19.08.01 (6 of 16)

00247

Kametolook River Coho Salmon Subsistence Project

Project Number:	00247
Restoration Category:	General Restoration
Proposer:	Perryville Village Council
Lead Trustee Agency:	ADF&G
Cooperating Agencies:	NONE
Alaska SeaLife Center:	NO
Duration:	4th year, 6-year project
Cost FY 00	$23.2
Cost FY 01	$23.5
Cost FY 02	$30.0
Geographic Area:	Perryville/ Kametolook River/ Alaska Peninsula
Injured Resources/ Service	Subsistence

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TRUSTEE COUNCIL

ABSTRACT

__Abstract:__ Subsistence users from the remote South Alaska Peninsula Native Village of Perryville have noted declines in the coho salmon (*Oncorhynchus kisutch*) run in the nearby Kametolook River since the *Exxon Valdez* oil spill (EVOS). The Trustee Council began funding this project in Federal Fiscal Year 1997 with the intent of restoring the coho salmon run to historic levels. This project is a continuation of an evaluative phase of the project funded through the EVOS criminal settlement (Grant Agreement Number 2168588). Although limnological, juvenile and adult fisheries data were not available or severely limited before the salmon decline, it was determined through the evaluation phase that instream incubation boxes in conjunction with self imposed harvest limits by subsistence users were the preferred alternatives for restoration this salmon run. In 1997, the Alaska Department of Fish and Game, Habitat and Restoration Division, aided the project by providing an Environmental Assessment. In 1997, a Finding of No Significant Impact was signed for NEPA compliance.

Community involvement by the villagers of Perryville is an integral part of restoring the Kametolook River coho as a subsistence resource. Presently, no regulations prohibit fishing in the Kametolook River; however, starting in 1997 the Perryville Village Council voluntarily closed the upper half of the Kametolook River to subsistence salmon fishing in order to not interfere with spawning salmon. In addition, as part of the community involvement portion of the project the Perryville Village Council has hired local assistants who received training to assist ADF&G with fieldwork including: genetic and pathological sampling, incubation box installation, egg takes and incubation techniques, and year around monitoring of the boxes and environment. Also, an aquarium has been set up in the village school where students actively participate in incubating coho salmon from egg to fry stage and releasing the fry into the Kametolook River. In May 1997 and 1998, each year about 125 fry from the school aquarium project were released into the Kametolook River. In the fall of 1998, approximately 300 fertilized eggs were placed in the school aquarium and the fry are expected to be released in the Kametolook River in the spring of 1999.

In 1997, two production type instream incubation boxes were installed in the upper reach of the Kametolook River. These boxes replaced and were in addition to a small test incubation box that has successfully incubated eggs. In 1997, the Kametolook River coho escapement was an estimated 724 salmon, nearly four times the estimated escapement during 1996. The increased escapement is attributed to the self imposed closure of the upper river by the villagers, a commercial fishing closure in marine waters during nearly the entire coho salmon run, and a strong run of coho salmon in general to the Chignik area. In 1997, several attempts to capture ripe coho salmon have generally been unsuccessful; eggs from only seven females (four of which were partially spent) have been deployed in the incubation boxes.

In 1998, in order to increase the egg take, two salmon holding pens were installed near the coho salmon spawning region of the Kametolook and used to make the recovery of ripe salmon more efficient. 16 female and 15 male salmon were captured and placed in the holding pens to ripen. Seven males were used to fertilize 11 ripe females and the fertilized eggs were placed in the two incubation boxes in November, 1998. The coho salmon escapement for 1998 was an estimated 148 salmon. The decreased escapement is attributed to a weak run of coho salmon in general to the Chignik area.

INTRODUCTION

This subsistence project is designed to restore coho salmon subsistence opportunities in the Alaska Peninsula village of Perryville. The project was initiated during community workshops held by the Subsistence Restoration Planning Team. Workshops in Perryville took place in September 1994 and May 1995. The project was subsequently endorsed by the Perryville Village Council. The project was also discussed and endorsed by the Chignik Regional Planning Team in the spring of 1995 and again in December 1996. Alaska Department of Fish and Game, Division of Commercial Fisheries, westward region staff assigned to the Chignik and Alaska Peninsula regions and the Division of Subsistence, have been involved in the planning and development of the project. In addition, an ADF&G biologist in the Norton Sound Region has provided technical expertise regarding the use of both instream incubator boxes and recirculating water incubators, which have been successful in the Norton Sound Region. Alaska Department of Fish and Game, Division of Habitat and Restoration staff have also been involved with the project, especially with the development of an Environmental Assessment.

In 1996, funding for the evaluation phase of the project was provided through a grant to the Native Village of Perryville by the Alaska Department of Community and Regional Affairs, using EVOS criminal settlement funds. During consultation about this grant, the State members of the Trustee Council requested that a proposal to the full Trustee Council be prepared to support the implementation of the project in subsequent years. This was accomplished and the Trustee Council began funding this project in Federal Fiscal Year 1997. The Environmental Assessment was approved and the resulting FONSI for this project was received by the Trustee Council in May, 1997.

It has been determined by the assessment team (PI's, Habitat and Restoration, and Perryville Village Council) that local salmon stock instream incubator boxes are the best method to help restore Kametolook River coho salmon runs. Applications for ADF&G fish transport permits are reviewed annually and a general habitat waterway/waterbody application has been granted for this project. In 1997, an environmental assessment was completed with a Finding of No Significant Impact signed for NEPA compliance. Samples of adult coho salmon will continue to be collected for genetic and pathology data until sufficient numbers are obtained. The assessment team will work with the Principal Geneticist, Principal Pathologist and Area Management Biologist to have the most safe and satisfactory project possible to help restore coho salmon in the Kametolook River to historic levels.

NEED FOR THE PROJECT

A. Statement of Problem

Since Perryville was founded in 1912, the Kametolook River has provided the community with much of its supply of subsistence coho salmon. Since the *Exxon Valdez* oil spill, Perryville residents have noted that there are fewer and fewer coho salmon in the river. It has become such a problem that many families must travel further away from Perryville to find sufficient amounts of salmon. Their use of these other areas has put additional pressure on fish stocks used for subsistence by the neighboring villages of Ivanof Bay, and the three Chignik villages.

Salmon are very important for Native people of Perryville, and are relied on greatly for their subsistence as well as economic livelihoods. Commercial fishing is the mainstay of Perryville's cash economy, where many residents travel to fish camps in Chignik Lagoon and Chignik Bay in the summer months to commercial fish, as well as to put up fresh sockeye salmon for smoking, canning or freezing. Those people who spend summer months in Chignik return to Perryville in the fall to put up coho salmon that are also smoked, as well as dried. Many other Perryville residents, however, do not commercial fish and stay in Perryville year around. Gradually throughout the summer, they travel to the Kametolook River to catch their year's supply of subsistence salmon that are primarily coho, pink, and chum salmon. (Sockeye, estimated at fewer than 100 adults annually, also spawn in the Kametolook River.)

Division of Subsistence personnel first did research in Perryville in 1984. Starting in 1990, the division has documented concerns by local residents that coho salmon availability in the Kametolook River is far below historical levels. Fish and Game biologists working in the Chignik region believe coho salmon stocks in the Kametolook River might be depressed, but have little data regarding historic or present escapement levels for this small, remote river.

B. Rationale/Link to Restoration

Salmon runs to the Kametolook River have been declining in recent years. Members of the village of Perryville requested the EVOS Trustee Council to fund a restoration project and they asked ADF&G to assist with this project. The cause of the decline in salmon numbers is unknown. A restoration project cannot be successful unless the cause of the decline is understood and the project is "fixing" the "right problem". An appropriate salmon restoration project will hopefully increase Kametolook River coho salmon relied on for subsistence by Perryville people back to historic levels. If more fish are available for subsistence, it will not only provide people with more coho salmon, but it will also take pressure off of other subsistence resources that were hurt by the spill, such as other salmon species, clams, seals and sea lions, as well as recent declines of local caribou.

C. Location

The remote Native village of Perryville is located approximately 500 air miles southwest of Anchorage on the Pacific side of the Alaska Peninsula. Veniaminof Volcano overlooks the village that is situated directly along the Pacific Ocean coastline with beaches of volcanic black sand. The Kametolook River is located four miles northeast of Perryville, and is easily accessible from the community via ATV, foot, or boat.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

The Trustee Council's goal of achieving additional local public involvement in the restoration process is addressed in that Perryville will be a partner with ADF&G personnel in this project. This project has been discussed and endorsed by the Chignik Regional Planing Team and the Perryville Village Council. Through project funds, the Perryville Village Council is responsible for hiring local assistants, and providing necessary logistical support for the operation of this project. The community has also contributed much in terms of local knowledge of the environment, including: historic to contemporary salmon run timing and numbers, subsistence harvest levels over time, identifying physical changes to the Kametolook River over time, helping ADF&G identify spawning and rearing areas, and identify potential characteristics of the river, such as where winter freeze over or spring and fall flooding might occur.

Several residents of Perryville have worked with ADF&G during assessment and implementation phases of the project. In addition, local assistants will monitor the project throughout the year, when ADF&G personnel will not be present. Local assistants through hands-on involvement have been trained by ADF&G personnel to monitor temperature and water level stations, to monitor the egg incubation boxes, participate in egg takes for seeding the incubation boxes, transporting eggs to the classroom incubator, and will transport fry to nearby lakes or adjacent rivers (depending on what the current review of the Fish Transport Permits allows).

Perryville residents have been kept informed about the progress of the project through the Village Council and village meetings. During these meetings residents have been informed about salmon run strengths, harvest levels, and rearing and habitat issues. The community has been encouraged to come up with ways that they can contribute toward restoring the coho run. Presently, no regulations prohibit fishing in the Kametolook River; however, starting in 1997 and continuing through 1998, the Perryville Village Council voluntarily closed the upper half of the Kametolook River to subsistence salmon fishing in order to not interfere with spawning salmon.

School children have had opportunities to learn, understand and appreciate the complexities of the growth cycle of salmon through the use of a classroom aquarium that is raising coho salmon from egg to fry stages. Fish resource permits have allowed the release of these fry into the Kametolook River (1996-1998). In addition, when allowed by the teachers and parents, older school children have accompanied ADF&G personnel to the Kametolook River and nearby lakes to assist with minnow trapping and biological and habitat sampling. This portion of the project has been in operation for three winters now, and expected to continue through 2002 and possibly beyond if the school continues to support the program.

PROJECT DESIGN

The primary goals of the project are to increase the coho salmon runs to the Kametolook River and to include the people of Perryville through involvement in the project and education. The method(s) used to accomplish this have been determined in 1996 and 1997 by a team of ADF&G specialists, and local Perryville residents. Funding for the first portion of the project was provided through a grant to the Native Village of Perryville from the criminal settlement funds. Beginning in Federal Fiscal Year 1997 funding has been provided by the Trustee Council. Personnel involved with the project have determined that the most appropriate rehabilitation method is through the use of instream incubation boxes. The team has acquired all the necessary permits (with the exception of the school aquarium Fish Transport Permit that is submitted to ADF&G for review annually). The Environmental Assessment and a Finding of No Significant Impact by the US Fish and Wildlife Service was approved in May of 1997. This project has the potential to make restoration of coho salmon in the Kametolook River possible. Similar projects in other regions of Alaska have proven to be successful.

In addition to school and village meetings where salmon life cycle processes were described instream incubation boxes have been determined to be the preferred restoration method. A test incubation box was positioned in a head water tributary of the Kametolook River to use the natural flow of water from the stream to incubate coho salmon eggs. This portion of the project has been successful; swimup fry were produced during April 1997. In the production phase of this project, genetic integrity of the Kametolook River coho salmon will be assured under the guidance of the department's Principal Geneticist. The potential incubation site has water temperatures consistent with natural spawning sites to insure that fry development and emergence occur at the same time as naturally occurring fry. The small scope of this project is not expected to noticeably add any coho salmon to other common property harvest groups (i.e. commercial fisheries).

From similar projects in Norton Sound, it has been found that improved returns were noticeable in about five years. If the number of coho salmon spawners is sufficient to allow an egg take, instream incubators will be employed. (Fish Transport Permits will require a minimum of 60 naturally spawning pairs before an egg take can occur and then 50% of the escapement above the 60 spawning pairs will be available for an egg take.) In 1998 and beyond, the use of salmon holding pens will be used to make the recovery of ripe salmon easier. The incubators are expected to operate annually from 1997 through 2002. Since a major expense is in the boxes (materials and installation), and establishing an incubation site, the annual cost of operation and maintenance is not significant.

Other restoration methods evaluated included a recirculating water incubation facility in the village, potential habitat manipulation to create or provide access to better spawning and rearing habitats, and a remote incubation facility. All of these alternative methods were rejected in favor of the instream incubators.

A. Objectives

There are two main project objectives: the first is community involvement described above, and the second is to restore the coho salmon returns to the Kametolook River and provide local subsistence salmon opportunities. The species of interest for this project is coho salmon. Phase 1 of the project included a complete assessment of the creek and river habitat in proximity to Perryville and interviews to determine salmon run strength, run timing and physical changes to local drainages. Phase 2 (1996) included installation and testing of a streamside incubation box, continuation of the classroom aquarium and education programs for adults and high school students. Phase 3 so far has included installation (August/September 1997) of large capacity streamside incubation boxes, installation and use of the school aquarium, education programs, and biological sampling for pathological and genetic testing. Phase 3 will continue through the end of the project with biological testing (until required amount necessary are obtained for genetic and pathology tests), annual egg takes for the incubation boxes and the school aquarium, continued education and habitat and harvest monitoring.

B. Methods/ May 1996-September 1999

May 1996 through September 1996/ This phase of the project was funded through the Criminal Settlement/ Project Perryville 96-1.

May 1996- Three ADF&G assessment team members traveled to Perryville and joined with local assistants to assess the Kametolook River in order to make recommendations for the best restoration efforts. A small instream test incubator box (2 foot square plywood box) was installed at the headwaters of the river. The incubator box was also equipped with a thermograph to aid in determining the potential of the incubation site. Thermographs were also installed at three other habitat-monitoring locations along the Kametolook River. Perryville guides showed the ADF&G team the different stream reaches; at this time, there was no evidence of blockages to adult or smolt migration. Blockage and breaching events apparently occur on a scale of about 2-10 years. ADF&G personnel were given the impression that the river has relatively unstable spawning areas with current upstream spawning sites improved from prior years. Young-of-the-year and fingerling coho were observed in several slough habitats and small ponds. Several ponds, deep main-stem pools, side-channel sloughs and spring areas apparently do not freeze solid and would provide over winter rearing habitat. During this trip preliminary investigations were also undertaken for possible stocking of rainbow trout or coho salmon into two landlocked lakes (Sandy and Sicken Lakes) in proximity to Perryville. At the high school ADF&G personnel discussed potential education projects such as a classroom salmon aquarium and recirculating egg incubators. (A detailed field trip report is available.)

Project 97247 (October 96-September 97)

October 1996- Three ADF&G assessment team members traveled to Perryville and joined with local assistants to expand the habitat surveys of drainages adjacent to Perryville, to place fertilized eggs in the experimental stream side incubation box and to initiate a cooperative educational program in the Perryville school. Local guides showed us much of the historic and potentially productive reaches of the Kametolook, Three Star and Long Beach Rivers. Long Beach River, although historically productive, presently had no quality spawning or rearing habitat. Three Star River, smallest of the three drainages, had some stable reaches but about half of the discharge had changed course and currently flows into Long Beach River. Some potential rearing habitat is present while spawning habitat appeared to be limited. Kametolook River currently showed the most salmon spawning and rearing potential. However, this system is dynamic and habitat quantity and quality may change annually.

Minnow trapping was conducted in all three drainages. Rearing and spawning habitat in Long Beach River appeared to be negligible. Three Star River had limited high quality slough habitat and supported juvenile coho salmon and Dolly Varden; spawning habitat appeared to be limited to several short stream reaches. Rearing habitat for juvenile coho salmon in the Kametolook River appeared to be quite abundant while upper stream reaches seemed able to support relatively good numbers of spawning salmon. Several high school students assisted with coho fingerling data collection efforts.

A total of 32 adult coho salmon were collected from the Kametolook River during this trip. Few other adult salmon were seen. Genetic and kidney samples, otoliths and scales were taken from each salmon. All observed coho salmon appeared to be recent arrivals to the river and were not ripe; seeding fertilized coho eggs into the incubation box was not possible. High school students, in addition to assisting with fingerling sampling, also explained the field trip experience to their fellow students. Each presented some aspect of the field studies and the ADF&G team participated by asking questions and explaining details. ADF&G personnel also demonstrated scale reading techniques and presented representative samples of all species collected from the minnow traps. Plans were developed with the science teacher to install and permit a classroom aquarium incubator for coho salmon eggs. (A detailed field trip report is available.)

November 1996- Two ADF&G assessment team members traveled to Perryville and joined with local assistants to capture and spawn one pair of coho salmon for the incubation box in the Kametolook River. Gillnetting captured about 20 salmon including 4 sockeye, 13 male coho and 3 female coho salmon. Following standard delayed fertilization techniques, the eggs were fertilized and seeded into the incubation box. A thermograph was deployed in the substrate near the largest group of spawning salmon. Although only a one time event, a survey to enumerate spawning coho was conducted. About 75% of all observed coho were located within 1 mile downstream of the incubation box; the remaining 25% were scattered in small groups throughout the remainder of the drainage. The total observed coho escapement was about 100 salmon with no ocean bright salmon observed. The subsistence harvest continued, and the observed escapement might have been higher than the actual spawning escapement. (A detailed field trip report is available.)

At the high school the ADF&G team assembled the aquarium incubator. When the eggs reach the eyed stage, about 250 eggs from the stream side incubator were transferred to the classroom incubator (January ADF&G field trip). (A detailed field trip report is available.)

<u>January 1997</u>- Two ADF&G team members traveled to Perryville. While waiting in King Salmon for the flight to Perryville they met with the Alaska Peninsula/Becharoff National Wildlife Refuge staff to discuss the Kametolook project and review the draft Environmental Assessment. In Perryville, they joined local assistants and checked the thermograph and staff gauge sites, shocked the incubating eggs, discarding dead eggs, and sorted out about 250 eggs which were transported to the school aquarium. An approved Fish Transport Permit allowed 250 eggs to be raised in the school aquarium and the release of any resulting fry back into the Kametolook River. With the assistance of five high school students the team measured physical characteristics of two landlocked lakes as potential coho fry or rainbow trout release sites and collected gravel for alevin habitat in the aquarium. A slide show of the restoration project and discussion of the life cycle of salmon was presented to all Perryville students. ADF&G personnel also attended a meeting sponsored by the Village Council where they presented a similar slide show. At the village meeting the restoration project and the school aquarium were discussed as well as the life cycle of coho salmon, the 1996 coho salmon escapement, and potential production from the escapement. (A detailed field trip report is available.)

