrient sources for nestling development.
- 5. Evaluate linkages between physical processes and marine productivity affecting upper trophic level predators by testing whether δ^{13} C and δ^{15} N values can explain spatial and temporal variation in kittiwake reproductive parameters.

B. Methods

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Sample Collection

In 1997, zooplankton samples were collected at stations within PWS and along the adjacent shelf area of the Gulf outside of Hinchinbrook Entrance. These samples have already been processed as part of the Pacific herring project 311. In 1998, zooplankton samples were collected as part of the GLOBEC project (US GLOBEC 1997) at select stations from the "Hinchinbrook Canyon Line" and from within Prince William Sound. Approximately 2000 samples were collected each in May and July 1998 and 500 samples in September 1998. These samples consisted mainly of copepods (Neocalanus spp.) and euphausiids (Thysanoessa spp.). Samples were frozen in the field in polyethelene vials and later freeze-dried in the laboratory and archived at the Prince William Sound Science Center. For the purpose of our study, we will analyze 400 zooplankters (individuals of large copepods and euphausiids and pairs of smaller copepods) each from the May and July cruises, for a total of 800 samples. It is imperative to analyze zooplankton samples from late-spring (May) and summer (July) to capture isotopic spatial variability at the source during the principal period of organic matter generation (i.e. the spring) and also establish food source gradients (that potentially will have drifted) during the kittiwake breeding period.

Adult black-legged kittiwakes in PWS typically lay eggs in early June and chicks hatch in early July after an approximate 25 day incubation period. The chicks remain in the nest for at least 35 days while the adults range from 5 to 60 km, on average, to obtain food for their nestling(s). Therefore, tissues of nestlings represent an integration of energy sources within a defined radius of the colony during the entire chick-rearing period (late June to mid-August). We collected samples from chicks that were about 30 days old to most completely represent conditions for all of chick-rearing (we avoided handling chicks older than 32 days to prevent the potential of forced premature fledging). We collected feather samples from nestlings because they could be obtained nonlethally by plucking (preferential to clipping because plucking triggers feather replacement, clipping does not). Ninety-two feathers (primary #5) in 1997 and 78 feathers in 1998 were plucked from the wings of kittiwake nestlings (most were alive, but some were found dead at the colonies). Feathers were frozen soon after collection and until processing in the lab. Prelimary analysis was conducted on 45 feather samples from 1997 (data reported in Fig. 3), therefore 125 samples remain to be processed. Kittiwake samples were collected from 11 colonies located throughout PWS.

Zooplankton and feather samples will be analyzed for stable-carbon and nitrogen isotope abundance according to the methods described below. Zooplankton samples will be shipped to the Stable Isotope Facility (SIF) at the University of Alaska Fairbanks for analysis. Feather samples will be analyzed by Dr. Keith Hobson at his laboratory in Canada (justifications for not sending feather samples to SIF are given below in section C, Cooperating Agencies, Contracts, and Other Agency Assistance). Data from the SIF are expected in about nine months from the date they receive the processed samples.

Zooplankton sampling methods. Terminal feeding stage copepodids and late stage euphausiids are being sampled with a MOCNESS on R/V Alpha Helix GLOBEC cruises. The MOCNESS is towed of obliquely through the upper 60 m of water column consistently collecting adequate sample sizes satisfying analysis of covariance and variance statistical tests. The May cruise is timed to catch the peak in occurrence of Neocalanus spp. copepodite V. Briefly, a MOCNESS

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system, consisting of nine remotely and sequentially deployed nets, is lowered from the surface, using net #1 as a drogue net, to below the acoustically-determined (by GLOBEC P.I. K.O. Coyle) zooplankton layer (~ 30 - 40 m) and closed at 100m (i.e., below the zooplankton layer). Net #1 thus effectively samples the upper water column from the surface to 100 m, while nets #2 to #9 are deployed to sample discrete depth zones of ~ 20 m thickness for use by Coyle in his analysis. Upon landing the MOCNESS on the vessel, the contents in the receiving bucket of net #1 are immediately sieved (stacked 30 cm diameter, 5 and 2 mm polyester mesh sieves and a polyethylene receiver pan, Nalgene) and sorted by species. Species identification is aided by low power (40 X) microscopic examination (Wild M3). Zooplankters are frozen, one sampling unit per vial, in small (4 mL) polyethelene vials (Wheaton Omni Vials). Samplings units consist of single zooplankters for copepodite V Neocalanus cristatus , euphausiids, and amphipods (when found) and two each for the smaller copepodite V of N. plumchrus and N. flemingeri. Frozen vialed samples are freeze-dried as previously described (Kline 1999).

