Baseline Mapping and Geomorphology of Kenai Peninsula Shoreline

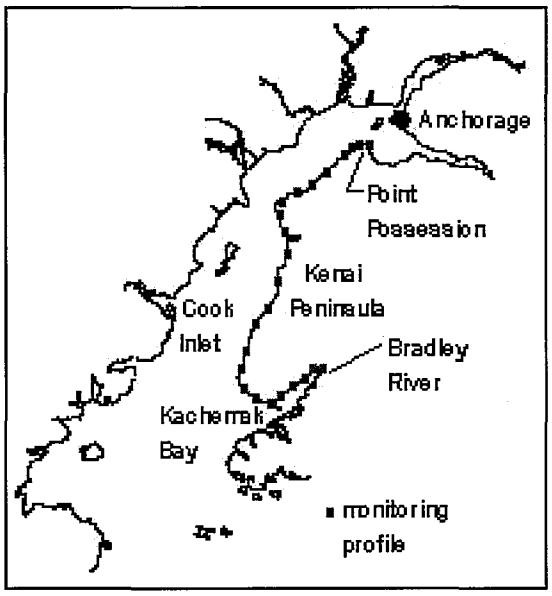
Project Number:	01583
Restoration Category:	Monitoring
Proposer:	University of Alaska Anchorage, School of Engineering
Lead Trustee Agency:	
Cooperating Agencies:	ADEC, ADNR, NOAA (in-kind contributions linked to separate projects of these agencies)
Alaska Sea Life Center:	no
Duration:	1st year, 2-year project
Cost FY 01:	$366,000
Cost FY 02:	$149,400
Geographic Area:	Kenai Peninsula
Injured Resource/Service:	Sediments, sub-tidal and inter-tidal communities, seabirds, marine mammals, and commercial, subsistence, and recreational fisheries

ABSTRACT

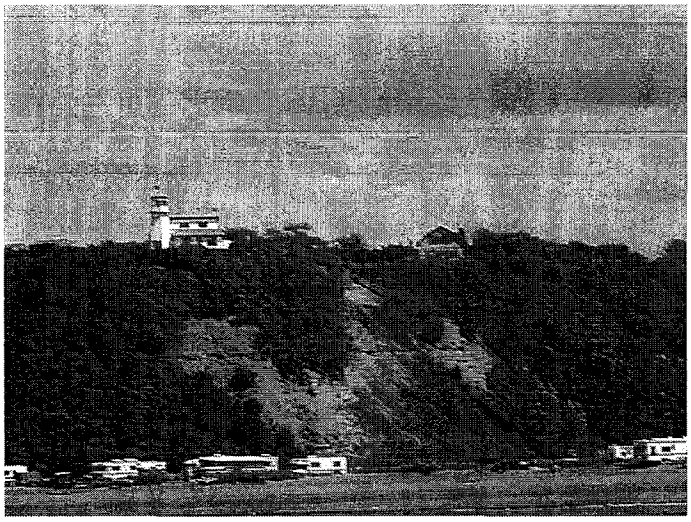
The proposed new project will create a GIS database of coastal geomorphology and mapping along the changeable shoreline of the Kenai Peninsula as a baseline for future monitoring in the GEM program. Color photogrammetry digital maps will be prepared for 270 km of coast from the head of Kachemak Bay to Point Possession. Cross-shore profiles and surface sediment characteristics will be measured in the first and second years at 30 locations intended for future monitoring of shoreline change. Boundaries of nearshore ecosystems and environmental sensitivity classifications defined by others will be verified and presented with shoreline data via the Cook Inlet Information Management/Monitoring System.

INTRODUCTION

Coastal processes and geomatics specialists at the University of Alaska Anchorage, School of Engineering propose to create a GIS database of coastal geomorphology along the changeable shoreline of the Kenai Peninsula as a baseline for future monitoring in the GEM program. EVOS effects on Cook Inlet shoreline resources can only be evaluated through knowledge of all ambient trends with reference to a precise baseline. This coast is the most densely populated, is subject to greatest development pressure, and harbors the highest commercial value of marine resources of EVOS-affected areas, including fisheries, oil, and gas resources. Forces of wind, waves, and tidal currents erode glacially deposited bluffs and human uses of the shoreline exacerbate natural erosion trends, with potential to pollute Cook Inlet water and sediment.

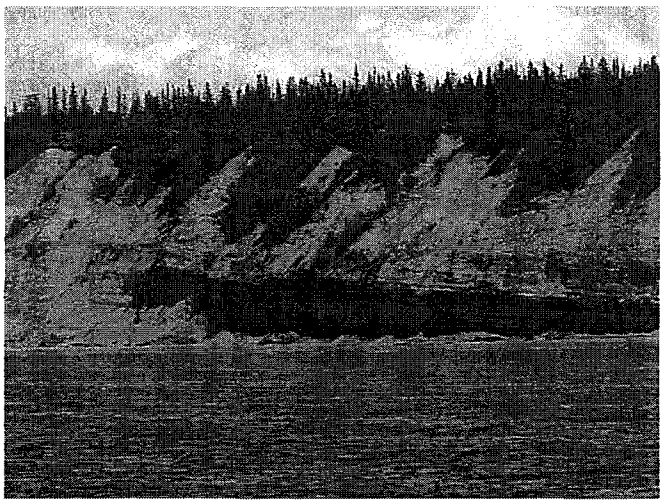


The proposed new project will create color photogrammetry digital maps from aerial photos of 270 km (168 mi) the Cook Inlet shoreline from Bradley River at the head of Kachemak Bay to Point Possession at the mouth of Turnagain Arm. Erodable bluffs fronted by sandy upper beaches and silty lower tidal flats characterize this shoreline. Shoreline elevations will be contoured at 1-m intervals. Representative profiles of the bluff, beach, tidal flats, and nearshore bathymetry, including laboratory characterization of surface sediments, will be measured at 30 locations, chosen for future monitoring of shoreline change, at an average interval of 9 km (5.6 mi). Profile data will be applied to verify mapping by photogrammetry. The profiles will be resurveyed in the second year of the project to begin the record of precise quantitative change. Historical shoreline survey data, aerial photography, and other information will be applied to derive shoreline retreat rates, estimates of sediment flux into the inlet from erosion, and future projections of shoreline position. The final product will be Internet-accessible via the Cook Inlet Information Management and Monitoring System (CIIMMS, Project 391 by ADNR and ADEC). The proposed project is a continuation of the "Cook Inlet Shoreline Resources Project" first sponsored in 1999 by the University of Alaska Natural Resources Fund. Beneficiaries of the project will include: government land and natural resource managers; environmental interest groups; land owners and developers; coastal engineers and scientific researchers; student participants and the general public.



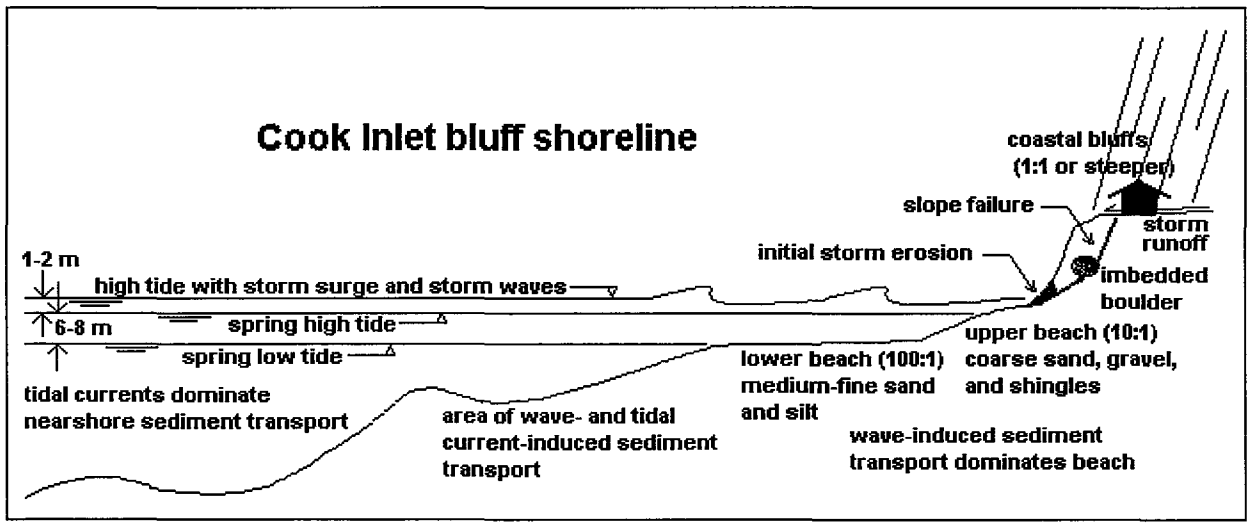
NEED FOR THE PROJECT

A. Statement of Problem



Marine transportation, fishing and human development all impact shoreline resources of Cook Inlet. The Exxon Valdez oil spill reached the southeastern shores of Cook Inlet along the Kenai Peninsula, affecting sediments, sub-tidal and inter-tidal communities, seabirds, marine mammals, and commercial, subsistence, and recreational fisheries. EVOS impacts occurred on a background of existing stresses and controversial management issues, including offshore oil and gas exploration and development. Both shoreline and oceanographic conditions are more complex and more variable in Cook Inlet than in Prince William Sound. Higher tides, larger waves, stronger currents, and a more erodable coastal geology create a situation of continuing change along the Cook Inlet shores of the Kenai Peninsula.

While much of Prince William Sound has steep rocky fjord shorelines, sedimentary deposits of glacial origin characterize the Kenai Peninsula coast of Cook Inlet (Reihle et al 1977, Schmoll et al 1984, Ward et al 1987). Coastal bluffs over 100 feet high along much of this shore are prone to dramatic erosion from combinations of onshore winds, high waves, extreme high tides, and storm surge. Cook Inlet tides have ranges exceeded only by the Bay of Fundy in all of the Americas. Tidal currents regularly exceed 4 knots and can exceed 6 knots near constrictions. Fetches for wave generation are longer than in Prince William Sound, resulting in higher wave energy at the shoreline. Direct exposure to these sources of turbulence has a catastrophic effect on coastal bluffs that are only marginally stable when high and dry, as illustrated below.



B. Link to Restoration

The recovery of species, habitats, and human services in this area affected by EVOS cannot be objectively evaluated or monitored without reference to a precise baseline of geomorphologic conditions. Neither can constructive measures to restore resources or services be rationally designed and evaluated without quantitative information regarding coastal morphology, associated surface sediments, and delineation of related habitats and ecological boundaries. In a coastal zone so changeable as this, effects of other stresses must be resolved to evaluate impacts of and recovery from the EVOS event. The project will apply historical data to determine trends of shoreline change underway before and since the EVOS (1989). Extrapolations of future shoreline retreat rates and position will be accomplished for coastal reaches with sufficient supporting historical information. This strategy is discussed in many articles and texts, *e.g.,* Klee (1999), as an integrated approach to coastal zone monitoring and management.

C. Location

The project will be undertaken all along the tidelands, upper beach, bluffs, and nearshore region of the Kenai Peninsula from the mouth of the Bradley River at the head of Kachemak Bay, including the northern side of the Kachemak Bay National Estuarine Research Reserve, to Point Possession at Chickaloon Bay on the mouth of Turnagain Arm. A total of 270 km (168 mi) of continuous shoreline will be mapped. Detailed cross-shore profiles of topography and bathymetry, and surface sediment characteristics will be measured at 30 locations along this shoreline at an average interval of 9 km (5.6 mi). Benefits will be realized by coastal residents of the Kenai Peninsula Borough and the communities of Homer, Anchor Point, Ninilchik, Clam Gulch, Kasilof, Kenai, Nikiski, and unnamed settlements between. Since the land-use management tool provided by the project will be applied to govern State-owned and Federal uplands, tidelands, and offshore areas, the entire State of Alaska will also benefit by completion of this project and subsequent monitoring.

COMMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

Interviews of local and regional land managers and long-time residents will be conducted to develop the history of the shoreline in the vicinity of each profile and, in general, all along the shoreline to be mapped. Local and traditional place names will be noted. Interviews will discuss local perception of EVOS and other human impacts on coastal habitats and resources. A literature and data search of reports, articles, and old maps and photos on file will supplement anecdotal information from personal interviews. Information papers designed to help local residents understand the ecological impact of coastal erosion and how they can help reduce human impacts in the coastal zone will be distributed. Literature, data, photographs, and interviews will be cited in the project report and in a bibliography incorporated into the GIS database with access by the public via Internet through the CIIMMS project.

PROJECT DESIGN

A. Objectives

1. The project will create color orthophotogrammetric maps and mapping data at 1-meter resolution or better for the entire Kenai Peninsula coast from Bradley River north to Point Possession.

2. Thirty profiles of topography and nearshore bathymetry will be measured during the first year and repeated in the second year in conjunction with sampling and testing characteristics of surface sediments. Survey monuments will be located at each profile so that the profile can be revisited in future years to monitor changes in geometry and sediment character. Survey monument positions and descriptions will be certified and publicly recorded by Registered Land Surveyors on the project team.

3. A GIS database will be created to hold the above map and profile information and other data gathered through this proposed project with an interface for public access via Internet through the CIIMMS project.

4. Boundaries of environmental sensitivity zones, habitats, land use, and other areas of ecological interest determined by others will be verified and delineated on the above maps and GIS data format compatible with access via Internet through CIIMMS.

5. Historical shoreline data will be cited and compared in GIS format to the baseline to derive shoreline retreat rates, changes in profile geometry and sediment character, estimates of sediment flux into the inlet from erosion, and future projections of shoreline position. This derived information will also be made available for public access via Internet through CIIMMS.

B. Methods

1. **Aerial photography:** A contract will be issued for aerial photography using a GPS-Inertial camera positioning system that provides survey accuracy without placement of visible target panels along the flight lines. This uniquely controlled camera system is available from AeroMap US of Anchorage. The aerial photography will include approximately 200 exposures at a scale of 1:14,400 (1 in = 1,200 ft). This scale (i.e., aircraft altitude) is designed to include Cook Inlet shoreline features in a single flight line with maximum resolution. High density scanned image files will be provided along with geographical coordinates and orientation parameters necessary for digital photogrammetry processing.

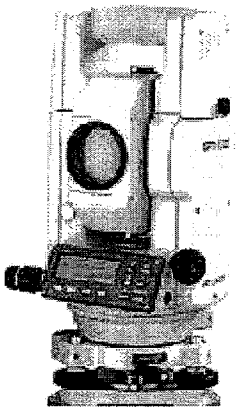
Two alternatives to this method of data collection for mapping were considered. The first is conventional aerial photography controlled by visible target panels placed by surveyors along the path of the aerial camera. The field time for panel placement would increase labor and travel requirements by an order of magnitude. The timely availability of the new GPS-inertial camera system precludes the need for panels.

The second alternative considered is airborne "LIDAR," a system that rapidly collects horizontal and vertical terrain positions by laser reflection. The digital data density from a LIDAR survey would be much greater, without the effort to operate digital stereo plotting software. The highly specialized and abstract software required for LIDAR analysis and the rare availability of the exotic equipment cause the price of map creation to be at least twice that for the method proposed. Furthermore, the utility of the color aerial images for delineation of vegetation types and other boundaries and interpretations is lost in the pure geometry of LIDAR.

2. **Photogrammetry:** The UAA Geomatics Department faculty and students, using three Dat/EM digital stereo plotting workstations on hand at the School of Engineering, will develop GIS-compatible digital maps from aerial images. This method is termed "softcopy photogrammetry" in the recent summary of shoreline mapping techniques by Moore (2000) and produces a quality of map at least as good as that prepared for coastal zone management purposes for many decades all over the world. Operators will trace or locate key coastal geographic features (roads, large buildings, towers...), generally following conventions of NOAA nautical charts. An array of topographic points will be located with the software to create a digital terrain model (DTM) from each of the 100 stereo (60 percent overlap) image pairs. GIS software will then be applied to derive 1- m contours from the selected topographic points and to add a coordinate grid, labels, colors, and other interpretive features.

3. **Cross-shore profiles:** A total of 30 profiles, each located to represent reaches of shoreline with general uniform orientation, shape, and sediment characteristics, will be surveyed by topographic and hydrographic methods. This approach, especially when subsequent collocated profiles are compared, is a well-accepted approach to evaluation of shoreline processes that it documented in many manuals and texts (*e.g.*, USACE 1984 and Komar 1998). Two permanent survey monuments will be positioned by static GPS methods for horizontal and vertical control at the onshore end of each profile. A Registered Land Surveyor on the project team will certify and submit a public record of monument descriptions and locations.

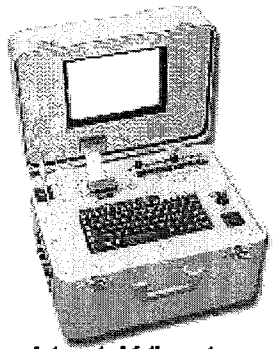
   Field parties measuring topographic portions of each profile will use a prismless total station, which is a survey theodolite with a built-in high-energy pulse laser range finder, to profile bluffs that would be dangerous for a person carrying a prism rod. Two prismless total stations will be acquired for use in this project and subsequent monitoring of profile changes.



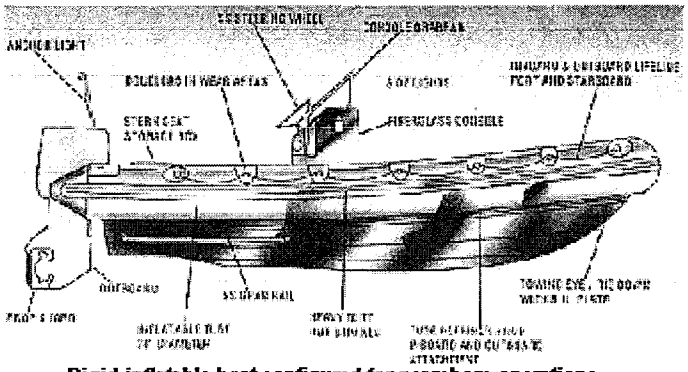
Prismless total station

Other necessary topographic hardware and software is already on hand at UAA. Samples of surface sediments will be collected from the nearshore uplands, the bluff face and within vertical zones across the beach. Samples will be visually classified on site and carried to Anchorage for gradation testing in the soils lab at the UAA School of Engineering.

Hydrographic portions of profiles will be measured from a small boat equipped with an integrated sounding, DGPS positioning, navigation, and data logging system. The boat crew will also collect bed samples for visual classification on site and grain size distribution analysis at UAA. Hydrographic profiles will extend beyond –2 m MLLW, which is the approximate limit of the littoral zone. A lightweight, highly stable rigid inflatable boat with outboard motors and trailer and the compact weatherproof integrated hydrographic survey system are proposed for acquisition in this project. The option of vessel chartering was considered, but would probably cost over 75 percent of the proposed purchase cost and might not be as safe or as efficient as the system contemplated for procurement. All equipment proposed for acquisition in this project will be used for teaching and for other coastal research at UAA, when not otherwise committed to the work proposed herein.



Integrated fathometer, DGPS positioning, and navigation/data-logging computer



Rigid inflatable boat configured for nearshore operations

All 30 profiles will be located, monumented, and surveyed in the first summer season of the project, generally concurrent with aerial photography. The profiles will be resurveyed in the second summer season of the project to establish the first short-term measure of change. Up to 5 additional profile stations may be established, if the experience and analysis of the first set and of aerial images reveals reaches of high variability not perceived in this proposal stage. Likewise, these return field visits will accomplish further refinements in delineating habitats, environmental sensitivity zones, land-use areas, and other pertinent patterns revealed by analysis of the first year's measurements and analyses. The opportunity to meet again with local leaders and long-term residents will be used to inform them of progress in the project, answer questions, and seek verification of trends revealed in the initial analysis.

4. **GIS application development**: ArcInfo, ArcView and associated add-on software of ESRI will be applied to develop a database with maps and georeferenced graphics (*e.g.,* plots of beach profiles and grain size distribution curves), tabulations, narrative descriptions, and photographs. A user-interface will be developed at UAA for access to the database and its graphical components via Internet by users unfamiliar with GIS software. Acquisition of two GIS workstations is proposed to avoid conflicts

between this project, teaching and other projects. An Internet server computer and all required development and server software are already on hand at UAA and available for application to this project. CIIMMS will link to the UAA server.

5. **Habitats and ecological zones**: Various studies by others, *e.g.,* Hayes et al 1977, RPI 1994, and a number of completed and ongoing EVOS Trustee Council-funded projects locate Cook Inlet shoreline features, habitats and zones of environmental sensitivity with a view toward oil spill impacts. This information will be translated and incorporated in the new Kenai Peninsula shoreline GIS for superposition on the baseline geomorphology measured as a part of this proposed project. Field visits to measure cross-shore profiles will also verify or note refinements to the locations and boundaries of shoreline features, habitats and zones of environmental sensitivity. A gallery of ground-level digital photos of geomorphologic and ecological details will be acquired and incorporated in the GIS database for viewing on demand via Internet.

6. **Incorporation and intercomparisons of historical data**: UAA investigators reviewed historical aerial photography of the Cook Inlet shoreline as a part of the Cook Inlet Shoreline Resources Project and identified a discontinuous series widely distributed in space and time. Very few surveys of small coastal areas are on file. Images on file are at higher altitudes than that proposed for this project and few have the prerequisite overlap for stereo plotting. Nevertheless, location of specific stable features (*e.g.*, the corner of an old building) on the new stereo photos by digital stereo mapping will establish map coordinates. The scale of the historic photo can be determined and an offset from the reference point to apparent shoreline features can be measured, *e.g.,* to the top of the bluff. Historical aerial photos will be selectively acquired from public and commercial archives for this purpose. Where practical, a history of shoreline locations will be derived and presented in the GIS application. Selected scanned historical aerial images will also be presented to illustrate the most significant changes.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

The Alaska Departments of Natural Resources and Environmental Resources CIIMMS team will collaborate with this project team to link CIIMMS with the proposed GIS application via the Internet. NOAA National Ocean Service will provide survey control information, record locations and descriptions of coastal monuments placed at profile sites, and otherwise consult on topographic and hydrographic surveying aspects of the work. NOAA Hazmat will provide data and consult with the project team to ensure consistency of environmental sensitivity and habitat delineations. This project team will collaborate and share data with NOAA investigators of intertidal shoreline community recovery in the Kachemak Bay National Estuarine Research Reserve, in particular, regarding precision measurements of coastal morphology and grain size distributions across the north shores of Kachemak Bay. NOAA investigators have also expressed an interest in collaboration on long-term monitoring of these conditions, with regard to effects of the EVOS and subsequent cleanup operations.

SCHEDULE

A. Measurable Project Tasks

Federal Fiscal Year 2001 (October 1, 2000 – September 30, 2001)

December 31, 2000	Complete literature/data search (90%; ongoing throughout project)
March 31, 2001	Equipment acquired; systems configured and tested
July 31, 2001	Complete aerial photography (contract)
August 15, 2001	Complete profile measurements, interviews, field work (year 01)
August 31, 2001	Deliver digital aerial images and control files (contract)
September 31, 2001	Complete initial GIS design and implement on web server

Federal Fiscal Year 2002 (October 1, 2001 – September 30, 2002)

November 31, 2001	Complete lab analysis of sediment samples and incorporate in GIS
December 31, 2001	Complete photogrammetry (shoreline maps), incorporate in GIS
March 31, 2002	Complete intercomparisons of historical shoreline information
July 15, 2002	Complete profile measurements, interviews, field work (year 02)
August 15, 2002	Complete lab analysis of sediment samples (year 02)
August 15, 2002	Final draft GIS compilation and user interface development
September 31, 2002	Incorporate final refinements and publish complete GIS on web

B. Project Milestones and Endpoints

September 31, 2001	Create a GIS database with web access through CIIMS (initial)
December 31, 2001	Create color orthophotogrammetric maps and mapping data
March 31, 2002	Intercomparisons of historical aerial photos and other data
August 15, 2002	Measure cross-shore profiles and sediment characteristics (2 years)
August 15, 2002	Boundaries of sensitivity zones, habitats, and land use areas
September 31, 2002	Create a GIS database with web access through CIIMS (final)

C. Completion Date

The final products will be delivered, i.e., published on the Internet via CIIMMS, by September 31, 2002 (Federal Fiscal Year 2002).

PUBLICATIONS AND REPORTS

A peer-reviewed journal article will be published to describe the findings of this project in the Journal of Coastal Research. A narrative executive summary of the entire project effort and findings will be provided as a component of the GIS available via the Internet. Maps and detailed data presentations will be published in the GIS via the Internet. An interim version will be made available to the public after the first year's field measurements and analyses, with means for feedback via email. Comments and suggestions will be addressed as the second year's field measurements and analyses are incorporated in the GIS database and user interface.

PROFESSIONAL CONFERENCES

At least two conference presentations by UAA students and faculty will be made in consecutive years at the annual Alaska Surveying and Mapping Conference. Other presentations of project findings at meetings of opportunity in Alaska are likely. The PI will make an international presentation at the International Coastal Engineering Conference in July 2002 at Cardiff, Wales.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The CIIMMS team will be routinely consulted as the GIS database for this project takes shape. Principal investigators of Trustee Council-funded projects with information pertinent to delineation environmental sensitivity zones, habitat, and land use areas will be contacted during the beginning literature and data search. Investigators of ongoing projects will be invited to use information gathered as a part of this proposed project. NOAA/NOS will be contacted during the initial literature and data search regarding horizontal and vertical control at profile locations and agency information on geomorphology of the specific area. NOAA/Hazmat will be contacted during the initial literature and data search regarding environmental sensitivity zones and related georeferenced data.

PROPOSED PRINCIPAL INVESTIGATOR

Orson P. Smith, PE, Ph.D.

University of Alaska, School of Engineering

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907-786-1910; 907-786-1079 fax; *afops@uaa.alaska.edu*

PRINCIPAL INVESTIGATOR

Orson P. Smith, PE, Ph.D. Orson Smith holds a BS in Mechanical Engineering, a graduate diploma in Coastal Engineering from Delft (the Netherlands), an MS in Civil (Coastal) Engineering, and a Ph.D. in Physical Oceanography. He first joined the US Army Corps of Engineers in Alaska in 1973 as an intern to become in 1975 supervisor of dredging and hydrographic surveying operations and later manager of harbor and coastal feasibility studies. He was a researcher at the Corps' Coastal Engineering Research Center from 1983 to 1986 and, after completing his Ph.D. at North Carolina State University, returned to the Alaska District Corps of Engineers as a manager of port and coastal projects that stretch from Barrow to Hyder. After teaching as an Adjunct Professor, he joined UAA full-time in 1998 as Associate Professor in the School of Engineering, Department of Civil Engineering. He teaches fluid mechanics, Arctic engineering, physical oceanography, port and harbor design, and coastal engineering courses and conducts research on navigation, sea ice, and coastal processes. He has been a registered Professional Engineer in Alaska since 1983. Dr. Smith will be responsible for overall schedule keeping and funds management, interpretation of photogrammetry, analysis of profile and sediment data, and intercomparisons of historical data.

OTHER KEY PERSONNEL

Ronald Cothren, RLS. Associate Professor Cothren has been a UAA faculty member since 1982 and is currently Chair of the Geomatics Department in the School of Engineering. He holds a BS in Civil Engineering Technology and an MS in Civil Engineering. He is a Registered Land Surveyor in Alaska. In addition to his teaching duties, he has also operated an independent land surveying business since 1986. He spent six months in Australia in 1988 as technical adviser to the Department of Geographic Information, and has worked as a design engineer and geodesist in both private industry and for the federal government. His teaching experience includes two years with the engineering department at Oregon State. He is a member of the American Congress on Surveying and Mapping, the Alaska Society of Professional Land Surveyors, and the American Society of Civil Engineers. He also serves on the National Publications Committee of the *Journal of Surveying Engineering.* Professor Cothren is the author of numerous papers relating to the geomatics profession and was the project coordinator of the 1989 Mt. McKinley Global Positioning System Expedition. He serves on the UAA Grants and Leave Committee and is faculty adviser to the Department of Geomatics Student Association. He is a Certified Trainer by Trimble Navigation Ltd. for GPS Courses. He will be responsible for field logistics, including monumentation of profile sites, execution of topographic and hydrographic measurements, and subsequent reduction and analysis of field survey data.

Don Davis, RLS, CP. Don Davis is a Registered Land Surveyor and Certified Photogrammetrist in Alaska and hold a BS in Applied Mathematics, a BS in Surveying, and an MS in Photogrammetry. He is an Associate Professor in the UAA Department of Geomatics, having joined faculty in 1991. In addition to his teaching duties, he has also worked as a photogrammetry consultant for DAT/EM Systems International in Anchorage and a land

surveyor for the Bureau of Land Management. Before coming to Alaska Professor Davis held positions as a systems analyst for General Dynamics, programming classified photogrammetric software and an engineer and estimator in the construction industry. He was also a teaching assistant while working on his masters degree at Purdue University. He will be responsible for supervision of contract aerial photography and photogrammetry analyses.

Cherie Northon, Ph.D. Cherie Northon joined the UAA School of Engineering, Department of Geomatics as an Associate Professor in 1999, and teaches courses in applications of Geographical Information Systems (GIS). Cherie Northon has two B.A. degrees, Geography and Anthropology, an M.A. and a Ph.D. in Geography from the University of California Berkeley. For over twenty years she has taught cartography and GIS while also running a successful cartographic consulting business. Some of her projects include mapping of Southern California beaches for litigation on the American Trader oil spill (1991), land use and water rights issues in Alaska, Idaho, and California, and areas impacted by mine outwash in Montana. She will be responsible for leading the design of the GIS database and associated Internet user interface.

Thomas Eley, Ph.D. Thomas Eley is an Adjunct Professor and Research Associate of the UAA School of Engineering, Department of Geomatics and holds M.A. and Ph.D. degrees in Geography from the University of California Berkeley and B.S. and M.S. degrees in Wildlife Ecology and Management at Humboldt State University. His specialties include natural resources management in coastal and marine environments, biogeography (particularly human impacts on the distribution of animals and plants), and the use of GIS and other Geomatics technologies in natural resources management. He has approximately 60 publications in technical journals and other periodicals. He was a Fulbright Fellow to Papua New Guinea. Throughout much of his career, he has worked for the U.S.F.W.S. and the Alaska Department of Fish and Game on a variety of issues concerning marine mammals, shore birds, waterfowl, and subsistence. He will be responsible for delineation of environmental sensitivity zones, habitats, and other coastal areas of concerns as identified by others and through field verification and interviews with local leaders and long-time residents of the coastal area.

Grant Baker, Ph.D. Grant Baker is an Assistant Professor in the UAA School of Engineering, Department of Civil Engineering, teaching courses in statics, dynamics, computer applications, thermodynamics, and corrosion. He holds a BS in chemical engineering, an MS in mining engineering, and a Ph.D. in geophysics. Dr. Baker has worked extensively with soil analyses including particle size distribution and zeta potential measurements. He has also conducted research and published articles on soil chemical treatment and solute transport in Alaskan soils including soils of seabed and shoreline areas. He will be responsible for collection and analysis of sediment samples.

LITERATURE CITED

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Moore, Laura, 2000. "Shoreline Mapping Techniques," Journal of Coastal Research, 16(1), 111-124, Coastal Education and Research Foundation, Royal Palm Beach, FL

Riehle, J., Reger, R., and Carver, C., 1977. "Geology and Geological Hazards of the Western Coast of the Kenai Peninsula from Kenai to English Bay [Nanwalek], Alaska," Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys

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Schmoll, H., Yehle, L., Gardner, C., and Odum, J., 1984. "Guide to Surficial Geology and Glacial Stratigraphy in the Upper Cook Inlet Basin," Alaska Geological Society

USACE, 1984. Shore Protection Manual, US Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS (*note: the PI was a contributor to this book*)

Ward, L., Moslow, T., and Finkelstein, K., 1987. "Geomorphology of a Tectonically Active, Glaciated Coast, South-central Alaska," in Fitzgerald, D., and Rosen, P., eds., Glaciated Coasts, Academic Press, Inc., New York

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

Budget Category:	Authorized FY 2000	Proposed FY 2001
Personnel		$94.1
Travel		$40.6
Contractual		$75.0
Commodities		$6.3
Equipment		$104.5
Subtotal	$0.0	$320.5
Indirect		$45.5
Project Total	$0.0	$366.0
Full-time Equivalents (FTE)		1.8
Other Resources		$17.3

LONG RANGE FUNDING REQUIREMENTS					
			Estimated FY 2002		
			$149.4		

Dollar amounts are shown in thousands of dollars.