<u>March-May 1997</u>- ADF&G personnel drafted an Environmental Assessment of the Kametolook River Coho Salmon Restoration Project. A FONSI was developed and in May was signed for NEPA compliance. A Habitat Permit was reviewed and accepted which allows the instream incubation boxes to be deployed. Fish Transport Permits were drafted for review to insure that management, genetic, and pathology concerns are addressed. Approximately 125 coho salmon fry were released into the river of origin (Kametolook) from the school aquarium project (Fish Resource Permit P-97-021).

<u>June-July, 1997</u>- Received appropriate fish transport permits from ADF&G for harvesting salmon eggs and releasing fry from incubation box and school aquarium for the 1997/98 season. Purchased materials for two incubation boxes and constructed them for later use. Met with the Chignik Regional Planning Team, Chignik Regional Aquaculture Association and public to development a Western and Perryville Districts coho salmon management plan.

<u>August 1997</u>- Transported incubation boxes to Chignik Bay (ADF&G M/V Resolution) and local Perryville resident transported them to Perryville via fishing boat.

<u>September 1997</u>- Two Perryville personnel were trained (2 weeks) at Pillar Creek Hatchery (Kodiak) in spawning and incubator maintenance techniques. Two ADF&G staff

attempted to travel to Perryville to install the two incubation boxes in Kametolook River, sample salmon and trout for age, length and abundance data, however weather prevented them from traveling beyond Chignik Lake. In late September, two Perryville assistants transported two egg boxes and other necessary equipment up Kametolook River to the installation site.

Project 98247 (October 97-September 98)

October-November 1997- The Perryville Village Council voluntarily closed the spawning areas of the Kametolook River to fishing (October 3). One ADF&G personnel traveled to Perryville October 31 through Nov. 6. On this trip ADF&G personnel 1) set up the school aquarium for incubation of coho salmon from egg to fry stages, met with the teachers and this year's upper class members and instructed them on classroom salmon incubation techniques; 2) discussed with the local assistants the placement of thermographs for the fall/winter/spring period of 1997-1998; 3) estimated the total coho salmon escapement to the Kametolook and Three Star Rivers; 4) with help of three local assistants, installed two production type salmon incubation boxes in the Kametolook River; 4) attempted a coho salmon egg take for the incubator boxes and the school aquarium 5) took samples of adult coho salmon for genetic and pathology data. Only two ripe and no spawned out fish were caught and added to one of the egg incubation boxes. Because of the lack of success finding ripe and spawned out salmon, it was decided that four local Perryville assistants would attempt additional egg takes through November.

Local Perryville assistants took 10 additional trips at different stream locations and several sets per day to capture ripe coho for the incubation boxes without much success (total catch: 7 females, 4 of which were partially spent) which were added to the incubation boxes. The problem was not in catching fish, but in catching ripe ones. Samples were taken for pathology and genetic testing from males and females harvested for sampling. They reinstalled and deployed thermographs at designated sites.

December 1997- The assessment team decided to install fish holding pens in 1998 to aid in capturing ripe salmon for egg incubation boxes. Perryville assistants traveled to egg incubation boxes and removed approximately 300-eyed eggs that were put inside the school aquarium.

January-March 1998- Perryville assistants took monthly monitoring trips to Kametolook River to check thermograph sites and egg boxes. Approval to release fry in Kametolook was denied by ADF&G Pathologist due to low number of females harvested; however, approved was granted to release them in local landlocked Sicken and Sandy Lakes in late April or May. The Perryville teacher communicated with ADF&G regarding status of eggs in aquarium. Survival fry from school incubation box will be transported and released in the Kametolook River in late April or May. Two net holding pens were acquired, and prepared for transport to Perryville in May. Present staff attended the State Board of Fisheries meeting and gave staff report regarding the project. They also attended Chignik RPT meeting and provided a project status report. The RPT continued to support project. A fish transport permit request was submitted to ADF&G for review.

Project 99247 (October 98-September 99)

<u>October 1998-</u> Jim McCullough participated in a field trip on 21 through 27 October 1998, to Perryville, Alaska. The purpose of the trip included: 1) to install temporary ripening pens for coho salmon, 2) foot survey of salmon in the Kametolook River, 3) capture and place in holding pens adult coho salmon, 4) clean the instream incubation boxes, 5) clean the school salmon egg incubation aquarium, and 5) collect and down load remote thermographs.

<u>October 23</u>- Jim McCullough along with the assistance of Jerry Yagie and Bruce Phillips installed holding pens for ripening coho salmon in a side pond of the Kametolook River. The Kametolook River was also surveyed for adult salmon. Approximately 70 coho and 25 sockeye salmon were observed in the main upriver spawning area located about ¼ mile below the incubation boxes. An additional 4 coho salmon were counted in the main stem of the river below the main spawning site and an additional 15 sockeye salmon in Candlefish Slough. The indexed escapement count for the Kametolook River is 148 coho salmon and 40 sockeye salmon. The indexed count for coho is twice the observed count (sockeye estimate not expanded). Although the river was somewhat turbid below the main spawning area, it was also obvious that there were few salmon present.

<u>October 24</u>- 16 female and 15 male coho salmon were caught and placed in the holding pens to ripen. The instream incubator boxes and water head collector boxes were cleaned and disinfected. The Three Star River was also visited where 5 adult coho salmon were spotted. Jim McCullough met with the new science teacher, Patsy Chapple and discussed report requirements and the permit process for running the school aquarium, and cleaned, disinfected, and filled the aquarium with fresh water and turned the chiller on.

<u>October and November 1998</u>- Jerry Yagie conducted weekly stream surveys of the Kametolook for the presence of coho.

<u>November 1998-</u> Jim McCullough and Melvin Chya participated in a field trip on 9 through 13 November 1998, to Perryville, Alaska. The purpose of the trip included: 1) foot survey of salmon in the Kametolook River, 2) spawn adult coho salmon that were ripening in holding pens, 3) fertilized and place coho salmon eggs in the Kametolook River incubation boxes, and 4) fertilize and place coho salmon eggs in the school aquarium. Melvin Chya works at the Pillar Creek Hatchery in Kodiak, Alaska.

<u>November 10-</u> Jim, Melvin and Jerry Yagie checked the Kametolook River incubation boxes to insure they were operating properly for the next days-planned egg take. The holding pens where checked for adult ripening coho salmon and noticed that the adult male salmon had escaped, the female salmon were still captive in their pen. The Kametolook River was surveyed again for adult salmon with approximately 20 coho and 10 sockeye salmon in the main upriver spawning area located about ¼ mile below the incubation boxes observed. None of these salmon appeared fresh and were likely counted

during the 23 October salmon survey. The indexed escapement count for the Kametolook River should remain at 148 coho salmon and 40 sockeye salmon, the survey count from 23 October.

November 11- Jim, Jerry, Melvin, Austin Shangin caught 7 male coho salmon from the Kametolook River and used them to fertilize the 11 ripe female coho salmon from the holding pen. Standard salmon delayed fertilization techniques were used and the fertilized eggs were immediately rinsed and placed in the instream incubators. All but about 300 unfertilized eggs which were held back for the school aquarium, were distributed between the two instream incubator boxes. Fin and kidney samples were collected form each salmon for genetic analysis and disease screening, and ovarian samples were collected from each female salmon for disease screening.

November 12- Jim and Melvin showed all the Perryville students from kindergarten through the sixth grade how to fertilize salmon eggs. After fertilizing the eggs, they were placed them in the school aquarium where the students will be able to watch their development through the swim up fry stage and their release into the Kametolook River in the spring of 1999.

November 13- Genetic samples were delivered to U.S. Fish and Wildlife laboratory in Anchorage and kidney and ovarian samples taken to Anchorage Alaska Department of Fish and Game laboratory for testing.

November 1998 through April 1999- Jerry Yagie continued to conduct bi-monthly trips to the instream incubation boxes to check their condition. He provided reports to the ADF&G staff.

January 1999- Jim McCullough attended the State Board of Fisheries meeting and gave a status report of this project.

March 1999- Jim McCullough and Lisa Scarbrough attended Chignik RPT and CRRAA meeting March 17-18 and provided project status report of project. Jim McCullough and Lisa Scarbrough constructed a project poster for the 1999, 10th annual EVOS conference "Legacy of an Oil Spill 10 Years After *Exxon* Valdez" March 23-26. Attended the conference and presented the poster during the scheduled poster session.

SCHEDULE

A.1. Measurable Project Tasks remaining for FY 99 (April- September 1999)

April/May 1999-
- -Review meeting with assessment team to evaluate the project.
- -Write DPD proposal for FY00 and FY 98 annual report.
- -Two ADF&G personnel travel to Perryville to assist Perryville assistants with fry release from egg boxes. Students release aquarium fry. Meet with community to review status of project and discuss community involvement activities.
- -Collect additional information from selected households to learn more about the subsistence practices of subsistence salmon by Perryville residents.
- -Perryville assistants continue to monitor incubation boxes.

June-Sept. 1999-
- -Perryville assistants monitor incubation boxes and conduct stream surveys.
- -Two ADF&G personnel travel to Chignik Bay for a Regional Planning Team meeting to review status of the project and discuss community subsistence needs.
- -Two ADF&G personnel travel to Chignik villages to discuss community subsistence harvest prior to Alaska Board of Fisheries fall work session.

A.2. Measurable Project Tasks for FY00 (October 1999 - September 2000)

October 1999-
- -One ADF&G personnel travel to Perryville to capture adult coho salmon (assisted by 2 or 3 Perryville assistants) and place in holding pens until salmon are ripe.
- -ADF&G and PV assistant conducts stream surveys of Kametolook River.
- -Consult with teachers and set up school aquarium and obtain FTP.
- -Perform maintenance of instream incubation system and school aquarium.
- -Status report of project to Alaska Board of Fisheries in Fairbanks.

Nov.-Dec. 1999-
- -Two people (Jim McCullough ADF&G and Pillar Creek Hatchery Specialist) travel to Perryville:
- -Meet with Perryville personnel and conduct escapement surveys.
- -Hatchery Specialist will conduct additional training for Perryville assistants and evaluate project/ make recommendations.
- -Perform a coho salmon egg take, fertilize eggs, place in incubation boxes.
- -Sample salmon for genetic and pathology tests.
- -Meet with school children and community to discuss project.
- -Renew school aquarium FTP

Jan.- Feb. 2000- -Perryville assistants transport a few fertilized eggs from egg boxes and place in school aquarium, continue monthly monitoring trips to check on egg boxes.
-ADF&G analyze subsistence and commercial harvest data.

April/May 2000- -Meeting with assessment team to evaluate the project.
-Write DPD proposal for FY01 and FY 99 annual report.
-One ADF&G personnel travels to Perryville to assist Perryville assistants with fry release from egg boxes. Students release aquarium fry.
-Meet with community to review status of project and discuss community involvement activities.
-Purchase and ship to Perryville any necessary equipment needed for project maintenance.
-Perryville assistants monitor incubation boxes.

June-Sept. 2000- -Perryville assistants monitor incubation boxes, and conduct stream surveys.
-Regional Planning Team meeting in Chignik Bay to review status of the project.

B. Project Milestones and Endpoints

Annually through the duration of the project: One day every month, one or two trained Perryville researchers will return to the Kametolook River to monitor the environment, the egg boxes, net pens and conduct general stream surveys (counting adult salmon). ADF&G will continue to supervise the project and continue to take trips to assist with the project. As this project continues; however, (up through 2002) Perryville assistants will continue to be better trained and will take on additional responsibility for the project. Some of their duties will include: conducting escapement surveys, netting salmon for holding in pens, harvesting and fertilizing eggs and transporting to egg boxes, taking samples of harvested salmon for genetic and pathology tests, assisting school children with obtaining eyed eggs for the school aquarium project, and releasing fry in the spring. (This is necessary because of budget constraints preventing ADF&G from being present at all critical times of the project.)

Annually, ADF&G staff will evaluate the Kametolook coho runs through subsistence harvest reports, evaluate incubator performance and stocking levels, perform egg takes, stocking, update project plan, review FTPs and FRPs, provide annual peer review and write annual reports. ADF&G biologists will determine any significant changes to the coho salmon spawning and rearing habitat of the rivers to determine appropriate stocking levels. ADF&G will also evaluate the use of Kametolook River coho salmon as brood stock and the release of fry back into the Kametolook, Three Star, and Long Beach Rivers and other potential stocking sites include Sandy and Sicken Lakes.

In order to rehabilitate the coho salmon run in the Perryville area, education of villagers through a better understanding of the life cycles and conservation of salmon is essential and will continue every year. The ADF&G team will assist with an educational process that focuses on teaching the community through the both the school children and adults. They plan to continue working with the community and teachers and help with this process. Results from all samples will continue to be shared with the school and community.

In conjunction with all other aspects of this project, the ADF&G team will continue to work with the Village Council to assess the project and look at ways the community can facilitate the success of the project and help increase the number of spawning coho salmon. As mentioned earlier, as of October 1997, Perryville Village council voluntarily closed the upper half of the Kametolook River to salmon fishing as a way to do their part at helping solve the salmon shortage problem. This action as well as other options will be evaluated and discussed with the community annually on a regular basis.

The ADF&G team expects the stream side incubation boxes, in conjunction with some fishing restraints, will provide sufficient coho salmon to rehabilitate the run within two to three life cycles. In addition to the Kametolook River, coho fry from the incubation boxes and school aquarium could also be stocked in both landlocked lakes (Sandy and Sicken), as well as nearby Three Star and Long Beach Rivers (approved by ADF&G FTP reviewers).

C. Completion Date

The project is anticipated to be completed by September 30, 2002.

Cooperating Agencies, Contracts, and Other Agency Assistance

Perryville

Perryville Village Council has hired a local project administrator to track the project, arrange for logistical support, and assist ADF&G with field work and long term monitoring of the project. Three additional Perryville residents have been hired (by the Village Council) to work annually, as needed, to assist ADF&G and the project administrator with building and hauling materials, maintenance of installed egg boxes, site selection and installation of fish holding nets. Local assistants will also help with capturing adult salmon, taking genetic and pathology samples, removing, fertilizing, and seeding eggs into incubation boxes, and releasing fry in spring. Village assistants will also need to continue providing a skiff and 4-wheelers as needed. The project administrator is responsible for checking the boxes and habitat monitoring sites throughout the winter to insure they are operating efficiently, and safe from natural or human harm. Wages for the four village assistants have been included in the cost of the grant.

Alaska Department of Fish and Game

Several ADF&G personnel have provided technical assistance for the project. Personnel responsible for the project include Jim McCullough, Fish Biologist III for Commercial Fisheries, Kodiak, and Lisa Scarbrough, Subsistence Resource Specialist II for Subsistence, Anchorage. Personnel assisting the project include: Bill Hauser, Fish Biologist IV for Habitat and Restoration, Anchorage; Joe Sullivan, Fish Biologist III for Habitat and Restoration, Anchorage, Dave Owen, Fish Biologist III, Chignik/Kodiak; Wayne Dolezal, Habitat Biologist III for Habitat and Restoration, Anchorage and Pete Velsco, Fish Culturist II for Commercial Fisheries, Nome (earlier in project/now retired).

Jim McCullough with ADF&G has several years of varied experience with fisheries enhancement and research projects as well as salmon management in the Alaska Peninsula. Lisa Scarbrough, has been doing subsistence research in the Alaska Peninsula (including Perryville) communities since 1989. Bill Hauser and Joe Sullivan have extensive experience in fisheries restoration and enhancement with the department. Dave Owen is Chignik's Area Management Biologist with several years of experience with fisheries in the Chignik/ Perryville region. Dave Owen is Chignik's Area Management Biologist with several years of experience with fisheries in the Chignik/ Perryville region. Wayne Dolezal is one of the State's leading experts on habitat restoration. Pete has several years of varied experience with instream and recirculating incubation box projects, particularly in Norton Sound. Labor (with the exception of .5 months/year for Lisa) will be provided by ADF&G as part of their normal salary, however, transportation costs and per diem will be covered through the grant.

PUBLICATIONS AND REPORTS

An annual report of activities will be submitted to the Restoration Office before 15 April of each year, commencing in 1998. Similar reports will also be presented to the Chignik Salmon Advisory Committee and the Alaska Board of Fish.

PROFESSIONAL CONFERENCES

None planned at this time.

NORMAL AGENCY MANAGEMENT

This proposed rehabilitation effort is not part of ADF&G's normal management responsibilities in the Chignik area.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project is a continuation of Perryville 96-01, funded by DCRA funds from the EVOS Criminal Settlement (in State Fiscal Year 1996) and Trustee Council Civil projects 97247, 98247 and 99247 (in Federal Fiscal Years 1997, 1998 and 1999).

PRINCIPAL INVESTIGATORS

Jim McCullough, Fish Biologist III
Alaska Department of Fish and Game
Division of Commercial Fisheries and Management
211 Mission Road
Kodiak, Alaska 99615-6399
Phone: (907) 486-1813
Fax: 486-1841
E-mail: jim_mccullough@fishgame.state.ak.us

1 Nov 1995 - Present: FB III Regional Resource and Development Biologist. Co-author of the Pillar Creek and Kitoi Bay basic and annual hatchery plans. Voting member of the Kodiak, Chignik and Alaska Peninsula/Aleutian Islands Regional Planning Teams. Author/Review regional Fish Transport and Fish Resource Permits. Regional Habitat Biologist. Coleader of an EVOS project to restore a coho stock for subsistence purposes in the Chignik Area.

30 June 1990 - 1 Nov 1995: FB III Alaska Peninsula Herring and Southeastern District Salmon Management Biologist. Compiled salmon and herring catch data and herring biomass and salmon escapement data which was analyzed to determine opening and closure of the various commercial fisheries as delegated by the Commissioner of ADF&G.

16 July 1985 - 31 May 1990: FB II Alaska Peninsula and Aleutian Islands Areas Finfish Research Biologist involved the design, organization, and completion of the annual catch and escapement program.

Lisa Scarbrough, Subsistence Resource Specialist II
Alaska Department of Fish and Game
Division of Subsistence
333 Raspberry Road
Anchorage, Alaska 99518-1599
Phone: (907) 267-2396
Fax: 267-2450
E-mail: LisaS@fishgame.state.ak.us

Lisa Scarbrough has been a subsistence resource specialist with the Division of Subsistence of the Alaska Department of Fish and Game since 1989. She has extensive subsistence research experience in the Chignik area, including the village of Perryville. This has included research on the effects of the oil spill on local subsistence patterns. Her work has also involved training residents of the Chignik area communities as research assistants. Since 1993, Lisa has been responsible for assessing Chignik Subsistence salmon permit data.