Sample preparation. The following detailed methods focus on the analysis of zooplankton samples. Analysis of feather samples will conform to equal standards and are, therefore, not described separately (except that feather samples will be washed with a chloroform:methanol solution prior to powdering). Samples will be thawed and cleaned up using distilled water in the laboratory prior to freeze-drying, i.e., removal of foreign material. Samples will be freeze dried in a Labconco shelf freeze drier (designed for bulk samples) and stored in the Omni Vials. Once the collection for a given area is ascertained, samples will be selected for mass spectrometry in accordance with the sampling scheme developed by Kline (1999). This consists of analyzing N=15 sampling units per species (when found) per station in the case of Neocalanus spp. and up to N=30 sampling units per station for euphausiids (in general, different euphausiid species were found at the stations in relationship to their location on the continental shelf).

Isotopic analysis. Zooplankton samples will be shipped to the University of Alaska Fairbanks Stable Isotope Facility (SIF) where replicate sub-samples of ~1.5 mg will be weighed to the nearest 1 mg (in the case of fish and large euphausiid samples) and loaded into tin combustion boats for mass spectrometric analysis. The sampling units of smaller zooplankton are designed to be ~ 2 mg dry weight, so the entire sample is weighed and loaded into a boat. Isotopic analyses will be performed using a semi-automated stable isotope analyzer (Europa Scientific 20/20 equipped with a Roboprep sample combustion and purification unit). A single isotopic analysis generates the following data: ${}^{13}C/{}^{12}C$ and ${}^{15}N/{}^{14}N$ ratios expressed in standard delta units, $\delta^{13}C$ and $\delta^{15}N$, respectively; and %C and %N. The conventional delta notation used to express stable isotope ratios will be reported relative to international standards (air for N and Vienna Peedee belemnite (VPDB) for C) and defined by the following expression:

(1)
$$\delta^{15}N \text{ or } \delta^{13}C ({}^{o}/_{oo}) = \left(\frac{R_{sample}}{R_{sample}} -1\right) X 1000$$

where $R = {}^{15}N/{}^{14}N$ or ${}^{13}C/{}^{12}C$. By definition, the isotope standards have delta values of zero, i.e. $\delta^{15}N = 0$ for atmospheric N₂. Typically, instrument replication is < 0.2 ". The %C and %N data

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will be used to calculate C/N atomic ratios. The data will consist of mean δ^{13} C, δ^{15} N and C/N for all replicated samples. Additionally, the SIF maintains rigid QA/QC methods including use of laboratory standards that are run between batches of 5 samples. Based on recent experience, the average turn-around time for analysis at the SIF is nine months. This is taken into account in the project timeline.

Removal of lipid (DeNiro and Epstein 1977) and trophic level effects from δ^{13} C values makes it possible to assess carbon source (Kline 1997, 1999). The method of McConnaughey and McRoy (1979) will be used to calculate lipid-normalized ¹³C/¹²C while the method of Kline (1997, 1999) will be used to normalize for trophic level. Details of these protocols are described in Kline (1997, 1999) and Kline et al. (1998). In general, normalization reduces sources of ¹³C variability, enabling comparisons among fishes without the confounding effects of trophic level and lipid content. The expressions $\delta^{13}C$, $\delta^{13}C'$, $\delta^{13}C$ TL, or $\delta^{13}C'TL$ will be used to denote $^{13}C/^{12}C$ abundance in relation to the international standard, normalized for lipid content, normalized for trophic level, and normalized for lipid content and trophic level, respectively. Whereas $\delta^{13}C'$, $\delta^{13}C$ TL, or $\delta^{13}C'TL$ is used in accordance to a particular data analysis context, "¹³C" is used to reflect generic ¹³C/¹²C isotopic trends irrespective of normalization.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

The U.S. Fish and Wildlife Service (USFWS, DOI) will establish contracts with the Prince William Sound Science center and Environment Canada (or alternatively they could be funded through the BAA).