Comments:
1. All equipment and contract costs occur in the first year of this two-year project.
2. UAA indirect is 27.4% of direct labor, commodities, and the first $25,000 of contract services. Indirect is not charged to permanent equipment purchases over $2,500 per item or to contract costs over $25,000. The FY 01 basis for indirect is therefore estimated as $165,983.
3. Faculty time during the academic school year that will be directed to this project is estimated as a total 400 labor hours, valued at $17,346 direct labor cost. These labor costs are contributed to the project by the UAA School of Engineering.

FY01

Prepared: 14 April 2000

Project Number: 01583
Project Title: Baseline Mapping and Geomorphology of Kenai Peninsula Shoreline
Name: University of Alaska Anchorage, School of Engineering

FORM 4A
Non-Trustee
SUMMARY

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

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2001
	O. Smith	PI	2	7.7		15.4
	C. Northon	Co-PI	2	6.7		13.4
	R. Cothren	Co-PI	2	7.1		14.2
	D. Davis	Co-PI	0.75	6.4		4.8
	G. Baker	Co-PI	0.75	6.8		5.1
	T. Eley	Co-PI	2.5	5.2		13.0
	Res. Analyst	GIS technician	3.75	3.7		13.9
	graduate	student aid	3.75	2.1		7.9
	undergrad	student aid	3.75	1.7		6.4
						0.0
						0.0
						0.0
		Subtotal	21.3	47.4	0.0	
					Personnel Total	$94.1

Travel Costs:			Ticket	Round	Total	Daily	Proposed
	Description		Price	Trips	Days	Per Diem	FY 2001
	O. Smith	travel to Kenai Peninsula by car			45	0.184	8.3
	C. Northon	travel to Kenai Peninsula by car			20	0.184	3.7
	R. Cothren	travel to Kenai Peninsula by car			45	0.184	8.3
	T. Eley	travel to Kenai Peninsula by car			20	0.184	3.7
	graduate	travel to Kenai Peninsula by car			45	0.184	8.3
	undergrad	travel to Kenai Peninsula by car			45	0.184	8.3
							0.0
							0.0
							0.0
						Travel Total	$40.6

FY01

Prepared:14 April 2000

Project Number:
Project Title: Baseline Mapping and Geomorphology of Kenai Peninsula Shoreline
Name: University of Alaska Anchorage, School of Engineering

FORM 4B
Personnel & Travel DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Contractual Costs:	Proposed FY 2001
Description	
Aerial photography and digital image files for creation of shoreline contour maps (contractor quote)	75.0
Contractual Total	$75.0

Commodities Costs:	Proposed FY 2001
Description	
Survey mat'ls & suppl.	1.0
Computer supplies	1.0
Environmental Sensitivity Index CD and Atlas	0.5
Total station datalogger	1.4
Total station accessories	2.4
Commodities Total	$6.3

FY01

Prepared:14 April 2000

Project Number:
Project Title: Baseline Mapping and Geomorphology of Kenai Peninsula Shoreline
Name: University of Alaska Anchorage, School of Engineering

FORM 4B
Contractual & Commodities DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2001
Prismless total station (vendor quote)	2	7.0	14.0
PC Workstation/monitor (computer system manager's estimate)	2	4.0	8.0
Integrated hydrographic survey system (vendor quote)	1	42.5	42.5
Small boat, motors, trailer, operational and safety accessories (system, project team experience)	1	40.0	40.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$104.5

Existing Equipment Usage: Description	Number of Units
GIS workstations	2
GIS software system	1
Internet server computer	1
Dat/EM digital stereo photo mapping hardware and software system	1
Trimble GPS survey system and accessories	1
Sediment sampling apparatus	3
Soils laboratory weighing, seiving, and related apparatus (system)	1

FY01

Prepared:14 April 2000

Project Number:
Project Title: Baseline Mapping and Geomorphology of Kenai Peninsula Shoreline
Name: University of Alaska Anchorage, School of Engineering

FORM 4B
Equipment
DETAIL

Climate change and forage fish abundance: development of stable isotope methods for long-term monitoring

Project Number:	~~XXXX~~ 01586
Restoration category:	Research
Proposers:	Merav Ben-David Bruce Finney Dan Mann
Lead Trustee Agency:	University of Alaska Fairbanks
Cooperating Agencies:	USGS – BRD, ADFG
Alaska SeaLife Center:	No
Duration:	1st year, 2 year project
Cost FY01:	$122.4
Cost FY02:	$50.0
Cost FY03:	None
Geographic Area:	Prince William Sound, Resurrection Bay, and Kodiak Island, Alaska
Injured Resource:	Forage Fish (Capelin, Herring, Sand Lance)

ABSTRACT

Monitoring of forage fish abundance through time is technically. logistically, and financially daunting using traditional methods of fish population sampling. Moreover, the monitoring of present and future populations will tell us nothing about the historical trajectories of forage fish in the past. Here we propose two alternative methods potentially useful in reconstructing forage-fish abundances over the time scales of centuries to millennia of interest in examining animal-climate relationships. Both methods are also applicable to contemporary population monitoring. The first technique utilizes nitrogen stable isotopes ($\delta^{15}N$) as a record of marine organic matter input. Recent studies by two of us have led to the development of a technique to reconstruct long-term records of salmon abundance from analysis of stable nitrogen isotopes in lake-sediment cores. Similarly, we predict that coastal-ponds and wetlands bordering seabird rookeries would provide the potential to record long-term changes in abundance of forage fish and associated seabird populations. The second method uses fish scales recovered from ocean sediment accumulated in anoxic basins as a direct record of fish abundances. This technique was used in classic work in sardine and anchovy population history in the Santa Barbara Basin, California. We will use available data on forage fish abundance, and reproductive success of seabirds form Prince William Sound and vicinity collected since 1989 to calibrate the results of both the ^{15}N and the fish scale analyses. These data will be used to develop a model for the relation between sedimentary $\delta^{13}C$ and $\delta^{15}N$ data, climate and changes in abundance of fishes and birds. Development of the model will provide an additional long-term monitoring tool for the Gulf Ecosystem Monitoring (GEM) program.

INTRODUCTION

Monitoring of forage fish abundance through time may provide a significant challenge logistically as well as financially. The development of new tools such as bioacoustics and aerial surveys allows researchers to obtain more accurate estimates of forage fish abundance (SEA citation). Nonetheless, these methods require intensive field work, are weather-dependent and expensive. Alternatives include the development of predictive models of fish population dynamics based on physical and biological oceanography (Norcross et al., in review) that will enhance our ability to track changes in fish numbers through time using indirect methodologies. Verification of these models, however, may require large monetary investments as well as multiple years of research.

A technique that has been successfully used to reconstruct past changes in forage fish abundance is based on the enumeration of scales preserved in anoxic sediments. A classic example of this approach is the work of Soutar and Issacs (1974) and Baumgartner et al. (1992), who reconstructed past changes in sardines, anchovies, and other fish from cores is the Santa Barbara Basin, southern California. These studies allowed quantitative views of natural patterns of variability, which were not evident from relatively short historical records. Finding suitable sites is critical for this work. Important criteria for sites include the presence of anoxic sediments (necessary for scale preservation) underlying appropriate areas with respect to forage fish distribution. Although the Santa Barbara Basin contains varved sediments (annual layers) this is not a requirement for this work as several dating methods are available in the absence of varves. There are many silled bays and with restricted circulation in Prince William Sound, in which the bottom water may periodically become anoxic. In addition, due to high organic matter flux such sites likely contain permanently anoxic sediments. In such cases, scales may be preserved and bioturbation may be significantly reduced, so that the sediments may be suitable for high-resolution paleoenvironmental reconstruction. We propose to identify and core several of these sites as part of this project. Specific sites will be selected in consultation with fisheries oceanographers, and based on knowledge of bathymetric setting. Suitable sites for reconstruction of marine forage fish abundance exist in Alaska, and have been identified in southeast and the Aleutian Islands (B. Finney and A. Springer, unpublished data).

Recent studies by B. Finney at the Institute of Marine Science, University of Alaska Fairbanks have led to the development of a technique to reconstruct long-term records of salmon abundance from analysis of stable nitrogen isotopes in lake sediment cores (Finney, 1998). This new application of N stable isotope analysis is based on the observation that Pacific salmon (*Oncorhynchus* spp.) supply measurable quantities of elements into freshwater systems when they return to spawn (Kline et al. 1993, Bilby et al. 1996). Nitrogen derived from adult salmon is enriched in ^{15}N relative to terrestrially derived N. The $\delta^{15}N$ of adult sockeye averages between 11 and 12 ‰ (Ben-David et al. 1998a, 1998b, Kline et al. 1993) as they feed at an elevated trophic level in the ocean. The other main source of N into freshwater systems is much lower in ^{15}N as it is derived from atmospheric N ($\delta^{15}N = 0$ ‰). This large difference in $\delta^{15}N$ of nitrogen sources allows salmon-derived N to be traced and quantified in freshwater environments. Thus,

past changes in the number of returning adult salmon are reflected by downcore changes in sedimentary $\delta^{15}N$.

Similarly, we predict that coastal-ponds and wetlands bordering seabird rookeries will provide the potential to record long-term changes in abundance of forage fish and associated seabird populations. The declines in availability of certain schooling forage fish which occurred during the regime shift in the Northern Gulf of Alaska in the late 1970s (Anderson et al. 1997), influenced seabirds dramatically. High-lipid forage fish, including capelin (*Mallotus villosus*), Pacific sand lance (*Ammodytes hexapterus*), and juvenile Pacific herring (*Clupea pallasii*), which were previously prevalent in diets of upper trophic level predators, were reduced in numbers. In a trend that has been observed throughout the northern Gulf of Alaska, these forage fish have become increasingly less common in diets of piscivorous seabirds over the last two decades. Conversely, low-lipid fishes, such as juvenile walleye pollock (*Theragra chalcogramma*), blennies (*Stichaeidae*), sculpins (Cottidae), and prowfish (*Zaprora silenus*), have become more common in seabird diets. Research led by D. Roby (Oregon Cooperative Fish and Wildlife Research Unit) and D. Irons (USGS – Biological Resources Division) demonstrated that the type of forage fish fed to young seabirds has dramatic effects on growth and development. Field studies have also provided support for the hypothesis that shifts in the availability and quality of forage fish constrain reproduction of Pigeon Guillemots (*Cepphus columba*), Black-legged Kittiwakes (*Rissa tridactyla*), and other piscivorous seabirds nesting within the Northern Gulf of Alaska. The relation between forage fish abundance and nesting success of kittiwakes will have significant effects on accumulation of marine-derived nutrient in coastal-ponds and wetlands bordering seabird rookeries. Because the number of nesting pairs, number of nestlings, and provisioning rate will affect the time adults spend at the colony it also will determine the amount of excretion deposited at the colony site.

In such systems, it is likely that input of seabird-derived fecal material will contribute significantly to nitrogen loading. The seabird-derived N will have elevated $\delta^{15}N$ reflecting the isotopic signature that is characteristic of marine fish (Ben-David et al. 1998b). Nonetheless, $\delta^{15}N$ values of forage fish (11 to 13‰) are significantly lower than those of intertidal fishes (11 to 17‰; Ben-David, unpub. data). Because of the overlap in $\delta^{15}N$ signatures, separation of these fish types is made clearer when $\delta^{13}C$ values are considered concurrently (Ben-David, unpub. data). While isotopic values of intertidal fish range between -13 and -17‰, those of forage fish range between -19 and -24‰ (Fig. 1). Thus, shifts in diet from forage fish to intertidal fish coupled with changes in the total deposition of fecal material will result in quantitative changes in ratios of ^{13}C and ^{15}N in annual sediment layers from coastal-ponds and wetlands.

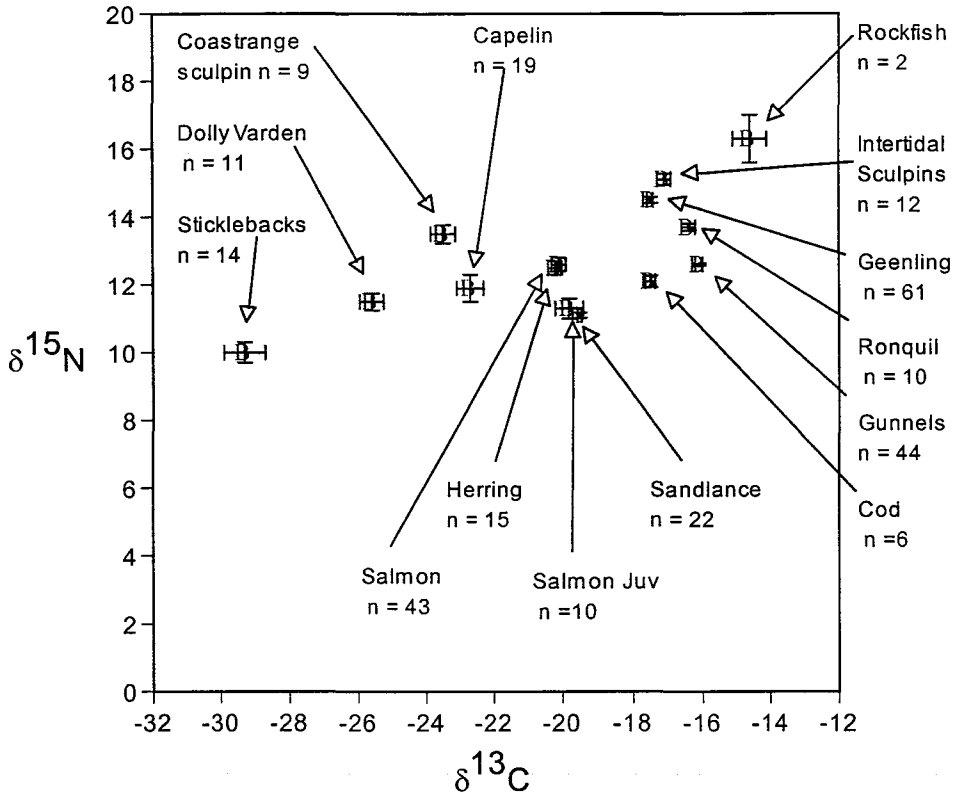

Figure 1 – Stable isotope values of intertidal, freshwater, and forage fish collected in Prince William Sound, Alaska, USA. Values for intertidal fish were significantly different from those of forage fish. (Data collected by M. Ben-David and A. Hirons, UAF, and T. C. Kline, PWSSC). Concurrent evaluation of $\delta^{13}C$ and $\delta^{15}N$ in annual sediment layers from coastal-ponds and wetlands will provide an index of the relation between changes in climate and changes in abundance of fishes and birds.

In the study, we propose to compare sedimentary $\delta^{13}C$ and $\delta^{15}N$ data collected in bird rookeries against available data on forage fish abundance, and reproductive success of seabirds form Prince William Sound and vicinity collected since 1989. These data will be used to develop a model for the relation between sedimentary $\delta^{13}C$ and $\delta^{15}N$ data, climate and changes in abundance of fishes and birds. Development of the model will provide an additional long-term monitoring tool for the Gulf Ecosystem Monitoring (GEM) program. In addition, data from this project will be used to support the ecosystem synthesis project "Effects of climate on interactions between ecosystems: biotic linkages between sea and land" that will investigate the effects of climate on nutrient transports in the marine terrestrial interface (Fig. 2).

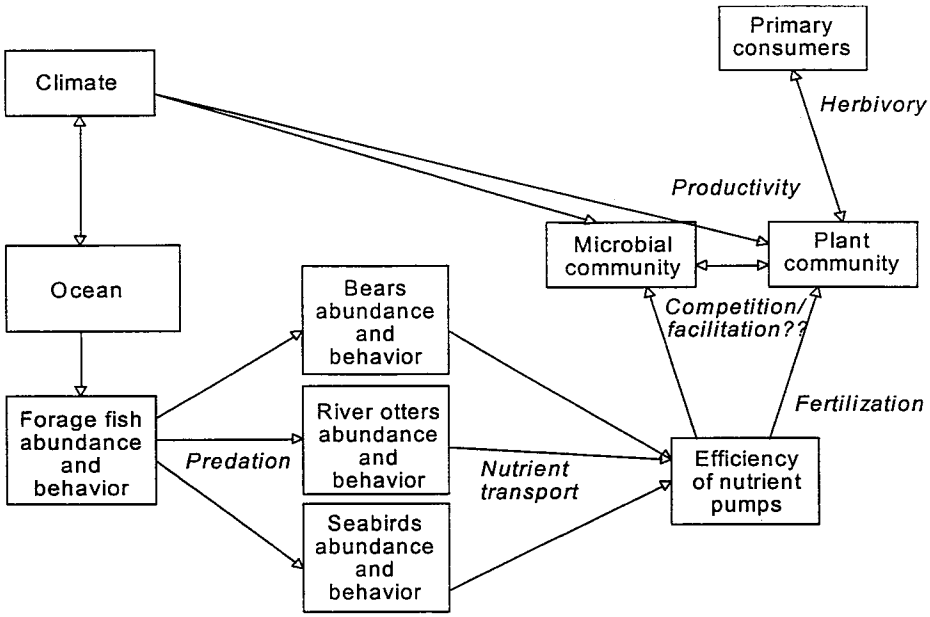

Figure 2 – A model describing contributions from ocean to land via biotic linkages. Such linkages, which are highly influenced by climate, may affect biodiversity and productivity in the terrestrial system.

Background

Potential effects of climate on abundance and behavior of forage fish and salmon:

The Northern Gulf of Alaska has undergone a significant change in climate in the last few decades (Enfield 1997, Freeland et al. 1997; Figure 3). Changes in ice cover in higher latitudes, sea surface temperatures and nutrient fluxes have been reported (Freeland et al. 1997, Whitney et al. 1998). Concurrently, changes in ocean primary productivity in the Northern Gulf of Alaska, declines in numbers of forage fish, and changes in species composition of invertebrates and fishes were also documented (Anderson et al. 1997, Piatt and Anderson 1996, Polovina et al 1995). These changes or regime shift were accompanied by changes in numbers of marine mammals and seabirds (Loughlin 1998, Piatt and Anderson 1996; Figure 4)

The observed regime shift may not, however, relate directly to global climate change. Other climatic phenomena may be interacting to produce variability in the productivity of the Northern Gulf of Alaska. Several researchers have described the relation between the El-Nino Southern Oscillation and North Pacific weather patterns as well as long term variability patterns such as the Pacific Interdecadal Mode (Enfield 1997, Neibauer 1988).

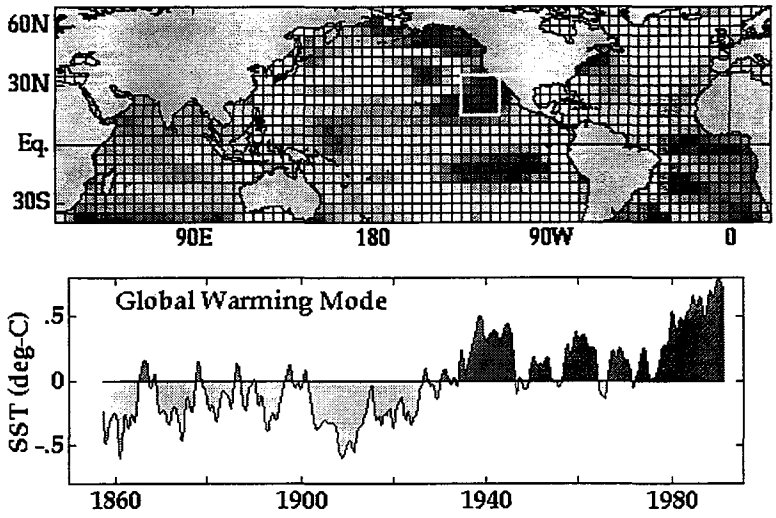

Figure 3 – An example of effects of climate change on sea surface temperatures in the Northern Pacific. Such changes likely influence primary productivity and fish stocks in the Northern Gulf of Alaska. Adopted from Enfield (1997).

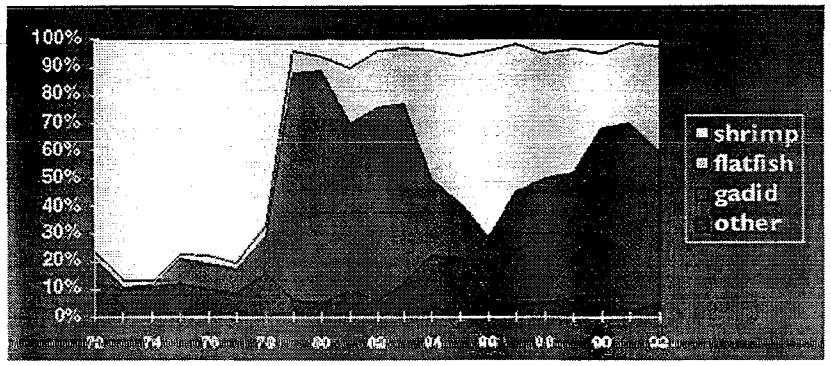

Figure 4 – Changes in species composition of trawl catches in the Northern Gulf of Alaska from 1972 to 1992. This regime shift may not relate directly to global climate change but corresponds to the most pronounced increase in sea surface temperatures (Figure 2). The decline in shrimp, which are cold water specialists, indicates increase in water temperatures. Adapted from Piatt and Anderson (1996).

Processes that may affect abundance and recruitment of forage fish and salmon populations in the nearshore environment have been studied recently by APEX, SEA, and NVP researchers. The abundance of forage fish and salmon in the nearshore environment (Figure 5) and their availability for consumption by seabirds will be determined by factors such as number of spawning adults, spawning locations, timing of nearshore migration, productivity, and recruitment of fishes.

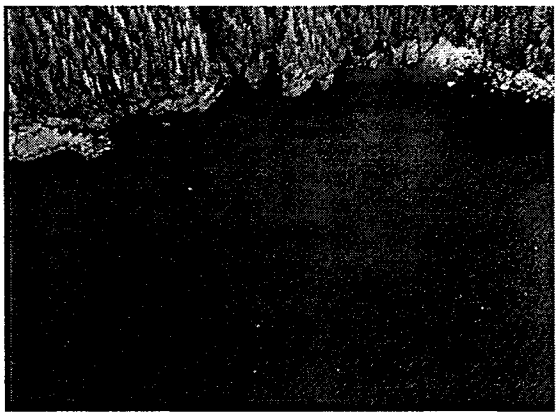

Figure 5 – Aerial photograph depicting two schools of forage fish in the nearshore environment in Prince William Sound. Photograph by Evelyn Brown, Institute of Marine Sciences, University of Alaska Fairbanks.

For example, an earlier study in Prince William Sound (PWS), through the Sound Ecosystem Assessment (SEA) program, used a multifaceted approach and focused on physical and biological variables that affected juvenile Pacific herring within PWS from 1995 to 1998. In this study, led by B. Norcross, spawning activities, as well as larval dispersal and recruitment were examined and modeled. This study demonstrated the importance of the presence or absence of the Gulf of Alaska stream and timing and duration of primary production events, which continually modified regional prey species composition and abundance within PWS. These variations in local food webs resulted in differences among bays in diet composition and growth of herring. Summer food availability and possibly competition within nursery areas affected the fall condition of juveniles, and consequently whole body energy content (WBEC) of herring differed among bays. The WBEC of juvenile herring in fall was critical to over-winter survival. Over-winter mortality of age-0 herring was modeled using fall WBEC of herring and winter water temperatures (Figure 6). Differences in feeding and energetics were detected among nursery areas during both summer and winter, indicating that habitat quality and resultant survival were not equal in all areas or all years. Differences in oceanic conditions accounted for these inequalities (Norcross et al. *in review*). These results illustrate the connection between ocean conditions and spatial and temporal variation in the availability of forage fish to seabird species.

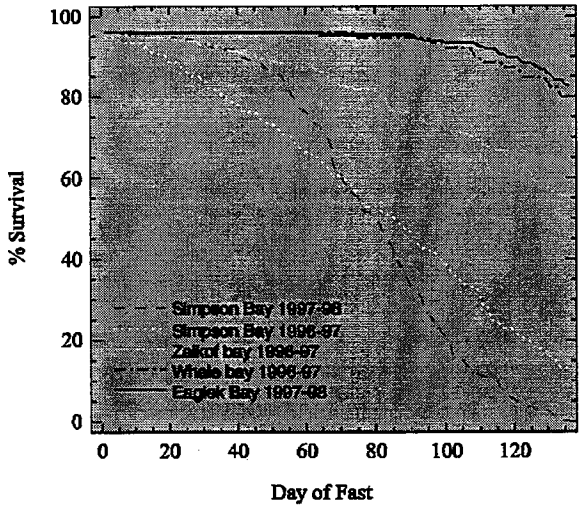

Figure 6 – Over-wintering survival of herring in different years and bays in Prince William Sound, Alaska. Survival estimates were obtained using results from a model that incorporated data on factors that determine body condition of fishes at the onset of the winter fast and winter ocean temperatures. Adopted from Norcross et al. (*in review*).

Seabird Productivity and Forage Fish Stocks in the Northern Gulf of Alaska

The declines in availability of certain schooling forage fish which occurred during the regime shift in the Northern Gulf of Alaska in the late 1970s (Anderson et al. 1997), influenced seabirds dramatically. High-lipid forage fish, including capelin, Pacific sand lance, and juvenile Pacific herring, which were previously prevalent in diets of upper trophic level predators, were reduced in numbers. In a trend that has been observed throughout the northern Gulf of Alaska, these forage fish have become increasingly less common in diets of piscivorous seabirds over the last two decades. Conversely, low-lipid fishes, such as juvenile walleye pollock (*Theragra chalcogramma*), blennies (*Stichaeidae*), sculpins (Cottidae), and prowfish (*Zaprora silenus*), have become more common in seabird diets. Our research led by D. Roby (Oregon Cooperative Fish and Wildlife Research Unit) and D. Irons (USGS – Biological Resources Division) has demonstrated that the type of forage fish fed to young seabirds has dramatic effects on growth and development. Nestlings raised on rations of high-lipid forage fish grow at higher rates and development into fledglings earlier than nestlings raised on low-lipid fishes. Also, nestlings that were raised on high-lipid fishes had greater fat reserves at fledging than nestlings raised on equal-caloric diets of low-lipid fishes. The energy density of high-lipid forage fish, such as capelin, sand lance, and juvenile herring, is generally about twice that of low-lipid forage fish, such as juvenile pollock. Thus when food availability is constrained, it is advantageous for parent seabirds to provision their young with high-lipid fishes. This provides strong support for the hypothesis that seabird populations in the Northern Gulf of Alaska are dependent on key forage fish stocks, especially capelin, sand lance, and herring.

Field studies have also provided support for the hypothesis that shifts in the availability and quality of forage fish constrain reproduction of Pigeon Guillemots (*Cepphus columba*), Black-legged Kittiwakes (*Rissa tridactyla*), and other piscivorous seabirds nesting within the Northern Gulf of Alaska. The lipid content of forage fish consumed by

these seabirds, which ranged from 2% to 61% of dry mass, was the primary factor determining energy density, which exhibited a five-fold difference (2.0 to 10.8 kJ/g wet mass). Most of this variation in fish quality was due to species-specific differences in lipid content, but there was also considerable intraspecific variation in forage fish quality related to age, sex, location, and reproductive status. Of the fish consumed by kittiwakes nesting in the Northern Gulf of Alaska, juvenile herring, pre-spawning capelin, and sand lance had the highest lipid contents and energy densities, and kittiwake diets were dominated by these three species.

Higher kittiwake nesting productivity at several study colonies in 1995 and 1996 was associated with increasing availability of sand lance, capelin, and especially juvenile herring. These two good years were followed by three poorer years (1997-1999) when the availability of these three key forage fish species was reduced. Also, particular kittiwake colonies that had access to resilient stocks of sand lance or juvenile herring were able to grow throughout the 1990s when most kittiwake colonies in the Northern Gulf of Alaska were in decline. These among year and between colony differences in kittiwake nesting success were associated with differences in the rates at which parent kittiwakes provisioned their broods with energy (Figure 7), which was a function of the quality and delivery rates of meals to nestlings. As expected, energy provisioning rates were also correlated with nestling growth and survival.

The relation between forage fish abundance and nesting success of kittiwakes will have significant effects on nutrient transport between sea and land. Because the number of nesting pairs, number of nestlings and provisioning rate will affect the time adults spend at the colony and will determine the amount of excretion deposited at the colony site.

Techniques for linking climate change and abundance of salmon:

Recent studies by B. Finney at the Institute of Marine Science, University of Alaska Fairbanks have led to the development of a technique to reconstruct long-term records of salmon abundance from analysis of stable nitrogen isotopes in lake sediment cores (Finney, 1998). This new application of N stable isotope analysis is based on the observation that Pacific salmon supply measurable quantities of elements into freshwater systems when they return to spawn (Kline et al. 1993, Bilby et al. 1996). In some systems, salmon may be the largest source of N and P annually. For example, in Karluk Lake, Kodiak Island, AK, 1 million sockeye bring in more N (64,100kg/yr) than that supplied by rivers (estimated to be 43,200 kg/yr when the effects of spawning salmon are excluded) and rain (800 kg/yr). Nitrogen derived from adult salmon is enriched in ^{15}N relative to terrestrially-derived N. The $\delta^{15}N$ of adult sockeye averages between 11 and 12 ‰ (Ben-David et al. 1998a, 1998b, Kline et al. 1993) as they feed at an elevated trophic level in the ocean. The other main source of N into freshwater systems is much lower in ^{15}N as it is derived from atmospheric N ($\delta^{15}N = 0$ ‰). This large difference in $\delta^{15}N$ of nitrogen sources allows salmon-derived N to be traced and quantified in freshwater environments. Thus, past changes in the number of returning adult salmon would be reflected by downcore changes in sedimentary $\delta^{15}N$. Periods of high abundance would result in high loadings of salmon-derived ^{15}N into freshwater systems, and high

sedimentary $\delta^{15}N$. Conversely, periods of low abundance will result in deposition of sediments with low $\delta^{15}N$.

Temporal trends of sedimentary $\delta^{15}N$ in Karluk Lake, closely follow the 75 year historical escapement record (Finney, 1998). In fact, the strong positive correlation between the decadal averages of $\delta^{15}N$ and escapement ($R^2 = 0.85$) establishes a calibration to hindcast past escapement in Karluk Lake (Fig. 8). In Frazer Lake, Kodiak Island, Alaska, a sharp increase in sediment $\delta^{15}N$ closely matches the time when salmon were introduced into this system (B. Finney, Unpublished data). The average sedimentary $\delta^{15}N$ in Alaskan sockeye lakes is positively correlated with the escapement/lake surface area ratio ($R^2 = 0.88$), which is a measure of the relative input of salmon-derived N (Finney, Unpublished data). This indicates that sedimentary $\delta^{15}N$ ratios reflect input of salmon-derived N and hence escapement. These lines of evidence offer strong support for the use of sedimentary $\delta^{15}N$ to reconstruct changes in sockeye salmon abundance through time. Sedimentary $\delta^{15}N$ data for sockeye salmon lakes has been determined at a number of sites in the Northern Gulf of Alaska, including southeast, Prince William Sound (1 site: Coghill Lake), Kodiak Island and Bristol Bay. This data will be compared and modeled against available climatic data and recent data on the relation between climate and salmon population dynamics to obtain a relation between changes in climate and changes in abundance of these fishes.