OTHER KEY PERSONNEL

Perryville Traditional Village Council
Gerald Kosbruk, President
Celia Yagie, Village Administrator
P.O. Box 101
Perryville, Alaska 99648
Phone: (907) 853-2203
Fax: 853-2230
Chief Community Coordinator- *Jerry Yagie* - Phone: (907) 853-2261

Bill Hauser, Fish Biologist IV
Alaska Department of Fish and Game
Division of Habitat and Restoration
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Wayne Dolezal, Habitat Biologist III
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Alaska Department of Fish and Game
Division of Commercial Fisheries and Management
211 Mission Road
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Phone: (907) 486-1806
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Chignik Regional Planning Team and Chignik Regional Aquaculture Association
Chuck McCallum, Chairman
614 Irving Street
Bellingham, Washington 98225
Phone: (360) 647-5540
Fax: 733-4744

Melvin Chya
Pillar Creek Hatchery
104 Center Avenue, Suite 202
Kodiak, AK 99615
Phone. (907) 486-6555

2000 EXXON VALDEZ TRU: COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel	$2.6	$2.9						
Travel	$6.8	$6.4						
Contractual	$10.0	$11.8						
Commodities	$0.3	$0.3						
Equipment	$0.0	$0.5	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$19.7	$21.9			Estimated FY 2001	Estimated FY 2002		
General Administration	$1.1	$1.3						
Project Total	$20.8	$23.2			$23.5	$30.0		
Full-time Equivalents (FTE)	0.5	0.5						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: An Environmental Assessment was approved in 1997. The final evaluation of the project is projected to be FY 2002.

This project was originally funded by Criminal Settlement funds in 1996. The budget estimate for 2000 through 2002 differs slightly from the projected amount stated on the 1999 DPD. Less money is requested for one less trip for ADF&G to travel to Perryville. Instead a Hatchery Specialist with the Kodiak Pillar Creek Hatchery will travel to Perryville for one trip to assist PI Jim McCullough and Perryville assistants with the November egg harvest and biological sampling. (Expenses are described under the contractual section). In 1998, this project funded the travel, wages and perdiem for two Perryville assistants to travel to Kodiak's Pillar Creek Hatchery for training in egg harvesting and biological sampling. Bringing the Hatchery Specialist to Perryville is less costly than sending Perryville assistants to Kodiak for updated training, and he will be able to evaluate the project and make recommendations, provide additional training to Perryville assistants and help with the egg harvest and biological sampling. In addition, Perryville provided personal gill nets in the past to capture salmon for the project, but a smaller mesh gill net is needed in order not to kill captured salmon that need to be held live in the holding pens and others not needed for the project (i.e. sockeye salmon). One trip was added for Jim McCullough to travel to Anchorage to attend the annual EVOS conference in March. Also, staff time (.5 months in 2000,2001 and 2.0 months in 2002) will continue to be requested annually in order to develop and monitor the subcontract with Perryville and provide other staff support for the project, and write the final report in 02. This amount increased in year 00 slightly due to a step salary increase of personnel listed.

FY00

Prepared: 4/13/99

Project Number: 00247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Agency: Alaska Department of Fish and Game

FORM 3A TRUSTEE AGENCY SUMMARY

2000 EXXON VALDEZ TRU: COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
						0.0
Lisa Scarbrough	Subsistence Resource Specialist II	16J	0.5	5.7		2.9
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.5	5.7	0.0	
					Personnel Total	$2.9

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
					0.0
*Kodiak/ Anchorage	0.4	4	11	0.1	2.7
Anchorage/ Perryville	0.8	3	13	0.1	3.7
					0.0
					0.0
* Note when traveling from Kodiak to Perryville it is necessary to overnight in Anchorage coming and going.					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$6.4

FY00

Prepared: 4/13/99

Project Number: 00247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Agency: Alaska Department of Fish and Game

FORM 3B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRU : COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Contractual Costs: Description		Proposed FY 2000
		11.8
4A Linkage	1) Contract With Native Village of Perryville (Perryville wages/ gasoline/ ATV or boat use/ insurance/ Village admin. fee (10%)	
	2) Contract With Kodiak Pillar Creek Hatchery (wages for one employee for 6 days/ travel and perdiem from Kodiak to Perryville)	
	3) Shipping costs of misc. maintenance supplies to Perryville, via Peninsula Air or USPS	
When a non-trustee organization is used, the form 4A is required.	Contractual Total	$11.8

Commodities Costs: Description	Proposed FY 2000
General maintenance supplies for incubation boxes/ egg take equipment/ fish holding pens/ temperature instruments/ school aquarium/ film development etc.	0.3
Commodities Total	$0.3

FY00

Prepared: 4/13/99

Project Number: 00247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Agency: Alaska Department of Fish and Game

FORM 3B
Contractual & Commodities DETAIL

2000 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			0.0
1 small gill net (100 feet Long X 2 feet deep /mesh 2 inch)	1.0	0.5	0.5
			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**	$0.5

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY00

Prepared: 4/13/99

Project Number: 00247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Agency: Alaska Department of Fish and Game

FORM 3B
Equipment
DETAIL

2000 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel	$5.4	$6.2						
Travel	$0.0	$1.2						
Contractual	$4.4	$4.4						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$9.8	$11.8			Estimated FY 2001	Estimated FY 2002		
Indirect								
Project Total	$9.8	$11.8			$12.2	$12.5		
Full-time Equivalents (FTE)	0.0	0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY00

Prepared: 4/13/99

Project Number: 00247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Name: Perryville Village Council

FORM 4A
Non-Trustee
SUMMARY

2000 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Personnel Costs:						
Name	Position Description		Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
						0.0
To be determined	Perryville					5.4
	Project Facilitator and assistants					0.0
						0.0
Note: Appx. 54 days of work @ about $100/day labor						0.0
						0.0
						0.0
To be determined	Pillar Creek Hatchery					0.8
	Hatchery Specialist					0.0
						0.0
Note: Appx. 6 days at: $135/ day						0.0
						0.0
		Subtotal	0.0	0.0	0.0	
					Personnel Total	$6.2

Travel Costs:					
Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2000
(Pilar Creek Hatchery)					0.0
*Kodiak to Anchorage	0.4	1	2		0.4
Anchorage to Perryville	0.8	1	5		0.8
					0.0
*Note: Due to travel from Kodiak to Perryville it is necessary to					0.0
overnight in Anchorage coming and going.					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$1.2

FY00

Prepared: 4/13/99

Project Number: 00247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Name: Perryville Village Council

FORM 4B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRU_ . __ COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Contractual Costs: Description	Proposed FY 2000
Perryville contract:	
Approx. 45 days of ATV use @ about $50/ day	2.3
Perryville's admin. fee at 10% of contract (not including insurance coverage)	0.8
Insurance for workman's compensation and general liability required of Perryville as contractor of the project by State of Alaska	1.3
Contractual Total	$4.4

Commodities Costs: Description	Proposed FY 2000
Commodities Total	$0.0

FY00

Prepared: 4/13/99

Project Number: 00247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Name: Perryville Village Council

FORM 4B
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
			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	

FY00

Prepared: 4/13/99

Project Number: 00247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Name: Perryville Village Council

FORM 4B
Equipment
DETAIL

00256B

Sockeye Salmon Stocking at Solf Lake

Project number:	00256b
Restoration Category:	General Restoration
Proposer:	USFS
Lead Trustee Agency:	USFS
Cooperating Agencies:	ADF&G
Alaska Sea Life Center:	No
Duration:	5th year, 7-year project
Cost FY 2000:	$TBD
Cost FY 2001:	$48.0
Cost FY 2002:	$50.0
Cost FY 2003:	$50.0
Cost FY 2004:	$2.5
Geographic Area:	Prince William Sound
Injured Resource:	Subsistence/Sockeye Salmon

RECEIVED
APR 15 1999
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

ABSTRACT

This project is designed to benefit subsistence users of Western Prince William Sound. Solf Lake has been recognized for many years as an opportunity to establish a self-sustaining sockeye salmon run. Habitat improvements were made in 1978, 1980 and 1981 to provide access to the lake for anadromous fish. The lake was never stocked and subsequent investigations suggested that it was fishless. There are two phases to this project: Phase 1, which began in FY96, has verified the ability of Solf Lake to support a sustainable population of sockeye salmon. Phase 2, included stocking the lake with approximately 100,000 sockeye salmon fry, then ensuring access to Solf Lake for returning adult salmon. The stocking program began in 1997 along with modification to the two outlets to control water levels, however further modifications to the eastern channel are still required to ensure adult returns to Solf Lake.

INTRODUCTION

Subsistence use of resources in the oil spill area declined following the spill. Although restoration studies have shown that harvest levels have since returned to pre-spill levels in most oil spill communities, Chenega Bay and Tatitlek are exceptions (Seitz and Fall, 1995; Seitz and Miraglia, 1995). These communities showed reduced harvest levels in 1993/94 and an increased reliance on salmon harvests (Seitz and Fall, 1995; Seitz and Miraglia, 1995). Solf Lake provides an opportunity to establish a large replacement fishery that is easily accessible, approximately 40 miles from Chenega Bay.

This proposal is a request for continued support from the Trustee Council to fund the fifth year of a seven-year project to restore sockeye salmon (*Oncorhynchus, nerka*) runs to Solf Lake. Construction of the structures that control water flow at the two outlets of Solf Lake are now complete and the stocking of sockeye salmon fry is underway (EVOS Projects, 97256b and 98256b). What work remains, is to ensure access to the Lake for returning adult salmon, in order to establish a sustainable run. Approval of this proposal would provide the necessary funding to construct the improvements needed to provide such access. The first returns from the 1998 stocking are expected in May and June of 2001, by that time the needed improvements must be completed to meet the project objectives.

Solf Lake has been recognized as an opportunity to reestablish a sockeye salmon run in Prince William Sound for many years. According to Nickerson (1978), "This system had historic runs of sockeye salmon. An earthquake in the 1930's caused blockages of the natural outlet resulting in water flowing over an impassable fall." Starting in the early 1970's, various attempts have been made to reestablish sockeye salmon in Solf Lake. For two years in this same period, ADF&G personnel transported adult sockeye salmon from Eshamy River to Solf Lake (Jackson, personal communication). Unfortunately, necessary stream improvements had not been completed when the offspring from the transplanted fish returned. In 1978, 1980 and 1981, the USFS implemented improvements to the lake and outlet stream. The work consisted of improving the eastern outlet and partially damming the western outlet. The dam was designed to raise the level of the lake to provide adequate water flow for fish passage at the eastern outlet. The improved eastern outlet channel is less than 100 meters in length, with an average gradient of 23 percent, see (Figure #2 in Appendix) for site details. Stocking of Solf Lake never occurred because of other priority projects for both the USFS and ADF&G, and the outlet improvements fell into disrepair.

ADF&G surveyed Solf Lake in 1985/1986 as part of a lake investigation study. The results of this survey, which included attempts to capture fish, suggest that the lake may be fishless (Pellissier and Somerville, 1987). However 1996 minnow trapping by USFS crews indicated a larger population of Dolly Varden (*Salvelinus malma*) than has been previously observed, but still not significant. These results are also supported by the composition and biomass of the zooplankton populations, which were sampled in 1986 (P. Shields, personal communication 1996). The Pellissier and Somerville (1987) survey also documented that water was flowing through the western outlet due to an incomplete seal by the dam structure. Three minor barriers to fish passage were identified in the eastern channel. The report also suggests that if all the water flowing under the dam at the western outlet was stopped, these barriers might disappear.

ADF&G recommends stocking levels based on their zooplankton studies. ADF&G will also take a conservative approach to stocking because barren lakes often have unstable macrozooplankton communities when faced with predation. With close evaluation, and by experimenting with stocking strategies, significant impacts to the macrozooplankton community will be ameliorated. Major reasons for the disparity of response to stocking barren lakes include 1) the inherent low productivity of these lakes; 2) macro zooplankton abundance, composition, and ability to adapt to predation; 3) stocking density; 4) morphometric factors and 5) variability in the indirect effects of predation in individual lakes. Consequently, based on limnological information for the first three years the stocking level at Solf Lake could be 400,000 fry annually, with monitoring of the zooplankton once per month during June-October required. After three years of stocking at this level, if the zooplankton community did not show a significant impact, the level could be increased to perhaps 500,000 fry. While Solf Lake is most likely capable of supporting stocking at this level, it has been decided to take a more conservative approach to stocking. Based on the amount of available spawning habitat and the RPT's (Regional Planning Team) recommendations a target of 100,000 sockeye fry will be stocked into Solf Lake on an annual basis.

Solf Lake is a clear water lake with a mean depth of 42.5 m and a surface area of approximately 0.61 km^2 (Barto and Nelson, 1982). Based on historical limnological data from the 1980's, stream survey data collected in 1996, and analysis of current limnological data it is reasonable to expect that the lake is capable of supporting a sustainable sockeye population. Based on the available spawning area, it is estimated that Solf Lake could sustain a run of approximately 10,000 sockeye salmon. An escapement goal of approximately 4,500 fish would be required to fully seed the system without depleting the zooplankton populations, leaving 5,500 sockeye available for harvest. Consequently, we are recommending stocking at the 100,000 fry level to meet the objective of the stated desired return and the assumption that there will be a high fry to adult survival.

With the exception of 1986, Diaptomus has accounted for more than 50% of the total biomass followed by Cyclops, which generally comprises about 30 % of the total. The remainder of the total macrozooplankton (TMZ) consists primarily of the cladoceran form Bosmina and very small numbers of Daphnia see Figure #3 in Appendix.

Diet selectivity studies for rearing sockeye fry have shown that fry presented with a wide choice of food items tend to select for cladoceran and large calanoid forms. Although sockeye fry do graze on Cyclops, it is not actively selected. Thus, In Solf Lake, we would expect the large, red pigmented, and therefore, highly visible Diaptomus, to be an indicator species of excessive grazing pressure and a guide to gauge stocking levels.

It appears that the 1998 stocking level of 109,827, .5 gm., sockeye fry has had little influence on (TMZ) or the abundance of preferred prey species Diaptomus and Bosmina. The 1998 annual mean (TMZ) biomass estimate of 382 mg/m^2 is approximately the midpoint of the range of yearly estimates, see Figure #4 in Appendix. The mean 1998 species biomass estimates, with the exception of Cyclops, also fall within the range of annual fluctuations. The decline in Cyclops is probably not due to grazing, it is doubtful we would see a decline in this species before the highly preferred types.

Decreases in species body size can also signify concentrated grazing pressure. We measure body size to the nearest .02 mm. and it appears that measurements taken in 1998, although slightly less, fall within the margin of error, again indicating little pressure from grazing fry.

Personnel from the Main Bay Hatchery successfully collected 139,00 green eggs from Eyak brood stock and reared them at their Main Bay facility. Overall, survival of green eggs to released fry was 92.9%. This resulted in the release of 109,872, 0.51-gram fry into Solf Lake in the spring of 1998. Of the total number of fry released 3,193 were marked with half-length coded wire tags # 13-01-02-08-10. Discussions with PWSAC and the RPT have indicated that PWSAC intends to change their Area Management Plan and that Coghill brood stock will be the only brood stock available at Main Bay for future stocking activities at Solf Lake.

The eastern outlet to the lake required reconstruction of the "irrigation type" control dam, this work was completed in 1997. During the 1998 field season Forest Service personnel completed the installation of the diversion weir structure at the lakes western outlet, EVOS Project 98256b. With the stop boards in place, the diversion weir successfully stops all low flows at the western outlet. The construction project was initiated in mid May and lasted into mid August. Fisheries crews, throughout most of the construction period, encountered high water conditions that slowed, or ultimately halted construction. Returning crews, on several occasions, found previous work damaged due to high water, resulting in additional labor cost.

Both the recently finished diversion weir at the western outlet and the control structure on the eastern outlet have been successfully completed and are working properly. During the1998 field season, the control structure at the eastern outlet was inspected for serviceability. After a full year exposed to the rigorous weather of Prince William Sound the structure remains operational showing little sing of wear. With control structures at both outlets, we can now control the discharge at Solf Lake to facilitate future surveys, construction activities, or simulate low water, a critical factor given the complexity of this channel and flashy nature of the system.

A survey and preliminary design for the fishway improvement in the eastern outlet will be completed by August 1, 1999. Because of the availability of qualified Engineering Staff to conduct the detailed surveys and develop a working design for the fishway, solid cost estimates are not yet available. The intent is to complete this work before the August Trustee meeting and submit an amendment with the expected cost based on the Engineers design. Funding for the final drafting of the construction plans will be paid for by the Forest Service.

NEED FOR THE PROJECT

A. Statement of Problem

Subsistence use of resources in the oil spill area declined following the spill. Although restoration studies have shown that harvest levels have since returned to pre-spill levels in most oil spill communities, Chenega Bay and Tatitlek are exceptions (Seitz and Fall, 1995; Seitz and

Miraglia, 1995). These communities showed reduced harvest levels in 1993/94 and an increased reliance on salmon harvests (Seitz and Fall, 1995; Seitz and Miraglia, 1995). Solf Lake provides an opportunity to establish a large replacement fishery that is easily accessible for subsistence users from Chenega Bay. Projects available for the restoration or replacement of lost subsistence services are limited; this proposal would use one of the few opportunities available.

This project has determined the feasibility of stocking Solf Lake with sockeye salmon and proposes the steps required to establish a replacement fishery for subsistence use. Based on historical limnological data from the 1980's, and stream survey data collected in 1996 it is reasonable to expect that the lake is capable of supporting a sustainable sockeye population with an adult return of approximately 10,000 fish.

B. Rationale/Link to Restoration

The *Exxon Valdez* Restoration Office's Invitation to submit proposals for FY97 stated that subsistence users are traveling greater distances and must invest more time in subsistence harvesting than they did before the spill. Unlike many other oil spill communities, Chenega Bay still shows reduced subsistence harvest levels and a greater reliance on subsistence harvest of salmon (Seitz and Fall, 1995; Seitz and Miraglia, 1995). Solf Lake is located approximately 40 miles from Chenega Bay and provides an opportunity to establish a replacement fishery that is accessible to subsistence users. The lake is a clear water lake with a mean depth of 42.5 m and a surface area of approximately 0.61 km^2 (Barto and Nelson, 1982). Analyses of current data suggest that the lake may support a self-sustaining population of 10,000 sockeye with roughly half being available for harvest. Establishing this fishery would directly benefit subsistence users in Western Prince William Sound.

C. Location

Solf Lake is located off Herring Bay on Knight Island. The lake is approximately 40 miles by boat from Chenega Bay and 46 miles from Whittier. The lake is unnamed on USGS maps; however, Nickerson (1978), PWSRPT (1983 and 1986), Barto and Nelson (1982) all refer to the lake as Solf Lake (ADF&G Stream 690). The lake is described in the Anadromous Waters Catalog as number 226-10-16900-0010 (ADF&G, 1992). See location map, (Figure #1 in Appendix).