<u>Prince William Sound Science Center (PWSSC)</u>: As part of EVOS restoration project 311, Tom Kline, PhD has already processed zooplankton samples collected in 1997. Zooplankton samples collected in 1998 have been collected and archived, but have not been processed. The contract between USFWS and the PWSSC will be for sample preparation and data analysis by Dr. Kline. Part of this contract will also include purchase order to the University of Alaska Fairbanks (UAF) for processing of 1998 samples. The lab at UAF, operated by Dr. D. M. Schell, has processed all samples for previous studies conducted in Prince William Sound by Dr. Kline.

Environment Canada: A contract will be establish between the USFWS and Environment Canada for the preparation and processing feather samples. Dr. Keith Hobson will be responsible for these tasks. Dr. Hobson was asked to be involved in this study because of his extensive experience in the application of stable isotope analysis of tissues (including feathers) from upper trophic level predators, particularly avian species. Additionally, the isotope lab at UAF appears to be operating at or above capacity and due to the time constraints on completing this study (to reduce costs), we feel it is more efficient for Dr. Hobson to process the feather samples. Dr. Hobson also donated time and equipment to run a subsample of our 1997 feather samples, allowing us to evaluate the potential success of this study which supported our decision to proceed. Thus for continuity in scientific collaboration and feather analyses, we consider Dr. Hobson's involvement to be much needed. Funding to Dr. Hobson's lab is only 6% of our total budget.

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SCHEDULE

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

We will accomplish our objectives with the following tasks:

FY 01,

March 1:	Tissue samples prepared for analysis
September 30:	Laboratory work complete

FY 02,

January :	Attend Annual Restoration Workshop
February 1:	Data analysis complete
May 15:	Submit manuscript to peer reviewed journal
September 30:	Submit final report and manuscript to Restoration Office

B. Project Milestones and Endpoints

FY 01 Objectives (from PROJECT DESIGN)

September 30: 1) Measure naturally occurring isotopes of ¹³C/¹²C and ¹⁵N/¹⁴N in samples of zooplankton collected in PWS and adjacent waters.
 2) Measure naturally occurring isotopes of ¹³C/¹²C and ¹⁵N/¹⁴N in feather samples from kittiwake nestlings (a record of summertime nutrient sources)

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for breeding birds) collected nonlethally at colonies throughout PWS.

FY 02 Objectives (from PROJECT DESIGN)

February 1:

1) From zooplankton samples, determine δ^{13} C gradients in water masses identifying PWS and Gulf of Alaska derived nutrients. 2) From kittiwake feather samples, determine δ^{13} C values and possible regional gradients (as in preliminary data from 1997) among colonies in PWS (northern vs. central vs. southern colonies) to identify differences in nutrient sources for nestling development.

April 1:

Evaluate linkages between physical processes and marine productivity affecting upper trophic level predators by testing whether $\delta^{13}C$ and $\delta^{15}N$ values can explain spatial and temporal trends in kittiwake reproductive parameters.

C. Completion Date

FY 02

September 30: Submit final report and manuscript to Restoration Office

PUBLICATIONS AND REPORTS

In FY02, we will submit a manuscript for publication in a peer reviewed journal. Our final report will be submitted during FY 02 and will contain the submitted manuscript (or publication reprint if available). The draft title for the publication is:

Stable isotopes identify variation in food web dependencies and nutrient sources controlling reproduction in breeding seabirds. Potential target journals: Marine Ecology Progress Series, Oecologia, Canadian Journal of Fisheries and Aquatic Sciences.

PROFESSIONAL CONFERENCES

During FY 02, we will attend the EVOS restoration workshop and present preliminary results.

During FY 02, we would like to present our results at an international marine science conference, possibly the North Pacific Marine Science Organization (PICES) annual meeting

NORMAL AGENCY MANAGEMENT

The proposed project is beyond the scope of basic monitoring activities conducted by the U.S. Fish and Wildlife Service. This study is designed to increase our understanding of complex ecosystem processes affecting the reproductive success of apex predators within the EVOS region and has possible application to long-term monitoring through the GEM program.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project relied on data collected from, and extensive integration with, two ecosystem studies within the EVOS Trustee Council program (SEA and APEX) and one ecosystem study (GLOBEC) funded outside of the EVOSTC. Therefore, the overall cost of our proposed work is only a fraction of that required to address our hypotheses without the support of these other programs. Additionally, interpretation of our results will greatly benefit from knowledge gained during these previous and ongoing ecosystem studies.