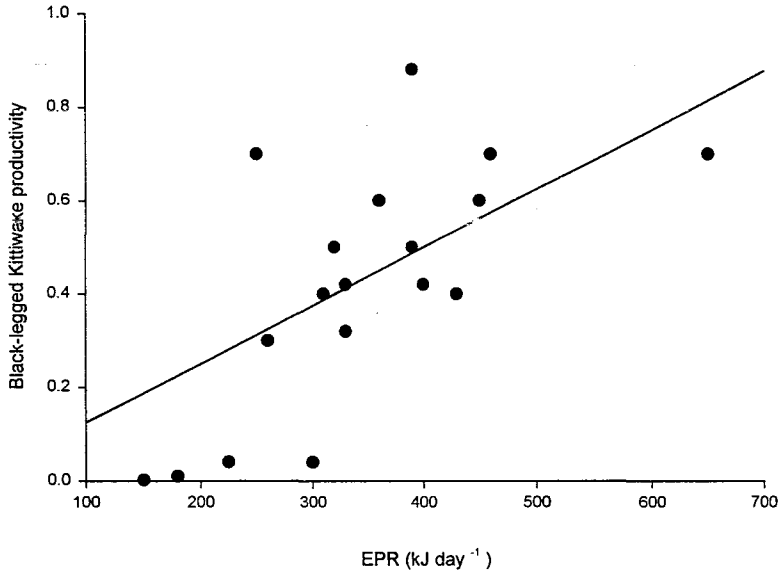

Figure 7 – Relation between energy provisioning rate by adult black-legged kittiwakes and productivity. Energy provisioning rate was calculated based on provisioning rates meal composition and energy density of fish in the chick meal. (D. Roby, Unpublished data).

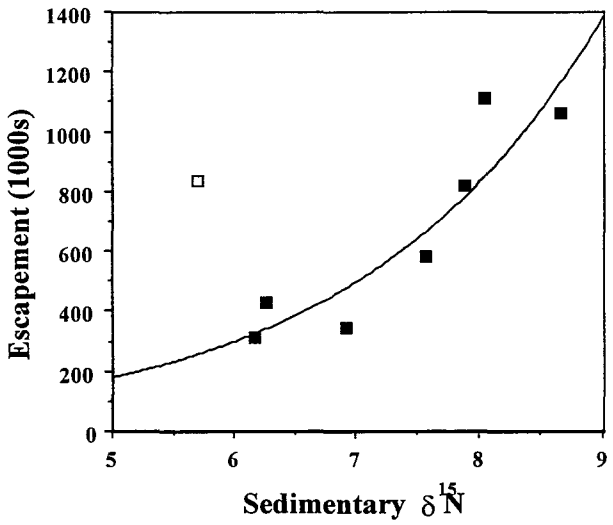

Figure 8 - Relationship between sedimentary $\delta^{15}N$ and sockeye escapement (in thousands of fishes) in Karluk Lake for the period since 1921 (decadal averages). An exponential curve fit (R^2 = 0.85) excludes the open symbol point, which may be low due to recent additions of fertilizer with $\delta^{15}N$ = 0 ‰ into the lake. The nonlinear relationship is expected because as escapement increases, the relative contribution of salmon-derived N decreases. Adopted from Finney (1988).

Similarly, we hypothesize that coastal-lakes and wetlands bordering seabird rookeries would provide the potential to record long-term changes in abundance of forage fish and associated seabird populations. In such systems, it is likely that input of seabird-derived fecal material will contribute significantly to nitrogen loading. The seabird-derived N will have elevated $\delta^{15}N$ reflecting the isotopic signature that is characteristic of marine fish (Ben-David et al. 1998b). Nonetheless, $\delta^{15}N$ values of forage fish (11 to 13‰) are significantly lower than those of intertidal fishes (11 to 17‰; Ben-David, unpub. data). Because of the overlap in $\delta^{15}N$ signatures, separation of these fish types is made clearer when $\delta^{13}C$ values are considered concurrently (Ben-David, unpub. data). While isotopic values of intertidal fish range between -13 and -17‰, those of forage fish range between -19 and -24‰ (Fig. 1). Thus, shifts in diet from forage fish to intertidal fish coupled with changes in the total deposition of fecal material will result in quantitative changes in ratios of ^{13}C and ^{15}N in annual sediment layers from coastal-ponds and wetlands.

NEED FOR THE PROJECT

A. Statement of Problem

Monitoring of forage fish abundance through time may provide a significant challenge logistically as well as financially. The development of new tools such as bioacoustics and aerial surveys allows researchers to obtain more accurate estimates of foreir broods with energy (Figure). Nonetheless, these methods require intensive field work, are weather-dependent and expensive. Alternatives include the development of predictive models of

fish population dynamics based on physical and biological oceanography (Norcross et al., in review) that will enhance our ability to track changes in fish numbers through time using indirect methodologies. Verification of these models, however, may require large monetary investments as well as multiple years of research.

In the study, we propose to compare sedimentary $\delta^{13}C$ and $\delta^{15}N$ data collected in bird rookeries against available data on forage fish abundance, and reproductive success of seabirds form Prince William Sound and vicinity collected since 1989. These data will be used to develop a model for the relation between sedimentary $\delta^{13}C$ and $\delta^{15}N$ data, climate and changes in abundance of fishes and birds. Development of the model will provide an additional long-term monitoring tool for the Gulf Ecosystem Monitoring (GEM) program. We will also determine the potential of bays in Prince William Sound for forage fish reconstructions based on fossil evidence, and if possible develop these records. In addition, data from this project will be used to support the ecosystem synthesis project "Effects of climate on interactions between ecosystems: biotic linkages between sea and land" that will investigate the effects of climate on nutrient transports in the marine terrestrial interface (Fig. 2).

B. Rationale/Link to Restoration

Development of this method will provide an additional cost-effective, long-term monitoring tool for the Gulf Ecosystem Monitoring (GEM) program. In addition, data from this project will be used to support the ecosystem synthesis project "Effects of climate on interactions between ecosystems: biotic linkages between sea and land" that will investigate the effects of climate on nutrient transports in the marine terrestrial interface.

C. Location

Sediment cores will be collected from three colonies of black-legged kittiwakes in Prince William Sound. Locations will be selected based on recommendations and in collaboration with Dan Roby and Dave Irons. Two additional sites will be selected in Resurrection Bay and Kodiak Island. We will also core 10 marine bays in Prince William Sound to assess the feasibility of fossil-based forage fish reconstructions, and select 2 of these bays for detailed analysis. Bays will be chose based on bathymetric characteristics, and fish distributions.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

This project will involve data collection both in the field as well as in the different laboratories. We will recruit high school and undergraduate students to assist in the collection of data. Preference will be given to students from local communities. In addition, it is our intention to contract local companies to provide us with boat services. We will also welcome opportunities to interact with local communities to present and discuss our findings.

PROJECT DESIGN

A. Objectives

The general objective of this study is to reconstruct past forage fish abundance based on two methods. One method will determine stable isotope profiles in sediment cores collected from coastal-ponds and wetlands near seabird colonies. The other method is based on fish scale deposition rates in sediments from marine bays. Sediments will be dated using Pb-210 and radiocarbon methods and the resulting isotopic profiles will be compared with existing data on forage fish abundance, and reproductive success of seabirds from the SEA and APEX projects.

B. Methods

Site Selection

A number of potential sites exist where ponds, lakes, or swamps exist within the boundaries of seabird colonies in southern Alaska. Potential sites include sedimentary basins that receive guano input directly or that receive drainage from a watershed receiving guano input. Ideal sites are small (<1 ha), deep (>2 m) ponds situated directly cliffs supporting nesting colonies. We found several such ponds on the Barren Islands near colonies of murres and puffins. Promising sites are small ponds or peat accumulations on "bird islands," islands like Middleton Island where nesting birds are abundant and are the dominant importers of ocean-derived organics onto the land. Marine bays will be selected from examination of bathymetric charts, and by consultation with fisheries experts regarding forage fish distributions. Because the preservation of scales and other fossil remains is uncertain, we propose to core 10 bays for preliminary analysis. Based on these results, we will select the best 2 sites for detailed analysis.

Collection of sediment cores

"Seabird" cores will be taken using a modified Livingstone corer with cutting teeth designed to penetrate mineral-rich and fibrous sediments (Wright et al., 1984). Coring will be done in shallow ponds by wading and in deeper water from a platform atop small rafts. Taking two cores from a small lake requires about four hours of field time and comprises a minimal disturbance to nesting seabirds. Cores will be extruded in the field into plastic half-tubes, wrapped in plastic and foil, then returned to the laboratory where they will be frozen until analyzed. Marine cores will be obtained with an oceanographic gravity corer. We will use a lightweight open-valve gravity corer to ensure recovery of the sediment water interface. Stratigraphy will be described in the laboratory on split cores using standard procedures including magnetic susceptibility (useful for intercore correlations), loss on ignition (total C content), and water content.

Age Control

Recent sediments will be dated by Pb-210 and Cs-137 methods (Naidu et al. 1998). These are standard techniques for dating the most recent 100 to 150 years, and should

work well for both marine and lacustrine sediments in this region. For older parts of the record, we will use AMS ^{14}C to date suitable macrofossils. Plant macrofossils (eg, twigs, seeds, leaves) will be extracted by sieving slices of the sediment cores. In the marine cores, if marine macrofossils will be used, a reservoir correction will be determined and applied. Ages will be calibrated using the most current calibration program. It is likely that ash layers will provide additional dating control. Without prior knowledge on sedimentation rates, it is uncertain as to the time frame and resolution the records will provide. Based on knowledge from similar environments in the Gulf of Alaska, we anticipate that for both marine and lacustrine settings, the records will span the past 500 to 2000 years, and that decade or better scale resolution will be possible for some sites. Radiocarbon dating will use accelerator mass spectroscopy methods at Beta Analytic Inc., a commercial radiocarbon laboratory.

Stable Isotope analysis

Samples will be kept frozen until preparation for determination of stable isotope ratios. Samples will be dried at 60° to 70° C for 48 hours and then ground to fine powder using a Wig - L - Bug grinder (Cresent Dental Co.). Samples will be acid washed if carbonates are present. Subsequently, a sub-sample of 8-25 mg will be weighed into a miniature tin cup (4 by 6 mm) for combustion. We will use a Europa C/N continuous flow isotope ratio mass spectrometer (CFIRMS) to obtain the stable isotope ratios. Each sample will be analyzed in duplicate and results will be accepted only if the variance between the duplicates will not exceed that of the peptone standard. ($\delta^{13}C_{std}$ = -15.8, $\delta^{15}N_{std}$ = 7.0, CV = 0.1). Assimilation efficiency of diet will be calculated based on %N and $\delta^{15}N$ values using a mixing model (Ben-David et al., 1997). Assimilation of hydrocarbon will be calculated based on $\delta^{13}C$ values (Ben-David, unpub. Data).

Forage fish reconstruction

We will follow the methods of Soutar and Issacs (1974) and Baumgartner et al. (1992) for processing sediments for fish scales. Sediments will be gently sieved through nested screens of graded mesh sizes and the retained material will be examined under a microscope. Fish scales are easily recognized among the debris. Taxonomic composition of scales will be facilitated through the development of a reference collection, and through consultation with taxonomic experts working in the north Pacific.

Comparisons with existing data on fish and birds abundance and paleoclimate records

For the historical part of each record, we will compare our isotope and fossil data to existing records of fish and bird abundance. We will compare our isotope and fossil-based records to 3 types of paleo-records. Spring-summer temperature records have been reconstructed using dendrochronology from several sites along the Gulf of Alaska coastline. Detailed tree-ring records extend to approximately 1600 AD (e.g., Wiles et al., 1996; 1998) and are probably the most detailed records that presently exist for this time-period. A 1119 year tree-ring record for Prince William Sound has been recently published (Barclay et al, 1999). Unfortunately, trees are largely "blind" to winter

climate, potentially the critical season for climatic control over circulation in the Gulf. Another set of climate proxy records exist in the form of glacier chronologies developed from glacier geology in the eastern and northern Gulf regions (Mann and Ugolini, 1985; Mann, 1986; Wiles and Calkin, 1994). Glaciers in southern Alaska are responding to climate primarily through its effects on winter precipitation, hence on winter-season storminess. The time resolution of glacial records is relatively coarse (100-200 years) except in some cased where chronologies can be tied to tree rings (Wiles et al. 1999). On the other hand, the glacier record extends further in time, to approximately 3000 years BP (Mann and Hamilton, 1995).

The third type of proxy-climate record we will use are high-resolution records representing global or northern hemisphere climate change, as some periods of climate change are widespread, and teleconnections exist between different past of the globe. An important record comes from ice cores in Greenland (O'Brien et al, 1995). These detailed (annual) records of changes in oxygen isotopes comprise the current standard against which all other climate records are compared. Of particular interest to our study, are the Greenland records of marine-derived ions (chlorine, sodium) that are thought to evidence changes in high latitude atmospheric circulation (O'Brien et al, 1995). An annual arctic temperature reconstruction that has been developed for the last 400 years is also of relevance (Overpeck et al, 1997).

C. Cooperating Agencies, Contracts, and Other Agency Assistance

This project is a collaborative research project of scientists from the USGS – BRD and ADFG. Locations of seabirds colonies and collection of samples will be done in collaboration with Dr. Dan Roby and Dave Irons. USGS – BRD will provide logistical support. Additional logistical support will be provided by ADFG (Howard Golden, as part of the project "Effects of climate on interactions between ecosystems: biotic linkages between sea and land".

SCHEDULE

A. Measurable Project Tasks for FY 01

This project will begin in 2000 and will be completed in 2002.

October – December 2000:	Develop sampling design
January - March 2001:	Attend restoration workshop and organize logistics
April – June 2001:	Collect sediment core samples
July – September 2001:	Complete lab analyses and analyze data
October 2001- April 2002:	Complete data analysis and write reports.

B. Project Milestones and Endpoints

FY 01: Project design, data collection, and data analysis
FY 02: Data analysis and submission of manuscripts

C. Completion Date

The work will be completed by Sept. 2002.

PUBLICATIONS AND REPORTS

No publications are expected in FY 01. All reports will be published in FY 02. We have an excellent record of publishing results from our research.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The project is closely linked with the development of the Gulf Ecosystem Monitoring Program (GEM).

PRINCIPAL INVESTIGATORS

Dr. Merav Ben-David
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University of Alaska Fairbanks
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(907) 474 - 6669 fnmb@uaf.edu

Merav Ben-David, Ph.D. is a research associate with the Institute of Arctic Biology University of Alaska Fairbanks. She has extensive experience in studying ecosystem processes using stable isotope analysis. She is currently funded for five projects involving stable isotope analysis. Her responsibilities in this project include project coordination, data interpretation, and report writing.

Dr. Bruce Finney
Institute of Marine Science, School of Fisheries and Ocean Sciences
University of Alaska Fairbanks
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(907) 474-7724 finney@ims.uaf.edu

Bruce Finney, PhD, is an associate professor in the Institute of Marine Science. Trained as a paleoceanographer, he currently works in marine and lacustrine sediments, and recent work has focused on sites in the North Pacific region. He uses a variety of tools to

reconstruct past climatic and environmental change, including stable isotopes. Recent research includes the development of stable N isotope techniques to reconstruct past salmon runs. His role includes marine coring, and interpretation of stratigraphy, dating, fossil and isotope data for all cores.

Dr. Daniel Mann
Institute of Arctic Biology
University of Alaska Fairbanks
206 Irving Bldg. UAF
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(907) 474 - 2419 dmann@mosquitonet.com

Daniel Mann, PhD., is a research associate at the institute of Arctic Biology. Trained in soil science and Quaternary geology, his current research interests include climate history and ecosystem development. His responsibilities in this project include procuring sediment cores from ponds and wetlands near seabird colonies and interpretation of core stratigraphy.

OTHER KEY PERSONNEL

Dr. Dan Roby
Oregon Cooperative Fish and Wildlife Research Unit
Oregon State University
Corvallis, OR 97331 - 3803
(541) 737-1955, robyd@ucs.orst.edu

Dr. Dan Roby has extensive experience studying seabirds in the Gulf of Alaska. He will participate in designing the project, data collection, and report writing.

Mr. David Irons
USGS – BRD
1011 Tudor Rd.
Anchorage, AK 99503
(907) 786-3636, david_irons@usgs.gov

Mr. Dave Irons has extensive experience studying seabirds in the Gulf of Alaska. He will participate in designing the project, data collection, and report writing. He will also provide logistical support.

Mr. Howard Golden
Wildlife Conservation
Alaska Dept. Of Fish and Game
333 raspberry Rd.
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(907) 267-2177, howard_golden@fishgame.state.ak.us

Mr. Howard Golden is a researcher with the Alaska Dept. of Fish and Game, Division of Wildlife Conservation. His specialty is studying furbearers including river otters. He is involved in the project "Effects of climate on interactions between ecosystems: biotic linkages between sea and land" and will be provide logistical support.

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2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$0.0						
Travel		$0.0						
Contractual		$114.4						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal		$114.4			Estimated FY 2002	Estimated		
General Administration		$8.0						
Project Total		$122.4			$50.0			
Full-time Equivalents (FTE)		0.6						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY01

Prepared:4/7/00

Project Number: 01586
Project Title: Climate change and forage fish abundance: development of stable isotope method for long-term monitoring
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$36.1						
Travel		$3.2						
Contractual		$50.2						
Commodities		$2.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal		$91.5			Estimated FY 2002	Estimated		
Indirect		$22.90						
Project Total		$114.4			$50.0			
Full-time Equivalents (FTE)		0.6						
			Dollar amounts are shown in thousands of dollars.					
Other Resources								

Comments:

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

(Use this statement if there is a graduate student tuition and use proper resident or non-resident amount)
Student personnel costs include non-resident tuition of $5,868 per year.

FY01

Prepared:4/7/00

Project Number:
Project Title: limate change and forage fish abundance: development of stable isotope method for long-term monitoring
Name: Ben-David, Finney, and Mann-Institute of Arctic Biology, UAF

FORM 4A
Non-Trustee
SUMMARY

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2000
	M. Ben-David	PI	1.0	5.3		5.3
	B. Finney	PI	1.0	7.7		7.7
	D. Mann	Senior Research	1.0	8.7		8.7
	O. Ormseth	Technician	2.5	3.2		8.0
	Technician	Technician	2.0	3.2		6.4
		Estimates include salary and staff				0.0
		benefits based on benefit rates of:				0.0
		26.2% for Ben-David and Mann				0.0
		29.2% for Finney				0.0
		34.4% for Ormseth				0.0
						0.0
						0.0
		Subtotal	7.5	28.1	0.0	
					Personnel Total	$36.1

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2001
	Fairbanks to Anchorage - restoration workshop (2 PI's)	0.3	2	6	0.1	1.2
	Fairbanks to PWS, Kodiak, field collection of data for all personnel	0.3	4	8	0.1	2.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$3.2

FY01

Prepared:4/7/00

Project Number:
Project Title: Climate change and forage fish abundance: development of stable isotope method for long-term monitoring
Name: Ben-David, Finney, and Mann-Institute of Arctic Biology, UAF

FORM 4B
Personnel
& Travel
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Contractual Costs:	Proposed
Description	FY 2001
	20.0
	18.0
	12.0
	0.2
Contractual Total	$50.2

Commodities Costs:	Proposed
Description	FY 2001
	2.0
Commodities Total	$2.0

FY01

Prepared:4/7/00

Project Number:
Project Title: Climate change and forage fish abundance: development of stable isotope method for long-term monitoring
Name: Ben-David, Finney, and Mann-Institute of Arctic Biology, UAF

FORM 4B
Contractual & Commodities DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2001
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units
	1
	3

FY01

Prepared:4/7/00

Project Number:
Project Title: Climate change and forage fish abundance: development of stable isotope method for long-term monitoring
Name: Ben-David, Finney, and Mann- Institute of Arctic Biology, UAF

FORM 4B
Equipment
DETAIL

Are Schools of Juvenile Herring Preferentially Selected by Piscivorous Seabirds? Factors Affecting Forage Fish School or School Group Selection in Prince William Sound.

Project Number:	01588
Restoration Category:	Research
Proposer:	U.S. Fish and Wildlife Service
Lead Trustee Agency:	DOI, ADFG
Cooperating Agencies:	H.T. Harvey & Associates, Ecological Consulting Inc.
Alaska SeaLife Center:	no
Duration:	2 year
Cost FY 01:	$92.8K
Cost FY 02:	$28.0K
Cost FY 03:	$0
Geographic Area:	Prince William Sound
Injured Resource/Service:	Pacific herring, marbled murrelet, pigeon guillemot

ABSTRACT

During the summer in Prince William Sound (PWS), schools of juvenile forage fishes exhibit a patchy distribution within the nearshore habitat. Piscivorous seabirds rely on these fish schools as food for their own survival and to meet the energetic demands of their rapidly growing young during the summer breeding season. However, often only a fraction of the schools are preyed upon by adult seabirds. Why might certain prey patches remain unexploited? The most plausible explanations are: 1) unexploited schools are simply excess prey; 2) unexploited schools have not attained a threshold in school density to qualify as an exploitable prey patch; 3) unexploited schools are not accessible to seabirds; or 4) unexploited schools are purposefully avoided by certain seabirds. The main goal of this project is to determine what factors (e.g. species composition, age class, threshold biomass, school depth, school location, etc.) determine whether or not a school of forage fish is truly available or of interest to foraging seabirds (both surface feeding and diving species). Using existing digital imagery and underwater videos of seemingly exploitable schools (i.e. at or near surface) with and without foraging seabirds present, we will examine the fine scale selection of fish schools by foraging seabirds. This study will provide important evidence in testing new hypotheses of food limitations in the recovery of seabird populations following the *T/V Exxon Valdez* oil spill.

INTRODUCTION

Evidence from past studies indicate that seabirds in Prince William Sound (PWS) exhibit prey species preference and that prey selection affects reproductive success (Golet et al. 2000, Suryan et al 2000). Differential effects of prey choice on reproductive success may, in part, may be caused by differences in energetic value, and therefore diet quality, among species and age classes of forage fishes consumed (Van Pelt et al. 1997, Anthony et al. in press). Additionally, these differential effects of prey choice may also result from schooling characteristics among fishes that affect the ease of capture or availability. Since 1989, for example, black-legged kittiwakes (*Rissa tridactyla*) at the two largest colonies in PWS show a strong relationship between reproductive success and an abundance index of juvenile Pacific herring (*Clupea pallasi*; Fig. 1). When the occurrence of herring declines in the diets of kittiwakes, the time it takes for adults to obtain a load of food generally increases (Fig. 2). This constitutes a possible mechanism for the reduced reproductive output that then follows. In support of a potential prey preference for herring schools, preliminary data from aerial surveys demonstrates an apparent difference in the use of herring versus Pacific sand lance (*Ammodytes hexapterus*) schools by seabirds. During two years, the percentage of herring schools fed upon by seabirds (35.7% and 43.6%) was two to four times greater than the percentage of sand lance schools (18.3% and 11.1%). We seek to determine whether such prey selection is a result of differential availability between species or a result of preferential prey choice. Additionally, we will identify mechanisms by which selection of a particular prey species or school type may result in increased or decreased foraging time and effort on the part of seabirds.

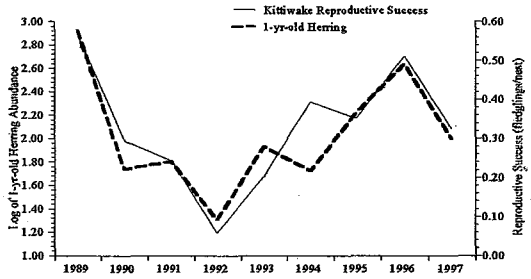

Figure 1. Trends in juvenile herring abundance (log_{10} in tonnes) and black-legged kittiwake reproductive success in Prince William Sound. Herring abundance is an index of 1-year-old fish back-calculated from age-structured biomass estimates of adult herring (ADF&G unpubl. data). Kittiwake reproductive success is an annual mean from the Shoup Bay and Passage Canal colonies.

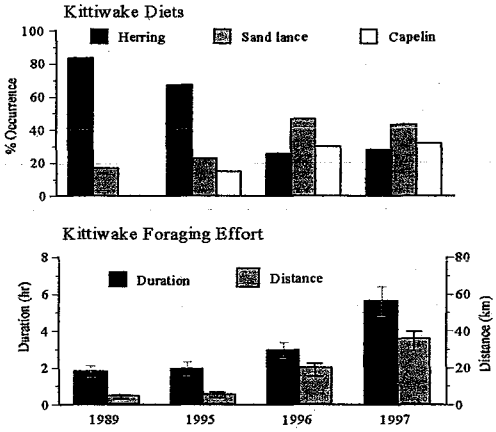

Figure 2. Data from the Eleanor Island kittiwake colony showing a decline in the annual consumption of herring and a concurrent increase in the annual mean foraging trip duration and mean maximum distance traveled to the farthest feeding location. Kittiwakes from Shoup Bay showed similar trends.

During 1996 through 1999 aerial surveys of forage fish schools and seabirds were conducted along the shorelines of PWS as part of the Sound Ecosystem Assessment and Alaska Predator Ecosystem Experiment (APEX) projects. In addition to data collected by the principal investigators of this proposal, digital video images were also collected along transects. Analysis of the video images could not be included in previous work funded by EVOS, but this information will be valuable for finalizing and testing new and previously generated hypotheses. This proposed study differs from currently funded work within the APEX project in two other important ways. First, we have seen that hydroacoustic surveys (APEX 163A) are valuable in determining biomass of certain prey species (particularly herring), but are often inadequate in sampling schools of sand lance in PWS; sand lance schools are often in very shallow, nearshore waters that are inaccessible to hydroacoustic gear. Second, the video images are collected over long time scales and large spatial scales that are comparable to those affecting regional and seasonal variation in reproductive success of seabirds in PWS. Therefore existing APEX

components cannot address hypotheses proposed in our study. The dynamics and limiting factors between forage fish assemblage characteristics and foraging success of seabirds still remain poorly understood although much progress was made in previously funded APEX and SEA studies. The findings of this study are therefore important in gaining a better understanding of those dynamics. The two primary hypotheses that will be tested by this project are:

1. Numbers and patterns of seabirds (surface feeding and diving) foraging on assemblages of surface fish schools are dependent on individual school characteristics, school group or shoal characteristics, or both. Individual school characteristics include: species, age composition of the fish, school size, school density, and school depth. School group characteristics include: species mix, age composition, total number of schools in the patch, school spacing, average school size in the patch, presence or absence of other avian or non-avian predators within the patch.

2. There is a region-specific threshold of fish school size, number, and/or school density (schools per unit area) below which foraging by seabirds is unlikely.

During several years we observed that the reproductive performance of black-legged kittiwakes was compromised even though their diets were dominated by sand lance. By incorporating results of this proposed study and data on the foraging and reproduction of kittiwakes, (already acquired and analyzed) we will test the following potential explanations for reduced reproductive success associated with increased consumption of sand lance:

1. There is no detectable reason to expect that kittiwake reproductive performance in PWS should be reduced with a diet of sand lance.
2. Sand lance were not sufficiently abundant (possibly affected by the EVOS)
3. Sand lance were sufficiently abundant, but of lower energetic value than herring and capelin (*Mallotus villosus*; we know this is true for young-of-year sand lance, but why can't kittiwakes just catch more sand lance if it is plentiful?).
4. Sand lance are abundant but of limited availability (due to depth, schooling characteristics, or predator avoidance behavior) to surface feeding seabirds like kittiwakes.

A primary objective of this project is to interpret, on the order of a few hundred meters, fine scale processes that affect sea bird foraging success. We will focus on three species of forage fish including herring, sand lance, and capelin. Our findings will provide information on an unknown aspect of feeding behavior and will be useful in the interpretation of seabird diets, foraging efforts, and reproductive success.

We have three types of data that will be used in this investigation. We have a 4-year database including distribution and abundance of surface-schooling forage fish and seabirds (example of output in Fig. 3). We have collected 12 hours of digital video aerial footage with well over 800 individual frames of fish schools with and without associated seabirds (1998 coverage is in Fig. 4; examples in Figs. 5 and 6). Finally, we have approximately 5 hrs of digital video underwater footage coinciding the 1999 aerial footage. The underwater footage will be used, in part, to calibrate the aerial footage (species identification, school spacing, presence/absence of predators). Investigators in this project have used digital images in the past to estimate parameters for modeling aerial survey data (Brown and Borstad 1998). This takes the utility of those images one step further. Therefore, this project is cost-effective since it entails only the processing of existing

data and images.

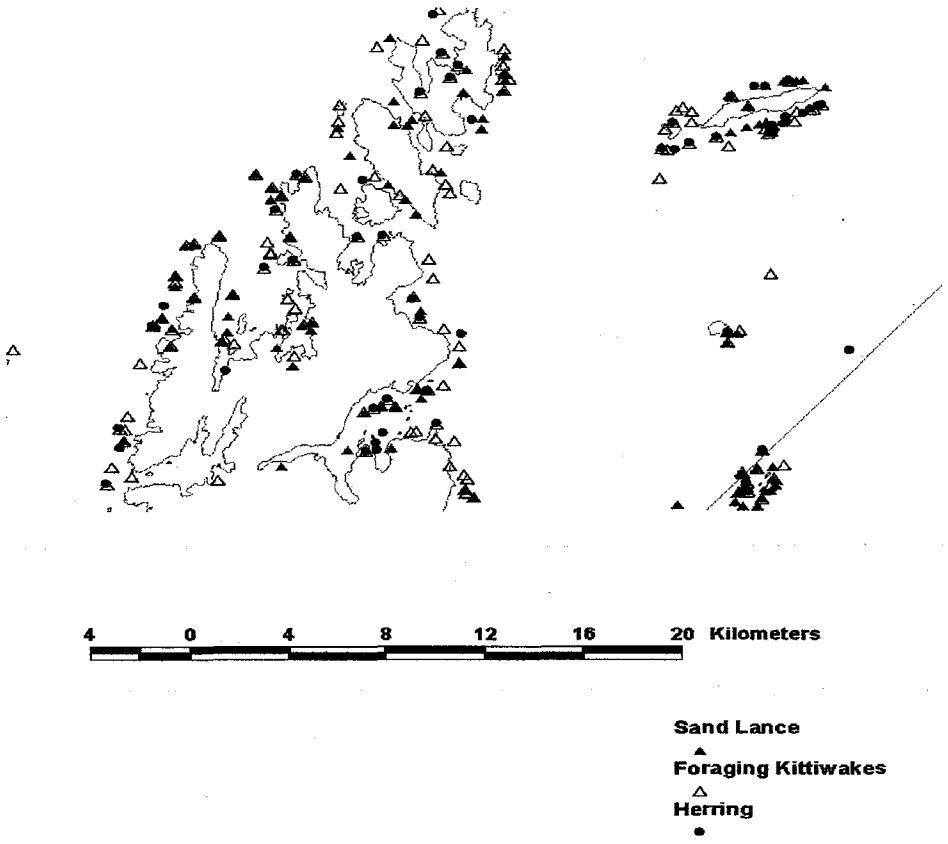

Figure 3. Locations of foraging kittiwakes, sand lance and herring schools in a blown-up region in central Prince William Sound (Knight Island group and Smith Island).