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

This project is designed specifically to benefit subsistence users of PWS; therefore, community involvement is an important component for the success of the project. The feasibility phase of this project (FY96) has determined the ability of Solf Lake to support a self-sustaining population of sockeye salmon. Contacts with the Chenega Bay community liaison will be maintained throughout the feasibility and implementation phases of this project to discuss what the potential production might be for the lake, and project schedules. Opportunities will be identified to include residents of Chenega Bay in habitat improvement work or in the post-stocking monitoring program.

PROJECT DESIGN

A. Objectives

All of the objectives described in Phase 1 will be completed in FY99. The phase 2 objectives will continue to be addressed in FY00.

Phase 1. The overall objective of this phase of the project was to determine the feasibility of stocking Solf Lake with sockeye salmon. There are four components to this objective:

1. Determine if Solf Lake can sustain a population of sockeye salmon; (completed).
2. Determine appropriate stocking levels; (completed).
3. Coordinate with PWSAC and Main Bay hatchery to establish an appropriate brood stock and the necessary logistics to begin a stocking program; (completed).
4. Evaluate the existing habitat improvement structures to ensure adequate conditions for adult migration; (to be completed in FY99).

Phase 2. This is the implementation phase of the project it has three components.

1. Design and construct necessary improvements to the outlet channel and dam to ensure adequate passage for adult salmon migration; (50% complete).
2. Stock Solf Lake with sockeye salmon to produce a self-sustaining population that can provide an adequate subsistence harvest; (ongoing).
3. Monitor zooplankton and out-migration to ensure appropriate stocking levels; (ongoing).

B. Methods

Project 96256 included one season of data collection to determine presence of resident fish and the potential carrying capacity of Solf Lake. Information collected in 1999 will identify the habitat improvements needed to establish a sustainable sockeye run and allow for the design of the fishway. The following section is divided into two parts. Part 1 describes the methods needed to establish a self-sustaining sockeye salmon population. Part 2 describes the steps that may be needed to provide access for returning adult salmon.

Part 1. This section outlines the methods to implement a stocking program at Solf Lake.

Interagency Coordination: Close coordination between the USFS, ADF&G, PWSAC and the PWS/CR RPT is mandatory for the success of this project. Prince William Sound is a complex ecosystem and the potential stocking of Solf Lake needs to be considered in perspective with the overall management of the Sound. Interagency coordination started in 1996 and continues through 1999 to identify appropriate brood stocks, determine appropriate stocking levels, meet hatchery-related requirements, and to address mixed-stock fisheries issues.

Stocking Program (1998 to 2002): Appropriate stocking levels and strategies have been determined in coordination with ADF&G and PWSAC using all available data. Fry are currently being short-term reared at the Main Bay Hatchery and transported to the lake for release. The Eyak and Coghill stocks are identified in the PWS/CR Phase 3 Comprehensive Salmon Plan (PWS/CR RPT, 1994) as potential stocks for Solf Lake. At least four years of fry transplants would be required to establish a sockeye salmon run.

On the recommendation of the RPT, Eyak fish were selected as the brood stock for the Solf Lake project. At that time, there was concern that the incubation temperatures were too high in Solf Lake for early run Eyak fish. However, an early run stock was chosen to minimize management conflicts. Since that time, PWSAC has updated their Area Management Plan, which includes discontinuing the rearing of all sockeye stocks except Coghill fish at their Main Bay facility. On February 18th a letter was sent to the RPT indicating that the Forest Service had no objection to switching the stock to Coghill fish, since these fish are also identified in the PWS/CR Phase 3 Comprehensive Salmon Plan as a suitable stock for Solf Lake. The mid run timing of the Coghill fish may additionally provide a more favorable incubation period than the Eyak stock, increasing the likelihood of a successful project.

Monitoring (1998 and beyond): Limnological data will be collected each year of the stocking program to evaluate the affect of the stocking program on the plankton population. This monitoring will include a summer and fall sampling period for water chemistry analysis and monthly zooplankton sampling from May through September. These procedures are described in detail in Koenings et. al. (1987). This would be a reduced sampling design from the one used during the feasibility assessment of the lake.

The success of the stocking program would also be monitored through sampling the fish population during the smolt out-migration and during adult escapement. Smolt will be collected by weir to estimate the total out-migration. Fish will be sampled to determine age, length and weight characteristics that can be used to evaluate the health of the population. Coded wire tags will be used to monitor the adult population. Returning adults will be enumerated at a weir on the outlet stream and if possible with aerial surveys. Scales will also be collected and the age structure of the returning fish will be analyzed.

Part 2. This section recognizes the work needed to provide access to the lake for returning adults. Until the engineering survey is completed in 1999, it is unknown what specific type of work may be needed at the eastern channel to ensure salmon have access to Solf Lake.

Outlet Flow Control Structures (1997 – 1998): The existing improvement structures at the two outlets of the lake were evaluated. It was determined that the old structure, which dams the impassable western outlet, required extensive reconstruction to provide adequate flow for fish passage at the lakes eastern outlet. The eastern outlet, that would provide fish access to the lake also required reconstruction of the "irrigation type" control dam, this work was completed in 1997. An engineered survey of the western outlet and suitable dam design were completed in 1997 and in 1998, installation of the new diversion dam at the western outlet was completed.

Channel Modifications (2000): Solf Lake was visited by ADF&G personnel as part of a PWS lake investigation project in 1985 (Pellissier and Somerville, 1987). Three minor barriers to fish migration were identified in the outlet channel. These barriers were velocity barriers that ranged in size from 1.5 to 2.5 meters. The barriers may potentially be removed through the creation of plunge pools or by installing steeppasses. The report also suggested that the barriers might not exist if more water were in the outlet channel, which could be achieved by repairing or rebuilding the dam at the waterfall of the original outlet channel. The actual methodologies used will be dependent upon the results engineering surveys and fishway design conducted in 1999.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

Personnel from the ADF&G Limnology Lab in Soldotna will conduct the limnological data collection. ADF&G will also complete the water chemistry and plankton analysis work. USFS will conduct the habitat surveys, evaluations of the habitat improvement structures, determine available spawning and rearing habitats, evaluate fish populations and construct improvements. Coordination will occur with PWSAC to make any necessary adjustments at the Main Bay Hatchery to accommodate additional incubation and short-term rearing. Coordination will also occur with PWSAC to perform any necessary fish culture work and transport the fry to the lake. Interagency coordination is essential to establish a successful population at Solf Lake. The PWS/CR RPT will be involved in assessing opportunities and for developing strategies for the stocking program. ADF&G, Residents of Chenega and the USFS will coordinate and develop a harvest strategy prior to sockeye returning to Solf Lake to prevent possible over escapements.

SCHEDULE

A. Measurable Project Tasks for FY00

Oct - June:	PWSAC. Rear sockeye fry at Main Bay.
January:	Attend Annual Restoration Workshop.
Jan - April:	USFS. Prepare for field season award contracts for logistics.
Jan - April:	USFS. Prepare and submit Annual Report and updated DPD.
June:	PWSAC. Release third year of sockeye fry at Solf Lake.
April - July:	USFS. Constructs fishway in eastern channel, monitor for returning jacks.
May - Sept:	ADF&G. Conduct limnological sampling and prepare report.
Aug:	PWSAC. Conduct egg takes for 1999 stocking at Solf Lake.

B. Project Milestones and Endpoints

Phase 1. The overall objective of this stage of the project was to determine the feasibility of stocking Solf Lake with sockeye salmon. This objective has been completed and mixed-stock fisheries and genetic risk issues are resolved.

Phase 2. This is the actual stocking phase of the project. With the completion of Phase 1 and a favorable recommendation from the RPT stocking began in FY98 and is on schedule for FY99.

The evaluation of the eastern channel at Solf Lake indicates that additional work is needed to allow for adequate fish passage. These improvements would have to be made before adult fish return to the lake in the year 2001. The following is a tentative schedule and measurable end points that apply to the two phases of this project.

Oct - Dec. FY97:	Determine appropriate brood stock and potential stocking levels. Coordinate with PWSAC and the PWS RPT for production planning.
Jan-April FY98:	Apply for necessary permits and hatchery space; complete NEPA process.
May-July FY99:	Survey and design of improvements for eastern channel.
April-July FY00:	Construct fishway in eastern channel, monitor for returning jack salmon.
June-July FY97-01:	Collect eggs for brood stock.
FY98 - FY02:	Release hatchery-reared fry Submit annual reports
FY01 - FY03:	Enumerate adult returns and evaluate fishway. Monitor zooplankton and smolt out-migration.
FY04:	Prepare and submit final report.

C. Completion Date

The project completion date for field work will be at the end of FY2003. This will be the final year of monitoring smolt out-migrations, plankton populations and detailed escapement counts. The final report will be prepared and submitted by April 15^{th} 2004.

PUBLICATIONS AND REPORTS

Annual reports and an updated DPD will be submitted during each year of the project. A final report will be submitted in FY04.

PROFESSIONAL CONFERENCES

At this time, there are no plans to present this project at professional conferences however, a poster display for educational and informational purposes is planned.

NORMAL AGENCY MANAGEMENT

Given current agency priorities the opportunity to conduct this project under normal agency management either now or in the near future is unlikely. However, some aspects of the long-term maintenance and monitoring of the project, may fall under the normal agency management. Shared cost proposals for this project will be presented in the future project work plans for the Forest Service but given budget fluctuations, secure funding is not a certainty.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Initial coordination with ADF&G biologists in Cordova, with the Regional Planning Team, and with PWSAC will continue throughout FY99 to address the mixed-stock fisheries and genetic risk issues that will influence the feasibility of this project. USFS Personnel attend the 1996 summer Regional Planning Team meeting to initialize the necessary coordination. The results from FY96 were presented to the RPT outlining, potential size of the stocking program and brood stocks. The information was used to assess the potential effects of this project on local wild stocks and on the commercial fisheries in the area.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

This proposal covers only one of the two locations described in the original proposal 96256. The proposal for the other site, Columbia Lake, was resubmitted as 97256a. The feasibility study of Columbia Lake determined that it would not be a good candidate for stocking at this time and has since been dropped from further study.

We proposed in the FY99 DPD to move back the implementation of the fishway construction until FY00, this modification has been approved by the Trustee Council. Close inspection of the eastern channel revealed subterranean flows and a great deal of rubble within the channel. These factors have required a much more detailed survey and an experienced Fisheries Engineer to develop a design that will function properly in this complex channel. Cost estimates provided with this proposal are based on known expenses not associated with construction of the fishway.

We intend to revise the FY00 budget estimate in an amendment to this proposal. The amended budget will reflect the cost associated with construction of the fishway. The amendment will be submitted to the Trustee Council for approval by August 1, 1999.

PROPOSED PRINCIPAL INVESTIGATOR

Dan Gillikin
Glacier Ranger District
P.O. Box 129
Girdwood, AK. 99587
(907) 783-3242

Patrick Shields
Limnology Laboratory (ADF&G)
3428 Kalifornsky Beach Rd. #8
Soldotna, AK 99669
(907) 262-9368

PRINCIPAL INVESTIGATOR

The principal investigator of this project will Daniel Gillikin, Fisheries Biological Technician; Glacier Ranger District. Dan is the logistics and construction specialist for the fisheries department at Glacier and will coordinate this project for the USFS. Currently Dan holds the position of Fisheries Technician on the Glacier District. Dan has twelve years of experience as a fisheries technician with Private and Federal Agencies in Washington and Alaska. He would work with the project manager and conduct project implementation, environmental compliance, agency coordination, budget management and reporting.

ADF&G is the cooperating agency on the project. Pat Shields, Fishery Biologist I, will be the principal investigator for the limnological and bathymetry work. Marsha Spafard, Fish and Game Technician III and Denise Cialek, Fish and Game Technician III, will assist in the data collection and laboratory analysis of the limnological data.

OTHER KEY PERSONNEL

Cliff Fox, U.S. Forest Service Glacier Ranger District Chugach National Forest. Currently holds the position of Resource Staff Officer on the Glacier District. Cliff has 20 years experience in natural resource management with State and Federal Agencies in California, Idaho and Alaska. Presently oversees the District s fisheries, wildlife, timber, ecology, minerals and air quality programs. Would be responsible for project oversight during implementation, environmental compliance, agency coordination, budget management and reporting.

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FAX: (907) 783-2094

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Pellissier, R.F. and M.A. Somerville. 1987. Field data summary for Copper River and Prince William Sound lake investigations, 1985. ADF&G contract no. 85-0159. 149p

PWSRPT. 1983. Prince William Sound - Copper River comprehensive salmon plan, phase I - 20 year plan (1983-2002). Prince William Sound Regional Fisheries Planning Team. Cordova. 176 pp.

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Seitz, J. and R.Miraglia. 1995. Chenega Bay. In: Fall, J.A and C.J. Utermohle, (eds). *An investigation of the sociocultural consequences of outer Continental Shelf development in Alaska; II. Prince William Sound.* MMS 95-011; Technical Report No. 160.

PERSONAL COMMUNICATIONS

Holbrook, K., US Forest Service, Anchorage. August 1995.

Jackson, M., Fish and Game Technician (retired). Alaska Dept. of Fish and Game. Cordova. April, 1995.

Shields, P., Fish Biologist I, Alaska Department of Fish and Game. Division of Commercial Fish Management and Development. Soldotna Limnology Lab. April 1996.

APPENDIX

Figure # 1. Solf Lake Location Map.

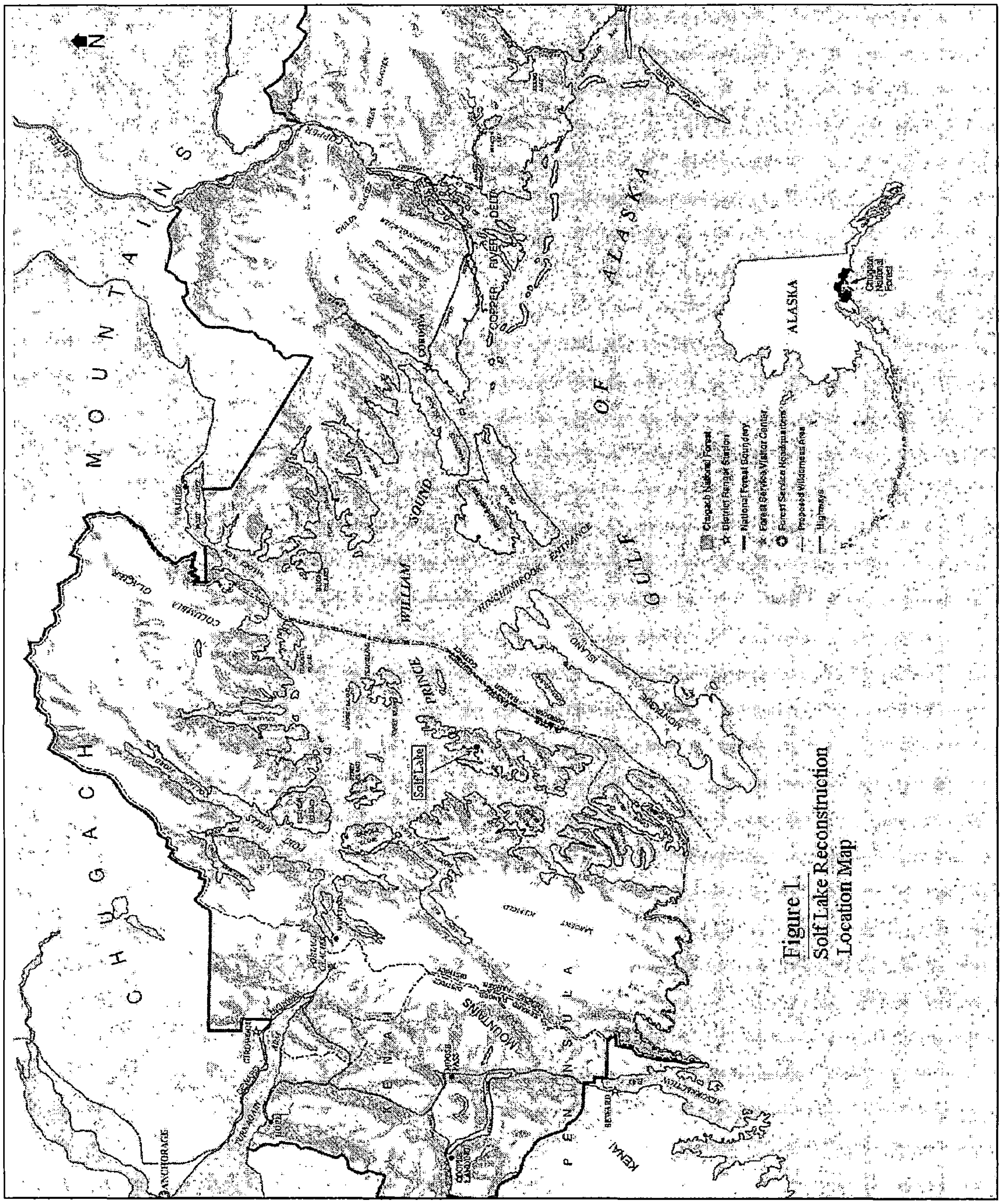


Figure # 2. Solf Lake Site Plan

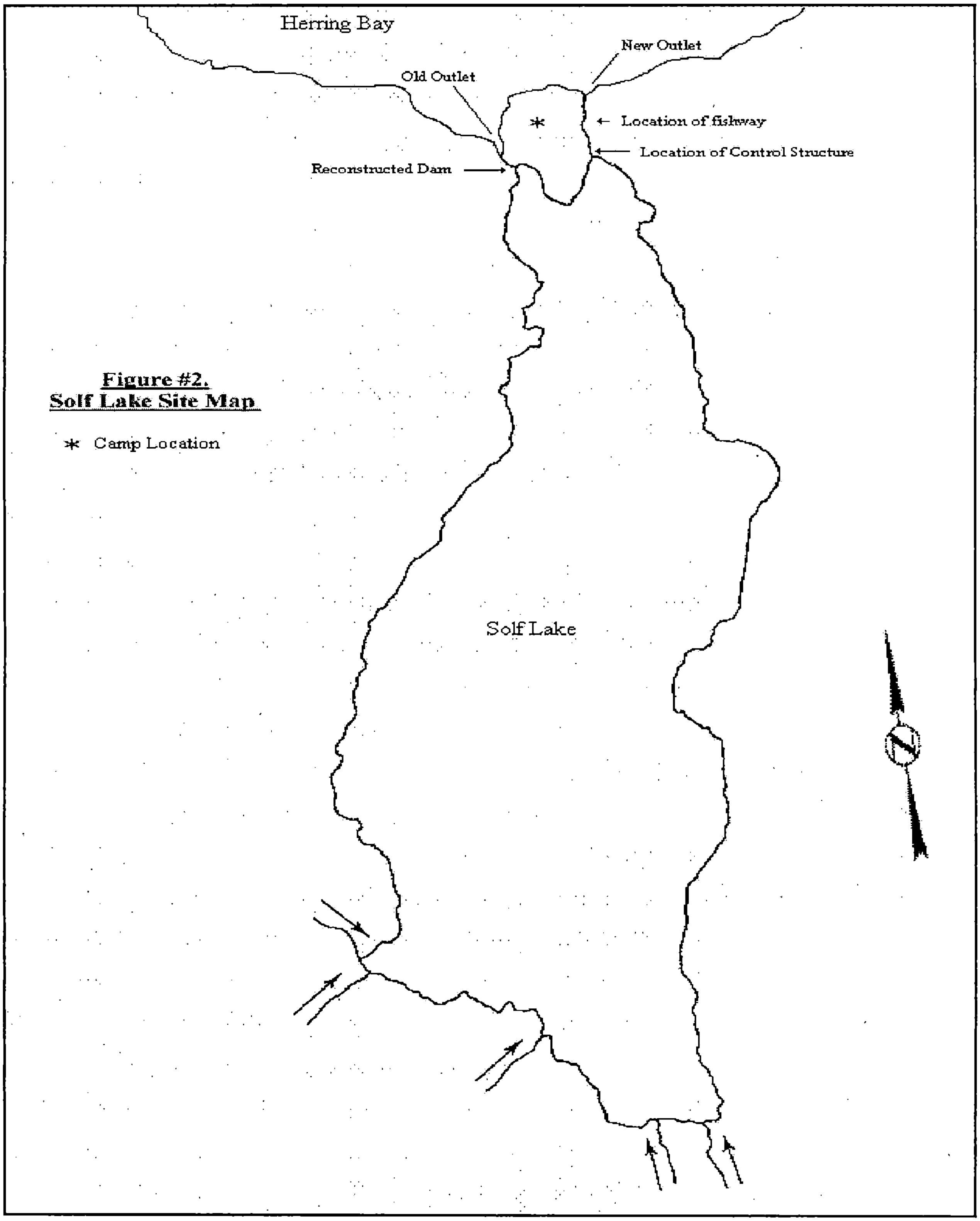


Figure # 3. Macrozooplankton Composition by Species Percentage.