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PROPOSED PRINCIPAL INVESTIGATORS

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PRINCIPAL INVESTIGATORS

Robert M. Suryan received a B.S. degree in wildlife management at Humboldt State University (1989), a M.S. degree in marine science at Moss Landing Marine Laboratories (1995), and has 15 years of experience in field biology. He has conducted studies of terrestrial and marine birds and mammals, involving population assessment, habitat use, foraging ecology, diving behavior, and effects of human disturbance. For the past five years, Rob has been a co-project leader for APEX component 163E and has conducted studies of the foraging ecology, reproductive biology, and population dynamics of Black-legged Kittiwakes in Prince William Sound, Alaska.

Rob will be responsible for meeting project objectives, tasks and producing the final publication.

Selected Reports and Publications

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- Suryan, R.M. and D.B. Irons. In review. Colony and population dynamics of Black-legged Kittiwakes in a heterogeneous environment. Auk.
- Suryan, R.M. and D.D. Roby. 1996. Management of Human Impacts. In: Warheit, K.I., C.S. Harrison, and G.J. Divoky (eds.) Exxon Valdez Oil Spill Seabird Restoration Workshop. Exxon Valdez Oil Spill Restoration Final Report, Project 95038. Technical Publication Number 1. Pacific Seabird Group, Seattle.
- Suryan, R.M. and J.T. Harvey. 1998. Tracking harbor seals (*Phoca vitulina richardsi*) to determine dive behavior, foraging activity, and haul-out site use. Mar. Mamm. Sci. 14(2):361-372.
- Suryan, R.M. and J.T. Harvey. 1999. Variation in reaction of harbor seals to disturbance. Fish. Bull. 97(2) 332-339.
- Ostrand, W.O., G.S. Drew, R.M. Suryan, and L.L. McDonald. 1998. Evaluation of radio-tracking and strip transect methods for determining foraging ranges of Black-legged Kittiwakes. Condor 100:709-718.

Thomas C. Kline, Jr.

Dr. Kline will be responsible for stable isotope analysis of zooplankton samples and formulation of the publication

T. Kline has been actively involved in stable isotope research since 1985. His has innovated applications of stable isotope analysis in fish ecology with emphasis on salmonid fishes in northern, western, south central and southeast Alaska. His techniques have enabled the quantification of 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 (Kline et al. 1990). His stable isotope models also enable the quantification of different sources of production important in salmon ecosystems (Kline et al. 1993). Dr. Kline also led an investigation relating feeding strategies to growth

forms in North Slope salmonids (Kline et al. 1998). 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 forum's (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 (Kline 1997, Kline and Pauly 1998). He was the first to provide direct evidence of the importance of carbon from the Gulf of Alaska in Prince William Sound (Kline 1997, 1998). The role of Gulf carbon was extended in a second EVOS project \311 which like \320I was completed in 1999.

- Kline, T. C., Jr.1997. Confirming forage fish food web dependencies in Prince William Sound using natural stable isotope tracers. In: Forage Fishes in marine Ecosystems, Proceedings of the International Symposium on the Role of Forage Fishes in Marine Ecosystems. Alaska Sea Grant College Program report No. 97-01. University of Alaska Fairbanks. Pp. 257-269.
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- Kline, T. C., Jr. 1999b. Temporal and Spatial Variability of 13C/12C and 15N/14N in pelagic biota of Prince William Sound, Alaska. Can. J. Fish. Aquat. Sci. 56 (Suppl. 1) 94-117.
- Kline, T. C., Jr., and D. Pauly. 1998. Cross-validation of trophic level estimates from a massbalance model of Prince William Sound using 15N/14N data. In: Funk, F., T.J. Quinn II, J. Heifetz, J.N. Ianelli, J.E. Powers, J.F. Schweigert, P.J. Sullivan, and C.-I. Zhang (eds.), Fishery Stock Assessment Models. Alaska Sea Grant College Program Report No. AK-SG-98-01. University of Alaska Fairbanks, pp. 693-702.
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Keith A. Hobson

Dr. Hobson will be responsible for stable isotope analysis of kittiwake feather samples and formulation of the publication

Dr. Hobson obtained his Ph.D. in 1992 from the University of Saskatchewan after conducting a pioneering study of the use of stable isotopes in high Arctic seabird research. He was then engaged in a postdoctoral position at the Freshwater Institute with Dr. Ray Hesslein using stable

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isotopes to investigate Arctic marine foodwebs before securing his current position as Research Scientist at the Prairie and Northern Wildlife Research Centre. During the last ten years, Keith has published extensively on various aspects of applying stable isotope analyses to the study of ecosystems involving high trophic-level organisms, especially seabirds and marine mammals. Currently, he is working on retrospective analyses of a GLOBEC isotopic dataset and is modelling carbon flow to seabirds and marine mammals in the Northwater Polynya.