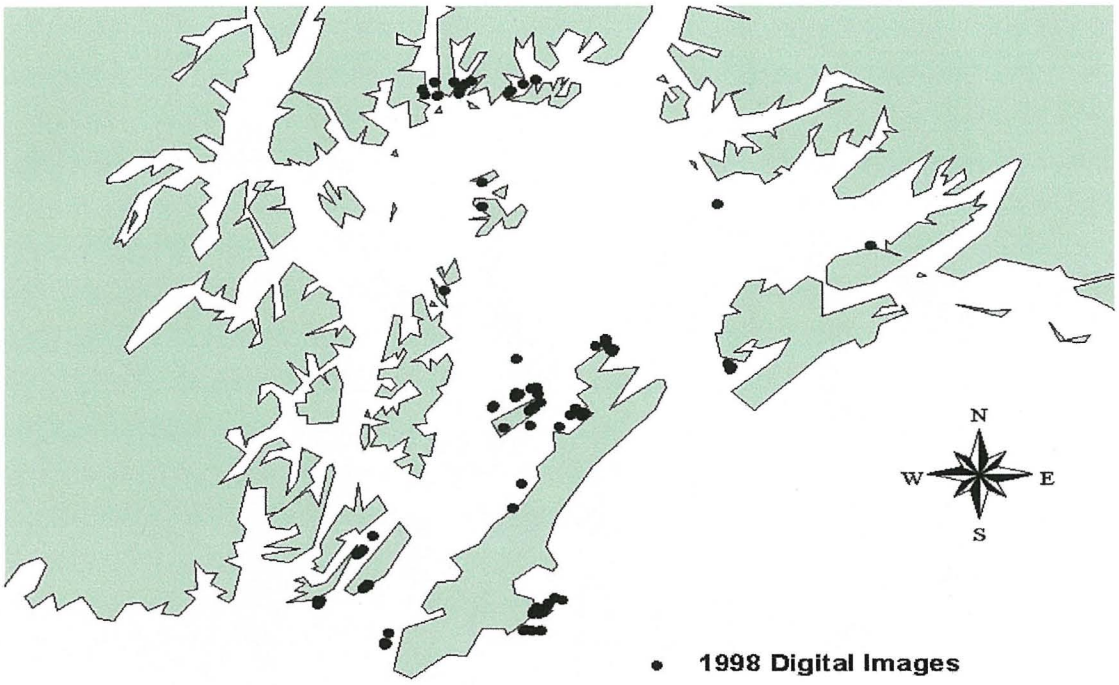

Figure 4. Locations of digital images collected in 1998 in Prince William Sound.

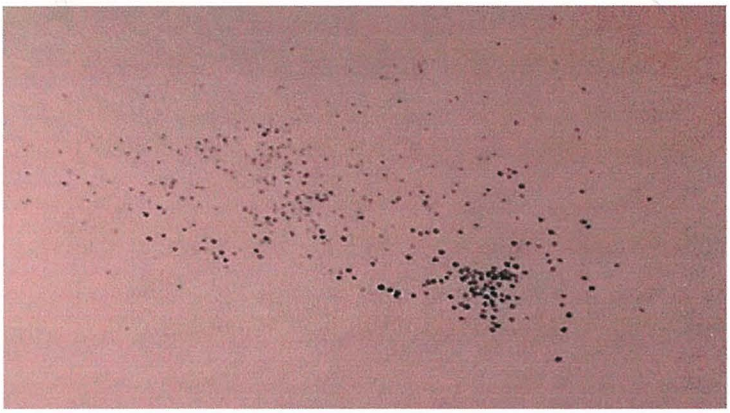

Figure 5. Enhanced digital image of resting bird pattern. Note: the printed reproduction of this digital color image is degraded compared to its original form

Figure 6. Digital image of Age-0 sand lance, kittiwakes and diving seabirds (alcids). Note: the printed reproduction of this digital color image is degraded compared to its original form

NEED FOR THE PROJECT

A. Statement of Problem

Six species of seabirds are listed as injured by the EVOS Trustee Council. Our proposed analyses will include two of these species, marbled murrelets (*Brachyramphus marmoratus*) and pigeon guillemots (*Cepphus columba*) and one that is not listed as directly injured by the EVOS. However, evidence exists that black-legged kittiwakes were indirectly affected by the population crash of a resource that was and still remains listed as injured, the Pacific herring (Fig. 1; Irons 1996). Moreover, the kittiwake has become a "model predator" owing to the unusual facility by which the species lends itself to research on foraging behavior. All of the above species of seabirds rely to some extent on small schooling fishes (primarily herring, sand lance, and capelin) to meet their own daily energy demands as well as that of their offspring. In addition, most of these species of piscivorous seabirds have exhibited decreased population sizes in PWS during the past two decades; trends that were implicated with large-scale declines in forage fish populations (Agler et al. 1999).

Similar declines in piscivorous seabirds and forage fishes were also documented in the Gulf of Alaska (Piatt and Anderson 1996) and Bering Sea (Springer 1993). In the Gulf of Alaska, dramatic declines in seabird and marine mammal numbers are thought to be linked to a crash in capelin populations, an energy rich prey item (Anderson and Piatt 1999). However, it is interesting to note that although the numbers of capelin apparently declined, populations of sand lance apparently remained relatively stable throughout the same period (Robards et al. 1999). Yet, seabird reproductive success and population sizes still declined, indicating sand lance availability was not sufficient to compensate for lack of capelin. However, there are locations where seabirds seem to thrive on diets of sand lance (e.g. Kachemak Bay [Piatt et al. 1998], the Shetland Islands of Scotland [Hamer et al. 1993, Monaghan et al. 1994]). What is unique about these locations and why can't sand lance alone support seabird populations in other areas? In

PWS little evidence exists to assess whether sand lance populations were injured by the EVOS. However, recent data from PWS suggest that numbers of sand lance were depressed in the early 1990s as evidenced by dramatically increasing populations since 1995. Yet seabird populations do not appear to be responding in concert with the increase in sand lance. Is the sand lance biomass still below a threshold in which seabirds populations would respond, or are sand lance schools underutilized in comparison to schools of herring and capelin? These are questions that we can address with our proposed analyses.

It is evident that sufficient quantities of high quality prey are necessary for the recovery of seabird populations. However, little is known of the factors influencing foraging strategies of seabirds or whether characteristics of forage fish assemblages (e.g. school size, species composition, behavior, and density) may be important. This project will assess forage fish assemblage characteristics that may affect the dynamics of foraging by seabirds to determine whether changes in assemblage characteristics can serve to limit seabird recovery. This project will test new hypotheses that are outside the current scope of APEX and APEX resources.

B. Rationale/Link to Restoration

The research completed under this project uses existing data from both the SEA and APEX projects and will help us refine our understanding of foraging dynamics between seabirds and their prey. Information obtained from our analyses will provide valuable insight regarding why certain species of schooling fish or school types may be underutilized by piscivorous seabirds. These results have direct application for evaluating why some seabird populations do not appear to be responding to an increase in particular prey species (e.g. sand lance), and therefore remain listed as injured by the EVOS trustee council.

C. Location

The data for this project were collected in July and August from 1996 - 1999 in Prince William Sound.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Although we have no direct involvement of the public, the images produced by this project can be used for public education purposes. As part of our deliverables, we will provide a GIS CD with the geocoded images for public viewing and use. Also, our analyses will provide quantitative evidence for evaluating traditional knowledge that strong herring populations are important to a heathy PWS ecosystem.

PROJECT DESIGN

A. Objectives

The primary objective of this project is to address the two hypotheses listed above . We intend to provide critical information concerning the relationship of forage fish assemblages to seabird foraging. We will use existing data on foraging locations and foraging success (funded by APEX program) as well as existing data on fish shoal locations and species/age composition from aerial surveys (funded by APEX and SEA). The only new data will be those variables derived from the digital images. Research tasks designed to test our two primary hypotheses include:

1. Group the video images by region, species, and shoal size (number of schools in each image quadrat) and assign continuous or categorical variables (these are the predictor variables).
2. For each image processed, determine the total number of kittiwakes and the nearest neighbor statistics of the birds (response variables).
3. Use multivariate statistics to determine statistical correlations and relationships between the predictor and response variables.
4. Determine if thresholding is occurring (no response values below defined levels of the predictor variables) and define it. Develop a probability associated with the threshold.

Once these initial analyses are complete, the next step will be to address the four secondary hypotheses by:

5. Incorporating data on diet, foraging effort, and reproductive success of kittiwakes from APEX projects 163E, G, Q, T to test our four potential explanations for decreased reproductive performance related to sand lance dominated diets.

B. Methods

Aerial surveys were conducted in PWS, a small adjacent portion of the Gulf of Alaska, and the Outer Kenai from 1995 to 1997 (Brown and Norcorss, 1997). Methodology for the surveys was developed in those years. In 1998 and 1999 repeat surveys were conducted over a more restricted temporal and spatial scale and sources of error were identified and quantified (Brown et al. 1999). In addition, the digital video camera, linked to the GPS, was added to the survey plane. Digital video flight tracks are georeferenced and mapped so that coordinates can be associated to each image extracted along the flight path. Individual images are orthorectified using ERDAS Imagine and ERDAS OrthoBASE for import to a GIS format. Each image or image series will be linked to aerial and validation data that provides fish species and age. The validation data comes from net catches linked via time and space codes to the images or from underwater video images that were taken synoptic with the aerial images. School and school group characteristics are extracted using ERDAS and ArcView (ESRI Corporation; see Verbyla and Chang, 1997) as well as nearest neighbor and abundance statistics for the kittiwakes and other predators. The output is then dumped to a spreadsheet or directly to S-plus statistical package (Spector 1994). Data extracted from a single or series of images is then linked to the appropriate seabird colony response variable and/or assigned a region code (based on known foraging regions). The regions are developed from existing data from kittiwake radio tagging about where and when birds from a particular colony foraged and from APEX foraging model output.

The data linked to each image is then sorted by region and other characteristics to determine if clumping of variables is occurring. We expect, due to the clumping of images in particular locations, that we may have to deal with spatial autocorrelation. If we find this to be a problem, we will group images and analyze image groups instead (i.e., analyze means of image groups) which will affect the overall sample size and may affect our choice of test to use.

We will use a multivariate approach for the analysis of the data. Applicable resource selection models to be evaluated will include, but are not limited to, logistic regression, canonical correlation analysis, and multi-dimensional scaling. Model selection will be based on Akaike's Information Criterion (AIC values) and follow the guidelines of Burnham and Anderson (1998). WEST Inc. will be contracted to assist in sampling design and model development. Statisticians with WEST have extensive experience with resource selection models and geostatistics. These models will be designed to address our two primary hypotheses and will include data on forage fish schools and seabirds (divers and surface feeders) collected from aerial surveys.

In addition, we will integrate these resource selection models with a wide array of kittiwake diet, foraging, and reproductive parameters. Each of these parameters represent periods of different energy demands during breeding (pre-egg laying, incubation, chick-rearing) and time scales of days (e.g. foraging trip duration), weeks (e.g. diets, chick growth), or months (e.g. overall reproductive success, fledglings/nest). This integration will allow identification of mechanisms controlling prey availability and reproductive performance.

Significant results will be published in an ecological journal. We will also deliver the data set for public use in the form of a CD containing the GIS database, the images, and ancillary data.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

The DOI-FWS and ADFG are the main agencies included in this proposal. The USFWS will establish a contract with H.T. Harvey & Associates and Ecological Consulting Inc. (or alternatively, they could be funded through the BAA). The ADFG will establish a contract with Airborne Technologies, Inc., an Alaskan company, for delivery and processing of the digital images and data analysis.

DOI-FWS: Rob Suryan's background in studying the ecological relationships between seabirds and schooling fish in PWS provided the impetus to focus this project's main hypotheses to address effects back at the colonies. He will be responsible for the integration of efforts, most of the analyses, and producing the final publication and report.

Alaska Department of Fish and Game: Evelyn Brown was responsible for collecting the aerial data. Her extensive experience in the field of aerial survey techniques and analyses related to studies of schooling forage fish in PWS is critical to the success of this project. She will be responsible for processing digital video images and formulation of the final publication.

H.T. Harvey and Associates: Dr. David Ainley has extensive experience with ecological studies of seabirds and the marine environment and has participated in the APEX modeling effort. Dr. Ainley will provide input in study design, analyses, integration with the APEX modeling effort, and formulation of the final publication.

Ecological Consulting, Inc.: Dr. Glenn Ford has expertise in modeling predator-prey interactions within the marine environment and has been a primary force in the APEX modeling effort. Dr. Ford will be responsible for providing input in study design, analyses, integration with the APEX modeling effort, and input on the final publication.

Western EcoSystems Technology, Inc. (WEST): Biometricians with WEST, Inc. will be contracted on an advisory basis while developing resource selection models and conducting all analyses.

Airborne Technologies, Inc.: Tim Veenstra was the pilot during APEX aerial surveys and was responsible for collecting the digital video images to used in this study. Mr. Veenstra's expertise in digital video technology will permit efficient acquisition of the images for processing.

SCHEDULE

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

In FY 01, we will address the objectives with the following tasks:

December 31, 2000:	Process and organize all digital images and associated data needed to create the variables.
January 16-26 2000:	Attend the annual EVOS restoration workshop
February 28, 2001:	Scale images and digitize parameters from each image.
March 1, 2001:	Participate in annual EVOS review.
March 15, 2001:	Complete nearest neighbor statistics for birds and schools.
May 15, 2001:	Complete multivariate analysis.
August 15, 2001:	Complete and submit the publication.

In FY 02, we will address the objectives with the following tasks:

December 15, 2001:	Revise and finalize publication.
January 2001:	Attend the annual EVOS restoration workshop
April 15, 2002:	Submit final report and reprint.

B. Project Milestones and Endpoints

FY 01

May 15, 2001:	Primary analyses complete.
August 15, 2001:	Publication submitted.

FY 02

December 15, 2001:	Publication finalized.
April 15, 2002:	Submit final report and CD.

C. Completion Date

December 15, 2001 for publication
April 15, 2002 for final report.

PUBLICATIONS AND REPORTS

An annual report will be prepared for the April 2002 deadline, but the final report will be in the form of a publication reprint. The draft title for the FY 02 publication is:

Factors affecting fish school selection by piscivorous seabirds. Suryan, R., E. Brown, D. Ainley, G. Ford, D. Irons, T. Veenstra. Target journals will include Marine Ecology Progress Series, Journal of Animal Ecology.

PROFESSIONAL CONFERENCES

During FY 01, R. Suryan and E. Brown will attend the EVOS Restoration Workshop (no travel funds are requested in this year). During FY 02, we will present our results at the EVOS Restoration Workshop and at a national conference.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project represents a synthesis of current information resulting from EVOS restoration research. Data collected by APEX 163E,G,T and SEA 320T, or generated through analyses by 163Q, will be incorporated in these analyses. In addition, we will use data already provided to us in the form of net catches, diver observations, and other field observations (where fish species were identified) to identify fish schools included in the images.

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.

Selected Reports and Publications

Suryan, R.M., D.B. Irons, and J. Benson. 2000. Prey switching and variable foraging strategies of Black-legged Kittiwakes and the effect on reproductive success. Condor 102:375-385.

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.

Evelyn D. Brown (formerly Biggs)

Education:

B.S. Zoology and Chemistry, University of Utah, Salt Lake City, 1977

M.S. Fisheries Biology and Aquacultural Engineering, Oregon State University, Corvallis, OR, 1980

Current PhD candidate in Fisheries at University of Alaska, Fairbanks

Experience:

Research Associate, University of Alaska, Fairbanks, 1995 to the present;

Herring and Fisheries Research Biologist, Alaska Department of Fish and Game, Cordova, Alaska from 1985 to 1995;

Principal Investigator, Injury to Prince William Sound Herring from the *Exxon Valdez* Oil Spill, NRDA FS 11, 1989-1992.

Fisheries Biologist, Florida Department of Natural Resources, St. Petersberg, Florida, 1987-1988; hydroacoustics.

Field Experience:

Aerial surveys; P.I. and primary surveyor, single and twin engine aircraft; 1988-present; techniques include lidar (laser sensing), digital imager, and visual surveys

Shipboard surveys; small vessels (30-60 ft); P.I. on 2, participated in over 12; last decade

Research SCUBA diving; PI for several studies of nearshore fish spawning and egg survival projects

Familiarity with a variety of marine electronics from acoustics, side-scan sonars, GPS, and computertized navigation to a Compact Airborne Spectrographic Imager (CASI)

Selected Publications:

Brown, E.D. and B.L. Norcross. In prep. Effect of herring egg distribution and ecology on year-class strength and adult distribution. To be submitted to Fisheries Research.

Brown, E. D., G.A. Borstad, and B.L. Norcross. In prep. Estimating forage fish and seabird distribution and abundance using aerial surveys: survey design and uncertainty. (In review, Ecological Applications).

Seitz, J., E.D. Brown, H.P. Huntington, and B.L. Norcross. In prep. Ecology of Herring and Other Forage Fish as Recorded by Resource Users of Prince William Sound and the Outer Kenai, Alaska (In review with the Alaska Fishery Research Bulletin).

Stokesbury, K. D. E., J. Kirsch, E. D. Brown, G. L. Thomas, B. L. Norcross. 2000. Spatial distributions of Pacific herring, *Clupea pallasi,* and walleye pollock, *Theragra chalcogramma,* in Prince William Sound, Alaska. Fish. Bull. 98:400-409.

Purcell, J.E., E.D. Brown, K.D.E. Stokesbury, and L.H. Haldorson. In press. Aggregations of the jellyfish *Aurelia aurita*: Abundance, distribution, association with age-0 walleye pollock, and behaviors promoting aggregation in Prince William Sound, Alaska, USA. Mar. Ecol. Prog. Ser. 00:00

Brown, E.D. , S. Vaughan, and B.L. Norcross. 1999. Annual and seasonal spatial variability of herring, other forage fish, and seabirds in relation to oceanographic regimes in Prince William Sound, Alaska *in* Ecosystem Approaches for Fisheries Management, University of Alaska Sea Grant, AK-SG-99-01, Fairbanks, Alaska.

Brown, E.D., T.T. Baker, J.E. Hose, R.M. Kocan, G.D. Marty, M.D. McGurk, B.L. Norcross, and J. Short. 1996. Injury to the early life history stages of Pacific herring in Prince William Sound after the *Exxon Valdez* oil spill. Am. Fish. Soc. Symp. 18. pp. 448-462.

Brown, E.D., B.L Norcross, and J.W. Short. 1996. An introduction to studies on the effects of the *Exxon Valdez* oil spill on early life history stages of Pacific herring, Clupea pallasi, in Prince William Sound, Alaska. *Can J. Fish. Aq. Sci.* 53: 2337-2342

David G. Ainley

David G. Ainley, PhD, has investigated the ecology of seabirds for 25 years, having conducted studies in Alaska, California, Mexico, Hawaii and Antarctica. Much of his research has involved the species of seabirds affected by EVOS, especially guillemots and murres. He has published over 125 scientific papers and has authored three books and 2 monographs. With Glen Ford, he participated in development of demographic models to assess impacts of catastrophic events on seabird populations in California (for NOAA, Gulf of the Farallones National Marine Sanctuary).

Selected Publications

Ainley, D.G. and R.J. Boekelheide (eds.). 1990. Seabirds of the Farallon Islands: Ecology, Structure and Dynamics of an Upwelling System Community. Stanford University Press, Palo Alto. 425 pp.

Ainley, D.G. N. Nur and E. J. Woehler. 1995. Factors affecting the size and distribution of pygoscelid penguin colonies in the Antarctic. Auk 112: 171-182.

Ainley, D.G., L.B. Spear and S.G. Allen. 1997. Temporal and spatial variation in the diet of the Common Murre in California. Condor.

Ainley, D.G., W. J. Sydeman, S. A. Hatch and U. W. Wilson. 1994. Seabird population trends along the west coast of North America: causes and the extent of regional concordance. Studies Avian Biol. 15: 119-133.

Ainley, D.G., W. J. Sydeman, R. H. Parrish and W. R. Lenarz. 1993. Oceanic factors influencing distribution of young rockfish (Sebastes) in central California: a predator's perspective. Calif. Coop. Ocean. Fish. Investig., Repts. 34: 133-139

Glenn R. Ford R.Glenn Ford, PhD, was trained in mathematical ecology at University of California, Berkeley, and has been investigating the quantitative ecology of seabirds for the past 20 years, especially in regard to species of the eastern North Pacific, Gulf of Alaska and Bering Sea. He is well versed in GIS applications, having developed software that has been used widely by marine ornithologists, including those studying marbled murrelets in Alaska. He has modeled impacts of oil spills to marine bird populations and conducted computer simulations of the response of seabirds to perturbations in their food supply. Dr. Ford has authored 23 scientific papers (and 28 reports), including 11 on marine birds.

Selected Publications

Ford, R.G., J.A. Wiens, D. Heinemann and G.L. Hunt, Jr. 1982. Modeling the sensitivity of colonially breeding marine birds to oil perturbation. J. Appl. Ecol. 19:1-31.

Ford, R.G., M.L. Bonnell, D.H. Varoujean, G.W. Page, H.R. Carter, B.E. Sharpe, D. Heinemann and J.L. Casey. 1996. Total direct mortality of seabirds from the Exxon Valdez oil spill. In. B. Wright, J. Rice, R. Spies and D. Wolfe (eds.) Am. Fish. Soc. Symposium, Vol. 18 (in press).

Nur, N., R.G. Ford and D.G. Ainley. 1993. Computer model of Farallon seabird populations. Natl. Ocean. Atmosph. Admin., Gulf Farallones Natl. Mar. Sanct., Contract CX-8140-1-0019. San Francisco CA.

Piatt, J.F. and R.G. Ford. 1993. Distribution and abundance of Marbled Murrelets in Alaska. Condor 95:662-669.

Wiens, J.A., R.G. Ford, D. Heinemann and C. Fieber. 1978. Simulation of marine bird population energetics, food consumption, and sensitivity to perturbation: Pribilof Islands. In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports 2: 1-83.

David B. Irons received his Ph. D. from the U. of CA, Irvine in 1992. His dissertation was on the foraging ecology and breeding biology of the black-legged kittiwake. The field work for this study was conducted in Prince William Sound. David received his M. S. from Oregon State University in 1982 where he studied foraging behavior of glaucous-winged gulls in relation to the presence of sea otters. David conducted marine bird and sea otter surveys in PWS in 1984 and

1985. He has been studying kittiwakes in PWS for 12 years and completed the EVOS kittiwake damage assessment study. David has overseen several seabird studies in the past few years including marine bird and sea otter surveys in PWS, Cook Inlet, and SE Alaska, a seabird monitoring study on Little Diomede Island, a cost of reproduction study on kittiwakes, a seabird/forage fish interactions study, and various population and reproductive studies on pigeon guillemots and marbled murrelets.

David will be responsible for providing input in study design, analyses, and publication.

Selected Publications:

Irons, D.B. 1998. Foraging area fidelity of individual seabirds in relation to tidal cycles and flock feeding. Ecology 79(2):647-655.

Irons, D.B. 1996. Size and productivity of black-legged kittiwake colonies in Prince William Sound, Alaska before and after the T/V *Exxon Valdez* oil spill. Pages 738-747*in* S. D. Rice, R. B. Spies, D. A. Wolfe, and B. A. Wright, editors. Proceedings of the *Exxon Valdez* oil spill symposium..American Fisheries Society Symposium 18.

Irons, D.B. 1992. Aspects of foraging behavior and reproductive biology of the black-legged kittiwake. Unpublished Ph.D. Dissertation.

Irons, D.B., R.G. Anthony, and J.A. Estes. 1986. Foraging strategies of Glaucous-winged Gulls in a rocky intertidal community. Ecology 67:1460-1474.

Golet, G. H. and D. B. Irons. 1999. Raising young reduces body condition and fat stores in black-legged kittiwakes. Oecologia 120:530-538.

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2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FFY 2000	Proposed FFY 2001
Personnel		$68.9
Travel		$0.0
Contractual		$10.5
Commodities		$2.3
Equipment		$0.0
Subtotal	$0.0	$81.7
General Administration		$11.1
Project Total	$0.0	$92.8
Full-time Equivalents (FTE)		0.8

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 2002			
$28.0			

Dollar amounts are shown in thousands of dollars.

Other Resources								

Comments:

The entire budget for this project is listed on these forms. However, R. Suryan, D. Irons, and E. Brown are the only PIs that can be funded through a Trustee Agency at this time. D. Ainley, and G. Ford will all require funding through the BAA or as contracts through the DOI-FWS. If the project is funded, these details can be solved at that time.

FY 01

Prepared: 1 of 4

Project Number: 01588
Project Title: Factors Affecting Forage Fish School or School Group Selection in Prince William Sound.
Agency: DOI - Fish and Wildlife Service, ADFG

FORM 3A
AGENCY
PROJECT
DETAIL

4/12/00

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:			GS/Range/	Months	Monthly		Proposed
PM	Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2001
	Suryan	Co-Project Leader	GS11 - 5	4.0	6,200		24.8
	Irons	Co-Project Leader	GS12 - 6	0.0	6,700		0.0
	Brown	Co-Project Leader		3.0	6,800		20.4
	Ainley	Co-Project Leader		0.8	11,360		9.1
	Ford	Co-Project Leader		0.8	11,360		9.1
	Unknown	Technician (Brown)		1.0	5,500		5.5
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		9.6	47,920	0	
Those costs associated with program management should be indicated by placement of an *.						**Personnel Total**	$68.9

Travel Costs:		Ticket	Round	Total	Daily	Proposed
PM	Description	Price	Trips	Days	Per Diem	FY 2001
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Those costs associated with program management should be indicated by placement of an *.					**Travel Total**	$0.0

FY 01

Project Number: 01_____
Project Title: Factors Affecting Forage Fish School or School Group Selection in Prince William Sound.
Agency: DOI - Fish and Wildlife Service, ADFG

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed
Description	FY 2001
Contract to Tim Veenstra (Airborne Technologies, Inc.) to aquire video images	4.5
Western EcoSystems Technology, Inc. for statistical consultation	6.0
When a non-trustee organization is used, the form 4A s required. **Contractual Total**	$10.5

Commodities Costs:	Proposed
Description	FY 2001
Office Supplies (Suryan)	0.3
Computer Supplies and Upgrades (Suryan)	1.0
Computer Supplies and Upgrades (Brown)	1.0
Commodities Total	$2.3

FY 01

Project Number: 01_____
Project Title: Factors Affecting Forage Fish School or School Group Selection in Prince William Sound.
Agency: DOI - Fish and Wildlife Service, ADFG

FORM 3B
Contractual & Commodities
DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2001
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY 01

4 of 4

Project Number: 01_____
Project Title: Factors Affecting Forage Fish School or School Group Selection in Prince William Sound.
Agency: DOI - Fish and Wildlife Service, ADFG

FORM 3B
Equipment
DETAIL

4/12/00

Project Title: A Prototype for Community-Based Environmental Monitoring and Watershed Assessment

Project Number:	01595
Restoration Category:	Monitoring
Proposer:	Cook Inlet Keeper
Lead Trustee Agency:	
Cooperating Agencies:	No others requesting funding under this project
Alaska SeaLife Center:	No
Duration:	4th year, 2-year request for funding
Cost FY 01:	$50,000 (out of $196,400 budget)
Cost FY 02:	$50,000 (out of estimated $197,000 budget)
Geographic Area:	Cook Inlet Basin
Injured Resources/Service:	This project takes an ecosystem approach toward community-based monitoring and will result in direct and indirect benefits to all injured resources and lost or reduced services located in the Cook Inlet basin.

ABSTRACT

Cook Inlet Keeper was the first community-based organization in Alaska to start a federal and state-approved citizen-based water quality monitoring program. Now, other groups in Cook Inlet communities are establishing similar monitoring programs, and requesting Keeper's help. Keeper is ready to unify Cook Inlet monitoring efforts by creating a Quality Assurance Management Plan (QAMP) which will ensure the consistency and credibility of citizen-based monitoring in the Cook Inlet watershed. Keeper will then explore ways to combine citizen monitoring with other tools to develop a watershed assessment prototype. Community-based watershed assessments will help Cook Inlet communities manage natural resources and plan development in ways that will benefit long-term conservation of injured resources and lost or reduced services.

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TRUSTEE COUNCIL

INTRODUCTION

In 1994, a group of fishermen, Native leaders, scientists, educators, homesteaders and others came together to form Cook Inlet Keeper, a nonprofit organization dedicated to protecting the Cook Inlet watershed and the life it sustains. Six years later, Cook Inlet Keeper is leading the way in a citizen-based watershed protection effort in Southcentral Alaska.

Cook Inlet Keeper was the first community-based group in Alaska to implement a credible citizen water quality monitoring program founded on U.S. Environmental Protection Agency- and Alaska Department of Environmental Conservation-approved methods. In 1996, Keeper convened a Technical Advisory Committee comprised of water quality professionals, and began its Kachemak Bay Pilot Project to train volunteers to monitor physical, chemical, and biological parameters in and around Kachemak Bay. In 1998, Keeper expanded its monitoring efforts to include data collection on four lower Kenai Peninsula salmon streams—Anchor River, Deep Creek, Ninilchik River, and Stariski Creek. As part of its monitoring work, Keeper created Alaska's first EPA- and DEC-approved Quality Assurance Project Plans and Volunteer Manual which assure scientific credibility of citizen-collected data.

Keeper's monitoring efforts have been extremely successful, and have become so popular that community groups throughout Cook Inlet and Alaska are now starting similar monitoring programs. Many of these groups begin, however, without knowing what resources are available to them or what other groups are working toward similar goals. Rather than having several monitoring efforts headed in separate directions, these groups recognize a need to come together in a unified effort with consistent data collection, coordinated data management, and credible quality assurance.

Subsequently, many of these groups have requested Keeper's assistance in starting citizen-based monitoring programs. Keeper works with the Kenai Watershed Forum to support citizen-based monitoring of the Kenai River and partners with UAA's Environment and Natural Resource Institute, Alaska Cooperative Extension's Master Watershed Stewards Program, the Anchorage Waterways Council, and the Wasilla Soil and Water Conservation District through formal Memoranda of Understanding to facilitate volunteer monitoring in the Anchorage Bowl and the Mat-Su Valley. Keeper networks with the Homer Soil and Water Conservation District, Anchor Point's Community Rivers Planning Coalition, Seldovia Oil Spill Response Team, Ninilchik Traditional Council, and Port Graham/Nanwalek Watershed Council on monitoring projects in Kachemak Bay and on lower Kenai Peninsula salmon streams.

Keeper is now the best-suited organization to guide the way toward a unified, defensible citizen-based water quality monitoring effort in the Cook Inlet watershed. To ensure consistency and credibility of these monitoring efforts, Keeper is positioning itself as the service center that will provide the following monitoring support to Cook Inlet groups and communities:

1) Alaska's only EPA- and ADEC-approved quality assurance documents for citizen-based water quality monitoring, which outlines protocols that ensure scientifically defensible data;
2) quality assurance checkups to make sure groups are following protocols;

3) comprehensive citizen training program using Alaska's only federal and state approved citizen training manual;
4) data management of all data collected throughout the Inlet in a MS Access database;
5) annual reports and analysis of collected data;
6) technical consultation and advice on equipment and data;
7) access to GIS mapping resources for local watersheds; and
8) access to monitoring data and reports on the Internet through Keeper's web page.

During FY 01, Keeper will refine its citizen-based monitoring program and capitalize on its previous successes to establish a Quality Assurance Management Plan (QAMP) which will ensure the consistency and credibility of citizen-based monitoring efforts in the Cook Inlet watershed. Keeper will base its QAMP prototype on the EPA guidelines outlined for professional monitoring programs, and adapt it for citizen-based monitoring programs in Alaska. This document will define the roles among various monitoring groups, unify the methods used by each group, coordinate the collection and management of data, and outline the quality assurance procedures needed to ensure credibility of citizen-based monitoring. The QAMP will serve as a prototype for unifying citizen monitoring efforts throughout Alaska.

In FY 01, Keeper will work toward the following goals and tasks.

Goal One: Refine Keeper's citizen-based water quality monitoring program and use it as a model for similar monitoring projects.