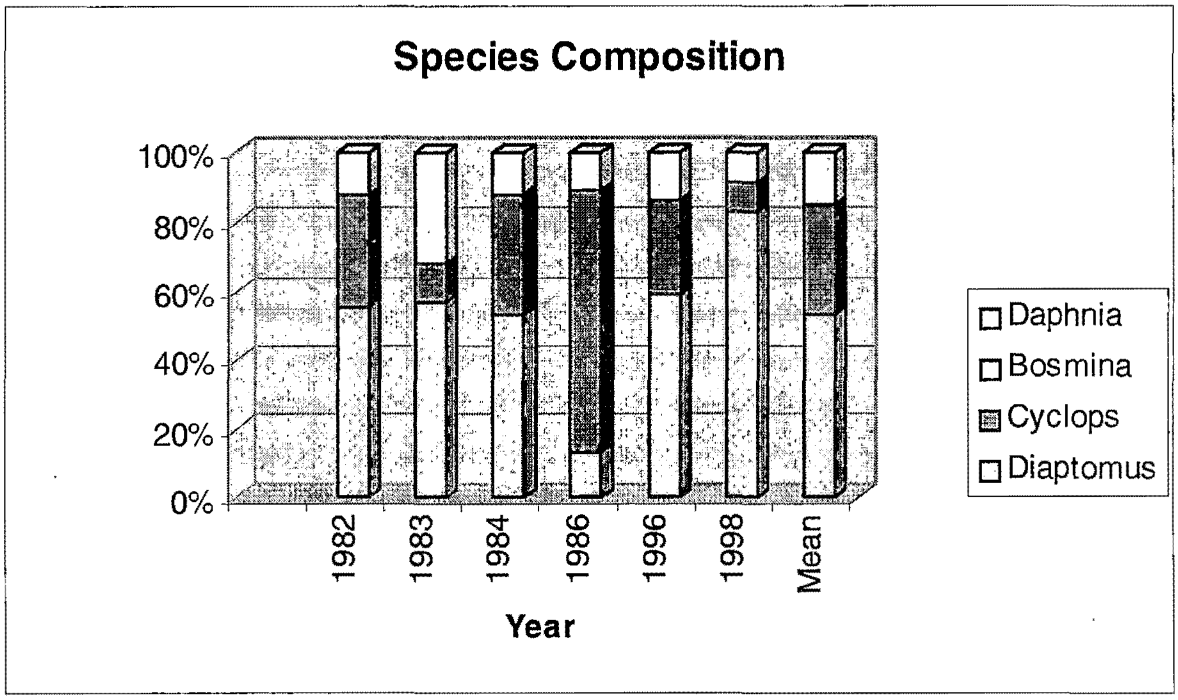
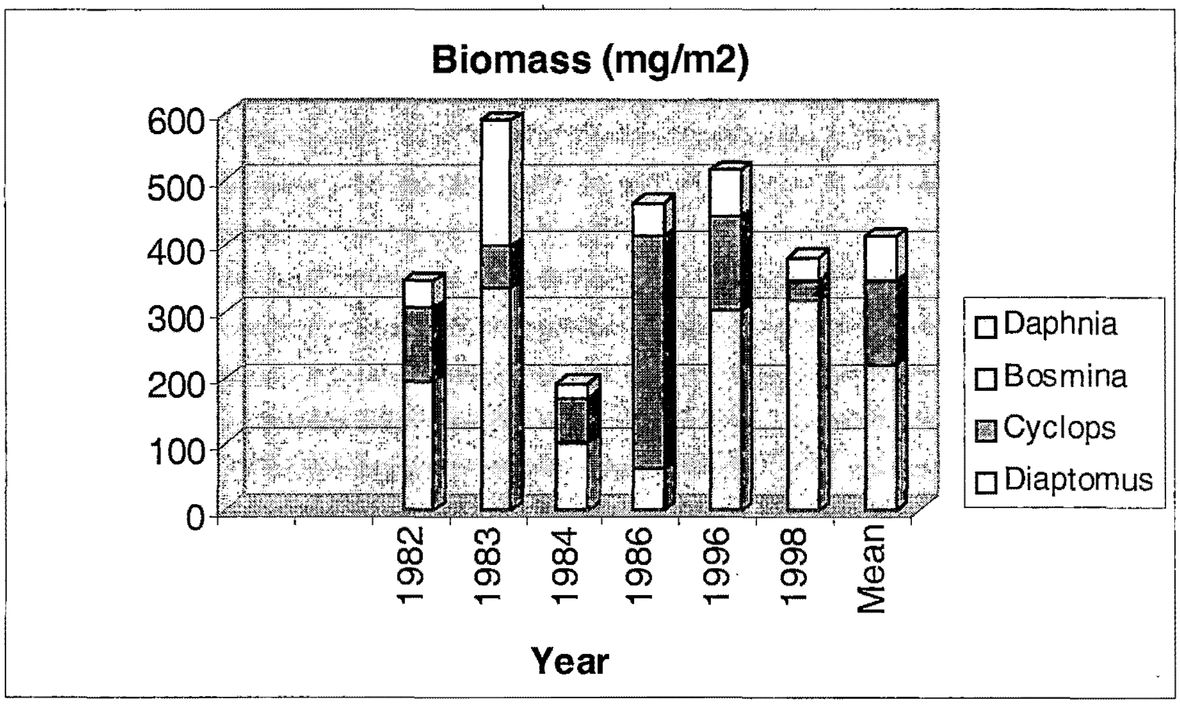


Figure # 4. Macrozooplankton Biomass (mg/m2).



2000 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000	PROPOSED FY 2000 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
				$39.1				
Personnel	$45.0	$34.3						
Travel	$3.8	$0.0						
Contractual	$6.4	$7.5						
Commodities	$3.3	$4.5						
Equipment	$2.5	$2.5	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$61.0	$48.8			Estimated FY 2001	Estimated FY 2002		
General Administration	$7.2	$5.7						
Project Total	$68.2	$54.5			$48.0	$50.0	$50.0	$2.5
Full-time Equivalents (FTE)	1.9	0.9						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$0.0	$0.0			$0.0	$0.0		

Comments: This is a continuation of project 99256B between the U. S. Forest service and the Alaska Department of Fish and Game.

FY00

Prepared:4/14/99, KEH

Project Number: 00256B
Project Title: Sockeye Salmon Stocking; Solf Lake
Lead Agency: U. S. Forest Service

FORM 2A
MULTI-TRUSTEE
AGENCY
SUMMARY

2000 EXXON VALDEZ TRU: COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000
Personnel	$18.7	$8.0
Travel	$3.4	$0.0
Contractual	$3.9	$5.0
Commodities		$0.8
Equipment		$0.0
Subtotal	$26.0	$13.8
General Administration	$3.1	$1.6
Project Total	$29.1	$15.4
Full-time Equivalents (FTE)	1.2	0.2
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

		Estimated FY 2001	Estimated FY 2002		
		$9.0	$10.0	$10.0	$2.5

Dollar amounts are shown in thousands of dollars.

Comments: Cost estimates provided with this proposal are based on known expenses not associated with the construction of the fishway, I.e., monitoring for returning jack salmon, finishing work on the diversions, logistic support for ADF&G, annual report writing, PWSAC fry rearing and release.

We intend to revise the FY00 budget estimate in an amendment to this proposal. The amended budget will reflect the cost of associated with construction of the fishway. The amendment will be submitted to the Trustee Council for approval by August 1, 1999.

FY00

Prepared:

Project Number: 00256B
Project Title: Sockeye Salmon Stocking; Solf Lake
Agency: U. S. Forest Service

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2000 EXXON VALDEZ TRU : COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
Rob Spangler	Fish biologist	GS-9	0.5	4.5		2.3
Dan Gillikin	Fish tech	GS-9	1.0	4.5		4.5
Seasonal	Bio tech	GS-5	0.5	2.3		1.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.0	11.3	0.0	
					Personnel Total	$8.0

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

FY00

Prepared:

Project Number: 00256B
Project Title: Sockeye Salmon Stocking; Solf Lake
Agency: U. S. Forest Service

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed
Description	FY 2000
Charter flights (3 hrs @ $250.00/ hr)	0.8
PWSAC contract for egg take, incubation, marking and release (Main Bay facility)	4.2
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$5.0

Commodities Costs:	Proposed
Description	FY 2000
train tickets (passanger)	0.1
train ticket (truck)	0.1
camp food ($18.00/ day for 32 days)	0.6
Commodities Total	$0.8

FY00

Prepared:

Project Number: 00256B
Project Title: Sockeye Salmon Stocking; Solf Lake
Agency: U. S. Forest Service

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
			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
Landing craft and other vessels		

FY00

Prepared:

Project Number: 00256B
Project Title: Sockeye Salmon Stocking; Solf Lake
Agency: U. S. Forest Service

FORM 3B
Equipment
DETAIL

2000 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel	$26.3	$26.3						
Travel	$0.4	$0.0						
Contractual	$2.5	$2.5						
Commodities	$3.3	$3.7						
Equipment	$2.5	$2.5	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$35.0	$35.0			Estimated FY 2001	Estimated FY 2002		
General Administration	$4.1	$4.1						
Project Total	$39.1	$39.1			$39.0	$40.0	$40.0	
Full-time Equivalents (FTE)	0.7	0.7						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: This provides for collection and analysis of 10 zooplankton samples at Solf Lake over the 5 trips during the 2000 season. This also includes monitoring smolt out migration at Solf Lake outlet.

FY00

Prepared:

Project Number: 00256B
Project Title: Sockeye Salmon Stocking; Solf Lake
Agency: ADF&G

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2000 EXXON VALDEZ TRU! COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
Pat Shields	GB2	16D	1.5	4.9		7.4
Lab tech			0.8	3.0		2.4
Field tech #1			1.0	3.0		3.0
Fielf tech #2			2.5	3.0		7.5
Field tech #3			2.0	3.0		6.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		7.8	16.9	0.0	
					Personnel Total	$26.3

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

FY00

Prepared:

Project Number: 00256B
Project Title: Sockeye Salmon Stocking; Solf Lake
Agency: ADF&G

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed
Description	FY 2000
Air charter ($250.00/ hr for 10 hrs)	2.5
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$2.5

Commodities Costs:	Proposed
Description	FY 2000
train tickets (passanger)	0.2
train tickets (truck)	0.2
camp supplies	1.4
camp food ($18.00/ dat for 40 days)	0.7
wier equipment	1.2
Commodities Total	$3.7

FY00

Prepared:

Project Number: 00256B
Project Title: Sockeye Salmon Stocking; Solf Lake
Agency: ADF&G

FORM 3B
Contractual &
Commodities
DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
Weather Port tent	1	2.5	2.5
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$2.5

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY00

Prepared:

Project Number: 00256B
Project Title: Sockeye Salmon Stocking; Solf Lake
Agency: ADF&G

FORM 3B
Equipment
DETAIL

00263

Project Title: Assessment, Protection and Enhancement of Wildstock Salmon Streams in the Lower Cook Inlet.

Project Number:	00263
Restoration Category:	General Restoration.
Proposer:	Port Graham Corporation
Lead Trustee Agency:	ADF&G
Cooperating Agencies:	None
Alaska SeaLife Center:	No
Duration:	FY97 FY00
Cost FY 00	$23.5.
Cost FY 01	$0.0.
Geographic Area:	Port Graham Corporation lands on the eastern and southern coasts of the Kenai Peninsula—specifically Windy Creek Left and Port Graham River.
Injured Resource/Service:	Replacement of Lost Subsistence Services.

RECEIVED
APR - 8 1999
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

ABSTRACT

This project will replace lost subsistence services resulting from the *Exxon Valdez* oil spill by constructing enhancement projects on two of the major salmon streams in the Lower Cook Inlet (LCI) oil spill area. During Year Two of this project, two projects were implemented: One was the Port Graham Fish Pass, which consisted of the construction of five dams thereby removing a natural barrier to spawning on the Port Graham river, the second project was the construction of two wall-based rearing ponds for coho salmon on Windy Creek Left. Year Three and Four will consist of monitoring for the success of these two projects by surveying the use by anadromous fish. In addition, the planting of vegetation in and around the rearing ponds on Windy Creek Left will be accomplished in Year Three. PGC management, with advice from an ADF&G fisheries specialist, will supervise the project and coordinate with a professional fisheries scientist and resource consultants. Local subsistence users will be employed as technical assistants during the monitoring and during construction of the habitat improvement on the rearing ponds.

INTRODUCTION

Subsistence users in the southern Kenai peninsula and specifically the residents of Port Graham are heavily dependent on these two major salmon streams and the salmon they produce for subsistence needs. These major salmon streams and their tributaries were inventoried and evaluated in FY97.

Year One of this project for FY97 consisted of habitat surveys. Standardized fisheries habitat survey techniques developed by ADF&G and the USDA Forest Service were used. From these surveys, appropriate prescriptions for structural improvement were then proposed based upon the species and the objectives desired for that stream. We proposed six individual projects on three streams. Of these, two were approved for funding by the EVOS Trustee Council in two phases. Phase One consists of permitting, environmental assessment and preliminary engineering. Phase Two consists of final engineering, construction and monitoring in FY98.

In FY98 site specific protection and restoration projects were implemented based upon the information gained from the field inventories completed in FY97. A fish pass on Port Graham River and two rearing ponds on Windy Creek Left were constructed during the fall of 1998. These projects are primarily targeting coho, pink,and chum salmon and possibly sockeye salmon for habitat enhancement.

Planting vegetation around the rearing ponds on Windy Creek Left for additional cover coho salmon fry and smolts is underway for FY99. In addition, Year Three and Four will consist of monitoring the success of the Year Two construction projects for success. We propose to conduct salmon run surveys on the Port Graham River, above and below the falls on weekly basis during the salmon spawning season. In addition, we will conduct fry and smolt surveys of the Windy Creek Left rearing ponds using the appropriate techniques. Hand tools and manual labor will be utilized extensively by the local subsistence users for much of the work underway in FY99.

The emphasis on employing local subsistence users for this project will provide for the high quality protection and enhancement of these valuable resources by the owners and stewards of the land and the users of the subsistence resource.

NEED FOR THE PROJECT

A. Statement of Problem

The loss of traditional subsistence resources and services has been extensively documented in this area. Some subsistence resources may never recover to their pre-oil spill levels. There is a need to substitute and increase the subsistence resources for the residents of LCI using the existing wildstocks of pink, coho and chum salmon. Subsistence harvests remain depressed compared to pre-spill levels. Other species damaged or impacted by the oil spill which would benefit from this project include the marbeled murrelet, the black oyster catcher, the river otter and the harlequin duck. Subsistence will be deemed to be recovered when the local residents have restored confidence of the abundance and safety of this important resource. This project seeks to replace lost or damaged resources by replacing or enhancing the habitat of wildstocks of salmon important to the people who live in Lower Cook Inlet.

B. Rationale/Link to Restoration

The inventory and assessment of these major salmon producing streams and lakes done in FY97 provided the information necessary for the construction of habitat protection and enhancement projects on these streams in FY98. This in turn will increase the salmon runs and therefore increase the available subsistence resources. This project will compensate and substitute for the damaged and lost resources available to subsistence users in the LCI. The protection and enhancement of these streams will not only aid the subsistence users but also the impacted commercial and sport users. The monitoring and additional enhancement projects will ensure the success of these projects.

The policy of the Trustee Council, as stated in the Restoration Plan, is that projects designed to restore or enhance an injured resource: 1) must have a sufficient relationship to the injured resource 2) must benefit the same user group that was injured 3) should be compatible with the character and public uses of the area. This project meets all three portions of the Trustee Council's policy toward restoring or enhancing an injured resource.

C. Location: Lower Cook Inlet

These streams are located in Port Graham and Windy Bay drainages on the Kenai peninsula. These projects will benefit the entire lower Kenai peninsula.

COMMUNITY INVOLVEMENT

This project will involve a significant amount of direct involvement of Port Graham residents and other local subsistence users. This project will be the direct responsibility of PGC. Through the training of PGC people for the field and office work, the depth of understanding of the streams and the fisheries resource will be enhanced. This will develop an awareness of the needs for protection and enhancement of these valuable resources.

Port Graham, Nanwalek and Seldovia residents will be consulted as to their local knowledge of these streams and their historic levels of spawning return. Local hire for field work will be used extensively. Study area is remote, extensive use of locals vehicles and housing will be required.

PROJECT DESIGN

A. Objectives

1. Monitor the use and success of the in-stream spawning and rearing habitat improvement projects constructed in FY98 for coho, pink and chum salmon.

2. Continue to enhance existing wildstocks of salmon to serve as substitution and compensation for the lost and damaged subsistence resources important to the subsistence users of the southern Kenai peninsula.

3. Educate and involve the subsistence users in the concepts of fisheries management and wise land stewardship.

4. Update existing information on wildstock salmon habitat from weekly salmon stream surveys. Enter relevant data into a data base for future management decisions.

5. Evaluate escapement levels of salmon returns to Port Graham River and Windy

Creek Left. Goal is to build salmon runs to near biological capacity with enhanced habitat.