Selected Publications

- Hobson, K.A., B.N. McLellan, and J. Woods. Using stable-carbon (δ¹³C) and nitrogen (δ¹⁵N) isotopes to infer trophic relationships among black and grizzly bears in Upper Columbia River Basin, British Columbia. *Canadian Journal of Zoology*, in press.
- Hobson, K.A., K. P. McFarland, L.I. Wassenaar, C.C. Rimmer, and J.E. Goetz. Linking breeding and wintering grounds of Bicknell's thrushes using stable isotope analyses of feathers. *Auk*, in review.
- Hobson, K.A., J Sirois, and M.L. Gloutney. 2000. Tracing nutrient allocations to reproduction using stable-isotopes: a preliminary investigation using the colonial waterbirds of Great Slave Lake. *Auk*, in press.
- Wassenaar, L.I. and K.A. Hobson. 2000. Improved technique for determination of D/H ratios in organic materials of ecological interest. Environmental Science and Technology, in press
- Lawson, J.W., and K.A. Hobson. 2000. Diet of harp seals (*Pagophilus groenlandicus*) in nearshore northeast Newfoundland: inferences from stable-carbon (δ¹³C) and nitrogen (δ¹⁵N) isotope analysis. *Marine Mammal Science*. 16(3): in press.
- Hebert, C.E., K. A. Hobson, and J. L. Shutt.. Changes in food web structure affect rate of PCB decline in Herring Gull (*Larus argentatus*) eggs. *Environmental Science and Technology*, in press.
- Hodum, P. J., and K.A. Hobson. 2000. Trophic relationships among Antarctic fulmarine petrels: insights into dietary overlap and chick provisioning strategies inferred from stable isotope analysis. *Marine Ecology Progress Series, in press.*
- Cherel Y., K.A. Hobson, and H. Weimerskirch. 2000. Using stable-isotope analysis of feathers to distinguish moulting and breeding origins of seabirds. *Oecologia*, *in press*.
- Hobson, K.A., Atwell, L., and L. I. Wassenaar. 1999. Influence of drinking water and diet on the stable-hydrogen isotope ratios of animal tissues. *Proceedings of the National Academy of Science* 96: 8003-8006.
- Hobson, K.A. 1999. Stable-carbon and nitrogen isotope ratios of songbird feathers grown in two terrestrial biomes: implications for evaluating trophic relationships and breeding origins. *Condor* 101:799-805.
- Hobson, K.A., and L.I. Wassenaar. 1999. Stable isotope ecology: an introduction. *Oecologia* 120:312-313.
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- Marra, P.P., K.A. Hobson, and R.T. Holmes. 1998. Linking winter and summer events in a migratory bird using stable carbon isotopes. *Science* 282:1884-1886.
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2001 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET October 1, 2000 - September 30, 2001

	Authorized	Proposed			
Budget Category:	FFY 2000	FFY 2001			
Porconnol		0.032			
Fraval					
Contractual		\$0.0			
Commodities		ψ <u>2</u> 9.2 ¹ \$5.8			
		\$0.0		LONG BANGE FUNDING REQUIE	PEMENTS
Subtotal	¢0.0	\$0.0 \$104.0	Fatimated		
Subiotal	φυ.υ	\$104.0	ESUMALEU		
	0.0	\$12.4 \$116.4	¢70.0		
Project rotar	φ0.0	φ110.4	\$70.0		
Full time Equivalents (ETE)	· · · · ·				
	_	0.9	Dallar amount-	are shown in thousands of dellars	
			Dollar amounts	are shown in thousands of dollars.	······
	•				
• •					
•	4				
			<u></u>		
	Project Num	ıber: 01 <u>5</u>	72		FORM 3A
EV 01	Project Num Project Title	ıber: 01 <u>5</u> : Use of Sta	7 <u>2</u> able Isotopes	to Identify Food Web	FORM 3A AGENCY
FY 01	Project Num Project Title Dependenci	ber: 01 <u>5</u> Use of States and Nut	구고_ able Isotopes	s to Identify Food Web	FORM 3A AGENCY PROJECT
FY 01	Project Num Project Title Dependenci	iber: 01 <u>5</u> : Use of Sta es and Nut	72 able Isotopes rient Sources	s to Identify Food Web s for Breeding Seabirds	FORM 3A AGENCY PROJECT DETAIL
FY 01	Project Num Project Title Dependenci Agency: DC	ber: 01 <u>5</u> Use of Sta es and Nut I - Fish an	구 <u>구</u> able Isotopes rient Sources d Wildlife Se	s to Identify Food Web s for Breeding Seabirds rvice	FORM 3A AGENCY PROJECT DETAIL