1) Incorporate more emphasis on visual assessment by training volunteers to make observations through narration, sketches, and photographs of the hydrologic, geographic, biologic, human use and impact, and other conditions within a 100-yard reach of each monitoring site;
2) Network with agencies such as the U.S. Fish and Wildlife Service to begin citizen monitoring in the Kenai National Wildlife Refuge, and the Kachemak Bay National Estuarine Research Reserve to coordinate monitoring efforts in the new Reserve;
3) Explore opportunities for—and needs to – monitor more parameters. Work with UAA's Environment and Natural Resources Institute to incorporate more volunteer macroinvertebrate monitoring in freshwater sites, and work with the Kachemak Bay NERR to explore options for volunteer monitoring of chlorophyll A in estuarine sites. Also explore possibility to monitor alkalinity and ammonia nitrogen;
4) Build more partnerships with other groups such as Native Tribes, commercial and sport fishing organizations, and other traditional partners;
5) Improve data management by refining the database to include automatic calculations for relevant parameters; flagging anomalous data; and making the database accessible via password on the Internet to water quality monitoring leaders throughout the Cook Inlet basin so that leaders can enter and review monitoring data;
6) Provide volunteer monitoring groups with more information on how to recruit and retain volunteers; and
7) Incorporate a greater use of GIS by linking the citizen monitoring database to GIS; using GIS in water quality reports; providing maps to volunteers that depict relevant features near their monitoring sites; and linking interactive GIS on the Internet.

Goal Two: Develop and implement a Quality Assurance Management Plan which will serve as a prototype to guide the consistency and credibility of citizen-based monitoring in the Cook Inlet watershed and beyond.

1) Identify the need for coordinating citizen-based monitoring efforts in Cook Inlet;
2) Review EPA-guidelines for QAMPs for professional monitoring programs;
3) Work with current and new partner groups to define roles of each partner;
4) Work with the Technical Advisory Committee to outline the methods groups should follow to ensure consistent data collection;
5) Create a system which coordinates the management and analysis of citizen-collected water quality data in Cook Inlet;
6) Identify the procedures needed to implement quality assurance checkups to assure credibility of citizen-based monitoring;
7) Create a draft QAMP to circulate among TAC members and partner groups; and
8) Complete and implement QAMP document and hold out as a prototype for coordinating a consistent and defensible citizen-based monitoring effort in Alaska.

In FY 02, Keeper will explore ways to combine its citizen environmental monitoring, GIS mapping, and other tools into a watershed assessment strategy. Keeper will then develop a community-based watershed assessment prototype that is compatible with EPA's Environmental Monitoring and Assessment Program. Watershed assessment will allow communities to gain a greater understanding of their local watershed ecosystem. With this information, communities can locate potential human impacts in their watersheds, prioritize areas needing restoration, and identify and achieve potential management strategies needed to benefit long-term conservation of local resources.

In FY 02 Keeper will work toward the following goal and tasks.

Goal One: Develop a conceptual prototype for community-based watershed assessment in the Cook Inlet watershed.

1) Explore citizen-based watershed assessment programs being implemented in other parts of the country;
2) Determine how those watershed assessment strategies could be adapted for the Cook Inlet watershed;
3) Travel to Cook Inlet communities to find out how citizen-based monitoring has worked for each community and to identify how watershed assessment might meet local needs, interests and values;
4) Identify appropriate partners and communities to network with on watershed assessment;
5) Determine what GIS information is most useful and needed for watershed assessment, possibly including land ownership, timber sales, miles of roads, miles of anadromous fish stream, vegetative cover and types, etc.
6) Identify opportunities for bringing communities, local governments, and funding and management agencies together to work toward a shared vision for resource management.
7) Develop conceptual prototype for a watershed assessment program in Alaska.

Through Watershed Assessment, communities can work together with funding and management agencies to develop a shared vision for resource conservation. These combined community-based strategies will provide citizens and decision makers with the tools they need to promote sustainable living in local watersheds.

NEED FOR THE PROJECT

A. Statement of Problem

The Cook Inlet watershed covers 47,000 square miles in Southcentral Alaska. The watershed encompasses diverse and unique habitats which support a rich fabric of life, including sea otters, harbor seal, orca whales, several species of waterfowl, diverse intertidal and subtidal communities, and all five species of wild Pacific salmon.

Cook Inlet communities depend on the watershed's healthy waters and habitats for their livelihoods. Native villages pursue a subsistence lifestyle that is centuries old, supplying up to 90% of the villagers' diet. Harbor Seal and fish account for the most significant marine subsistence resources for Cook Inlet's Natives, along with other important marine foods such as sea bird eggs, subtidal invertebrates such as mussels and clams, and sea algae. Cook Inlet represents one of the most productive commercial fisheries in Alaska, in which salmon, herring, scallops, rockfish, halibut, and several other species of bottom fish are harvested. And each year, nearly one million visitors from around the world venture to Cook Inlet for sport fishing, wildlife viewing, hiking and other recreational opportunities.

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

Although some recovery has occurred, Cook Inlet's sensitive resources face ongoing threats from a host of unsustainable activities, including rapid filling of wetlands; additional oil spills from an aging oil and gas infrastructure; discharge of pollutants from industrial activities; and increased nonpoint runoff from population growth and sprawl. Approximately 400,000 people, nearly 2/3 of Alaska's population, live in the vast Cook Inlet watershed, and a population increase of 600% over the past thirty years has substantially magnified pressures on Cook Inlet's sensitive resources.

In addition to changes from population growth and urban sprawl, the Cook Inlet watershed is experiencing another type of change in landscape. Cook Inlet's forests are suffering from what the Natural Resource Conservation Service calls the world's largest spruce bark beetle epidemic in recorded history. On the Kenai Peninsula, where the spruce bark beetle epidemic is most intense, property owners are responding with rapid clearing of dead trees while they still retain economic value. Since 1989, approximately 100,000 acres of timber have been harvested on the Kenai Peninsula, with a 300% increase in the last five years. The health of Cook Inlet's terrestrial, coastal and marine ecosystems will likely be affected by these activities.

B. Rationale/Link to Restoration

Healthy coastal resources are critical to the economic and social wellbeing of Cook Inlet communities. One of the challenges in the efforts to restore the environmental following the *Exxon Valdez* oil spill has been the lack of adequate data describing water quality prior to the spill. It is essential that monitoring takes place in Cook Inlet now, before more impacts are realized, so that reference conditions can be established from which to notice changes. Yet, state and federal agencies responsible for water quality monitoring are strapped by budget cuts, and unable to collect the water quality information needed to ensure compliance with state and federal water quality standards. As government budgets for water quality monitoring continue to decline, citizens have stepped in to gauge the health of our viable yet stressed public resources.

Citizens care about their water resources, and want to participate in efforts to understand their watersheds. Several Cook Inlet communities have already begun to organize to protect local habitat and water quality. Many of these efforts, however, begin without knowing what resources are available, or what other groups are working toward similar goals. Now more than ever, Alaska's communities are ready to come together in an integrated citizen environmental monitoring effort. Cook Inlet Keeper is the organization best positioned to move forward in unifying this effort, and then uphold this work as an applicable prototype for coordinating a consistent and defensible citizen monitoring program in Alaska.

Citizens also desire tools to translate their monitoring efforts into sustainable community development, environmental protection and resource management that is compatible with local values. Watershed assessment is an important tool used in many other states. For example, EPA's Environmental Monitoring and Assessment Program emphasizes the importance of translating environmental monitoring into an assessment of ecological conditions to help forecast future risks, and foster a sustainable use of our natural resources. Keeper recognizes the need for Alaska to keep up with innovative monitoring and assessment programs. In FY 02, Keeper will begin looking toward a conceptual prototype in which it can combine citizen monitoring, GIS mapping and other tools in a more holistic community-based watershed assessment program.

By improving our understanding of water quality, enhancing watershed stewardship among citizens, and providing communities with the tools they need to management human uses and reduce pollution; this project will improve the rate of natural resource recovery in the Cook Inlet watershed and help prevent future harms from occurring.

C. Location

Keeper's Citizen Environmental Monitoring and Watershed Assessment Program will take place in the Cook Inlet basin, which covers 47,000 square miles of terrestrial, coastal and marine habitat in Southcentral Alaska. Communities involved in and affected by the project includes Talkeetna, Willow, Wasilla, Palmer, Knik, Chickaloon, Eklutna, Eagle River, Anchorage, Girdwood, Cooper Landing, Nikiski, Kenai, Soldotna, Ninilchik, Anchor Point, Homer, Seldovia, Port Graham, Nanwalek, Tyonek and others. Keeper's Citizen Environmental Monitoring and Watershed Assessment prototypes can be used to guide citizen monitoring and assessment projects throughout the state of Alaska.

COMMUNITY INVOLVEMENT AND TRADTIONAL KNOWLEDGE

Citizen-based monitoring is a community-owned and community-driven effort. It is a highly effective way to bridge the gap between citizens and natural resource agencies. Citizens are directly involved in collecting and tracking water quality information, and have a greater sense of ownership of the monitoring findings.

Citizen monitoring is also an important way to integrate traditional environmental knowledge (TEK) with science. Many of the citizens who become involved in the monitoring efforts have a long history with their local regions; and during that time, have observed environmental changes. Keeper is set to begin working with Alaska Native organizations, including the Chugach Regional Resource Council (CRRC) and the Native American Fish and Wildlife Society (NAFWS), in citizen monitoring efforts. Keeper recognizes the powerful role that TEK can play to further water quality monitoring goals. Visual and other observations through narration, photographs and sketches may be one way to better incorporate TEK into citizen-based monitoring, and Keeper will continue to work with groups like CRRC and NAFWS to strengthen TEK components.

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

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

As Keeper begins exploring and developing a prototype for a watershed assessment program, Keeper will once again travel to Cook Inlet communities in a scoping effort to gain a better understanding of what communities need and value. As part of this effort, Keeper will receive valuable feedback from its existing partners on how the citizen monitoring programs have worked, and how monitoring can be better incorporated into a more comprehensive watershed assessment program. This process will help Keeper identify what opportunities exist for communities to work together toward a shared vision for resource management, and Keeper will be better able to integrate local concerns and interests into the watershed assessment prototype.

PROJECT DESIGN

A. Objectives

Cook Inlet Keeper's project objective is to establish a unified citizen-based water quality monitoring program in the Cook Inlet watershed, and a conceptual watershed assessment prototype which will:

1. Inventory baseline water quality in the waters of the Cook Inlet basin using established monitoring protocols;

2. Detect and report changes in water quality information and track water quality trends;

3. Put water quality and watershed assessment information into the hands of the public and decision makers;

4. Involve citizens in hands-on watershed stewardship by connecting them to the water resources in their back yards; and

5. Provide environmental monitoring and watershed assessment information as tools for communities to plan community development, environmental protection and resource management for their local watersheds.

B. Methods

To achieve monitoring project objectives, Keeper has selected water quality parameters that will enhance understanding of overall environmental health, and testing methods that have proven successful in citizen-based programs throughout the United States.

Keeper's monitoring efforts are guided by Technical Advisory Committees (TAC) composed of environmental scientists from throughout Alaska and the U.S. (TAC lists enclosed). Some of the TAC members include professors and researchers from the University of Alaska Fairbanks and University of Alaska Anchorage; scientists with agencies such as the National Oceanic and Atmospheric Administration, U.S. Geological Survey, National Biological Service, Environmental Protection Agency, and Alaska Department of Environmental Conservation; and other professionals with water quality and ecology expertise.

Keeper's TAC chose methods based on: 1) precision; 2) accuracy; 3) representativeness of true environmental conditions; 4) comparability to similar studies; 5) completeness; 6) economics; 7) citizens ability to perform; 8) reliability; 9) credibility – EPA approved; and 10) application by other users. These monitoring methods are outlined in the enclosed EPA- and ADEC-approved Quality Assurance Project Plans. These documents include detailed descriptions for data quality objectives, citizen training requirements, sampling method requirements, analytical method requirements, quality control requirements, instrument/equipment testing, inspection and maintenance, data management, validation and verification methods, and more.

Keeper staff train citizens and groups to take surface water samples using water test kits containing a combination of LaMotte, Hach, Hanna and Micrology Laboratories equipment and supplies. Courses which train volunteer monitors are based on Keeper's EPA and ADEC-approved Citizen Training Manual, and are held quarterly in Homer. Re-certification/Quality Control (QC) sessions are held biannually in Homer. Keeper also works with its monitoring partner groups to conduct periodic trainings in Anchorage, Mat-Su Valley, Seldovia, Port Graham/Nanwalek, and Soldotna. Volunteers are instructed to monitor 16 times per year – once each month from October through May and twice a month from June through September.

In order to obtain useful baseline inventory and monitoring information, Keeper selects sampling sites which are representative of the various hydrologic, geographic, biologic, land use, and other conditions within the watershed. Site selection works to ensure a balance between more impacted and less impacted areas. Keeper also selects sites which are safely and reasonably accessible. Finally, to maintain volunteer involvement, it is important to select sites in which volunteers have a personal interest. For example, Native communities may choose sites that are important for traditional subsistence uses. Some of the 110 volunteer monitoring sites occur in and around: Anchor River, Diamond Creek, Bishops Beach, Beluga Slough, Mud Bay, Homer Boat Harbor, Fritz Creek, Fox River Flats, Bear Cove, Halibut Cove, Peterson Bay, Seldovia Bay, Seldovia Boat Harbor, Port Graham Bay, Kenai River, Tuxedni Bay, Chester Creek, Campbell Creek, Ship Creep, Little Susitna River, Cottonwood Creek and other waterbodies. Keeper also conducts more extensive water quality monitoring at two sites on the Stariski Creek, three sites in both Deep Creek and Ninilchik River watersheds, and four sites in the Anchor River watershed.

Individual citizens and citizen teams test surface water samples for water temperature, turbidity (clarity), pH, salinity, and dissolved oxygen. Current monitoring also includes tests for water color, conductivity, oxidation-reduction potential (ORP) and screening tests for nutrients (nitrate-nitrogen and ortho-phosphate), and bacteria (E. coli & general coliform). In addition to most of the parameters above, Keeper's monitoring on the four lower Kenai Peninsula salmon streams also tests for suspended solids, nitrogen-ammonia, nitrogen-nitrite, total phosphorous, discharge and stage. Keeper also performs periodic bioassessment sampling for macroinvertebrates in cooperation with UAA's Environment and Natural Resource Institute (ENRI). Keeper will work with ENRI over the next year, to integrate more volunteer macroinvertebrate sampling. In the future, monitoring for additional parameters such as chlorophyll A, and boat-based programs for sediment and water column testing may be considered in cooperation with the Kachemak Bay National Estuarine Research Reserve. These elements will be addressed in future addendum to, or edition of QAPP documents as they are implemented.

Citizens are also encouraged to record narrative environmental data and to photograph each site during each sampling visit. These visual and other observations complement the quantitative physical and chemical data collected at each established monitoring site. Data collected by volunteers is turned in to the Keeper office where it is entered, managed and analyzed in an MS Access database.

Cook Inlet Keeper's citizen environmental monitoring and watershed assessment efforts do not test specific hypotheses but help detect water quality changes which will inform future research

and formalized hypotheses testing. Citizen monitoring data is compared to the state and federal water quality standards as applicable. Monitoring data is also analyzed considering seasonal variability; water quality differences between upstream and downstream sites; and tidal influence on water chemistry in the estuarine zone. Keeper also compares current data with historical data collected by USGS.

Keeper's TAC reviews the methods outlined in the QAPP documents periodically, and considers if and when changes should be made. Any changes in methods are submitted to EPA and ADEC for approval before implementation.

As a result of Keeper's success, several other groups in the Cook Inlet watershed have adopted Keeper's methods and procedures to guide their volunteer monitoring efforts. Groups such as the Kenai Watershed Forum, Anchorage Waterways Council, Alaska Cooperative Extension Service, UAA's Environment and Natural Resource Institute, and the Wasilla Soil and Water Conservation District have come to Keeper for assistance in starting and developing their community-based monitoring programs. More and more citizen-based monitoring projects are being started in Cook Inlet. To ensure consistency and credibility of these monitoring efforts, Keeper is positioning itself as the service center that provides the following monitoring support to Cook Inlet groups and communities:

1) Keeper provides its EPA- and ADEC-approved quality assurance documents for other groups to adopt according to their own needs and goals to guide their citizen-based water quality monitoring with protocols that ensure scientifically defensible data.
2) Keeper will conduct annual quality assurance checkups in each community to make sure groups are following protocols.
3) Keeper will conduct annual "Train-the-Trainers" workshop to instruct leaders from each partner group to provide the skills they need to train volunteers in their communities using Keeper's EPA- and ADEC- approved Citizen Training Manual. Keeper will also work with the groups to conduct the first volunteer training course in each community and co-train additional courses until the monitoring leaders feel comfortable conducting volunteer training courses on their own.
4) Keeper works with partners to coordinate data management of all data collected throughout the Inlet in MS Access database. Currently, each member group has an individual copy of a unified database. These databases will be merged to ensure all citizen-collected data for the Cook Inlet watershed is in one location. Then the database will be up-linked to Keeper's web page where monitoring partner leaders can access the database via a password and enter volunteer data for their community. Keeper will manage the data and coordinate data analysis and reporting among partner groups. Keeper will also provide a read-only version of the data and reports, so that this useful water quality information is available to the volunteer monitors and the general public.
5) Keeper will provide partner groups with technical consultation and advice on equipment ordering and maintenance; tips on data management; advice on volunteer recruitment; coordinating and retention; and other information that may strengthen their citizen-based monitoring programs.

6) Keeper will make its GIS mapping resources available to partner groups for them to use in their water quality reports, and in other ways that further their monitoring and watershed protection efforts.

To best integrate and unify citizen-based water quality monitoring efforts in Cook Inlet requires a formal plan outlining methods and protocols for delivering these services. During FY 01, Keeper will refine its citizen-based monitoring program and capitalize on its previous successes by establishing a Quality Assurance Management Plan (QAMP) which will ensure the consistency and credibility of citizen-based monitoring efforts in the Cook Inlet watershed. Keeper will base its QAMP prototype on the EPA guidelines outlined for professional monitoring programs, and adapt it for citizen-based monitoring programs in Alaska. This document will define the roles among various monitoring groups; unify the methods used by each group; coordinate the collection and management or data; and outline the quality assurance procedures needed to ensure credibility of citizen-based monitoring. The QAMP will serve as a prototype for unifying citizen monitoring efforts throughout Alaska.

During FY 01, Keeper will work toward the following goals and tasks.

Goal One: Refine Keeper's citizen-based water quality monitoring program and use it as a model for similar monitoring projects.

1) Incorporate more emphasis on visual assessment by training volunteers to make observations through narration, sketches, and photographs of the hydrologic, geographic, biologic, human use and impact, and other conditions within 100-yard reach of each monitoring sites;
2) Network with agencies such as the U.S. Fish and Wildlife Service to begin citizen monitoring in the Kenai National Wildlife Refuge, and the Kachemak Bay National Estuarine Research Reserve (NERR) to coordinate monitoring efforts in the new Reserve;
3) Explore the opportunities for – and needs to – incorporate more parameters. Work with UAA's ENRI to incorporate more volunteer macroinvertebrate sampling on fresh water sites, and work with the Kachemak Bay NERR to explore options for volunteer monitoring of chlorophyll A on estuarine sites. Also explore possibility to monitor alkalinity and ammonia nitrogen;
4) Build more partnerships with other groups such as Native Tribes, commercial and sport fishing organizations, and other traditional partners;
5) Improve data management by refining the database to include automatic calculations for relevant parameters; flagging anomalous data; and making the database accessible via password on the Internet to water quality monitoring leaders throughout the Cook Inlet basin so that partner leaders can enter and review monitoring data;
6) Provide volunteer monitoring groups with more information on how to recruit and retain volunteers; and
7) Incorporate a greater use of GIS by linking the citizen monitoring database to GIS; using GIS in water quality reports; providing maps to volunteers that depict relevant features near their monitoring sites; and linking interactive GIS on the Internet.

Goal Two: Develop and implement a Quality Assurance Management Plan which will serve as a prototype to guide the consistency and credibility of citizen-based monitoring in the Cook Inlet watershed and beyond.

1) Identify the need for coordinating citizen-based monitoring efforts in Cook Inlet;
2) Review EPA-guidelines for QAMPs for professional monitoring programs, and determine how to adapt for citizen-based monitoring programs;
3) Work with current and new partner groups to define roles of each partner;
4) Work with the Technical Advisory Committee to outline the methods groups should follow to ensure consistent data collection;
5) Create a system which coordinates the management and analysis of citizen-collected water quality data in Cook Inlet;
6) Identify the procedures needed to implement quality assurance check-ups to assure credibility of citizen-based monitoring;
7) Create a draft QAMP to circulate among TAC members and partner groups; and
8) Complete and implement QAMP document and hold it out as a prototype for coordinating a consistent and defensible citizen-based monitoring effort in Alaska.

In FY 02, Keeper will explore ways to combine its citizen environmental monitoring, GIS mapping, and other tools into a watershed assessment strategy. Keeper will then develop a community-based watershed assessment prototype that is compatible with EPA's Environmental Monitoring and Assessment Program. Watershed assessment will allow communities to gain a greater understanding of their local watershed ecosystem. With this information, communities can locate potential human impacts in their watersheds, prioritize areas needing restoration, and identify and achieve potential management strategies needed to benefit long-term conservation of local resources.

In FY 02, Keeper will work toward the following goal and tasks.

Goal One: Develop a conceptual prototype for community-based watershed assessment in the Cook Inlet watershed.

1) Explore citizen-based watershed assessment programs being implemented in other parts of the country;
2) Determine how those watershed assessment strategies could be adapted for the Cook Inlet watershed;
3) Travel to Cook Inlet communities to better evaluate how citizen-based monitoring has worked for each community and to identify how watershed assessment might meet local needs, interests and values;
4) Identify appropriate partners and communities to work with on watershed assessment;
5) Determine what GIS information is most useful and needed for watershed assessment, possibly including land ownership, timber sales, miles of roads, miles of anadramous fish stream, vegetative cover and types, impermeable surface cover, etc.
6) Identify opportunities for bringing communities, local governments, and funding and management agencies together to work toward a shared vision for resource management; and
7) Develop a conceptual prototype for a watershed assessment program in Alaska.

C. Cooperating Agencies, Contracts and Other Agency Assistance

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

SCHEDULE

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

October 2000:	Identify and define need for coordinating citizen-based water quality monitoring efforts in the Cook Inlet watershed
October 2000-September 2001:	Work with partner monitoring groups to define roles, coordinate data management, unify monitoring efforts, etc.
October 2000 - September 2001:	Identify and meet with new potential volunteer water quality monitoring partners, possibly including the American Native Fish and Wildlife Society (ANFWS), Chugach Regional Resource Council (CRRC), Eklutna and Chickaloon Tribal Councils, Friends of Cooper Landing, Tyonek community; Ninilchik Native Association, Cook Inlet Aquaculture Association, North Pacific Fisheries Association, United Cook Inlet Drift Association, and others
October 2000:	Conduct quality assurance checkup in Kenai in cooperation with the Kenai Watershed Forum and The Nature Conservancy
October 2000 - September 2001:	Conduct quarterly volunteer training courses in Homer using citizen training manual
November 2000:	Meet with TAC, citizen advisory panel, Native organizations such as ANFWS and CRRC to develop additional procedures to better incorporate visual and other observations and traditional knowledge into existing monitoring protocols
November 2000:	Meet with the Kachemak Bay National Estuarine Research Reserve to outline a plan for coordinated monitoring efforts in Kachemak Bay
November 2000:	Review EPA's QAMP guidelines for professional monitoring and adapt for citizen-based monitoring in Cook Inlet
December 2000:	Work with TAC to identify the methods that all monitoring partner groups should follow to ensure consistent and credible data, and refine procedures for conducting quality assurance checkups
January 2001:	Circulate draft QAMP to TAC members and monitoring partner groups.
January 2001:	Conduct volunteer training in Port Graham/Nanwalek in cooperation with the Port Graham/Nanwalek Watershed Council and CRRC
January 2001:	Provide GIS maps to volunteer monitors of their monitoring sites
February 2000:	Complete and implement QAMP document and hold out as a prototype for coordinating citizen-based monitoring programs in Alaska.
February 2001:	Link GIS to water quality database
February 2001:	Conduct volunteer training and quality assurance checkup in Seldovia in cooperation with the Seldovia Oil Spill Response Team

February 2001:	Meet with TAC, NERR and ENRI to explore opportunities for, and needs to, add additional parameters, such as chlorophyll A in estuarine sites, and more macroinvertebrate sampling and alkalinity and ammonia nitrogen testing in fresh water sites
March 2001:	Conduct volunteer training and quality assurance checkup in Wasilla with the Wasilla Soil and Water Conservation District
March 2001:	Make interactive Cook Inlet GIS information available on the Internet
April 2001:	Make water quality database accessible to water quality monitoring leaders throughout the Cook Inlet via the Internet
April 2001:	Provide draft water quality monitoring reports to the Technical Advisory Committees for review
May 2001:	Conduct quality assurance checkup in Anchorage with the Anchorage Waterways Council and Alaska Cooperative Extension Master Watershed Stewardship Program
June 2001:	Publish and distribute final annual water quality monitoring reports
June 2001:	Conduct volunteer bioassessment training in Homer in cooperation with UAA's Environment and Natural Resource Institute
June 2001:	Initiate a volunteer water quality monitoring program in the Kenai National Wildlife Refuge in cooperation with the U.S. Fish and Wildlife Service
July 2001:	Conduct Train-the-Trainers workshop to train water quality monitoring leaders of organizations such as the Kenai Watershed Forum, Anchorage Waterways Council, Wasilla Soil and Water Conservation District, etc. Training will include information on how to access and use the water quality database, and how to recruit and retain volunteers.
Aug.-Oct. 2001:	Research models for citizen-based watershed assessment programs
September 2001:	Hold TAC meeting to chart out vision for a citizen-based watershed assessment program
Ongoing:	Collect and analyze water quality information; enter and manage water quality data in MS Access database; analyze water quality data; present water quality information in publications and at seminars as the opportunities arise; manage volunteers; manage monitoring equipment and supplies; and provide monitoring support to groups and communities in the Cook Inlet watershed.

B. Project Milestones and Endpoints

Keeper's most significant milestones include establishing a Quality Assurance Management Plan to coordinate citizen-based monitoring efforts in Cook Inlet; and creating a conceptual prototype for community-based watershed assessment. The first milestone will be reached in February 2001, when Keeper will have finalized its Quality Assurance Management Plan to serve as a model for unifying a consistent and defensible citizen-based monitoring in Alaska. This prototype, although specific to water quality monitoring, will have applications to other citizen-based monitoring projects in the coastal marine environment.

The milestone for the conceptual prototype for citizen-based watershed assessment will be reached in September 2002, after Keeper has researched other models throughout the nation and adapted them for compatibility with Alaska's unique environmental conditions and community values.

The milestones for the projects longer-term objectives are outlined below.

1. *Inventory baseline water quality in the waters of the Cook Inlet basin;*

Keeper has identified at least three to five years as the necessary timeframe to adequately inventory baseline water quality conditions for a particular monitoring site. Monitoring at volunteer sites has begun at varying times and new sites are added on a regular basis. As a result, baseline conditions will be realized for different sites at different times. Keeper anticipates it will begin to recognize baseline conditions for some of the sites in each region on the following schedule:

Kachemak Bay:	2000 - 2002	Deep Creek:	2002 - 2004
Kenai River:	2001 - 2003	Ninilchik River:	2002 - 2004
Anchorage Bowl:	2002 - 2004	Stariski Creek:	2002 - 2004
Mat-Su Valley:	2003 - 2005	New sites in the Cook Inlet	
Anchor River:	2002 - 2004	watershed:	2003 & beyond

2. *Detect and report changes in water quality information and track water quality trends;*

After baseline conditions are recognized, citizens will continue to monitor in order to detect and report changes in water quality information. Any changes that may occur may be recognized after baseline conditions have been established.

3. *Put water quality and watershed assessment information into the hands of the public and decision makers.*

Keeper will meet this objective annually when it produces its annual water quality reports. Keeper's current cycle for annual reports is June of each year. Keeper's reports are available in hard copy and on the internet. Keeper also distributes its water quality information through its bi-annual newsletter; news media stories; conferences, workshops and booths at public events; and through word of mouth.

4. *Involve citizens in hands-on watershed stewardship by connecting them to the water resources in their back yards.*

Keeper meets this objective each time citizens attend volunteer monitoring trainings, and each time volunteers monitor a site. To date, Keeper has helped train 220 people from more than 10 Cook Inlet communities. Keeper anticipates it and its partner groups will train an additional 65 volunteers in FY 01. This objective will be better fulfilled as citizens become more active in long-term monitoring of their water quality sites. Keeper and partnering groups currently have 113 active monitors, and anticipate 40 new active volunteers by the end of FY 01.

5. *Provide environmental monitoring and watershed assessment information as tools for communities to plan community development, environmental protection and resource management for their local watersheds.*

To some degree this objective is already being realized. For example, in 1999, Keeper used a small scale watershed assessment approach to produce the Bridge Creek Watershed Report. This report is now helping guide the City of Homer as it begins planning for the Bridge Creek Watershed – its only municipal drinking water source. However, Keeper realizes that a more comprehensive watershed assessment program can lead to greater fulfillment of this objective. Keeper anticipates this outcome can best be measured starting one year after watershed assessment activities have occurred within a specific watershed. Keeper plans to implement its conceptual watershed assessment prototype in FY 2003 (after October 2002). Given that time frame, this objective may begin to be fulfilled on a significant scale in FY 2004.

C. Completion Date

Each of the project's objectives will be measured and evaluated in 2001. However, satisfactory fulfillment of each objectives will require that the project continue to 2006 and likely beyond. The very nature of a monitoring project requires that information be collected over a long enough time frame to identify baseline conditions and trends, and possible deviations from these conditions. It then takes additional time to translate this information into action that will help communities plan development, environmental protection and resource management to benefit long-term conservation of local resources.

PUBLICATIONS AND REPORTS

In January 2000, Keeper released its first water quality report: "Preliminary Water Quality Assessment of Lower Kenai Peninsula Salmon Streams." Later in the spring, Keeper will release a separate water quality report which will analyze three-years of water quality data collected by volunteers in the Kachemak Bay watershed.

Keeper has submitted its first manuscript for publication, called "Collection of baseline water quality data on the Lower Kenai Peninsula, Alaska," by Beth Lambert, Keeper's Stream Ecologist and Joel Cooper, Keeper's Research Coordinator. The manuscript is now "in press". The manuscript was submitted for the Proceedings of the American Water Resources Association 2000 conference on "Water Resources in Extreme Environments", May 1-3 in Anchorage. At the conference, Keeper will present a poster which summarizes the manuscript.

With the release of Keeper's first water quality reports, Keeper will more assertively submit manuscripts for publication in peer-reviewed journals. Keeper is currently researching the opportunities for publication, but is unaware at this point, which publications it will pursue during FY 01.

Keeper plans to release annual water quality reports each June, and will have a draft of the FY 01 reports available for the Trustees review on April 15, 2001.

PROFESSIONAL CONFERENCES

Several professional organizations hold conferences relevant to water quality monitoring. Keeper attends conferences where it may make the best use of its particular experience and expertise, and where Keeper can best benefit from the networking and exchange of information. Through conference participation, Keeper's monitoring work is strengthened and better able to stay current in the field.

Cook Inlet Keeper will attend the U.S. EPA's 6th National Volunteer Monitoring Conference in Austin, Texas on April 26-29, 2000. This conference will cover issues such as data management, volunteer data presentation, agency use of volunteer data, and more. Although Keeper will not be presenting its project results at this conference, it can use the conference to identify opportunities for presenting and sharing project results in the future.

Keeper will present a poster summarizing collection of baseline water quality information on the lower Kenai Peninsula at the American Water Resources Association (AWRA) special conference in Anchorage in May 2000. Keeper will consider attending AWRA's 2001 annual meeting to present its water quality data results. AWRA also holds local chapter meetings and "special topics" meetings in different locations, with several in the Pacific Northwest each year. Keeper will explore the options for presenting its project results at these meetings as well.