6. Improve quality and quantity of wildstock salmon as a subsistence resource in the lower Kenai Peninsula. Gauge success by comparing returns in next ten years with historic averages.

7. Discuss and coordinate with Federal, State and local agencies. Maintain permits for any additional enhancement projects.

B. Methods

Field: In FY98 site specific protection and restoration projects are being implemented from the field inventories completed in FY97. A fish pass on Port Graham River and rearing ponds on Windy Creek Left were constructed in FY98. These projects are primarily targeting coho, pink,and chum salmon and possibly sockeye salmon for habitat enhancement.

Monitoring, maintenance and refinement of these enhancement projects are proposed for FY99 and FY00 for Years Three and Four of ##263. The Port Graham River fish pass will be monitored during high water and the necessary maintenance done during low water. Planting vegetation around the rearing ponds on Windy Creek Left for additional cover for coho salmon fry and smolts and adding additional large woody debris are proposed for FY99. The following is our monitoring plan as proposed:

1999-2001 Proposed Monitoring Plan and Procedures:

Port Graham River Fishpass FY99 Monitoring:

1. Designate stream reaches from FY97 inventory for FY99 monitoring. Obtain historic information from ADF&G COMFISH in Homer.

2. 1999 Inventory Procedure: Mark stream reaches for monitoring purposes. Forms for monitoring by foot surveys will include the following information:

    - All Anadromous Fish Species (coho targeted species)
    - Location
    - Number of fish (including carcasses in later surveys)

3. Method:
   Begin surveys in early July from 9.5 mile bridge to fishpass.
   From fishpass to 6.5 mile bridge and from 6.5 to river mouth.
   Proposed interval: 4 times during the coho run: early, mid, late and end.
   Conduct spot counts at fishpass as needed.

4. Coordination:
   Supply all data and information to COMFISH and Port Graham Hatchery.

Windy Creek Left Rearing Ponds FY99 Monitoring:

1. Measure dissolved oxygen and water temperature on a seasonal basis, once each during spring, summer, fall and winter (under ice if desirable).

2. Conduct fry surveys using baited minnow traps and seasonal surveys to determine species composition, length and relative abundance.

Future monitoring will be critical to assess the rate of success and to determine which objectives have been met or exceeded. Final reports and data will be compiled in FY00.

C. Cooperating Agencies, Contracts and Other Agency Assistance

ADF&G will be the lead trustee agency. ADF&G will then contract through KPB-EDD who will then contract with the Port Graham Corp. for the entire project. Technical assistance from ADF&G will be required and sought for all phases of this project. Salmon run surveys will be coordinated with ADF&G and COMFISH utilizing their existing surveys for pink and chum salmon.

SCHEDULE

A. Measurable Project Tasks for FY 2000

January—May 15: Develop final enhancement plans. Field review projects. Plan maintenance projects as needed.

May 15—July 15: Maintain Port Graham River Fish Pass, repair or improve if needed. Plant willow & alders around Windy Creek Left Rearing Ponds and add woody debris. Monitor use of rearing ponds by coho fry and smolt.

July 15 — October 15: Conduct salmon run surveys on Port Graham River. Coordinate with ADF&G COMFISH. Monitor Port Graham River Fish Pass and conduct maintenance as needed. Monitor use of Windy Creek L. rearing ponds by coho fry and smolt.

October 15- April 15: Final report prepared.

B. Project Milestones and Endpoints

May 1999: Inspect enhancement projects and evaluate and finalize plans .

October 1999: Complete salmon run surveys for 1999.

April- 2001: Evaluate success of Enhancement Projects and summarize and report salmon counts to ADF&G and COMFISH.

C. Completion Date

April 15 2001: Complete final report and submit for peer review.

Proposed Enhancement Projects:

Rearing Ponds Enhancement: To provide cover for coho fry and smolt, plant willows and alders on the banks of the rearing ponds on Windy Creek Left. Additional woody debris will be added as needed. These ponds were constructed in FY98.

PUBLICATIONS AND REPORTS

Annual Reports: Annual Reports will be prepared for each FY. The survey reports, database and accompanying maps will be delivered to ADF&G upon their completion. The final report will be prepared in FY00 and will emphasize the subsistence resource enhancement success of this project.

PROFESSIONAL CONFERENCES

The project results will be presented at the appropriate EVOS conferences and technical sessions and other conferences.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project will be coordinated with all previous and ongoing ADF&G and PGC/EVOS Projects. Coordination between the Port Graham Corporation, the Port Graham Village Council, ADF&G and the KPB-EDD will be critical for the success of this project.

PROPOSED PRINCIPAL INVESTIGATOR

Walter Meganack, Jr. will be the principal investigator under the direction of the management of the Port Graham Corporation.

This project will be organized and managed by the following agencies and entities:

Trustee Agency:	Alaska Dept. of Fish & Game
ARDOR:	Kenai Peninsula Borough Economic Development District Will be the state contracting agency
Contractor:	Port Graham Corporation Patrick Norman-President Walter Meganack, Jr.-Project Manager P.O. Box 5569 Port Graham, Alaska 99603-5569

PERSONNEL

Overall project management will be under the direction of Walter Meganack, Jr. and Pat Norman of the Port Graham Corp.

John L. Hall & Arvid J. Hall of Taiga Resource Consultants will work under PGC as assistant managers and provide technical advice.

Dr. Douglas Martin, Fisheries Biologist will provide technical expertise.

LITERATURE REVIEW

Carpenter, Dickson, et al. 1995,
Exxon Valdez Oil Spill State/Federal Natural Resource Damage Assessment Final Report. Survey and Evaluation of Instream Habitat and Stock Restoration Techniques for wild Pink and Chum Salmon.
Alaska Department of Fish and Game.

Martin, 1996. Fish Habitat and Channel Conditions for Streams on Forested Lands of Coastal Alaska: An Assessment of Cumulative Effects.
Pentec Environmental.

Regional Interagency Executive Committee 1995,
Ecosystem Analysis at the Watershed Scale: Federal guide for Watershed Analysis, Version 2.2. U.S. Government Printing Office.

Stanek, 1985. Patterns of Wild Resource Use in English Bay and Port Graham, Alaska. Alaska Department of Fish and Game.

Sundet & Kuwada, 1994. Stream Habitat Assessment Project: Prince William Sound and Lower Kenai Peninsula, Project No. R-51. Exxon Valdez Trustee Council Restoration and Habitat Protection Planning. Alaska Department of Fish and Game.

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category	Authorized FY 99	Proposed FY 00				
Personnel	$.0.	$0.00.				
Travel	$.0.	$0.00.				
Contractual	$39.3.	$21.96.				
Commodities	$.0.	$0.00.				
Equipment	$.0.	$0.00.	LONG RANGE FUNDING REQUIREMENTS			
Subtotal	$39.3.	$21.96.	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004
ADF&G (7%)	$2.7.	$1.54.				
Subtotal	$42.0.	$23.50.	$.0	$.0	$.0	$.0
Total	$42.0.	$23.50.				
Full-time (FTE)		$0.00.	Dollar amounts are shown in thousands			
Other Resources						

Comments:

- Administrative cost for the contractor, Kenai Peninsula Borough Economic Development District is 10% of the project costs.

2000

Project Number: 00263
Project Title: PGC Wildstock Salmon Stream Assessment & Enhancement
Trustee: ADF&G

FORM 3A TRUSTEE AGENCY SUMMARY

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs			Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
Name	**Position Decription**					
			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.
	Subtotal		0	0	0	
					Personnel Total	$0.0.

Travel Costs	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 2000
Description					
					$0.0.
					$0.0.
					$0.0.
					$0.0.
					$0.0.
					$0.0.
Subtotal					
				Travel Total	$0.0.

2000

Project Number: 00263
Project Title: PGC Wildstock Salmon Stream Assessment & Enhancement
Name: Port Graham Corporation

FORM 3B
Personnel
& Travel
Detail

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2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

New Equipment Purchases:	Unit Price	Proposed FFY 2000
Description:		
	$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 the placement of an R.		$0.0.

Existing Equipment Usage:	Number of Units	Proposed FFY 2000
Description		
	0	
		0

2000	**Project Number: 00263** **Project Title: PGC Wildstock Salmon Stream Assessment & Enhancement** **Trustee: ADF&G**

Form 3B
Equipment
DETAIL

Prepared 3/17/99 11:45 AM

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed FFY 2000
Description:	
Contract with Kenai Peninsula Borough Economic Development District	$21.96.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
Contractual Total	$22.0.

Commodities Cost	Proposed FFY 2000
Description	
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
Commodities Total	$0.0.

2000	Project Number: 00263 Project Title: PGC Wildstock Salmon Stream Assessment & Enhancement Trustee: ADF&G	Form 3B Contractual &Commodities DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category	Authorized FY 99	Proposed FY 00					
Personnel	$4.5.	$1.5.					
Travel	$1.2.	$2.0.					
Contractual	$27.0.	$15.5.					
Commodities	$2.5.	$.4.					
Equipment	$.5.	$.5.	LONG RANGE FUNDING REQUIREMENTS				
Subtotal	$35.7.	$19.9.	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	
Indirect	$3.6.	$2.0.					
Subtotal	$39.3.	$21.9.	$12.0	$.0	$.0	$.0	$.0
Total	$39.3.	$21.9.					
Full-time (FTE)		$.0.	Dollar amounts are shown in thousands				
Other Resources							

Comments:

• KPB-EDD will receive%10 for indirect, not to exceed $3,500.

•In FY 01 , $12.0 may be needed for additional improvements to Pond #1

2000

Project Number: 00263
Project Title: PGC Wildstock Salmon Stream Assessment & Enhancement
Name: Port Graham Corporation

FORM 4A
NON-TRUSTEE
SUMMARY

Personnel Costs			Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
Name	**Position Decription**					
Walter Meganack, Jr.	Project Management		0.5	2.5	0	$1.25
			0	0	0	$0.00
			0	0	0	$0.00
			0	0	0	$0.00
			0	0	0	$0.00
			0	0	0	$0.00
			0	0	0	$0.00
			0	0	0	$0.00
			0	0	0	$0.00
TBN	Administrative Support		0.25	1	0	$0.25
	Subtotal		0.25	1	0	
					Personnel Total	$1.50

Travel Costs	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2000
Description					
RT PG-Homer	$60	4	8	$50	$0.64
RT PG-Anchorage	$190	4	6	$100	$1.36
	$0	0	0	$0	$0.00
			0	$0	$0.00
					$0.00
					$0.00
Subtotal		8	14	150	
				Travel Total	$2.00

2000

Project Number: 00263
Project Title: PGC Wildstock Salmon Stream Assessment & Enhancement
Name: Port Graham Corporation

FORM 4B
Personnel
& Travel
Detail

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 2000
Description:			
Field Equipment	1	$0.5.	$0.5.
			$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 the placement of an R.		New Equipment Total:	$0.5.

Existing Equipment Usage:		Number of Units	Proposed FY 2000
Description			
None			
	0	0	
			0

2000

Project Number: 00263
Project Title: PGC Wildstock Salmon Stream Assessment & Enhancement
Name: Port Graham Corporation

FORM 4B
Equipment
DETAIL

Contractual Costs:	Proposed FY 2000
Description:	
Contract with TRC for Windy Creek Left Rearing Ponds Monitoring	$4.5.
Contract with TRC for Port Graham Fish Pass Monitoring	$6.5.
Contract with TRC for Preparation of Annual Report	$4.5.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
Contractual Total	$0.0.
	$15.5.

Commodities Cost	Proposed FY 2000
Description	
Office supplies & postage	$0.4.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
Commodities Total	$0.4.

2000

Project Number: 00263
Project Title: PGC Wildstock Salmon Stream Assessment & Enhancement
Name: Port Graham Corporation

Form 4B
Contractual
&Commodities
DETAIL

00273

Project Title: Scoter life history and ecology: Linking Satellite technology with traditional knowledge to conserve the resource.

Project Number:	00273
Restoration Category:	Subsistence, Research
Proposer:	Dan Rosenberg Alaska Dept. of Fish and Game 333 Raspberry Road Anchorage, Alaska 99503
Lead Trustee Agency:	ADFG
Cooperating Agencies:	DOI
Alaska SeaLife Center:	No
Project Duration:	3rd year, 3-year project
Cost FY 00:	$206,100.
Cost FY 01:	$NA
Cost FY 02:	$NA
Geographic Area:	Prince William Sound, Lower Cook Inlet
Injured Resource/Service:	Subsistence; intertidal community.

RECEIVED
APR 14 1999
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

ABSTRACT

This project will study the life history and ecology of surf scoters (*Melanitta perspicillata*) that over winter in, or migrate through Prince William Sound (PWS) and lower Cook Inlet (LCI). This information will be integrated with traditional ecological knowledge. Scoter populations in Alaska are declining. Communities in PWS and LCI harvest scoters for subsistence purposes. Scoters are among the least studied of North American waterfowl and little is known of their life history, ecology, and distribution. Scoters will be marked with surgically implanted satellite transmitters to define the breeding areas, molting areas, and wintering areas. Local participation will be solicited and information will be conveyed to local residents. Participation of local students will be encouraged through the Chugach School District and Youth Area Watch programs.

INTRODUCTION

This project will study the life history and ecology of surf scoters (*Melanitta perspicillata*) that winter or migrate through Prince William Sound (PWS) and lower Cook Inlet (LCI) and integrate this information with traditional ecological knowledge collected from community members within the study area. In the first year (FY98) we initiated a pilot project to test the feasibility of catching scoters in PWS. In late-April and early-May, 1998 we marked ten birds with surgically implanted satellite transmitters (Rosenberg and Petrula 1999, Rosenberg and Petrula, in prep.). Satellite telemetry is providing information that allows us to define breeding, molting, and wintering areas of this subsistence resource. In FY99 (April/May) we will mark an additional fifteen surf scoters with satellite transmitters. In addition to tracking birds via satellite telemetry, we propose conducting surveys at molting and breeding areas (censuses) and gather information on breeding ecology.

Since 1977, scoters in Alaska have been estimated to decline by as much as 40% (Hodges et al. 1996). Between 1972-1973 and 1989 estimated winter populations of scoters in PWS declined from 56,600 to 14,800 birds. Summer populations (July) declined from 13,000 to 5,400 birds (Klosiewski and Laing, 1994). An estimated 1,000 scoters died as a direct result of the *Exxon Valdez* oil spill (John Piatt, pers. comm.). Since the spill, the number of wintering scoters in PWS may be increasing (Agler and Kendall 1977), but are still below historical levels. Initially, the spill had a negative effect on summer populations of scoters in PWS (Klosiewski and Laing 1994). However, by 1998, Irons et al. (in prep.) no longer detected an oil spill effect in summer.

Scoters are an important subsistence resource to the people living in the communities of PWS and LCI (James Fall, ADF&G, pers. comm., Gary Kompkoff, Tatitlek IRA, pers. comm.) These species of seaducks comprise the large majority of the sea duck harvest in the communities of Tatitlek, Chenega Bay, Port Graham, and Nanwalek (Scott et al. 1996). Residents of the communities affected by the *Exxon Valdez* Oil Spill remain concerned about the abundance of their traditional food resources and maintaining their cultural ties to their traditional use of fish and wildlife (*Exxon Valdez* Oil Spill Trustee Council, 1999). In 1993, 55% of the households in Tatitlek reported using scoters harvested for subsistence purposes, as did 40% of the households in Nanwalek and almost 12% of Port Graham households (Scott et al. 1996).

Scoters are among the least studied of North American waterfowl (Godfrey 1989, Savard and Lamothe 1991, Henny et al. 1995, Savard et al. 1998). Little is known about the ecology, breeding areas, molting areas, and migration routes of these species anywhere in North America (Bellrose 1976; Herter et al. 1989; Goudie et al. 1994, Savard et al. 1998). Surf scoters, black scoters (*M. nigra*), and white-winged scoters (*M. fusca*) all occur in PWS and lower Cook Inlet. Among these, the surf scoter is the most abundant (Isleib and Kessel 1973). It occurs as both a year-round resident and migrant. Surf scoters are most numerous in spring due to the influx of migrants probably in response to spawning Pacific herring (*Clupea pallasi*) (Isleib and Kessel, 1973; Bishop et al. 1995). Nonbreeders remain in PWS in summer, although these birds may not be part of the PWS winter population. Basic ecological information is lacking for scoter populations that use PWS.

Most scoters depart PWS in spring to unknown nesting areas, perhaps in interior Alaska and the Yukon (Gabrielson and Lincoln 1959), as far north as the Mackenzie Delta and the Brooks Range (Johnson and Richardson 1982), and as far east as the Horton River, Yukon Territory (Rosenberg and Petrula, in prep.). Male seaducks abandon incubating females in early summer and congregate at communal molting sites (Salomonsen 1968). Often these areas are distinct from nesting or wintering areas. Three male surf scoters marked in PWS, bypassed breeding areas and migrated by a coastal route to molting areas at the mouth of the Kuskokwim River (Rosenberg and Petrula 1999, Rosenberg and Petrula, in prep.). As with other waterfowl, wing feathers are lost simultaneously, rendering birds flightless for about one month until new feathers emerge.

In winter, scoters feed in intertidal and subtidal zones, areas susceptible to contaminants (Vermeer and Peakall 1979). Among the three scoter species, surf scoters are most associated with intertidal areas in PWS (Patten et al. 1998). They feed primarily on bivalves, especially mussels (Crow 1978, Vermeer 1981), but in spring they may switch to a diet composed primarily of herring roe (Vermeer 1981, Goudie et al. 1994, Bishop et al. 1995).

Sea ducks are among the species most vulnerable to mortality from oil spills (Piatt et al. 1990). Further compounding any direct mortality from the spill, is contamination or reduction of their principal food resources. Mussels and intertidal sediments in PWS showed increases in petroleum hydrocarbon concentrations directly attributable to *Exxon Valdez* oil (Short and Babcock 1996), and oil in mussel beds in PWS and the Kenai Peninsula persisted for several years after the spill (Babcock et al. 1996). Further, the PWS herring stocks suffered a dramatic decline in 1993 and stocks have remained depressed (Morstad et al. 1997). The large increase in sea otter populations since the mid-1900's may have led to increased competition for food between scoters and otters (Nanwalek residents, pers. comm). Quite likely, any decline results from a combination of factors such as food and habitat changes, contaminants, or climate change.

The large decline in PWS between 1972-1973 and 1989 may be a result of long-term oscillations in ocean temperatures in the Gulf of Alaska (Piatt and Anderson 1996) or effects from exposure to contaminants. Several studies have shown scoters and other sea ducks to bioaccumulate trace metals and organochlorines from their environment (Vermeer and Peakall 1979, Henny et al. 1991, Olendorf et al. 1991, Henny et al. 1995). White-winged scoter die-offs occurred in the Cape Yakataga area in southeast Alaska during 1990-1992 (Henny et al. 1995). Although no definitive cause could be identified, elevated levels of cadmium were detected in the birds, but no source of contamination could be identified. The difficulty of detecting a source of contamination was confounded by lack of specific information on breeding, molting, or wintering areas.