2001 EXXON VALDEZ TRUS October 1, 2000 - Jeptember 30, 2001

Per	sonnel Costs:		GS/Range/	Months	Monthly		Proposed
PM	Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2001
	Suryan	Co-Project Leader	GS11 - 5	3.0	6,200	·	18.6
	Kline	Co-Project Leader		3.0	8,735		26.2
	Uknown	Technician (Kline)		4.0	5,385		21.5
	Unknown	Technician (Hobson)		0.5	5,385		2.7
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
ļ		· · · · · · · · · · · · · · · · · · ·				·	0.0
		Subtot	al de la	10.5	25,705	0	
Ino	se costs associated with	n program management should be indicated b	y placement of a	in *.	Per	sonnel Total	\$69.0
Trav	vel Costs:		Ticket	Round	Total	Daily	Proposed
PM	Description		Price	Trips	Days	Per Diem	FY 2001
	Data will not be availab	le for presentation during the FY01 EVOS					0.0
	restoration workshop, 1	therefore travels funds are included in					0.0
	the projected FYU2 cos	IS.	· · · ·				0.0
1			1				0.0
ļ							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
Tho	Lecosts associated with	program management should be indicated b	v placement of a	un *		Travel Total	\$0.0
ليستع							
		Direiget Number 01)	
1							
	FY 01	Project Title: Use of Stable Isoto	pes to Identify	Food Web		1	ersonnel
'		Dependencies and Nutrient Sour	ces for Breed	ing Seabirds	s		& Travel
		Agency: DOI - Fish and Wildlife	Service				DETAIL

2 of 4

4/12/00

2001 EXXON VALDEZ TRUS October 1, 2000 - September 30, 2001

Contractual Costs:		Proposed
Description		FY 2001
Stable Isotope Analysis (Kline: 800 samples @ \$25/sample)		20.0
Stable Isotope Analysis (Hobson: 125 samples @ \$25/sample)		3.2
Freeze Drier Use Fee (Kline: 800 samples @ \$3/sample)		2.4
Lab Supplies (Kline)		2.0
Lab Supplies (Hobson)		0.4
Vials, chemical, grinder blades (Kline)		1.0
Vials, chemical, grinder blades (Hobson)		[·] 0.2
When a non-trustee organization is used, the form 4A is required.	Contractual Total	\$29.2
Commodities Costs:		Proposed
Description		FY 2001
Office Supplies (Kline)		0.8
Office Supplies (Suryan)		0.5
Computer Supplies and Upgrades (Kline)		1.0
Computer Supplies and Upgrades (Suryan)		0.8
Network charge (Kline)		. 0.8
Photocopying (Kline)		0.5
Shipping (Kline)		0.8
Communications (fax, phone; Kline)		0.6
	Commodities Total	8.0¢
Project Number: 01		
FY 01 Project Title: Use of Stable Isotopes to Identify Food Web	Cor	ntractual &
Dependencies and Nutrient Sources for Breeding Seabirds	Coi	mmodities
Agency: DOL - Fish and Wildlife Service		DETAIL

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

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New Equipment Purchases:		Number	Unit	Proposed
Description		of Units	Price	FY 2001
				0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
				0.0 0.0 0.0
nose purchases associated wi	th replacement equipment should be indicated by placement of an R.	New Equ	ipment lotal	\$0.0
Existing Equipment Usage:			Number	Inventory
FY 01	Project Number: 01 Project Title: Use of Stable Isotopes to Identify Food Web Dependencies and Nutrient Sources for Breeding Seabiro Agency: DOI - Fish and Wildlife Service	ls	F(Eq D	DRM 3B uipment DETAIL 4/1