Keeper will continue looking at other possibilities for presenting information at professional conferences. At this time, Keeper is unaware which conferences it might attend in FY 01.

NORMAL AGENCY MANAGEMENT

Not applicable.

COORDINATION AND INTEGRATION OF RESTORATION EFFORTS

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

Keeper will continue to coordinate with the Kachemak Bay National Estuarine Research Reserve, and will work to share resources to support and coordinate monitoring in Kachemak Bay. The information Keeper collects through its monitoring and GIS project will be integrated with much of NERR's information on the Bay and will help provide a more complete picture of

the Kachemak Bay ecosystem. Most likely, KBNERR and Keeper will coordinate on shared field sites, sample collection, funding, joint training workshops, and other collaborative efforts. Keeper also collaborates with UAA's Kachemak Bay Campus which makes an in-kind contribution of lab space for water quality laboratory analysis.

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

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

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

Keeper's monitoring budget for FY 01 is $196,400. Keeper anticipates a few more years of funding from EPA, including $110,000 in FY 01. Keeper will raise an additional $30,500 in other sources including grants, individuals, businesses and fees for services. Keeper currently has grants pending with the Wilburforce Foundation to support GIS mapping components of the project, and will submit a proposal to the Tides Foundation in April to support networking components of the project. Keeper is also exploring the feasibility of a business fundraising effort to solicit businesses to adopt monitoring sites for the cost of sampling equipment needed to monitor that site for one year.

After establishing itself as the preeminent citizen-based water quality monitoring group in the State, Keeper is moving into more of a monitoring support role, to act as the service center for citizen-based monitoring, GIS and assessment for Cook Inlet groups. EPA money, however, is unable to cover Keeper's need for additional resources to fill this larger role. Therefore, Keeper is requesting $50,000 from EVOS for FY 01 to help cover these necessary expenses as it continues to develop a model for citizen-based monitoring in Alaska. Keeper also hopes to approach EVOS in FY 02 for an additional $50,000 to help Keeper embrace its monitoring successes into a citizen-based watershed assessment prototype.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

Not applicable.

PROPOSED PRINCIPAL INVESTIGATOR IF KNOWN

Name:	Brad van Appel, Program Director
Affiliation:	Cook Inlet Keeper
Mailing Address:	PO Box 3269, Homer, Alaska 99603
Phone number:	(907) 235-4068
Fax number:	(907) 235-4069
E-mail Address:	brad@inletkeeper.org

PRINCIPAL INVESTIGATOR

For the past two and a half years, Brad van Appel has served as Program Director for Keeper's GIS and monitoring projects. As part of his position, Brad worked with Keeper's Technical Advisory Committee to develop Alaska's first U.S. EPA- and ADEC-approved Quality Assurance Project Plan for citizen-based water quality monitoring. Brad also created Alaska's first and only EPA- and ADEC- approved Citizen Training Manual for volunteer water quality monitoring. Brad has worked closely with communities throughout Cook Inlet, and he helped organize a series of educational workshops to introduce hundreds of Alaskans to the power of GIS as a tool for resource management and environmental protection.

Brad's backgrounds include nonprofit management, natural history and public relations. Prior to joining Keeper in 1997, he was Assistant Director to the Transportation Project at the Alaska Center for the Environment, where he later handled membership, personnel and finances for ACE. Brad's presence promotes a sense of confidence and stability which translates into solid working relationships with Keeper staff, contractors and the general public.

OTHER KEY PERSONNEL

Joel Cooper, Research Coordinator
Joel joined Keeper's staff in 1998 to coordinate and oversee Keeper's citizen water quality monitoring program. Prior to joining Keeper, some of Joel's work experience included conducting stream surveys for the U.S. Forest Service, serving as an Organic Chemist for the Rocky Mountain Analytical Laboratory, and working as Environmental Scientist for the Southern Illinois University Department of Pollution Control. With a B.S. in Environmental Studies focusing on forestry, plant and soil sciences from Southern Illinois University, and with considerable sampling and monitoring experience with the U.S. Fish & Wildlife Service, National Park Service and the U.S. Forest Service, Joel is well-qualified to coordinate Keeper's water quality monitoring efforts.

Beth Lambert, Stream Ecologist
Beth joined Keeper in 1998 to oversee the Salmon Stream Monitoring Project. Beth holds a B.A. in Geology from Carleton College and a M.S. in Physical Geography from Oregon State University where she conducted a thesis on mountain stream dynamics. Prior to joining Keeper, Beth served as Water Quality/Education Coordinator with the Umatilla Basin Watershed Council, where she worked with federal, tribal, state and local governments, landowners and volunteers to monitor water quality of streams in the Umatilla Basin. .

Mike Gracz, Geographic Information Systems (GIS) Specialist
Mike is a forest ecologist with degrees from State University of New York-Syracuse College of Environmental Science & Forestry (B.S.) and the University of Washington (M.S.). He has backgrounds in computer mapping technologies, forest disturbance ecology and botany. Prior to joining Keeper in 1997, Mike worked for the Kenai National Wildlife Refuge, Alaska Maritime National Wildlife Refuge, and Olympic National Park. He current serves as a board member for the Kachemak Heritage Land Trust.

ATTACHMENTS
(one copy each)

GIS Map - Citizen-based Monitoring in Cook Inlet

Quality Assurance Project Plan – Citizen Environmental Monitoring Program

Quality Assurance Project Plan – Lower Kenai Peninsula Watershed Health Project

Volunteer Training Manual

Preliminary Water Quality Assessment of Lower Kenai Peninsula Salmon Streams

Technical Advisory Committee and Citizen Advisory Panel lists

Citizen-based Monitoring Support Services

Memoranda of Understanding
- Between Cook Inlet Keeper &
- Anchorage Waterways Council
- UAF's Alaska Cooperative Extension
- UAA's Environment and Natural Resources Institute

Draft Memorandum of Understanding
- Between Cook Inlet Keeper &
- Wasilla Soil and Water Conservation District

Draft Outline for Quality Assurance Management Plan

Letters of Support
- Anchorage Waterways Council
- Kenai Watershed Forum
- Ninilchik Traditional Council
- Native Village of Port Graham
- ADEC Watershed Management Quality Assurance Project Officer 1998
- ADEC Watershed Management Quality Assurance Project Officer 2000

Fall '97 Volunteer Monitoring Magazine Article: "Water Quality Monitoring in Native Alaskan Communities"

EVOS Trustees Council
Budget Form
October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$112.8						
Travel		$6.6						
Contractual		$16.1						
Commodities		$6.1						
Equipment		$15.5	LONG RANGE FUNDING REQUIREMENTS					
Subtotal		$157.1	Estimated FY 2002					
Indirect		$39.28						
Project Total		$196.4	$197.0					
Full-time Equivalents (FTE)		44.5						
	Dollar amounts are shown in thousands of dollars.							
Other Funds		$146.4						

Comments: Keeper's indirect cost is 25% of total direct costs and includes expenses such as rent, equipment repairs and maintenance, professional services, contribution expenses, dues and subscriptions, insurance, salary and benefits for accounting, fundraising and supervision, and other misc. indirect costs. Of the total direct costs, approximately 10% is for report writing, 5% for conferences and publications, 35% for community involvement, and the remaining percentage is for data collection and management, quality assurance oversight, etc. Cook Inlet Keeper's monitoring projects have been funded by EPA 319 money over the last two years, along with other sources to meet EPA's required 40% match. Keeper's other monitoring support has included grants from the Skaggs Foundation ($10,000), Norcross Wildlife Foundation ($10,000), River Network Watershed Assistance Grant ($20,000), Bullitt Foundation ($10,000), individuals and businesses (~$10,000) and fees for services for GIS Maps (~$5,000). Keeper anticipates a few more years of funding from EPA, including $110,000 in FY 01. Keeper will raise an additional $36,400 in other sources including grants, individuals, businesses, and fees for services. Because Keeper is moving into more of a monitoring service center role, EPA money is not covering all the bases. Therefore, Keeper is requesting $50,000 from EVOS for FY 01 to help cover its additional expenses as it continues to develop a model for citizen-based monitoring in Alaska. Keeper also hopes to approach EVOS in FY 02 for an additional $50,000 to help embrace its monitoring successes into a community-based watershed assessment prototype.

FY 01

Prepared:
12-Apr-00

Project Number: 01595
Project Title: A Prototype for Citizen-based Monitoring and Watershed Assessment
Agency: Cook Inlet Keeper

FORM 4A Non Trustee SUMMARY

EVOS Trustees Council
Budget Form
October 1, 2000 - September 30, 2001

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2001
J. Cooper	Research Coordinator (.96 FTE)		11.5	2.9		33.4
B. Lambert	Stream Ecologist (.97 FTE)		11.6	2.5		29.0
Will hire in July	K-Bay Monitoring Coordinator (1.0 FTE)		12.0	2.2		26.4
M. Gracz	GIS/Web Specialist (.85 FTE)		6.0	2.3		13.8
B. van Appel	Program Director (.28 FTE)		3.4	3.0		10.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		44.5	12.9	0.0	
					Personnel Total	$112.8

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 2001
6 RT Homer to Anchorage- J. Cooper to do quality assurance & trainings		0.17	6	10	0.05	1.5
4 RT Hom. to Anch. - B. Lambert & J. Cooper to attend conferences (EVOS)		0.17	4	8	0.05	1.1
1 RT Homer to Seldovia - J. Cooper to conduct training		0.05	1	3	0.05	0.2
1 RT Homer to Port Graham - J. Cooper to conduct training		0.07	1	3	0.05	0.2
1 RT Homer to Austin, Texas for National Volunteer Mon. Conf.		0.95	1	6	0.05	1.3
1 RT Homer to Minniapolis, MN for River Network Conf.		0.80	1	4	0.05	1.0
1 RT Homer to New York for Keeper Alliance Conf.		1.00	1	5	0.05	1.3
					Travel Total	$6.6

FY 01

Prepared:
12-Apr-00

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

FORM 4B
Personnel
& Travel
DETAIL

EVOS Trustees Council
Budget Form
October 1, 2000 - September 30, 2001

Contractual Costs:	Proposed
Description	FY 2001
Advertising for water quality monitoring workshops	0.3
Communications (phone, fax, email) with monitoring partners, TAC members, supply vendors, etc.	2.6
Postage and Delivery for supplies, documents, reports, etc.	0.9
Technical Services and independent lab analysis	5.3
Printing & Copying of reports, QAPPs, QAMP, volunteer training manuals, etc.	7.0
Contractual Total	$16.1

Commodities Costs:	Proposed
Description	FY 2001
Data Acquisition for GIS and reports	0.2
Supplies for volunteer appreciation event	1.4
Sampling supplies (chemicals, film, supplied for kits, etc.)	4.5
Commodities Total	$6.1

FY 01

Prepared:
12-Apr-00

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

FORM 4B
Contractual & Commodities DETAIL

EVOS Trustees Council
Budget Form
October 1, 2000 - September 30, 2001

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2001
New Computer to keep up with GIS mapping technologies	1	3.0	3.0
New GIS software	1	0.5	0.5
Sampling Equipment (monitoring kits, meters, etc.)	24	0.5	12.0
			0.0
			0.0
			0.0
			0.0
			0.0
Indicate replacement equipment with an R.		**New Equipment Total**	$15.5

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

FY 01

Prepared:
12-Apr-00

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

FORM 4B
Equipment
DETAIL

Evaluation of Yakataga Oil Seeps as Regional Background Hydrocarbon Sources in Benthic Sediments of the Exxon Valdez Spill Area

Project Number:	01599
Restoration Category:	Research and Monitoring
Proposer:	Jeffrey W. Short NMFS, Auke Bay Laboratory ABL Program Manager: Dr. Stan Rice NOAA Program Manager: Bruce Wright
Lead Trustee Agency:	NOAA
Cooperating Agencies:	U. S. Geological Survey Payne Environmental Consultants
Alaska Sea Life Center:	No
Duration:	1 year
Cost FY01:	$ 10,500 (closeout)
Geographic Area:	Gulf of Alaska
Injured Resource/Service:	Benthic Sediments

ABSTRACT

This project will evaluate fluxes of crude oil from terrestrial oil seeps and of particulate coal near Yakataga into the northern Gulf of Alaska to delineate the extent of "natural oil pollution" in the area affected by the Exxon Valdez oil spill.

INTRODUCTION

Scientists contracted by Exxon corporation have claimed that benthic coastal sediments of the northern Gulf of Alaska (GOA), including Prince William Sound (PWS), receive crude oil produced naturally by terrestrial oil seeps at Katalla and Yakataga. If true, this suggests that the marine biota of the EVOS spill area are adapted to oil pollution, thus promoting recovery of species exposed to toxic components of oil spilled from the T/V *Exxon Valdez*. Thus, fauna that show induction of cytochrome-P450 in the spill area may be responding to natural oil pollution and not to the spilled oil. A recent study by Trustee scientists casts considerable doubt on oil from Katalla as a candidate source of hydrocarbons in these sediments, hence sources near Cape Yakataga have been emphasized by the Exxon team. The study proposed here will compare hydrocarbon transport from oil seeps with coal deposits in drainages where oil seeps or particulate coal particles have been located in the Cape Yakataga area, to resolve the relative contributions from these two alternatives to benthic sediments offshore of these drainages in the GOA. Resolution of coal and sediment-bound oil will be achieved by physical separation, with less dense coal particles floated off from the more-dense inorganic fraction of sediments in a liquid of intermediate density.

NEED FOR THE PROJECT

A. Statement of Problem

Long-term toxic effects of the oil spilled by the T/V *Exxon Valdez* may be confounded by the presence of other sources of crude oil affecting the spill area. Oil seeps near Cape Yakataga continue to be promoted as significant alternative sources of crude oil in PWS. Coal from terrestrial source beds has also been verified as a hydrocarbon source. However, toxic hydrocarbons in coal are sequestered and not available biologically, consequently they are incapable of inducing molecular indicators of PAH exposure (i.e. cytochrome P450). If the terrestrial oil seeps near Cape Yakataga are shown to be negligible compared to coal beds there, then cytochrome P450 induction that continues to be observed in some non-recovered species within the spill area are more likely the result of exposure to residual oil spilled from the T/V *Exxon Valdez*.

B. Rationale

The criteria used to evaluate recovery of sediments and of biota that continue to show increased cytochrome P450 depends on the extent of background oil contamination in the affected area from sources other than the T/V *Exxon Valdez*. This project will provide much more precise criteria for these assessments. Oil from terrestrial seeps at Katalla and near Cape Yakataga was claimed to have associated with fine-grained sediments, flushed into the norther GOA, and then transported by the ACC into PWS where the sediments deposited in the calmer waters there. However, these studies ignored the possibility that terrestrial coal deposits could be a more dominant source in these areas. Although such coal deposits have been verified as dominant sources at Katalla, coal sources have not as yet been documented in the Cape Yakataga area. The

oil seeps at Cape Yakataga are the last remaining plausible alternative oil sources for the regional background hydrocarbon signature found inside PWS. If the contribution of hydrocarbons from these seeps is shown to be negligible in comparison with coal sources, then definitive criteria for recovery of benthic sediments inside PWS follows immediately, and the link between cytochrome P450 induction and exposure to residual *ExxonValdez* oil is made much stronger.

C. Location

The samples collected for this project will be taken from the coastal and terrestrial margin of the northern GOA between the Duktoth River drainage in the west to Icy Bay in the east. Several short coastal streams bisect the Sullivan syncline in this area and receive oil from seeps associated with the syncline. These samples will be analyzed in Juneau, AK, and in Menlo Park, CA. The benefits of the project will apply most directly to communities and to other Trustee projects in the spill area. The communities that may be directly affected include Cordova, Valdez, and Whittier.

COMMUNITY INVOLVEMENT

Communities will become informed about this project through radio and newspaper interviews responding to agency press releases, which will include communicate significant findings in non-technical language. The necessary vessel and aircraft charters will be advertized in Cordova and in Yakutat, the two communities closest to the study area, but cost will be the primary factor determining selection. Neither traditional nor local knowledge is expected to play a significant part in this project now.

PROJECT DESIGN

A. Objectives

This project has 1 objective:

1. Measure contributions of hydrocarbons from oil seeps and from terrestrial coal deposits to benthic marine sediments adjacent to the northern GOA margin from Icy Bay to the Duktoth River.

B. Methods

Water sampling will focus on 4 streams in the Cape Yakataga area, 2 of which receive oil from seeps and 2 of which do not. Three water samples will be collected from each of the two streams that receive seep oil. One 4 L water sample will be collected oil above the point of oil entry, another sample will be collected 100 m downstream of the oil-seep entry point into a stream, and a final sample will be collected just above tidal influence near the stream mouth on the GOA. Only 1 water sample will be collected from each of the streams that do not receive seep-oil.

Each water sample will be partitioned into a dissolved and particulate fraction as describe by Payne et al. (International Oil Spill Conference, 1999). Particulate material will be separated from each water sample, and then split into two subsamples. One subsample will be analyzed for PAH, and the other will be split again according to density in a high-density liquid to separate coal from inorganic rock, the density-separated samples will be analysed individually. This will permit estimation of the proportion of total PAH contributed by coal particles in the suspended particulates of these streams. The filtered water samples will also be analyzed for PAH to determine the dissolved PAH content.

Approximately 12 benthic GOA sediment samples and 5 PWS samples will be collected and analyzed for PAH to determine the extent of coal-contributed PAH to sediments across the GOA from Yakutat to PWS. Each of these sediment samples will be subjected to a high-density liquid to separate coal particles from the remainder of the sediment. Each fraction will be analyzed for alkane and polycyclic aromatic hydrocarbons (PAH; analysis at ABL), and for hydrocarbon biomarkers (analysis at USGS). These analytes will also be determined in the benthic sediment sample without brine separation to compare the hydrocarbon concentrations found in the separated samples with the original samples.

Analysis of sediment samples for PAH will follow methods described by Short et al. (American Fisheries Society Symposium 18, pp.140-148, 1996). Biomarker analysis is summarized by Carlson et al. (U.S. Geological Survey Open File Report 97-518, 1997).

By physically separating the coal particles from these sediments, the contribution estimate from this source will be quite unambiguous. Comparison of dissolved and particle-bound hydrocarbons in the water samples together with stream discharge estimates will further constrain contributions from oil seeps. Hydrocarbon pattern recognition will follow methods summarized by Short et al. (Environmental Science & Technology, Vol 33, pp. 34-42, 1999).

C. Contracts and Other Agency Assistance

The U.S. Geological Survey will cooperate with this project. Their participation is necessary because they have the expertise required to perform the brine density separations of the sediment samples, and the analysis of the samples for hydrocarbon biomarkers.

Collection and partitioning of the water samples will be contracted to Payne Environmental Consultants, who have developed the sample fractionation methodology to be used.

SCHEDULE

A. Measurable Project Tasks for FY01

FY01:

Sep 30 - Apr 15: Prepare final report and research paper reporting the results of this project

in a peer-reviewed journal.

B. Project Milestones and Endpoints

Complete final report and submit manuscript for publication in peer-reviewed journal by Apr 15, 2001.

C. Completion Date

April 15, 2001

PUBLICATIONS AND REPORTS

A final report will be produced by April 15, 2001. A manuscript will be submitted for publication in peer-reviewed journal by Apr 15, 2001.

PROFESSIONAL CONFERENCES

Results from this project will be presented at the Arctic Marine Oilspill Program sponsored by Environment Canada in June, 2001.

NORMAL AGENCY MANAGEMENT

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

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project will complete work funded under Trustee project 290 in previous years to identify and interpret hydrocarbon signals in the oil spill region.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

The sampling design was modified in response to new information presented in reports by Exxon-sponsored scientists in fall 1999.

PROPOSED PRINCIPAL INVESTIGATOR

Jeffrey W. Short

Auke Bay Laboratory, Alaska Fisheries Science Center
National Marine Fisheries Service, NOAA
11305 Glacier Highway, Juneau, Alaska 99801-8626
Phone: (907) 789-6065
FAX: (907) 789-6094
e-mail: jeff.short@noaa.gov

PRINCIPAL INVESTIGATORS

1. Jeffrey W. Short (Sediment sample collection; PAH analysis and interpretation)

Education: M.S. (Physical Chemistry)

Relevant Experience:
1989- Present: Established and managed the hydrocarbon analysis facility at ABL to analyze hydrocarbon samples generated by the *Exxon Valdez* NRDA effort (about 20% of these samples were analyzed at ABL).
1989 - 1992: Principal Investigator, Exxon Valdez project Air/Water #3: Determination of petroleum hydrocarbons in seawater by direct chemical analysis and through the use of caged mussels deployed along the path of the oil spill.
1991 - 1996: Principal Investigator, Exxon Valdez project Subtidal #8: Development of computer-based statistical methods for global examination of sediment and mussel hydrocarbon data produced for the Exxon Valdez NRDA effort for systematic bias, and for identification of probable sources of hydrocarbons.
1996 - present: Principal Investigator, Restoration Project 290, Database Management: Discovered particulate coal on beaches near Katalla is a major source of background PAH in marine sediments of the spill area.

2. Keith A. Kvenvolden (Sediment sample collection and partitioning; hydrocarbon biomarker analysis; biomarker and geochemistry interpretation)

Education : Ph. D. (Geology)

Relevant Experience:

Group Leader, Organic Geochemistry
Branch of Pacific Marine Geology
U. S. Geological Survey
Menlo Park, CA

Over 250 peer-reviewed scientific publications on hydrocarbons in the marine environment

3. James R. Payne (Water sample collection and partitioning, interpretation of aqueous hydrocarbon results)

Education: Ph. D (Chemistry)

Relevant Experience:

Author of 4 books and 27 peer-reviewed scientific publications on effects of water-borne hydrocarbon pollutants.

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001	PROPOSED FY 2000 TRUSTEE AGENCIES TOTALS ADEC	ADF&G	ADNR	USFS	DOI	NOAA
							$3.0	$7.5
Personnel	$24.9	$4.7						
Travel	$5.1	$1.4						
Contractual	$17.5	$2.5						
Commodities	$1.3	$1.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$48.8	$9.6			Estimated FY 2002			
General Administration	$5.0	$0.9						
Project Total	$53.8	$10.5			$0.0			
Full-time Equivalents (FTE)	0.3	0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$0.0				$0.0	$0.0		

Comments:

Total NOAA Contribution: 10.1K Jeff Short 1 mo @ 10K
Total DOI Contribution: 6.6

FY00

Prepared: 4/13/99

Project Number: 01599
Project Title: Evaluation of Yakataga Oil Seeps as Regional Back ground Hydrocarbon Sources in Benthic Sediments of EVOS Area
Lead Agency: National Oceanic & Atmospheric Administration

FORM 2A
MULTI-TRUSTEE
AGENCY
SUMMARY

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 2000	Proposed FY 2001
Personnel		$2.1
Travel		$1.4
Contractual		$2.5
Commodities		$1.0
Equipment		$0.0
Subtotal	$0.0	$7.0
General Administration		$0.5
Project Total	$0.0	$7.5
Full-time Equivalents (FTE)		0.0
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
		Estimated FY 2002			
		$0.0			

Dollar amounts are shown in thousands of dollars.

Comments:

FY00

Prepared: 4/13/99

Project Number: 01599
Project Title: Evaluation of Yakataga Oil Seeps as Regional Background Hydrocarbon Sources in Benthic Sediments of EVOS Area
Lead Agency: National Oceanic & Atmospheric Administration

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
Jeff Short	Research Chemist	13/6	0.2	10.4		2.1
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.2	10.4	0.0	
					Personnel Total	$2.1

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 2000
						0.0
AMOP conference		0.8	1	2	0.3	1.4
	in Calgary, Alberta					0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$1.4

FY00

Prepared: 4/13/99

Project Number: 01599
Project Title: Evaluation of Yakataga Oil Seeps as Regional Background Hydrocarbon Sources in Benthic Sediments of EVOS Area
Lead Agency: National Oceanic & Atmospheric Administration

FORM 3B
Personnel
& Travel
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Contractual Costs:		Proposed
Description		FY 2000
Payne Environmental Consultants		2.5
When a non-trustee organization is used, the form 4A is required.	**Contractual Total**	$2.5

Commodities Costs:		Proposed
Description		FY 2000
Page Charges for manuscript		1.0
	Commodities Total	$1.0

FY00

Prepared: 4/13/99

Project Number: 01599
Project Title: Evaluation of Yakataga Oil Seeps as Regional Background Hydrocarbon Sources in Benthic Sediments of EVOS Area
Lead Agency: National Oceanic & Atmospheric Administration

FORM 3B
Contractual & Commodities DETAIL

New Equipment Purchases:			
Description	Number of Units	Unit Price	Proposed FY 2000
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:		
Description	Number of Units	Inventory Agency

FY00

Prepared: 4/13/99

Project Number: 01599
Project Title: Evaluation of Yakataga Oil Seeps as Regional Background Hydrocarbon Sources in Benthic Sediments of EVOS Area
Lead Agency: National Oceanic & Atmospheric Administration

FORM 3B
Equipment
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Budget Category:	Authorized FY 1999	Proposed FY 2000
Personnel		$2.6
Travel		$0.0
Contractual		$0.0
Commodities		$0.0
Equipment		$0.0
Subtotal	$0.0	$2.6
General Administration		$0.4
Project Total	$0.0	$3.0
Full-time Equivalents (FTE)		0.0

LONG RANGE FUNDING REQUIREMENTS

		Estimated FY 2001	Estimated FY 2002		

Dollar amounts are shown in thousands of dollars.

Other Resources								

Comments:
USGS Contribution: K.Kvenvolden, Group Leader Chemist, .5 mo @ 13.2K for a total USGS contribution of 6.6

FY00

Prepared: 4/13/99

Project Number: 01599
Project Title: Evaluation of Yakataga Oil Seeps as Regional Background Hydrocarbon Sources in Benthic Sediments of EVOS Area
Agency: DOI- USGS

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000 - September 30, 2001

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
Name	Position Description					
Keith Kvenvolden	Group Leader, Organic Geochemistry	GS-14	0.2	13.2		2.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.2	13.2	0.0	
					Personnel Total	$2.6

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

FY00

Prepared: 4/13/99

Project Number: 01599
Project Title: Evaluation of Yakataga Oil Seeps as Regional Background Hydrocarbon Sources in Benthic Sediments of EVOS Area
Agency: DOI- USGS

FORM 3B
Personnel
& Travel
DETAIL

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

Commodities Costs:	Proposed FY 2000
Description	
Commodities Total	$0.0

FY00

Prepared: 4/13/99

Project Number: 01599
Project Title: Evaluation of Yakataga Oil Seeps as Regional Background Hydrocarbon Sources in Benthic Sediments of EVOS Area
Lead Agency: National Oceanic & Atmospheric Administration

FORM 3B
Contractual & Commodities DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY00

Prepared: 4/13/99

Project Number: C1599
Project Title: Evaluation of Yakataga Oil Seeps as Regional Background Hydrocarbon Sources in Benthic Sediments of EVOS Area
Agency: DOI- USGS

FORM 3B
Equipment
DETAIL

Kodiak Archipelago Youth Area Watch

Project Number:	01610
Restoration Category:	General Restoration
Proposer:	Chugach Regional Resources Commission
Lead Trustee Agency:	ADFG
Cooperating Agency:	Kodiak Island Borough School District
Alaska SeaLife Center:	Yes
Duration:	2nd year, 3-year project
Cost FY 00:	$104.7
Cost FY 01:	$105.0
Cost FY 02:	$105.0
Geographic Area:	Kodiak Archipelago
Injured Resources/Services:	Harbor seals, sub-tidal and inter-tidal communities, subsistence, and commercial fishing

ABSTRACT

In FY 99, Chugach Regional Resources Commission collaborated with the Kodiak Island Borough School District to institute an internship program within the Community Involvement Project. This internship program chose one student in the communities of Akhiok, Larsen Bay, Old Harbor, Port Lions, Kodiak and Karluk. In FY00 this project was expanded to include a Youth Area Watch Program. The program has collaborated with four research projects in FY00, including EVOS-sponsored 00482, PSP Field Testing Kit; EVOS-sponsored 00245, Harbor Seal Bio-Sampling; intensive monitoring with the Fisheries Industrial Technology Center and National Oceanic and Atmospheric Administration; and finally an algae testing project with Dr. Gerry Plumley.

Project plans for FY01 include the expansion of two additional communities to the program, Chiniak and Port Lions, site teacher training in collaboration with the Kodiak College, the construction of a web site for students, teachers, administrators, and project scientists to collaborate, share, and coordinate projects, as well as post data; additional equipment for monitoring activities; and participation by students, teachers, scientists in the annual Science Camp held at Afognak.

All these steps will continue the project in the direction of student oceanographic monitoring in collaboration with the Fisheries Industrial Technology Center, continued beach monitoring for PSP and algal blooms, harbor seal bio-sampling, and hands-on training for a select number of students within the Kodiak Island Borough School District with western scientific knowledge and traditional ecological ways of knowing. A project with the National Marine Fisheries Service to investigate stomach contents of halibut to determine the population and prevalence of sandlance and capelin may possibly be integrated as well.

INTRODUCTION

The Youth Area Watch program instituted in the Prince William Sound and lower Cook Inlet has been one of the most popular and supported projects that the Trustee Council has implemented. The spill area does not strictly include only those areas though, but instead encompasses Kodiak Island and the Alaska Peninsula. In FY00, the Kodiak Island Borough School District and Chugach Regional Resources Commission were successful with implementing four core research projects, two of which were funded by the Trustee Council. These project included 1) 00482, Field-Testing of PSP Test Kits for Subsistence Use; 2) 00245, Harbor Seal Biosampling, will train and involve Kodiak Island Youth Area Watch participants in the program. They will be trained in how to conduct a biosample, where to ship the sample, and what the uses of the seal are for research: 3) Dr. Gerry Plumley, University of Alaska-Fairbanks, received funding from the Alaska Science and Technology Foundation to test algae for a possible connection to the infection of PSP to shellfish. He has involved Youth Area Watch participants in FY00 and will continue to utilize them in FY01; and 4) the Fisheries Industrial Technology Center and National Oceanic and Atmospheric Administration have been working closely with the program to develop and implement a long-term, consistent monitoring program that will focus on salinity, water temperature, and a host of other oceanographic indicators. Comprehensive monitoring kits were purchased for use in each of the participating communities by local participants.

In FY01, we are proposing to continue the efforts began the first year of this program. Dr. Gerry Plumley will continue to work with the program to monitor algal blooms at the various sites around the island, assessing a connection with algal blooms and the prevalence of PSP in shellfish. The Alaska Native Harbor Seal Commission, through 01245, Harbor Seal Bio-sampling, will continue to support the program through bio-sample training in various communities throughout the region. The Fisheries Industrial Technology Center and National Oceanic and Atmospheric Administration will continue to collaborate with the project and students to collect oceanographic monitoring data. This information will be used to assist the Trustee Council with the Gulf Ecosystem Monitoring Plan. Data collected through this program will fill a hole of oceanographic information that will be necessary for the formation of a 100-year data set. Continued work with 01482, Field-Testing of PSP Test Kits for Subsistence Use, will be achieved in FY01 regarding beach monitoring and chronic PSP site identification. Possible work with the National Marine Fisheries Service regarding the analysis of halibut stomach

contents to determine the presence and abundance of sandlance and capelin is being developed as well.

In addition, students will select a local project to conduct. Connections to traditional knowledge, and integrating TEK data into a format traditionally used in western science will be developed and coordinated with the Alaska Knowledge Science Initiative, funded by the Alaska Federation of Natives. Teri Schneider, Cultural Coordinator at the Kodiak Island School District, is very interested in pursuing this integration. It is an option to implement their own small-scale research. These projects would be presented at the January 2001 Restoration Workshop.