Human activities, such as hydroelectric development (Savard and Lamothe 1991), estuarine pollution (Ohlendorf et al. 1991), or introductions of exotic species (Bordage and Savard 1995) on the breeding, wintering, or molting areas potentially have profound affects on abundance or distribution of a population. The lack of information on distribution and migration patterns can prevent the identification of potential harmful environmental exposures or alterations and make it extremely difficult to determine possible causes of population declines. Location of and links between breeding grounds, migration routes, and timing of migration are important factors used to evaluate contaminant uptake or loss in a migratory species as well as changes to food resources and other environmental changes (Henny et al. 1991). Nesting is considered one of the weakest links in the life cycle, especially with regard to contaminant effects (Henny et al. 1995).

In summary, little is known about the ecology, breeding areas, molting areas, and migration routes of scoters anywhere in North America. Population trends in scoters are uncertain, but appear to be declining in most regions. Affiliations between breeding and wintering areas are unknown, compounding meaningful integration of survey data. The susceptibility of seaducks to contaminants is a concern to resource managers and subsistence consumers. Determining distribution is the first step in assessing breeding, wintering, and molting ecology. Potential breeding and molting sites range throughout Alaska and the Yukon Territory. We propose a program that will integrate traditional knowledge, scientific methods, and modern technology to perpetuate the subsistence patterns of these communities. This will be accomplished through greater understanding of scoter life history and ecology, sharing knowledge with local community members, involving the youth of the communities in the restoration process, and improving conservation strategies for this species.

White-winged scoters, black scoters, and Barrow's goldeneyes (*Bucephala islandica*) are also an important subsistence resource to communities in PWS and LCI (Scott et al. 1996). Using EVOS funds as a financial match, we have received a grant to purchase and monitor an additional 10 satellite transmitters. These will be placed in White-winged scoters in PWS and LCI.

This project is integrated with project \052B Traditional Ecological Knowledge, project \210 Youth Area Watch, project \025 Nearshore Vertebrate Predator Project, \320 Predation on Herring Spawn, project \407 proposed Harlequin Duck Recovery Monitoring, and project \159 Prince William Sound Marine Bird Surveys.

We have created an Internet site that provides information on this project and tracks the movements of satellite transmitted birds (Rosenberg and Petrula 1999). Movements of marked birds will be regularly updated.

NEED FOR THE PROJECT

A. Statement of Problem

Scoters are an important component of the traditional culture of the communities affected by the oil spill and scoter populations in Alaska and PWS have been declining. Native inhabitants of PWS have used scoters (locally known as black ducks) as a subsistence resource for centuries. Surf scoters, black scoters, and white-winged scoters, are the most abundant avian species found at archeological sites in PWS (Linda Yarborough, USFS, pers. comm). However, little is known about the distribution or movements of these birds within or outside of PWS. Although scoters are known to breed throughout much of Alaska and Canada (Gabrielson and Lincoln 1959; Godfrey 1986), until this project (Rosenberg and Petrula in prep.) nothing was known about specific populations and the affiliations between winter, breeding, and molting areas. The few studies that have identified molting sites have not made the link between these and winter and breeding areas (Johnson and Richardson 1982, Dau 1987).

In marine environments, scoters feed on bivalves, especially blue mussels (*Mytilius edulis*), species known to concentrate contaminants. Herring roe, another important food source has become less abundant, as herring stocks have recently declined in PWS. As mentioned, scoters are known to bioaccumulate contaminants and die-offs have occurred, including several among white-winged scoters at Cape Yakataga, in southeast Alaska (Henny et al. 1995). The cause of this die-off was undetermined. Individual scoters range over a broad geographic area. They are susceptible to environmental changes and habitat alterations over their entire range.

Exposure of migratory waterfowl to contaminants or other mortality factors may occur during migration, nesting, molting, or at wintering areas. To begin to understand factors such as contaminants that may limit or reduce populations we first need to make the affiliations between winter, breeding, and molting areas. This would allow us to direct sampling and monitoring efforts at specific population segments. Traditional marking of birds with metal leg bands has little success with sea ducks because so few birds are killed in the harvest. The vast geographic range of the birds (Rosenberg and Petrula 1999, Rosenberg and Petrula in prep.) makes conventional telemetry impractical and costly. Satellite telemetry studies offer the best method for identifying migration routes, staging areas, and breeding, molting, and wintering sites.

B. Rationale/Link to Restoration

The location of breeding grounds, migration routes, winter areas, and the timing of migration are all critical factors used to evaluate contaminant uptake or loss in a migratory species as well as evaluating the consequences of other environmental disturbances or changes (Henny et al. 1991). Scoter populations are susceptible to natural and man-made disturbances over a wide and inaccessible geographic area.

To conserve these subsistence resources and restore the traditional activities associated with these two species, we have proposed to identify their movements, distribution, and ecological relationships using satellite telemetry. This information is necessary to identify problems and develop and implement management strategies to promote the species long-term conservation. We hope this information and the activities associated with collecting this data will 1) allow resource managers to reverse population declines; 2) renew local confidence in the health of this food supply; 3) help maintain traditional lifestyles; 4) provide opportunities to the youth of local communities to promote their historical connection with this subsistence resource; 5) merge traditional knowledge with modern science to develop a more complete understanding of scoter and goldeneye life history and ecology; and 6) help students develop skills to promote the long-tern conservation of this species and others important to their economy and lifestyle.

Restoration requires assessment of population health and definition of impediments to recovery. The tasks presented in this proposal will begin the process of understanding the factors that affect population dynamics in surf scoters and develop management strategies to ensure the long-term health and welfare of the population. Without an understanding of the underlying events that influence population change, we can not prescribe specific activities to conserve or enhance the population.

C. Location

In FY 00 capture work will be conducted in Prince William Sound and/or Lower Cook Inlet. Capture sites will occur in northern PWS between Valdez and Cordova and on northern Montague Island. Capture sites in Lower Cook Inlet will be located in or near Kachemak Bay, Port Graham, or Nanwalek. The abundance and distribution of birds will ultimately determine sites. Work at breeding or molting sites will be dictated by information on breeding and molting distribution collected in FY99 and FY00.

In FY00, community involvement (Chugach School District, Youth Area Watch, and traditional knowledge) will be focused in the villages of Tatitlek, Chenega Bay, Nanwalek, and Port

Graham. Nanwalek and Port Graham are not within the Chugach School District and are not part of the Youth Area Watch Program.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

This program will continue to exchange information with residents of the communities of Prince William Sound and lower Cook Inlet. In FY98 and FY99 the principal investigator exchanged information and attended workshops in Tatitlek, Chenega Bay, Nanawalek, Seldovia, and Port Graham. The principal investigator was a member of the planning team for the youth-elders subsistence conference in Cordova and presented findings of this study at the conference and at the EVOS annual workshop. The principle investigator has also made presentations and exchanged information and ideas at community facilitator meetings in Anchorage.

Efforts have and will continue to be made throughout the restoration process to participate in and provide public involvement in the design and implementation of this project. The project will continue to inform and coordinate our community involvement activities, including the collection of indigenous knowledge with Dr. Henry Huntington, TEK specialist Chugach Regional Resources Commission; Hugh Short, Community Coordinator, EVOS Restoration Office; Roger Sampson and Rick DeLorenzo, Chugach School District; and the Subsistence Division of the Alaska Department of Fish and Game.

Information gathered from this project will continue to be shared with local communities. We will continue to gather information on TEK through synthesis workshops, local community facilitators, and residents. The Chugach School District, through Youth Area Watch, will provide interested students and teachers to participate in capture and monitoring. We have initiated a sea duck monitoring program in the Tatitlek Narrows through the YAW program and Tatitlek School. The school district will provide classroom aides (computer and software, maps etc.) to be used in local schools for monitoring bird movements throughout the year. ADF&G will relay satellite-monitoring information to local communities. Students will assist in collecting information from local residents on TEK, and report band returns from local hunters.

Project personnel will adhere to the protocols for including indigenous knowledge in the restoration process presented in Appendix C of the Invitation to Submit Restoration Proposals for Federal FY 2000. Boat and air charter contracts, and other services will be contracted from local sources when possible.

PROJECT DESIGN

A. Objectives

<u>FY 00:</u>

1) Capture 15 surf scoters in spring on saltwater in PWS and/or LCI,

2) Mark 8 adult male and 7 adult female surf scoters with surgically implanted satellite

telemetry transmitters;

3) Capture and band as many additional seaducks as time and budget allows;

4) Determine migration routes, breeding areas, and molting and wintering sites;

5) Census scoters at breeding and molting areas; collect samples for contaminant studies;

6) Conduct brood surveys to document productivity,

7) Document traditional ecological knowledge about seaducks from residents of PWS and LCI communities (and perhaps communities in the breeding and molting areas, and migration paths); and

8) Incorporate local residents through the Chugach School District and Youth Area Watch program in the collection and monitoring of data, including traditional knowledge.

B. Methods

Capture and Marking

ADF&G will capture, mark, and monitor scoters with professional staff, veterinarians, and local assistance. We will capture adult birds between late March and early May during the herring spawn, when large flocks of sea ducks aggregate to feed on herring roe. The commercial herring gillnet fishery, which precedes major spawning events by a few days, ranges from April 9-28 for the period from 1972-1993 (Donaldson et al. 1995). Capture sites will be determined by monitoring known areas of herring spawn deposition (Morstad et al. 1996), scoter concentrations, ADF&G Commercial Fisheries Division aerial spawn and survey maps, and local knowledge. Scoters will be captured at one or two locations in northern PWS and one in LCI. Results in FY99 may dictate FY00 capture sites.

Scoters will be captured with floating mist nets suspended among decoys. Trap locations will be mapped using Global Positioning Systems and nautical charts (NOAA).

All captured seaducks, in addition to those marked with telemetry, will be banded with USFWS aluminum leg bands. Sex will be identified based on plumage characteristics and age will be determined by bursal probing. Adults do not have a bursa; if possible, second-year birds will be distinguished from third year subadults by bursa depth. Prior to release, birds will be weighed, measured (culmen, tarsus, and wing length) and blood and feather samples will be collected and archived for future contaminant, genetics, and stable isotope studies.

Once transported to the work vessel, a certified veterinarian, trained in avian implant surgeries, will place transmitters in the peritoneal cavity with the antenna exiting caudally, following procedures described by Petersen et al. (1995). The capture, marking, and handling of birds will follow procedures of the Ornithological Council (1997). Satellite transmitters will measure 10 mm deep, 55 mm long, 35 mm wide and weigh approximately 38g (Microwave Telemetry, Columbia, Maryland). Battery life can be expected to last about 10 months depending on advances in technology at time of purchase. Efforts will be made to maximize battery life. Each transmitter will be hermetically sealed with a Teflon-coated multi-strand stainless-steel antenna.

Transmitters will be programmed and calibrated to record and transmit body temperature to confirm that signals are being emitted from live birds. After surgery, birds will be held in an appropriate container and provided water. Ducks will be released when the veterinarian determines they have recovered from the effects of surgery. All ducks will be released at the point of capture.

Satellite signals will be analyzed using Service Argos Data Collection and Location System (Landover, Maryland). Argos Standard and Animal-Tracking data processing services will provide near real-time information on the precision of each location through on-line interrogation. Movements will be monitored throughout the life of the transmitter. Locations will be mapped using a Geographic Information System (GIS) and posted on the Internet. Movements and locations of scoters will be forwarded to the Chugach School District and affected communities so students can monitor the progress and movements of birds between breeding, molting, and wintering areas.

Nesting and molting studies.

In early to mid-June we will conduct helicopter surveys to estimate densities of scoters on lakes and ponds within a ten-km radius of each satellite location. Birds will be counted and classified as breeding pairs, adult males, adult females, and subadults. Within these same areas brood surveys will be conducted in July and August. July surveys may miss late-hatching broods, while August surveys may miss early-fledged broods or broods that died prior to fledging (Savard and Lamothe 1991). The number of young and their estimated age will be recorded. To estimate brood density, results of the two surveys will be combined. Attempts will be made to capture and mark broods on lakes or ponds with high densities. Scoters will be captured with drive traps and mist nets and banded with standard USFWS metal leg bands. Birds will be weighed, measured, and blood and feather samples will be collected.

In July and August, aerial surveys will be conducted to count scoters at coastal and inland molting sites where we have obtained satellite coordinates.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

Dan Mulcahy, a licensed veterinarian with USGS-BRD, will assist in satellite telemetry implants.

All data collection and analysis will be supervised by ADF&G. Private sector contracts for fuel purchase, equipment, vessel support and air charter will be solicited, usually from the local Prince William Sound or lower Cook Inlet region. Contracts for satellite transmitters and data downloading will be solicited from the private sector.

Cooperation for community involvement will be sought through the EVOS Restoration Office, Chugach School District, the villages of Tatitlek, Port Graham, and Nanwalek, and the Alaska Department of Fish and Game Subsistence Division (see above).

SCHEDULE

A. Measurable Project Tasks for FY 00

November-February:	Coordinate and plan community involvement, Youth Area Watch and TEK. Attend Synthesis Workshops in local communities. Meet with local subsistence harvesters. Attend Restoration Workshop. Order satellite transmitters and field gear. Contract for vessel support, veterinary services. Organize field gear, test equipment.
March-April:	Reconnaissance surveys for scoter and goldeneye concentrations. Capture birds for radio implants. Maintain and store field equipment.
May-September:	Monitor satellite transmitters. Coordinate community involvement, Youth Area Watch and TEK. Plan field logistics and organize equipment and personnel. Conduct surveys and field work at nesting and molting areas.

B. Project Milestones and Endpoints

FY00

October-March:	Monitor satellite transmitter birds. Post results on the Internet. Coordinate and plan community involvement.
March-April:	Capture birds for transmitter implants.
April:	Submit annual report.
May-September:	Monitor birds for defining migration routes, breeding areas, and molting areas. Coordinate with local communities.
July-August:	Breeding and molting site surveys, habitat assessment, productivity studies.

FY01

October-March:	Monitor satellite transmitter birds. Post results on the Internet. Coordinate and plan community involvement, Youth Area Watch, and TEK.
April:	Submit final report.
May-September:	Continue to monitor any active transmitters.

C. Completion Date

All project objectives, except final reports and publications, will be met following FY00.

PUBLICATIONS AND REPORTS

An annual report of FY00 activities will be submitted to the Restoration Office before 15 April 2000. Journal publications will be prepared upon completion of all fieldwork.

PROFESSIONAL CONFERENCES

To be determined.

NORMAL AGENCY MANAGEMENT

The work proposed here is not part of normal agency management and is related specifically to research addressing oil spill restoration concerns. No similar work has been conducted, is currently being conducted, or is planned using agency funds.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

As described in the Introduction, this research relies on incorporation of methods and data from other EVOS Trustee sponsored research, including projects /427 and /025. Equipment purchased by those projects will be used to conduct this research. Location of research sites, and data collection and analysis will follow previously established standards. All efforts will be made to share vessel support, telemetry monitoring, study sites, and equipment with other EVOS projects.

This project is integrated with project \052B Traditional Ecological Knowledge; project \210 Youth Area Watch; project \025 Nearshore Vertebrate Predator Project; project \320 Predation on Herring Spawn; project \427 Harlequin Duck Recovery Monitoring; and project \159 Prince William Sound Marine Bird Surveys.

See Community Involvement and Traditional Ecological section above for more details on coordination of TEK and Youth Area Watch activities.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

There are no major changes from the FY99 proposal. Results of the FY99 field season and advances in satellite transmitter technology may necessitate some changes to this proposal.

PROPOSED PRINCIPAL INVESTIGATORS

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PERSONNEL QUALIFICATIONS

Dan Rosenberg has been a waterfowl biologist for The Alaska Department of Fish and Game (ADF&G) since 1985. From 1980-1983 Mr. Rosenberg conducted field research in Alaska as a waterfowl biologist for the U.S. Fish and Wildlife Service and from 1983-1984 as a Habitat Biologist for ADF&G. Mr. Rosenberg received a Bachelor of Science degree in Wildlife Management from Humboldt State University, Arcata, CA in 1979.

Mr. Rosenberg has conducted harlequin duck population (age and sex structure) and production surveys in Prince William Sound since 1994 as the Principle Investigator of a Trustee sponsored restoration project. He has conducted extensive waterfowl population monitoring and habitat assessment surveys on the Copper River delta, Stikine River delta, Kenai wetlands, upper Cook Inlet, Aleutian Islands, and Kodiak Island. As project leader, Mr. Rosenberg has assessed impacts to waterfowl and wildlife populations from hydroelectric development, urban expansion, habitat alterations, chemical pollutants, timber harvest, and surface mining.

OTHER KEY PERSONNEL

Mike Petrula, Wildlife Biologist, ADFG. Field logistics, capture, data analysis, telemetry monitoring, report preparation.

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

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel	$90.2	$84.6						
Travel	$11.7	$10.7						
Contractual	$38.3	$47.2						
Commodities	$49.8	$47.0						
Equipment	$0.0	$0.6	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$190.0	$190.1			Estimated FY 2001	Estimated FY 2002		
General Administration	$12.9	$16.0						
Project Total	$202.9	$206.1			$0.0	$0.0		
Full-time Equivalents (FTE)		1.4						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:
The greatest expense for this project is the cost of satellite transmitters and related data downloading expenses from Service Argos Inc., a satellite based location and data collection system. Both are sole source at this time.

Additional costs from FY99 are increased boat charter time to include scoter capture in both Prince William Sound and lower Cook Inlet.

No money is allocated for NEPA compliance. Only salary money is allocated for attendance at Anchorage workshops. Travel to villages for TEK "Synthesis Workshops" is included. Travel for students to participate in field work as part of Youth Area Watch and school district programs is not included in this budget.

If proposed ADFG project 00407 is funded, some costs may be shared with that project.