NEED FOR PROJECT

A. Statement of Problem

Kodiak Island Youth Area Watch would share much of the same values and objectives as the original Youth Area Watch. The commitment would be to assist in the restoration of the spill area through the collection and requisite samples and data for principal investigators of research projects. Research dollars are often scarce – the assistance of labor through this project to the four core projects would be an invaluable asset to the overall restoration effort.

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

B. Rationale/Link to Restoration

The Kodiak Island Youth Area Watch will work in primarily three areas. First, harbor seals disastrously affected by the oil spill are being studied under 00245. YAW participants would assist in this recovery effort of the Alaska Native Harbor Seal Commission and Trustee Council. Secondly, the enhancement of safe shellfish to eat would benefit the use of subsistence greatly; consequently, assisting in the recovery of the subsistence service by providing a replacement subsistence resource for harvesters. The field test and algae project both will assist in making shellfish safer for everyone. Finally, the Fisheries Technology Center and the National Oceanic and Atmospheric Administration have ongoing oceanographic monitoring. The eagerness of these organizations has been established by their commitment to establishing the current monitoring data for the long-term collected by YAW students.

The public/youth involvement through this project in the restoration process will assist the Trustee Council in their mission to inform and involve the public regarding the restoration program.

C. Location

Kodiak Island Youth Area Watch will take place in the Kodiak Island communities of Akhiok, Old Harbor, Larsen Bay, Port Lions, Ouzinkie, Chiniak, and Kodiak. Site teachers will be continually trained through the school district and Teri Schneider will serve as the coordinator for the program for the school district. Hugh Short and Elmer Moonin will work with the school district and provide outreach to tribal councils throughout Kodiak Island, utilizing the Community Involvement and GEM Planning Project. Additionally, TEK will be integrated into the program with the assistance of TEK Specialist, Dr. Henry Huntington.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

In addition to assisting in research, community involvement and the utilization of traditional ecological knowledge are at the heart of this program. Tribal councils, schools, communities, regional organizations, and researchers will all be collaborating to ensure that this project is a success. CRRC will work closely to ensure that each of the tribal councils where there is YAW participants will have a voice in the research and curriculum of the program. Traditional ecological knowledge will be integrated into the projects that student's design and collaborating researchers will be encouraged to utilize TEK on their particular projects.

PROJECT DESIGN

A. Objectives

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

1. Research project personnel interact with students, communities, and staff.
2. Identify all research and data collection activities.
3. Orient researchers on working with students.
4. Conduct research with the four projects.
5. Update MOA between CRRC and KIBSD.
6. Purchase additional monitoring equipment for expansion of area-wide monitoring.
7. Complete site teacher training and training with the Kodiak College regarding science monitoring and research.
8. Conduct school orientations for student in YAW.
9. Set up Kodiak Archipelago Youth Area Watch web site to store data, stay informed regarding all activities, and coordinate efforts of staff, students, researchers, and community members.
10. Involve students in the annual Science Camp to be held in June of 2001. This camp will allow students to present their work to the other participants, educating and enlarging the support and momentum of the project. The Science Camp will be an opportunity for youth to recap that activities of the year and plan for the coming year.

11. Complete student project training with tribal council and site teacher.
12. Facilitate project follow-up training with site teachers.

METHODS

CRRC will update the current sub-contract with the Kodiak Island Borough School District. Agreements will be re-issued with tribal councils throughout the island to ensure their meaningful involvement in the project. Researchers involved will sign contracts to ensure their follow-through of involving the youth in their projects.

Teri Schneider, Cultural Coordinator with the Kodiak Island Borough School District, and Elmer Moonin with CRRC, will work cooperatively to plan the involvement and logistics of youth and researchers field work. Additionally, training will take place with all involved parties to ensure that this project will work for everyone.

We have selected methods to choose students based on academic standing, personal interest, and potential for improvement. Up to 16 students will be selected in the second year of the project. While distribution may vary according to interest and ability of students that apply, it is expected that the distribution will be as follows: three from Kodiak, two from Old Harbor, two from Larsen Bay, two from Port Lions, two from Ouzinkie, two from Chiniak, and two from Akhiok.

Prior to the school year in the fall, participating YAW teachers will congregate in Kodiak to conduct a two-day training on what the program will encompass. We will ask that researchers attend as well. Since funding will not yet be available, CRRC will front the cost of this training. Protocols from principal investigators and program details will be discussed. In addition to the site teachers, we will invite tribal council representatives.

All of the coordinating projects, field test PSP kit, algae testing, and biosampling, and oceanographic monitoring will take place geographically close to the participant's communities. It will be the responsibility of the site teacher and participants to determine field schedules. Harbor seal biosampling will require two training sessions and coordination with local seal harvesters. The oceanographic monitoring project will require coordinated efforts on contracted vessels and such. This will be negotiated between the Fish Tech Center and CRRC. Schedules will be determined when appropriate. Quarterly, students and support staff will congregate in Kodiak for a day to discuss progress and evaluate the program. Training will be on going and project objectives will be met.

Ongoing projects will include:

1) PSP Field Testing, 01482 – Jellet Biotek – Dr. Jellet and Dr. Roberts are selecting sites throughout the spill area to field test their PSP testing kit to be used in place of the existing mouse bioassay. Students in the program will continue to do beach monitoring to determine patterns, high-risk beaches, and precautions to consider

when harvesting shellfish. Also, information collected may be used to develop local aquaculture programs that would supply jobs and boost the economy in the villages.

2) Harbor Seal Biosampling, 01245 – Alaska Native Harbor Seal Commission – YAW will work with local harvesters involved in the program to biosample harbor seals caught for subsistence purposes. Mitch Simeonoff, Akhiok, will work with CRRC and the school district to train and involve students.
3) Algal PSP Testing – Dr. Gerry Plumley – University of Alaska Fairbanks – Dr. Plumley will train students in how to test algae in their area for algal PSP infection. This project will provide data to Dr. Plumley regarding where PSP originates.
4) Fisheries Technical Center and National Oceanographic and Atmospheric Administration - This will involve utilizing the monitoring kits we have acquired in establishing and continuing a long-term oceanographic monitoring program. Indicators to be monitored will include ocean temperature, salinity, tides, and other information as it pertains to the project.

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

The participation of the students in the annual Science Camp will be an additional component of this year's program. The annual Science Camp is an opportunity for students from across the Island to learn about science basics, how traditional ways of knowing is incorporated into western science, natural science phenomena's around the island, and present information on particular projects they have been involved in the previous year. In kind funds of $75,000 will be put toward this camp from the Alaska Federation of Natives, as well as $20,000 from the Kodiak Area Native Association. We are asking for $15,000 from the Trustee Council for this portion of the project.

The development of a web site that will be integrated into the Kodiak Island Borough School District will be developed as well. The Kodiak School District's Information Technology Department will work with project staff to construct the site. The formation of this web site is seen as a necessary step to bring the program to a new level of communication, coordination, and information transfer. Intended uses will be to post oceanographic data, PSP and algae data and results, stomach content information, and harbor seal bio-sample information. The tangible-ness of a web site is necessary to keep the youth interested in the nuts and bolts of the program and is seen by all involved as a must have step.

School credit for the youth involvement in this project will be strongly encouraged. We anticipate allowing credit to those who participate for the whole length of the project. This will encourage more participation and give credibility to the project among site teachers and students who are thinking about applying to the project. This project is popular and receives island-wide attention for the tremendous efforts it has accomplished.

COOPERATING AGENCIES

The Chugach Regional Resources Commission will serve as the administering agency for this project and work closely with the Kodiak Island Borough School District to implement the project. CRRC has a positive history with the Alaska Department of Fish and Game and expects to continue that partnership through this project. We will update our current contract with the school district to reflect the new changes to the program and work to coordinate and collaborate on the successful implementation of the project.

CRRC has a history working with tribal councils on Kodiak Island additionally. We implemented and completed the Subsistence Service Assessment with tribal councils on Kodiak Island, hiring many employees directly. We have a strong partnership with the Community Involvement and GEM Planning Project and have demonstrated a commitment to involving all Alaska Native Tribes and organizations in the restoration process.

Partnerships with the Fisheries Industrial Technology Center and the National Oceanographic and Atmospheric Administration will continue to perpetuate the ocean monitoring component of the project.

SCHEDULE

A. Measurable Project Tasks for FY 00

July 1, 2000 – August 1, 2000	Confirm research and data collection activities
August 15-16, 2000	Site teacher, tribal, and researcher orientation
August 17-18, 2000	Site teacher training with Kodiak College
September 1 – 18, 2000	School site orientations
September 15 – 30, 2000	Students selected
October 15 – 31, 2000	Student orientation and training
October 1 – November 15, 2000	Web site development
November 1, 2000 – July 30, 2001	Students participate in research activities
March 1, 20001	Site teachers send data to project PI
March 1 – 15, 2001	Site teacher follow-up training
June 2001	Project Coordinator sends data to PI
June 2001	Students participate in Science Camp
June 2001	Students complete FY 00 projects

On-going activities

October 2000 to July 2001	Students collect shellfish samples for field test
October 2000 to July 2001	Students analyze algae
October 2000 to July 2001	Students conduct harbor seal biosamples
October 2000 to July 2001	Students conduct their local research project

October 2000 to July 2001	PI interact and share information with students

B. Project Milestones and Endpoints

October 17, 2000	Students selected
October 30, 2000	Protocol training complete
November 1, 2000	Students conduct project activities
March 1, 2001	Data/samples to PI
June 1, 2001	Data/samples to PI and reports complete

D. Completion Date

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

PUBLICATIONS AND REPORTS

No specific publications are planned at this point.

PROFESSIONAL CONFERENCES

Youth will participate in the Restoration Workshop in January 2001.

NORMAL AGENCY MANAGEMENT

Not applicable.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project will work closely with the Community Involvement and GEM Planning Project (01052) and the Harbor Seal Biosampling Project (01245). If funded, this project will work closely with PSP Field Testing (01482).

PROPOSED PRINCIPAL INVESTIGATOR

Patty Brown-Schwalenberg
Executive Director
Chugach Regional Resources Commission
4201 Tudor Centre Dr., Ste. 300
Anchorage, AK 99508
(907) 562-6647
fax: 562-4939
crrcomm@alaska.net

PRINCIPAL INVESTIGATOR

Patty Brown-Schwalenberg is the Executive Director of Chugach Regional Resources Commission. She maintains all management and administrative authority over CRRC programs and projects. She has extensive experience in project administration, tribal relations, and managing budgets. Ms. Schwalenberg will be responsible for all expenditures, contracts, and project management.

OTHER KEY PERSONNEL

Elmer Moonin is the Office Assistant with Chugach Regional Resources Commission.

Teri Schneider is the Cultural Coordinator with the Kodiak Island Borough School District.

Hugh Short is the Community Involvement Coordinator for the Chugach Regional Resources Commission.

All three have experience in outreach, education, and project coordination.

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000- September 30, 2001

Budget Category:	Authorized FY 1999	Proposed FY 2000
Personnel		$0.0
Travel		$0.0
Contractual		$98.8
Commodities		$0.0
Equipment		$0.0
Subtotal	$0.0	$98.8
General Administration		$5.9
Project Total	$0.0	$104.7
Full-time Equivalents (FTE)		0.0
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
		Estimated FY 2001	Estimated FY 2002		
		$105.0	$105.0		

Dollar amounts are shown in thousands of dollars.

Comments:

FY01

Prepared: 4-14-00

Project Number: 01610
Project Title: Kodiak Archipelago Youth Area Watch
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.0		0.0	
					Personnel Total	$0.0

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

FY01

Prepared: 4-14-00

Project Number: 01610
Project Title: Kodiak Archipelago Youth Area Watch
Agency: Alaska Department of Fish and Game

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed
Description	FY 2000
Contract with Chugach Regional Resources Commission	98.8
	0.0
	0.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$98.8

Commodities Costs:	Proposed
Description	FY 2000
Commodities Total	$0.0

FY01

Prepared: 4-14-00

Project Number: 01610
Project Title: Kodiak Archipelago Youth Area Watch
Agency: Alaska Department of Fish and Game

FORM 3B
Contractual & Commodities
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL 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
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.			**New Equipment Total**	$0.0

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency

FY01

Prepared: 4-14-00

Project Number: 01610
Project Title: Kodiak Archipelago Youth Area Watch
Agency: Alaska Department of Fish and Game

FORM 3B
Equipment
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000- September 30, 2001

Budget Category:	Authorized FY 1999	Proposed FY 2000
Personnel		$2.5
Travel		$25.4
Contractual		$61.9
Commodities		$0.0
Equipment		$0.0
Subtotal	$0.0	$89.8
Indirect		$9.0
Project Total	$0.0	$98.8
Full-time Equivalents (FTE)		1.0

LONG RANGE FUNDING REQUIREMENTS					
		Estimated FY 2001	Estimated FY 2002		
		$98.8	$100.0		

Dollar amounts are shown in thousands of dollars.

Other Resources								

Comments:

FY01

Prepared: 4-14-00

Project Number: 01610
Project Title: Kodiak Archipelago Youth Area Watch
Name: Chugach Regional Resources Commission

FORM 4A
Non-Trustee
SUMMARY

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

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2000
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	0.0	0.0	0.0	
					Personnel Total	$0.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2000
	Village - Kodiak - Anchorage (Restoration Workshop) 6 communities	0.5	16	45	0.0	8.0
	Kodiak - Akhiok	0.2	3	3	0.1	0.9
	Kodiak - Old Harbor	0.2	3	3	0.1	0.9
	Kodiak - Ouzinkie	0.2	3	3	0.1	0.9
	Kodiak - Larsen Bay	0.2	3	3	0.1	0.9
	Kodiak - Port Lions	0.2	3	3	0.1	0.9
	Kodiak - Karluk	0.2	3	3	0.1	0.9
	Anchorage - Kodiak	0.4	4	8	0.1	2.4
	Science Camp Trip	0.3	16			4.8
	Coordination travel Kodiak to villages	0.2	12	24	0.1	4.8
						0.0
						0.0
					Travel Total	$25.4

FY01

Prepared: 4-14-00

Project Number: 01610
Project Title: Kodiak Archipelago Youth Area Watch
Name: Chugach Regional Resources Commission

FORM 4B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed
Description	FY 2000
Contract with Kodiak Island Borough School District to provide services below 1 coordinator staff - Teri Schneider at $30.0 personal equipment at $5000 (16 X $300) school district technology support (web site) $10.0 contract with vessel or project participation costs (e.g. training or equipment) at $3.5 teacher training at Kodiak College at $4.0 (10 x $400) Science Camp materials at $9.4	61.9
Contractual Total	$52.5

Commodities Costs:	Proposed
Description	FY 2000
Commodities Total	$0.0

FY01

Prepared: 4-14-00

Project Number: 01610
Project Title: Kodiak Archipelago Youth Area Watch
Name: Chugach Regional Resources Commission

FORM 4B
Contractual & Commodities DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		New Equipment Total	$0.0

Existing Equipment Usage: Description	Number of Units	

FY01

Prepared: 4-14-00

Project Number: 01610
Project Title: Kodiak Archipelago Youth Area Watch
Name: Chugach Regional Resources Commission

FORM 4B
Equipment
DETAIL

Alaska Peninsula Youth Area Watch

Project Number:	01611
Restoration Category:	General Restoration
Proposer:	Chignik Lake Village Council
Lead Trustee Agency:	ADFG
Cooperating Agency:	Lake and Peninsula Borough
Alaska SeaLife Center:	Yes
Duration:	1st year, 2-year project
Cost FY 01:	$81.4
Cost FY 02:	$85.0
Geographic Area:	Alaska Peninsula
Injured Resources/Services:	Harbor seals, sub-tidal and inter-tidal communities, subsistence, and commercial fishing

RECEIVED
APR 14 2000
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

ABSTRACT

The Chugach and Kodiak Island Youth Area Watch programs have been developed over the past five years within the oil spill region. These worthwhile projects have increased the interest of youth and enhanced the ability of the Trustee Council to conduct low-cost monitoring and research. It is in the interest of the Alaska Peninsula oil spill affected communities to bring this program to the region. We are proposing the incorporation of the Youth Area Watch program to include two major components: 1) Greg Ruggerone of the Fishing Research Institute conducts monitoring projects in the Chignik Lake and Black Lake areas on an annual basis. We would like to incorporate the participation of youth from Chignik Lake, Chignik Lagoon, Chignik Bay, Perryville, and Ivanoff Bay in his program; 2) The Alaska Department of Fish and Game conducts a weir site near the mouth of the Chignik River between the Lagoon and Lake. We would propose to involve youth from the region in this annual initiative.

The knowledge gained from each of these projects could enhance their ability to provide consistent and concise monitoring and research for the benefit of youth, injured species, and resource users.

In addition to these projects, we would like to enter into a oceanographic and climatical monitoring program in cooperation with such programs as the GLOBE program, or involvement with the Kodiak Archipelago oceanographic monitoring project.

INTRODUCTION

The Youth Area Watch program instituted in the Prince William Sound and lower Cook Inlet has been one of the most popular and supported projects that the Trustee Council has implemented. The spill area does not strictly include only those areas though, but instead encompasses Kodiak Island and the Alaska Peninsula. The villages on Kodiak Island have all seen results from this Youth Area Watch. It is with this in mind that we strive to bring the program to the communities of the Alaska Peninsula spill area.

Children in high school will be selected to participate depending on their scholastic skills, interest in science, and ability to commit to the project. This project will encourage youth, primarily Alaska Natives, to participate in the sciences and possibly go on to pursue careers in the science field. It will be a coordinated effort between the school district, Tribal Councils, and the Lake and Peninsula Borough.

Two research projects we are proposing for the incorporation of the Youth Area Watch program to include: 1) Greg Ruggerone of the Fishing Research Institute conducts monitoring projects in the Chignik Lake and Black Lake areas on an annual basis. We would like to incorporate the participation of youth from Chignik Lake, Chignik Lagoon, Chignik Bay, Perryville, and Ivanoff Bay in his program; 2) The Alaska Department of Fish and Game conducts a weir site near the mouth of the Chignik River between the Lagoon and Lake. We would propose to involve youth from the region in this annual initiative; and 3) The Alaska Native Harbor Seal Commission conducts bio-samples villages in our region. We would train our youth to conduct the bio-samples on seals caught by our hunters.

In addition to these projects, we would like to enter into a oceanographic and climatical monitoring program in cooperation with such programs as the GLOBE program, or involvement with the Kodiak Archipelago oceanographic monitoring project. Students will also select a local project to conduct. Possible connections to traditional knowledge, and integrating TEK data into a format traditionally used in western science are an option.

NEED FOR PROJECT

A. Statement of Problem

The Alaska Peninsula Youth Area Watch would share much of the same values and objectives of that as the original Youth Area Watch. The commitment would be to assist in the restoration of the spill area through the collection and requisite samples and data for principal investigators of research projects. Research dollars are often scarce – the assistance of labor through this project to the four core projects would be an invaluable asset to the overall restoration effort.

The public aspect of this would also be invaluable to the Trustee Council. Youth involved in science, especially Alaska Natives, has been difficult to achieve in many cases. This project give students hands-on experience and an avenue to achieve goals

that may before have seemed impossible. Youth Area Watch has received tremendous support throughout the spill area and beyond and the benefits of this project are felt in many different arenas. The Trustee Council would be supporting a win-win situation by funding this project.

B. Rationale/Link to Restoration

The Alaska Peninsula Youth Area Watch will work in primarily two areas. First, harbor seals disastrously affected by the oil spill are being studied under 00245. YAW participants would assist in this recovery effort of the Alaska Native Harbor Seal Commission and Trustee Council. Secondly, Greg Ruggerone of the Fishing Research Institute conducts monitoring projects in the Chignik Lake and Black Lake areas on an annual basis. We would like to incorporate the participation of youth from Chignik Lake, Chignik Lagoon, Chignik Bay, Perryville, and Ivanoff Bay in his program. Finally, the Alaska Department of Fish and Game conducts a weir site near the mouth of the Chignik River between the Lagoon and Lake. We would propose to involve youth from the region in this annual initiative.

The public/youth involvement through this project in the restoration process will assist the Trustee Council in their mission to inform and involve the public regarding the restoration program.

C. Location

Kodiak Island Youth Area Watch will take place in the Alaska Peninsula communities of Chignik Lake, Chignik Lagoon, Chignik Bay, Perryville, and Ivanoff Bay. .

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

In addition to assisting in research, community involvement and the utilization of traditional ecological knowledge are at the heart of this program. Tribal councils, schools, communities, regional organizations, and researchers will all be collaborating to ensure that this project is a success. The Chignik Lake Village Council will work closely to ensure that each of the tribal councils where there is YAW participants will have a voice in the research and curriculum of the program. Traditional ecological knowledge will be integrated into the projects that student's design and collaborating researchers will be encouraged to utilize TEK on their particular projects.

PROJECT DESIGN

A. Objectives

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

1. Research project personnel interact with students, communities, and staff.
2. Identify all research and data collection activities.
3. Orient researchers on working with students.
4. Conduct research with the four projects.

5. Create MOU between Chignik Lake Village Council, Lake and Peninsula Borough School District and Borough..
6. Complete site teacher training.
7. Conduct school orientations for student in YAW.
8. Complete student project training with tribal council and site teacher.
9. Facilitate project follow-up training with site teachers.

METHODS

Chignik Lake will create a sub-contract with the Lake and Peninsula Borough School District. Agreements will be made with tribal councils throughout the region to ensure their meaningful involvement in the project. Researchers involved will sign contracts to ensure their follow-through of involving the youth in their projects.

Virginia Aleck, Community Facilitator, will work cooperatively with the School District to plan the involvement and logistics of youth and researchers field work. Additionally, training will take place with all involved parties to ensure that this project will work for everyone.

We will utilize the Chugach School Districts developed tool for selecting applicants for the program. Up to 13 students will be selected in the first year of the project. While distribution may vary according to interest and ability of students that apply, it is expected that the distribution will be as follows: two from Chignik Lake, two from Chignik Lagoon, two from Chignik Bay, one from Ivanoff Bay, and two from Perryville.

Prior to the school year in the fall, participating YAW teachers will congregate in King Salmon to conduct a two-day training on what the program will encompass. We will ask that those researchers who are available to attend as well. Protocols from principal investigators and program details will be discussed. In addition to the site teachers, we will invite tribal council representatives.

All of the coordinating projects will take place geographically close to the participant's communities. It will be the responsibility of the site teacher and participants to determine field schedules. Harbor seal biosampling will require two training sessions and coordination with local seal harvesters. Quarterly, students and support staff will congregate in one of the villages for a day to discuss progress and evaluate the program. Training will be on going and project objectives will be met.

Ongoing projects will include:

1) Greg Ruggerone of the Fishing Research Institute conducts monitoring projects in the Chignik Lake and Black Lake areas on an annual basis. We would like to incorporate the participation of youth from Chignik Lake, Chignik Lagoon, Chignik Bay, Perryville, and Ivanoff Bay in his program
2) Harbor Seal Biosampling, 00245 – Alaska Native Harbor Seal Commission – YAW will work with local harvesters involved in the program to biosample harbor seals caught for subsistence purposes.

3) The Alaska Department of Fish and Game conducts a weir site near the mouth of the Chignik River between the Lagoon and Lake. We would propose to involve youth from the region in this annual initiative.

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

School credit for the youth involvement in this project will be strongly sought after. We anticipate allowing credit to those who participate for the whole length of the project. This will encourage more participation and give credibility to the project among site teachers and students who are thinking about apply to the project. It is anticipated that this project will be strongly popular and receive region-wide attention for the tremendous efforts it will accomplish.

COOPERATING AGENCIES

The Lake and Peninsula Borough will serve as the administering agency for this project and work closely with the School District and the Chignik Lake Village Council to implement the project.

SCHEDULE

A. Measurable Project Tasks for FY 0

July 1, 2000 – August 1, 2000	Confirm research and data collection activities
August 15-16, 2000	Site teacher, tribal, and researcher orientation
September 1 – 18, 2000	School site orientations
September 15 – 30, 2000	Students selected
October 15 – 31, 2000	Student orientation and training
November 1, 2000 – July 30, 2001	Students participate in research activities
March 1, 20001	Site teachers send data to project PI
March 1 – 15, 2001	Site teacher follow-up training
June 2001	Project Coordinator sends data to PI
June 2001	Students complete FY 00 projects

On-going activities

October 2000 to July 2001	Students collect shellfish samples for field test
October 2000 to July 2001	Students analyze algae
October 2000 to July 2001	Students conduct harbor seal biosamples
October 2000 to July 2001	Students conduct their local research project
October 2000 to October 2001	PI interact and share information with students

B. Project Milestones and Endpoints

October 17, 2000	Students selected
October 30, 2000	Protocol training complete
November 1, 2000	Students conduct project activities
March 1, 20001	Data/samples to PI
June 1, 2001	Data/samples to PI and reports complete

D. Completion Date

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

PUBLICATIONS AND REPORTS
No specific publications are planned at this point.

PROFESSIONAL CONFERENCES
Youth will participate in the Restoration Workshop in January 2001.

NORMAL AGENCY MANAGEMENT
Not applicable.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT
This project will work closely with the Harbor Seal Biosampling Project (01245).

PROPOSED PRINCIPAL INVESTIGATOR
Johnny Lind
President
Chignik Lake Village Council
P.O. Box 18
Chignik Lake, AK 99584
(907) 845-2233
fax: same

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000- September 30, 2001

Budget Category:	Authorized FY 1999	Proposed FY 2000	LONG RANGE FUNDING REQUIREMENTS					
Personnel		$0.0						
Travel		$0.0						
Contractual		$76.8						
Commodities		$0.0						
Equipment		$0.0						
Subtotal	$0.0	$76.8			Estimated 2002	Estimated 2003		
General Administration		$4.6						
Project Total	$0.0	$81.4			$81.4	$85.0		
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY01

Prepared: 4-14-00

Project Number: 01611
Project Title: Alaska Peninsula Youth Area Watch
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000- September 30, 2001

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.0		0.0	
					Personnel Total	$0.0

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

FY01

Prepared: 4-14-00

Project Number:
Project Title: Alaska Peninsula Youth Area Watch
Agency: Alaska Department of Fish and Game

FORM 3B
Personnel
& Travel
DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000- September 30, 2001

Contractual Costs:	Proposed
Description	FY 2000
Contract with Chugach Regional Resources Commission	98.8
	0.0
	0.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$98.8

Commodities Costs:	Proposed
Description	FY 2000
Commodities Total	$0.0

FY01

Prepared: 4-14-00

Project Number:
Project Title: Alaska Peninsula Youth Area Watch
Agency: Alaska Department of Fish and Game

FORM 3B
Contractual & Commodities DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000- September 30, 2001

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 2000
Description			
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number of Units	Inventory Agency
Description		

FY01

Prepared: 4-14-00

Project Number:
Project Title: Alaska Peninsula Youth Area Watch
Agency: Alaska Department of Fish and Game

FORM 3B
Equipment
DETAIL

2001 EXXON VALDEZ TRU[illegible]E COUNCIL PROJECT BUDGET

October 1, 2000- September 30, 2001

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$15.0						
Travel		$19.8						
Contractual		$15.0						
Commodities		$5.0						
Equipment		$15.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$69.8			Estimated 2002	Estimated FY 2002		
Indirect		$7.0						
Project Total	$0.0	$76.8			$80.0	$80.0		
Full-time Equivalents (FTE)		1.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY01

Prepared: 4-14-00

Project Number:
Project Title: Alaska Peninsula Youth Area Watch
Name: Chignik Lake Village Council

FORM 4A
Non-Trustee
SUMMARY

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000- September 30, 2001

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2000
	Virginia Aleck	Coordinator	4.0	3750.0		15.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	4.0	3750.0	0.0	
					Personnel Total	$15.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2000
	Alaska Peninsula to Anchorage (Restoration Workshop)	0.8	11	44	0.1	13.2
	Training in King Salmon	0.3	7	21	0.1	4.2
	Travel among villages for students, site coordinators, and staff	0.2	12	0	0.1	2.4
		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	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
						0.0
						0.0
					Travel Total	$19.8

FY01

Project Number:
Project Title: Alaska Peninsula Youth Area Watch
Name: Chignik Lake Village Council

FORM 4B
Personnel
& Travel
DETAIL

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

Prepared: 4-14-00

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000- September 30, 2001

Contractual Costs:	Proposed
Description	FY 2000
Contract researchers for support services	15.0
Contractual Total	$15.0

Commodities Costs:	Proposed
Description	FY 2000
Supplies for meetings and projects	5.0
Commodities Total	$5.0

FY01

Prepared: 4-14-00

Project Number:
Project Title: Alaska Peninsula Youth Area Watch
Name: Chignik Lake Village Council

FORM 4B
Contractual & Commodities DETAIL

2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2000- September 30, 2001

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 2000
Monitoring equipment for use by students and site coordinators			15.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$15.0

Existing Equipment Usage:	Number	
Description	of Units	

FY01

Prepared: 4-14-00

Project Number:
Project Title: Alaska Peninsula Youth Area Watch
Name: Chignik Lake Village Council

FORM 4B
Equipment
DETAIL

Project Title:	**Sound Waste Management Plan: Boat Harbor Sewage System Phase**
Project Number:	01616
Restoration Category:	General Restoration
Proposer:	Prince William Sound Economic Development Council
Lead Trustee Agency:	ADEC
Cooperating Agencies:	ADF&G
Alaska SeaLife Center:	No
Duration:	FY01 "1st year, l-year project"
Cost FY 01:	$92,000. From EVOS ($276,000.ADF&G)
Cost FY 02:	0
Geographic Area:	Prince William Sound
Injured Resource/Service:	All

ABSTRACT

Providing communities the capacity to manage and control pollutants will protect Prince William Sound species and will aid the recovering species affected by the *Exxon Valdez* oil spill Boat harbor pump-out systems will provide seasonal safe sewage management for marine vessels. The systems can be easily activated in winter in case of a natural or man-made emergency. This system will protect the commercial shellfish operations around the sound, as well as the other fish and marine mammal populations recovering from the oil spill.

INTRODUCTION

It is suspected that salmon, a major fish species injured during the oil spill, when out-migrating through the harbors of Chenega Bay, Cordova, Tatitlek and Whittier, suffer when exposed to raw sewage. In turn, these smolt are consumed by other species, such as the common loon, pelagic cormorants, harbor seals and sea otters, still not listed as recovered ten years after the spill. Another example of the danger presented by raw sewage in harbors would be polluted beach areas, a habitat for blue mussels. Blue mussels are a major food source for young sea otters, black oyster catchers, several species of diving ducks, such as harlequin ducks, all affected by the oil spill, and as yet unrecovered.

According to data gathered for the Clean Vessel Act, shellfish as "filter feeders" are especially vulnerable to bacteria from sewage and pass this bacteria on through the food chain. The bacteria also use oxygen and may deplete the water's oxygen level, causing stress to fish and other aquatic animals.

The purpose of this proposal is to construct sewage pump-out stations in the communities of Chenega Bay, Cordova, Tatitlek, and Whittier. This project would help reduce sewage disposal in the entire Prince William Sound. Port Valdez will have a sewage pump-out in operation by May, 1999, setting a standard for southcentral Alaska. This is a crucial issue as more and more pleasure boaters, tourists, "live-aboards" and fishermen spend time in the waters of the sound. The systems must be convenient and easily maintained. The systems cannot be subject to expensive user fees to be successful. Currently, many boats are dumping their sewage into the harbor waters. This is a hazard to not only recovering species affected by the oil spill, but Alaska's human population, as well.

NEED FOR THE PROJECT

A. Statement of Problem

Currently, many boats are dumping their sewage into Prince William Sound harbor waters. Most boats have small holding tanks. Without a convenient place to empty their tanks the waste is often discharged into the harbors. This project will improve water quality and protect all species.

The problem is that as boating populations grow, so does the human waste contribution in popular regions. Only within the past ten years has this problem been addressed in the United States. We have an opportunity, by creating sewage-pumping stations in every port in Prince William Sound, to set a precedent for Alaska and perhaps eventually other areas of the Pacific Rim.

In the original Sound Waste Management Plan for Prince William Sound, the urgency for chemical and hazardous waste clean-up was first and foremost. Now, with increasing traffic and

the new road opening in 2000 from Portage to Whittier, the potential increased environmental hazards from increasing sewage waste are apparent

B. Rational/Link to Restoration

A boat harbor sewage system will diminish stresses for recovering species in Prince William Sound. According to *National Estuary Program Challenges - Nutrient Overloading* published by the EPA, states, "Nutrients such as nitrogen and phosphorus are necessary for growth of plants and animals and support a healthy aquatic ecosystem. In excess, however, nutrients can contribute to fish disease, red or brown tide, algae blooms, and low dissolved oxygen. The condition where dissolved oxygen is less than 2 parts per million is referred to as hypoxia. Many species are likely to die below that level- the level of healthy waters is 5 or 6 parts per mission. Sources of nutrients include point and non-point sources such as sewage treatment plant discharges, stormwater runoff from lawns and agricultural lands, faulty or leaking septic systems, sediment in runoff, animal wastes, atmospheric deposition originating from power plants or vehicles, and groundwater discharges."

It further states, "Excessive nutrients stimulate the growth of algae. As the algae die, they decay and rob the water of oxygen The algae also prevent sunlight from penetrating the water. Fish and shellfish are deprived of oxygen, and underwater seagrasses are deprived of light and are lost. Animals that depend on seagrasses for food or shelter leave the area or die. In addition, the excessive algae growth may result in brown and red tides which have been linked to fish kills, manatee deaths and negative impacts to scallops. Increased alga may also cause foul smells and decreased aesthetic value."

Sewage contamination is measured in terms of fecal coliforms - bacteria produced in the intestines of all warm-blooded animals. Test results are expressed as the number of bacteria per 100 mililiters of water. Shellfish beds are closed to harvesting when the coliform count reaches 14 per 100ml of water. Public beaches are closed to swimmers when the coliform count reaches 200 per 100 ml of water.

Areas most likely to be affected are sheltered waters with low flushing rates, waters with significant recreational value, and areas set aside for shellfish harvesting, (Chenega Bay and Tatitlek farm oysters), State and Federally designated significant habitats such as those in Coastal Zone programs, as well as waters designated by the Environmental Protection Agency as "No Discharge Areas".

Shellfish are filter feeders that eat tiny food particles filtered through their gills into their stomachs, along with bacteria from sewage. Shellfish can convey nearly all water-born pathogens to humans.

C. Location

The project will take place in Chenega Bay, Cordova, Tatitlek and Whittier. The project will benefit the harbors in each town or village, and adjacent waterways entering the harbors, and to some degree, the Gulf of Alaska. It is hoped that Prince William Sound will affect all ports in Alaska, as a prototype in responsible waste management.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

All towns and villages want the sewage pumpout systems in their harbors. All have, or will have soon, letters or resolutions showing their support for the project. The systems should be quite uncomplicated.

The project will protect economic resources in the economically limited communities of Chenega Bay and Tatitlek.

PROJECT DESIGN

Project design will be done by Stephl Engineers, with approval by the various port authorities, Alaska Department of Environmental Conservation and U. S. Coast Guard.

A. Objectives

1. Protect recovering marine resources from further damage due to sewage.

2. This project will ensure that all types of vessels can get their sewage properly dispatched from spring until fall, when 90% of the vessel use will occur.

3. It will be easily activated in the winter months for emergency response efforts for natural catastrophes or other emergencies.

4. It will be supported and maintained by communities and easy to operate.

Boats in Prince William Sound can be separated into four different user groups. Each group of users operates their vessels in a manner and at a schedule that is different from the other users. Each user group has its own unique requirements for convenient sewer service.

Tour Boats The tour boat user group consists of 50' to 100' boats. These boats generally operate full-time from May through September. They each make on the average of one to two trips per day in and out of the harbor during the peak summer operating months. During the winter months these boats operate periodically. The tour boats have sewer holding tanks ranging in size from 200 to 300 gallons. The tanks have the capacity to hold one day of sewage flow

volume. Under normal circumstances, the tanks are emptied each evening when the boats are cleaned, fueled and restocked for the next day's tours.

Transient Boats This group of user generally includes recreational vessels or daily fishing charter vessels from 20' to 60' in length and is a major concern as the numbers grow every year. They operate during the summer months from May through September. Generally, this class of user is traveling in and out of the harbor on the days when they are aboard their vessel. The typical transient vessel is not used for permanent housing in the same manner as a live-aboard vessel. The transient boats typically have sewer holding tanks ranging in size from 30 to 100 gallons. They normally have the opportunity to discharge the holding tank contents when traveling in and out of the harbor.

Fishing Boats The fishing boat user group consists of transient commercial vessels that arrive to harvest the summer fish runs. The fishing boats typically have sewer holding tanks ranging in size from 30 to 100 gallons. Because they are often moored in rafts, they do not have the opportunity to conveniently motor to a pump out station located elsewhere in the harbor.

Live-aboard Boats The boat is often the vessel owners permanent place of residence. These are called live-aboard vessels. Live-aboard vessels occasionally motor in and out of the harbor. The live-aboard boats have sewer holding tanks ranging in size from 30 to 50 gallons. They do not often have the opportunity to conveniently motor to a pump-out station located elsewhere in the harbor.

Emergency Response Efforts In case of an emergency, for instance a tsunami or earth quake or perhaps an oil spill, all of the above can be called upon to aid in relief efforts. Not only would local sound vessels be enlisted but vessels from other ports around Alaska and the northwest, making the sewage systems an even more important part of habitat protection.

B. Methods

Each town or village has specific needs and harbor configurations. There are three main types of sewage pumping systems manufactured for use in boat harbors. A number of manufacturers are building harbor pumping systems today. Many models of pumps, pump-out stations, controls, etc., are available. The recent demand for harbor sewage pumping systems has fueled a growth in this special industry.

A number of options can be considered such as dock mounted pump-outs, mobile pump-out systems with large (300 gallon) tanks mounted in skiffs or specially built self-sufficient floating barges with large holding tanks. The barges are often anchored offshore in the harbors or attached to a dock float.

Chenega Bay Chenega Bay is a community of 80 persons that is located in the southwest portion of Prince William Sound. The town has a small boat harbor with permanent mooring space for approximately 20 boats. During the salmon season, a large number of fishing boats

raft-up to the main float. Most of the vessels permanently moored to the dock are fishing boats. The community recently installed fueling facilities at the harbor. In the near future, they anticipate that more transient vessels will visit the dock to purchase fuel. Chenega Bay has the only fueling station in the southwest part of the sound. The opening of the Portage /Whittier road in 2000 is expected to increase boat traffic immensely.

It is recommended that a permanent pump-out station be installed on the dock and sewage be pumped into the community sewer system. Access to the dock is provided down a relatively steep path to the ramp landing. The community sewer system is approximately 300 feet from the dock and is located approximately 60' above the ramp. A second sewage pump will be needed to overcome the high head. Sewage from the pump-out could be conveyed to the public sewer system via an above ground small diameter flexible line. The pipe would be drained in the winter to prevent freezing. The pump-out system would not operate in the wintertime, unless an emergency occurred.

Cordova Cordova's small boat harbor serves approximately 800 boats. During the peak fishing season from May through September, many fishermen and their crews live on their boats when they are moored in the harbor. The Cordova harbor currently accommodates mainly fishing boats. The harbor has a few transient boats. Tour boats are expected to begin mooring in Cordova in the near future. Cordova does not have any sewage pumping facilities in the small boat harbor at this time.

It is recommended that the Cordova boat harbor could be best served by installing a single pump-out station on a dock float that is centrally located in the harbor. This location would provide easy access for boats coming and going from the launching ramp and can be accessed by the larger fishing tenders and seiners that are 50' or more in length.

Sewage collected in the pump-out station would be conveyed to a city sewer line located nearby in Harbor Drive. The proposed system would consist of a pump-out station, piping along or under the dock, and a second station with adequate capacity to pump sewage uphill to the city sewer line.

Tatitlek Tatitlek currently does not have a small boat harbor. However, they are actively pursuing funding to construct a new harbor. Currently, local fishing boats permanently anchor offshore. Owners and crews travel back and forth to their vessels in skiffs. Boats do have the opportunity to use the ferry dock for temporary moorage when loading or unloading supplies.

Tatitlek's two existing docks present problems for a pumping station mounted on the dock. One dock is exposed to ocean swells, making a secure sewage transfer hazardous. The other dock is dry at low tide, presenting another problem.

A transitional approach is necessary. Sewage collection in Tatitlek can be accomplished with a portable tank mounted in a skiff. This method of sewage collection is very common in other harbors in the U. S. where permanent docks do not exist. These systems normally include a 300 gallon tank and gas driven pump mounted in an 18' skiff which is powered by an outboard motor. In Tatitlek, the tank would be emptied into the community sewer system via a portable

flexible pipe running from the skiff to a nearby manhole. As soon as the new dock is constructed, the tank will be removed from the skiff and mounted on the new dock

Whittier The Whittier boat harbor will experience an unparalleled increase in vessel use within the next few years after the road from Portage is completed. The harbor currently serves fishing boats, tour boats and transient boats. A steep increase in the number of transient boats is expected to occur after the new road opens in 2000. The Whittier harbor does not have sewage pumping facilities at this time.

A mobile pump-out system is recommended for serving the Whittier Harbor. A tank and vacuum pump mounted on a trailer would allow the City the flexibility to pump out boats at various places in the harbor and also provide a means for transporting the waste to a dump site located on the City sewer collection system.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

Alaska Department of Environmental Conservation will provide environmental leadership. Stephl Engineers was chosen to design and construct these facilities. Contracts will be written and approved by all agencies involved. Project management will be done by Prince William Sound Economic Development Council. A request for additional funding will be presented to the Alaska Department of Fish and Game as a cooperating agency.

SCHEDULE

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

October 15, 2000 First meetings with all participants to discuss plans, any changes in plans will be made at this time.

December 1, 2000 Approval of finalized plans/building permits from city or IRA Council/review by local Ports and Harbors Commissions/U. S. Coast Guard approval, NEPA approval

September1, 2001, all pumping systems installed and operational.

B. Project Milestones and Endpoints

December 15, 2000 - Installation and training begins in all four communities.
September 1, 2001 - All pumping systems installed and operational.

C. Completion Date - September 1, 2001

PUBLICATIONS AND REPORTS Restoration articles will be offered to various boating magazines, Sunset Magazine' Northwestern life section, various environmental publications.

PROFESSIONAL CONFERENCES Participants will attend *Exxon Valdez* Trustee Council Annual Conference and other required meetings.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project builds on the success of the community based Sound Waste Management Plan previous funded by EVOS, and specifically addresses additional pollutants not mentioned previously.

EXPLANATION OF CHANGES IN [1]CONTINUING PROJECTS (N/A)

PROPOSED PRINCIPAL INVVESTIGATOR, IF KNOWN (Unknown)

OTHER KEY PERSONNEL

Marianne See, EVOS Liaison, Office of the Commissioner, Alaska Department of Environmental Conservation, 555 Cordova St., Anchorage, Alaska 99501. (907) 269-7635, FX (907) 269-7508.

Prince William Sound Economic Development Council were project managers on the Chenega Bay Restoration Project, EnVironmental Operating Stations for Prince William Sound communities, and the Valdez Duck Flats Feasibility Study. Sue Cogswell, Executive Director, has twenty years experience in non-profit organizations and construction projects and joined PWSEDC in 1998. PWSEDC, P. O. Box 2353, Valdez, AK 99686, (907) 835-3775, FX (907) 835-3265.

Matt Stephl is the owner of Stephl Engineers with over 14 years experience in Alaska, (please see attached).

LITERATURE CITED

Sound Waste Management Plan, February, 1996
1992 Clean Water Act
EPA Office of Water, *Challenges Facing Our Estuaries: Key Management Issues*
EPA Office of Water, *Managing Common Estuarine Environmental Problems*

1

THE CITY OF WHITTIER

Gateway to the Western Prince William Sound

P. O. Box 608 • Whittier, Alaska 99693 • (907) 472-2327 • Fax (907) 472-2404

April 12, 2000

Sue Cogswell
Prince William Sound Economic Development Council
P. O. Box 2353
Valdez, AK 99686

To Whom It May Concern:

On behalf of the Whittier City Council, I would like to express my support for the Whittier Small Boat Harbor sewage pump-out stations for Whittier and the other communities in Prince William Sound. A resolution from the Whittier City Council will be forthcoming.

The road is scheduled to open on June 7, 2000 and will open the Prince William Sound to Southcentral Alaska and a possibility of an additional 700 vessels that have applied for permanent berth in Whittier Small Boat Harbor. The road access and the estimated increase of pleasure vessel traffic creates a critical need for support of infrastructure and the sewer pump-out stations.

The new Whittier road will make it extremely important to offer these facilities to recreational boaters, as their numbers are expected increase each year when the Whittier Road opens. Other small craft will find these facilities useful, as well.

We strongly support Prince William Sound Economic Development Council's proposal to fund this project.

Sincerely,

Allen L. Arneson
Vice-Mayor

cc: Whittier City Council
Whittier Port & Harbor Commission

CHENEGA CORPORATION

Phone: 907.277.5706
Fax: 907.277.5700
e-mail: chenega@chenegacorp.com
Aleut Plaza, 4000 Old Seward Highway, Suite 101, Anchorage, Alaska 99503

April 11, 2000

Sue Cogswell
Prince William Sound Economic Development Council
P.O. Box 2353
Valdez, AK 99686

To Whom It May Concern:

On behalf of the Chenega Corporation, I would like to express my support of the small boat harbor sewage pump-out stations for Chenega Bay and the other villages and towns in Prince William Sound.

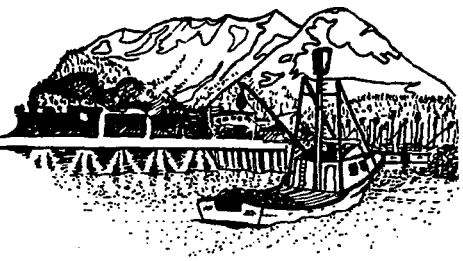
The impact soon to be felt by the new Whittier Road will make it extremely important to offer these facilities to recreational boating enthusiasts, as their numbers are expected to increase each year. Other small craft will find these facilities useful, as well.

Chenega Corporation strongly supports the proposal for funding this project. The pump-out station will help keep our waters pristine, especially important to the oysters being grown in Chenega Bay.

Sincerely,

Charles W. Totemoff
President & CEO

CITY OF CORDOVA



March 22, 2000

Sue Cogswell
Prince William Sound
Economic Development Council
Box 2353
Valdez, Alaska 99686

Sue,

Cordova strongly supports your proposal for a sewage pump station located in Cordova and the other communities around Prince William Sound. There are currently five houseboats and up to 800 other vessels harbored in Cordova with no means of discharging sewage. Additionally, demand from transient boats and cruise ships is increasing. It would be invaluable for Cordova to be able to offer wastewater disposal to these vessels.

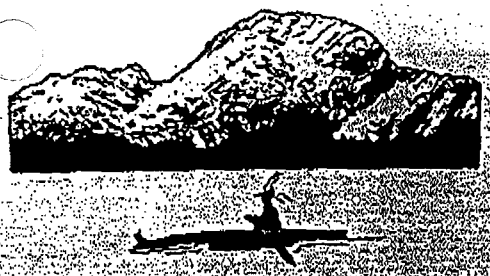
Considering the tight economic conditions among Alaskan fishing communities, it is highly unlikely that our community could supply the cash for engineering and construction of such a service in the near future. With this system, Cordova has a chance of attracting additional revenues from tourist related visits to our City.

Again, Cordova strongly supports the proposed sewage handling system for our harbor.

Sincerely,

Larry Hancock
City Manager

602 Railroad Avenue P.O. Box 1210 Cordova, Alaska 99574 Telephone (907) 424-6200 Fax (907) 424-6000



Tatitlek Village IRA Council

"God's Country, USA"

April 11, 2000

Sue Cogswell
Prince William Sound Economic Development Council
P. O. Box 2353
Valdez, AK 99686

To Whom It May Concern:

On behalf of the Tatitlek IRA Council, I would like to express my support for the small boat harbor sewage pump-out stations for Tatitlek and the other villages and towns in Prince William Sound.

The new Whittier Road will make it extremely important to offer these facilities to recreational boaters, as their numbers are expected to increase each year when the Whittier Road opens. Other small craft will find these facilities useful, as well.

We strongly support Prince William Sound Economic Development Council's proposal to fund this project.

Sincerely,

Gary Kompkoff
Tatitlek IRA Council

STEPHL ENGINEERS
Anchorage, Alaska

MATT STEPHL
Civil Engineer

B.S. Civil Engineering, University of Alaska Anchorage, 1984
Registered Professional Engineer, Alaska CE7881

Background

Matt Stephl is the owner of Stephl Engineers. He is a senior civil engineer with over 14 years of experience in study, design and construction of projects in Alaska. He has a broad base of experience in water, sewer, landfill, building and earthwork projects. Mr. Stephl is also an experienced project manager and construction services manager.

Experience

Mr. Stephl was the project manager providing construction management services to the Prince William Sound Economic Development Council during construction of four DNR marine recreation facilities in Prince William Sound. The projects included restrooms, trails, fishing access facilities and parking areas. Work included inspections, pay request review, submittal review and budget control of $1.0 M worth of construction in Valdez, Cordova and Chenega Bay.

He was the project manager for a force-account construction project in Chenega Bay Village in Prince William Sound. The $130,000 project was completed in 1996 and involved construction of a gravel trail and 50-foot wood beam bridge. Mr. Stephl prepared material takeoffs and was responsible for assuring that the materials arrived in Chenega. He managed the 3-month construction project that was performed by the local labor force.

He was the project manager of the Small Boat Harbor Restroom design for the City of Valdez. This project included design of a 1000 square foot public restroom building located adjacent to the main entrance to the harbor. Work included design of a stepped concrete foundation, wood frame structure, oil heating system and unique covered entrances to the restrooms.

He is the project manager on the $1.1 million EVOS Station design and construction project in Prince William Sound. Engineering design work was completed for five buildings in PWS to handle waste oil, bilge water and other oily waste products produced in Cordova, Valdez, Chenega, Tatitlek and Whittier. Mr. Stephl provided construction management services during the construction work in 1997.

He was project manager of the Fleming Spit Recreation Area design for the Prince William Sound Economic Council. The project included developing design drawings of access trails, ADA designed access platforms along the waterfront and dredging of an intertidal lagoon. The purpose of the project was to improve fish habitat and sport fishing access in Cordova.

Mr. Stephl was the project manager on the Ski Hill Restroom project for the City of Cordova. The project included design of a 200 square foot public restroom to serve summer users at the Eyak Ski Hill. The all wood structure on a concrete slab included three restrooms, one of which is designed to provide ADA access.

Matt Stephl designed water, sewer and storm sewer pipe improvements for the City of Valdez North Harbor Drive Improvement Project. This $1.9 million project included reconstruction of the street and improvements to the storm water system to help improve water quality in the small boat harbor. Construction was completed in the spring of 1998.

Matt Stephl was responsible for evaluating the solid waste transfer process and preparing project cost estimates for the City of Cordova Mile 17 Landfill Study and Design Project. The City is preparing to construct a new landfill 17 miles from town. He was responsible for a pre-design of the new 60-acre landfill site, 1.2 mile access road, construction and demolition waste disposal area, cover material borrow area, fencing, and landfill cell. Mr. Stephl evaluated four waste transfer options; 1) rebuilding the existing baler machine, 2) a new solid waste baler machine, 3) a new compactor, and 4) direct hauling with existing collection trucks. His analysis showed that installing a new baling machine was the most cost effective long-term solution.

Mr. Stephl is the project manager and lead designer on the City of Valdez Small Boat Harbor Sewage Pump-out System project. The project involves a study and design of a sewage pumping system in the harbor to serve transient boats, fishing boats and tour boats. The project is scheduled to be constructed in the spring of 1999.

He was the project manager for the MOA Department of Public Works 48th Avenue/Crossroads Business Park Drainage Project. The study and design project included 2,300 feet of new 48-inch storm pipe and over-excavation and reconstruction of 1,400 feet of a 48th Avenue. The project included traffic control and shoring of the excavation along residential properties. Mr. Stephl meet with the Spenard Community Council three times during this project.

Mr. Stephl was the project manager on the DPW 80th Avenue/Spruce Street/84th Avenue Storm Drain project. This project included design of a stormwater treatment basin near Campbell Creek, proposed over-excavation and reconstruction of portions of 84th Avenue, evaluation of hazardous soils in the selected pipe alignment, ILLUDAS modeling and public involvement with the Abbott Loop Community Council.

As project manager on the Municipality of Anchorage Regional Landfill Cell 4 and 5 Design, Mr. Stephl was responsible for design improvements of a 23-acre HDPE lined cell and leachate treatment system for this $8.5 million project. He was also project manager during the construction management phase which included submittal review, change order processing, document interpretation, final inspection and asbuilts.

Mr. Stephl was project manager for a 3,800 foot, 60-inch diameter concrete pipeline design for Anchorage's Department of Public Works. The $1.6 million project included design of 1,300 feet of open channel stream, refuse disposal, odor control, specialized pipe and manhole testing requirements and abandonment of an existing CMP storm pipe buried under the Merrill Field landfill.

Mr. Stephl was project manager for the $4.7 million City of Cordova sewer collection system rehabilitation project. He lead the study and design efforts and was onsite during the two year construction project. The project included 3,500 feet of new sewer, 12,000 feet of sliplined sewer, 28,500 feet of chemically sealed pipe, and service line and manhole repair. During construction, Mr. Stephl was responsible for overall construction management as well as pay

requests, onsite inspections, change order processing, submittal review and public education tasks.

Mr. Stephl was project manager for the City of Cordova solid waste management plan update. The plan addressed the siting of a new landfill, recycling, waste reduction and waste disposal regionalization. An economic analysis concluded that transporting waste to Seattle was as economical as constructing a new lined landfill in Cordova.

As project manager for the City of Bethel, City Subdivision Water and Sewer Wastewater Study, Mr. Stephl was responsible for evaluating aboveground and buried pipe systems, improvements to the existing water treatment plant, and development of a preliminary layout for a piped water and sewer system to serve this subdivision of 160 homes.

Mr. Stephl is the project manager on a civil engineering services term contract to the Municipality of Anchorage Water and Wastewater Utility. Stephl Engineers is responsible for study, design and construction management of sewer system repair and replacement projects. The on-going project started in 1998.

Mr. Stephl was the lead designer of the City of Nome Wastewater Treatment Plant expansion project that included design of a two cell primary treatment lagoon and associated piping. The unlined lagoon was constructed in a tundra area underlain with frozen gravels. Mr. Stephl also designed a pump station and approximately one-mile long force main to convey sewage from the City to the new lagoon.

Mr. Stephl was the project manager for the study, design and construction repair to the City of Seward's Lowell Point Lagoon wastewater treatment system. This $1.2 million, 5-acre lagoon construction project included a new aeration system, new XR-5 liner system, concrete center divider wall and floating baffle curtain. The project included construction management and onsite inspection services during the summer of 1993.

As project engineer on the City of Nome Icy View Subdivision Water and Sewer Study, Mr. Stephl evaluated wastewater treatment and disposal options including a package treatment plant, soil absorption system, lagoon treatment and conveyance to the City's existing collection system.

Mr. Stephl was project manager for the $1.4 million Borough of Yakutat wastewater treatment plant study and design. The project included a drogue study and dilution analysis to predict offshore impacts of the marine outfall. An engineering study was completed that recommended primary screening and disinfection be provided to meet water quality requirements. The study evaluated lagoon treatment and septic tank treatment options.

Mr. Stephl provided civil engineering services on the City of Cordova water master plan and watershed protection project. His work included watershed inspection and characterization in addition to evaluation of the city's water system reservoirs, surface water sources, disinfection facilities, pump stations and distribution system.

Mr. Stephl was the engineering team project manager for the $1.9 million project to complete restoration work on eight oiled beaches near the village of Chenega Bay in Prince William Sound. The restoration work involved injection of a surfactant to release residual oil remaining from the Exxon Valdez oil spill. Mr. Stephl was responsible for completing a remediation plan

that included cost estimates, public involvement with Chenega representatives, permitting, pre and post treatment sampling and remediation design specifications. The restoration work was completed in 1997 by local Chenega village labor in conjunction with restoration specialists.

He was project manager for the $1.6 million Bethel FAA Sewer Extension for the City of Bethel. An engineering study and design were completed for 10,000 feet of above ground force main, a sewer pump station and 500 feet of buried gravity sewer.

Mr. Stephl has been responsible for the design, inspection and evaluation of over 300 onsite sewer system projects since 1984. He has evaluated site soils for drainage characteristics and performed percolation tests. Mr. Stephl has designed onsite sewers for residential homes, multifamily dwellings, commercial establishments, restaurants and businesses. He has performed numerous adequacy tests to determine the condition of existing onsite sewer systems. Mr. Stephl has designed mound type onsite systems for properties with marginal soils and high ground water tables. His past experience with large community onsite systems includes the evaluation and design of the onsite systems for the Alyeska Pipeline Pump Station 10 Camp and for the Tok Elementary School.

He was the lead engineer and project manager for the Alyeska Pump Station 10 Septic System Evaluation and Design. The project involved evaluation of the failed community drainfield serving the 100 person pipeline camp. During the project Mr. Stephl visually inspected the drainfield clogged soils layer and performed a field test to determine the effects of rejuvenation on the existing drainfield. The field test with hydrogen peroxide indicated that it would not be effective to rejuvenate the existing drainfield. Mr. Stephl designed a new replacement drainfield and a new 11,000 gallon septic tank for the facility. During the project three other wastewater disposal options were evaluated including; a package treatment plant, sewage lagoon and stack injection.

Mr. Stephl designed a new septic system for the Tok Elementary School. Soils at the site showed poor percolation characteristics. Mr. Stephl designed an absorption system with two identical drainfield beds that would alternate their operation every year. To extend the life of the system, one drainfield bed would be taken out of service to rest and naturally aerate while the other was in operation. The design also included the design of a concrete septic tank. A second chamber in the tank contained dual siphons that were installed to provide dosing of effluent into the drainfield bed.

Other projects that Mr. Stephl has managed or worked on include:

City of Cordova Whitshed Road Solid Waste Landfill Closure Plan
City of Port Lions Waterline Extension Project
City of Unalaska Sewer Infiltration and Inflow Study
Elmendorf AFB 4 Million Gallon Fuel Tank Abandonment Design
Girdwood 1991 Water Distribution System Improvements Design
City of Kenai Wastewater Treatment Plant $1.2 million improvements
City of Cordova Copper River Interceptor sewer line project
Wastewater Treatment Plant Expansion project for City of Soldotna
Ketchikan Gateway Borough wastewater comprehensive plan
City of Nome wastewater facilities plan
Chignik Lake Village bulk fuel storage facility construction management

Municipality of Anchorage C-5 Interceptor rehabilitation study
City of Seldovia Septic Tank and Outfall Design
City of Cordova High School Boiler Upgrades
City of Port Lions Water and Sewer Study
Ketchican Gateway Borough, Mt. Point Subdivision Sewer System Study

Publications

Effectiveness of a Small Community Sewer Rehabilitation Project. Presented at the Water Environment Federation Conference, New Orleans, LA, September 1992.

Four Basic Methods of Manhole Rehabilitation. Presented at the Alaska Water Management Association Conference, Anchorage, AK, May 1992

Municipal Landfill Leachate Infrastructure Corrosion. Presented at the NACE Canadian Region Western Conference, Anchorage, AK, February 1996

Case History of a Lined Wastewater Treatment Lagoon Failure, co-authored with Kelly Merrill P.E. Presented at the Cold Regions Conference, Fairbanks, Alaska, 1996

New Facilities for Handling Used Oil and Bilge Water in Prince William Sound. Presented at the Alaska Harbormasters Conference, Wrangell, AK, October 1997

Cordova					
Description	Quantity	Unit	Unit Price	Subtotal	
Pump-out station w/controls	1	EA	$26,000	$26,000	
Electrical improvements	1	LS	$6,000	$6,000	
Discharge pipe	500	LF	$45	$22,500	
Uplands sewer pipe	50	LF	$200	$10,000	
Misc. fittings,signs, hoses	1	LS	$4,000	$4,000	
Nonpotable water hose bib	1	EA	$2,000	$2,000	
Subtotal					$70,500
Whittier					
Description	Quantity	Unit	Unit Price	Subtotal	
Mobile Pumpout Station	1	EA	$20,000	$20,000	
Misc. fittings,signs, hoses	1	LS	$2,000	$2,000	
Subtotal					$22,000
Chenega Bay					
Description	Quantity	Unit	Unit Price	Subtotal	
Pump-out station w/controls	1	EA	$25,000	$25,000	
Electrical improvements	1	LS	$6,000	$6,000	
Discharge pipe	300	LF	$45	$13,500	
Uplands above ground sewer	270	LF	$45	$12,150	
Uplands below ground sewer	30	LF	$160	$4,800	
Misc. fittings,signs, hoses	1	LS	$2,500	$2,500	
Nonpotable water hose bib	1	EA	$2,500	$2,500	
Subtotal					$66,450
Tatitlek					
Description	Quantity	Unit	Unit Price	Subtotal	
Portable tank and pump	1	EA	$9,000	$9,000	
Outboard motor and skiff	1	EA	$13,000	$13,000	
Flexible discharge hose	100	LF	$25	$2,500	
Misc. fittings, equipment	1	LS	$2,500	$2,500	
Subtotal					$27,000
Subtotal					$185,950
Contingency 35%					$65,083
Subtotal Construction Cost					$251,000
Administration/Engineering 35%					$87,850
Permits and NEPA Documents					$20,000
Final Project Report					$7,000
ADEC Management					$2,500
TOTAL PROJECT COST					$368,000
EVOS 25% Funding Portion					$92,000
Funding from others 75%					$276,000

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

Budget Category:	Authorized FY 2000	Proposed FY 2001						
Personnel		$8.4						
Travel		$1.6						
Contractual		$82.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$92.0			Estimated FY 2001	Estimated FY 2002		
Indirect								
Project Total	$0.0	$92.0						
Full-time Equivalents (FTE)		2.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY00

Prepared:

Project Number: 01616
Project Title: PWS Boat Harbor Sewer Stations
Name:

FORM 4A
Non-Trustee
SUMMARY

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

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2001
						0.0
PWSEDC	Project manager		12.0	0.5		6.0
ADEC	Project manager		12.0	0.2		2.4
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		24.0	0.7	0.0	
					Personnel Total	$8.4

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2001
					0.0
PWSEDC project manager from Valdez to Chenega	1.1	1	1	0.0	1.1
PWSEDC project manager from Valdez to Tatitlek	0.5	1	1	0.0	0.5
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$1.6

FY00

Project Number:
Project Title: PWS Boat Harbor Sewer Stations
Name:

FORM 4B
Personnel
& Travel
DETAIL

Prepared:

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

Contractual Costs:	Proposed
Description	FY 2001
NEPA Environmental Assessments	3.0
Permits	2.0
Engineering Study and Design	8.0
Construction management	7.0
Construction	45.0
Construction contingency	15.0
Final report	2.0
Contractual Total	$82.0

Commodities Costs:	Proposed
Description	FY 2001
There are no commodities costs in this project	0.0
Commodities Total	$0.0

FY00

Prepared:

Project Number:
Project Title: PWS Boat Harbor Sewer Stations
Name:

FORM 4B
Contractual & Commodities DETAIL

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

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 2001
We have included these under contractural costs for construction. It is included in the contractural catagory because the contractor will be responsible for its purchase.			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number	
Description	of Units	

FY00

Prepared:

Project Number:
Project Title: PWS Boat Harbor Sewer Stations
Name:

FORM 4B
Equipment
DETAIL