FY00

Prepared:4/9/99

Project Number: 00273
Project Title: Scoter Life History and Ecology: Linking Satellite Technology with Traditional Knowledge to Conserve the Resource.
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
D. Rosenberg	WBIII, Principle Investigator	18J	6.5	5.9		38.4
Mike Petrula	WBI, Data analysis, report prep., graphics	14C	6.5	4.5		29.3
1 F&G Tech.	F&G Tech. III, Field Tech/graphics	11F	2.0	3.8	1.0	8.6
1 F&G Tech.	F&G Tech. III, Field Tech	11F	1.0	3.8	0.5	4.3
2 Local Tech.	Field Assistants	11F	1.0	3.5	0.5	4.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		17.0	21.5	2.0	
					Personnel Total	$84.6

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
Portage-Whittier Alaska Railroad vehicle,boat, and 1 psng.	0.4	2			0.8
Portage-Whittier Alaska Railroad vehicle and psng.	0.2	4			0.8
Portage-Whittier Alaska Railroad Psg. fare	0.1	1			0.1
Anchorage-Tatitlek by air	0.4	3	3	0.1	1.5
Anchorage -Valdez by air	0.2	2	4	0.1	0.8
Anchorage-Chenega by air	0.3	2	2	0.1	0.8
Anchorage -Port Graham/Nanwalek by air	0.3	3	4	0.1	1.3
Airport parking, taxi fare, excess baggage	0.2				0.0
Per diem, Homer, Whittier, Valdez			10	0.1	1.0
Travel to molt and nest sites, commercial airlines to charter location	0.5	6	6	0.1	3.6
					0.0
				Travel Total	$10.7

FY00

Prepared:4/9/99

Project Number: 00273
Project Title: Scoter Life History and Ecology: Linking Satellite Technology with Traditional Knowledge to Conserve the Resource.
Agency: ADFG

FORM 3B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed
Description	FY 2000
Air charter for field support 15 hrs @ $250/hr	4.0
Boat and outboard motor repair	0.8
Trailer and boat moorage Whittier, Homer	0.2
Photo processing, presentation productions	0.3
Vessel support for bird capture and marking 15 days @1300/day	19.5
Satellite telemetry data downloading 15 birds at $900/bird	13.5
Air freight - equipment shipment	0.5
Veterinarian Surgical Implants	3.0
Anesthetist Administer anesthetics	1.6
Blood analysis, $35/sample x 50 samples	1.8
Cospass-Sarsat ground receiver rental $38.50/day x 45 days,insurance, shipping	2.0
When a non-trustee organization is used, the form 4A is required. Contractual Total	$47.2

Commodities Costs:	Proposed
Description	FY 2000
Boat fuel 175 galllons @ $1.50/gal	0.3
Boat supplies- parts, props, fuel lines, fuel filters, water filters, battery, absorbent rags, oil, emergency provisions	0.8
Field survey supplies- rite-in-rain notebooks/paper, nautical charts, batteries,	0.3
Computer software for analysis, graphing, mapping, web page development	0.6
Camp materials and supplies	0.7
Camp Food, 4 people x10 days @ $18/day/person	0.8
Mist nets and trapping equipment	1.6
Satellite radio transmitters - 15 @ $2,700 each	40.5
Veterinarian surgical supplies	1.0
Blood sampling supplies	0.4
Commodities Total	$47.0

FY00

Prepared:4/9/99

Project Number: 00273
Project Title: Scoter Life History and Ecology: Linking Satellite Technology with Traditional Knowledge to Conserve the Resource.
Agency: ADFG

FORM 3B
Contractual &
Commodities
DETAIL

2000 EXXON VALDEZ TRUS' COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 2000
EPIRBS	2	0.3	0.6
			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**	$0.6

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency
20 ft. Caribe rigid hull inflatable	1	ADFG
17 ft. Boston Whaler	1	ADFG
10x40 binoculars	4	ADFG
Spotting Scopes	2	ADFG
Achilles 8 ft inflatable dinghy	2	ADFG
Remington Shotguns	2	ADFG
Honda generators	3	ADFG
Survival Suits	2	ADFG
Outboard Motors/various hp	6	ADFG
Magellan GPS	3	ADFG
Marine VHF radios	4	ADFG

FY00

Prepared:4/9/99

Project Number: 00273
Project Title: Scoter Life History and Ecology: Linking Satellite Technology with Traditional Knowledge to Conserve the Resource.
Agency: ADFG

FORM 3B
Equipment
DETAIL

PROJECT TITLE: Development of an Ecological Characterization and Site Profile of the Kachemak Bay Watershed/Lower Cook Inlet Area

Project Number:	00278
Restoration Category:	Ecosystem Synthesis, General Restoration (suggested)
Proposer:	ADFG
Lead Trustee	ADFG
Duration:	2nd year of 2-year project
Cost FY 00:	$52.4
Geographic Area:	Kachemak Bay, Southern Kenai Peninsula, and Lower Cook Inlet
Injured Resource/Service:	Kachemak Bay includes all injured resources (except cutthroat trout, Dolly Varden, and AB Killer Whale pod) and all the lost or reduced services, each of which will be addressed in the development of this ecological characterization and site profile of the Kachemak Bay Watershed/Lower Cook Inlet area.

ABSTRACT

This project will develop an ecological characterization and site profile to collect, synthesize, analyze, and document available physical, biological, and human or socioeconomic information on the Kachemak Bay/Lower Cook Inlet area. The project will result in the development of a database management system with products produced in electronic format (hypertext markup language with selective use of compact computer disk – CD – and Internet media) and summarized on paper. The overall project has three main components: 1) the ecosystem narrative description; 2) a spatial data component using a Geographic Information System (GIS); and 3) the annotated bibliography and research summary/tracking system. The proposed EVOS funds will target the spatial data component and annotated bibliography. The products will be presented in an interactive, easy-to-use information format to: (1) improve accessibility of ecological information to the public, researchers, and managers; (2) assist in land use and protection (including parcels purchased by the EVOS Trustees); (3) help plan for a possible long-term ecological monitoring and research program in the Northern Gulf of Alaska; and (4) assist in resource management and planning for the Lower Cook Inlet area.

INTRODUCTION

This proposal is a continuation of a project funded in FY99. The ecological characterization and site profile (hereafter referred to as the "characterization") of Kachemak Bay will be completed in FY00.

The overall goal is to: 1) provide stakeholders with ecological information from EVOS and other sources, and 2) develop a research, management, and planning tool for the EVOS restoration effort and other organizations making natural resources decisions. The overall project was based on an initial user need survey. We developed and implemented the first year of the project with the users in mind. We are collecting, synthesizing, and analyzing ecological information about the Lower Cook Inlet area, with an emphasis on the Kachemak Bay Watershed. This information base covers all elements of the ecosystem, including biological, physical, human, and socioeconomic. The project will deliver the information using these tools: 1) an interactive ecosystem description; 2) a Geographic Information System (GIS); and 3) an annotated, searchable bibliography synthesizing and tracking current research. Information will be presented electronically in hypertext markup language (HTML) on a CD-ROM, and ultimately via the Internet. Additionally, as funding permits, we hope to produce the information in hard copy format. Data and information are being gathered from existing literature and the management and scientific communities. The resulting interactive digital characterization will include detailed, site-specific information suitable for both novice and technically sophisticated users.

To begin this rigorous project in FY98, the department secured additional funding and partners, hired staff, and established additional cooperative agreements. The principal contributing partner is the National Oceanic and Atmospheric Administration (NOAA), Coastal Services Center (CSC). While a major player, the CSC is not requesting funding from the Trustee Council. The Center has done a similar ecological characterization for Otter Island, S.C., and is completing a second ecological characterization in the Ashepoo-Cambahee-Edisto (ACE) Basin in South Carolina (SCDNR, NOAA/CSC, NGDC, 1996). The CSC not only adds experience and expertise, but also brings substantial cost sharing opportunities to this EVOS restoration effort. The Center has funded a two-year "Coastal Management Fellowship" (October 97 to September 99), partnered with ADFG to collect existing spatial data through a NOAA National Spatial Data Infrastructure Program, and entered into a two year cooperative agreement with ADFG for the overall project (April 1, 1998 to March 31, 2000).

Orchestrating the extensive ecosystem description, GIS atlas and models, searchable bibliography, and research synthesis in an electronic format represents a large and complex undertaking. Securing sufficient resources to complete all aspects of the project will result in a more comprehensive, easy-to-use product of substantial value to many users (resource managers, scientists, land owners and the general public). Continued Trustee Council participation will play a critical role in successfully completing this project.

Kachemak Bay was designated as the 23rd National Estuarine Research Reserve (NERR) in the National System on February 12, 1999 (ADFG and NOAA, 1998). The NERR System is a non-regulatory program which supports and promotes long-term research, monitoring, and education in estuaries. The Kachemak Bay NERR will play a lead role in maintaining the ecological characterization and the associated GIS over time. The goals and objectives of the proposed reserve are compatible with the goals of the Trustees Council as presented in the EVOS Restoration Plan (EVOS Trustee Council, 1994). The new NERR designation offers numerous cost-sharing opportunities, and can bring additional NOAA expertise and public participation into the EVOS restoration effort. Moreover, the NERR System as a whole, and in particular the Kachemak Bay NERR, places an emphasis on getting scientific information to managers, resource users, and the general public. Through this and future efforts, we can assist the Trustees in getting EVOS funded research and other information to stakeholders.

NEED FOR THE PROJECT

A. Statement of Problem

To date, EVOS restoration efforts have focused largely on restoration projects, research, and monitoring. The Invitation to Submit Restoration Proposals for FY99 and FY00 indicated a shift in emphasis from research to synthesizing and integrating information (see pp. 31 and 32, Ecosystem Synthesis section). The Ecological Characterization is designed to meet this need – it summarizes existing information, involves stakeholders in its development, and presents an easy-to-use product of value to many stakeholders.

At the10th annual EVOS Restoration Workshop, the Chief Scientist and others pointed to the need to compile comprehensive baseline data on the ecosystem's physical, chemical, biological, and human elements. Such data would serve as the backbone of a long term monitoring program, such as that being developed by the Trustee Council for the Restoration Reserve. In collating the information available for all these elements, the characterization project will establish baseline data for future monitoring efforts in Lower Cook Inlet and Kachemak Bay.

At the beginning of this project, ADFG conducted an extensive survey of potential users to determine what information they needed and the most appropriate format for presentation (Callahan et al, 1998). Highlights include:

> ***Participants:*** Over forty managers, researchers, and educators from 28 organizations active in the Kachemak Bay/Lower Cook Inlet area were interviewed to assess information needs, including researchers involved in EVOS restoration studies.
>
> ***Management Issues:*** The survey identified several priority management issues. Respondents noted the importance of distinguishing between human-induced and

natural changes. While meeting the needs of EVOS, compiling this information into a single source will also significantly help regional managers and resource users.

Primary Information Needs for Managers and Researchers: Managers and researchers said they need a better holistic understanding of the local ecosystems and how their components interact. In addition, they agreed that the information currently available is too general. This project proposes to update existing information and develop more site-specific spatial information.

Geospatial Information Needs, Capabilities, and Uses: This section of the survey queried the audience about their spatial data needs, agency capabilities, and existing and potential uses of GIS. We will provide GIS data and training for product users.

Product Format and Access Recommendations: Respondents said the primary problem was that they could not access existing information. They prefer to have information readily available using a combination of CD, Internet, and paper media.

Summary: Respondents voiced a need to develop a socioeconomic and ecological database for research, management, and planning. At present, managers and researchers seek information from a wide array of sources, leading to time-consuming and often fruitless searches for site-specific details. Data and qualitative information are archived separately in management agencies throughout the state. The daunting task of searching for and trying to access information on the Kachemak Bay watershed has led to repeated requests for a centralized source of site-specific details. This task may be even more difficult for community members than for agency staff.

All of the interview participants viewed the proposed products and data management systems as tools for management and research. The respondents said that a site-specific knowledge base that identifies what is known and not known about the Bay's ecosystem would be very useful for daily and long-term activities. The information in the characterization may be used in developing plans and recommendations for resource use, restoration, research, and ecological monitoring.

We will continue to work with users of the project. Community involvement and participation is also built into the characterization project and has been a significant part of our outreach efforts to date.

Rationale/Link to Restoration

The proposed project is closely linked to the mission, policies, and objectives of the Trustee Council. With respect to goals and objectives of the Trustee Council, the ecological characterization will:

1. Elucidate the state of knowledge of injured species, resources, and services in Lower Cook Inlet and Kachemak Bay;

2. Identify gaps in ecological knowledge of Kachemak Bay;
3. Help identify opportunities to restore or enhance these resources and services;
4. Collect information useful for other EVOS efforts related to restoration, research, and long-term monitoring;
5. Provide an information base and data management system for future EVOS and agency restoration efforts (both research and long-term monitoring), management, and natural resource planning.

The list below describes how this project addresses the Trustee Council policies. Policy numbers refer to those listed in Chapter 2 of the 1994 EVOS Restoration Plan (pages 12 to 17).

Ecosystem Approach, Policies 1 and 2 –This project promotes an ecosystem approach towards restoration, management, and use of Kachemak Bay. The study area is the entire watershed of Kachemak Bay, encompassing those lands already purchased by the Trustee Council on the south side of the Bay and the proposed purchases on the north side. This watershed approach will clearly benefit multiple species and services.

Injuries Addressed by Restoration, Policies 3, 4, and 6 – Tasks 1 to 5 above relate to the restoration of injured species and resources. Many of the injured species and services have substantial economic, cultural, and subsistence value to the state and the region.

Location of Restoration Actions, Policy 8 – Kachemak Bay is in the spill area. Council policy allows study of ecosystem aspects that may affect marine resources.

Restoring a Service, Policy 9 – Most of the injured services occur within the Kachemak Bay area. Through an analysis of present and historical information, this project will identify services that can be protected, restored, or enhanced.

Efficiency, Policies 11 and 14 – This project maximizes cost sharing. The EVOS restoration effort can gain significant benefits from this product with relatively little expense. Proposed EVOS funding represents a relatively small but critical component of total costs for creating the information synthesis.

Partnerships, Policy 15 – This project emphasizes partnerships with governmental and non-governmental agencies to define user needs, develop the product, and maintain it.

Clear, Measurable, and Achievable Endpoint – The ecological characterization will be completed in mid-FY00. The products will be available to managers, researchers, local governments, and the public. ADFG is requesting FY00 funds to complete the GIS component, the final production and evaluation phases of the project, and produce 200 copies of the CDs for EVOS PIs.

Synthesis of Findings/Project Integration/Remaining Issues and Information Gaps, Policy 18 – The project summarizes and synthesizes available information (EVOS and non-EVOS), and thereby identifies information gaps. Future NERR efforts may try to address these information gaps, for example through field monitoring efforts, but such actions are not part of the current characterization project. This project will help support protection of various lands purchased by the Council (e.g., the Beluga Slough and Homer Spit parcels in the Homer area, and large parcels of Seldovia Native Association land), as well as the injured species and services they support.

Public Participation, Policy 19 – ADFG has sought comments from several non-governmental entities in project design, and has completed an extensive need assessment. Continued involvement of agencies and the public will foster ownership and product use.

Access to Information and Data, Policy 20 – This project intends to make EVOS-funded and other information readily available to the public and agencies in a user-friendly form. User participation in the project assures the usefulness of the product. This project will complement other efforts of the Trustee Council's staff to disseminate information.

Normal Agency Activities – The preparation of an ecological characterization is not a normal ADFG activity and has not been conducted by the department in any other area.

C. Location

The project study area is mapped in Figure 1 (next page). Figure 1-A represents the "focus area," or the area of intensive data collection and synthesis. This includes Kachemak Bay and its watershed. Data collection and synthesis in the focus area will include updating existing data and incorporating additional scientific and local knowledge. To illustrate how Kachemak Bay interacts with the larger ecosystem, the overall extent of spatial data collection will be extended to all of Cook Inlet and parts of the outer Kenai Peninsula, as delineated on Figure 1-B. Outside the focus area, spatial data capture will be limited to existing data sets. The primary affected communities

Figure 1-A: Kachemak Bay Focus Area

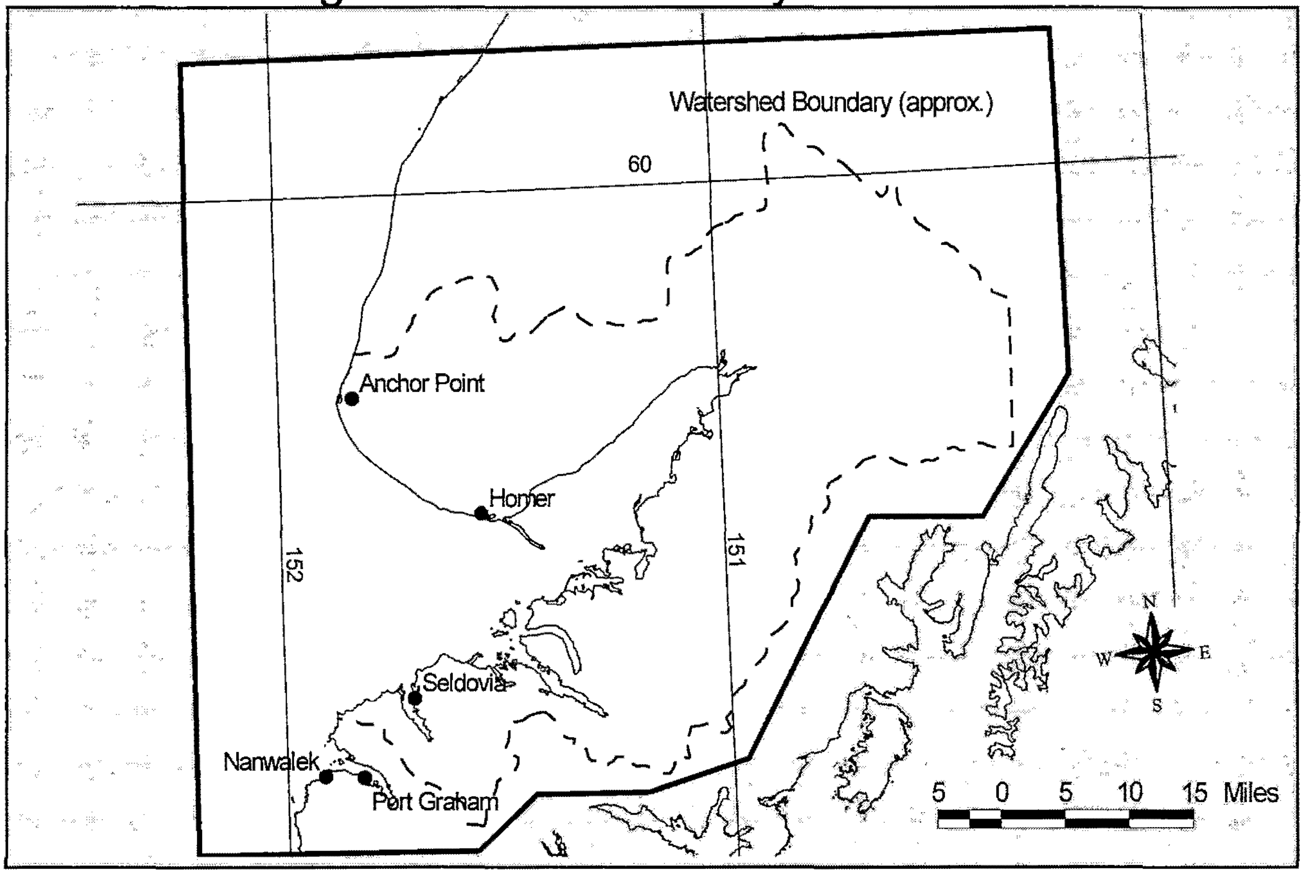
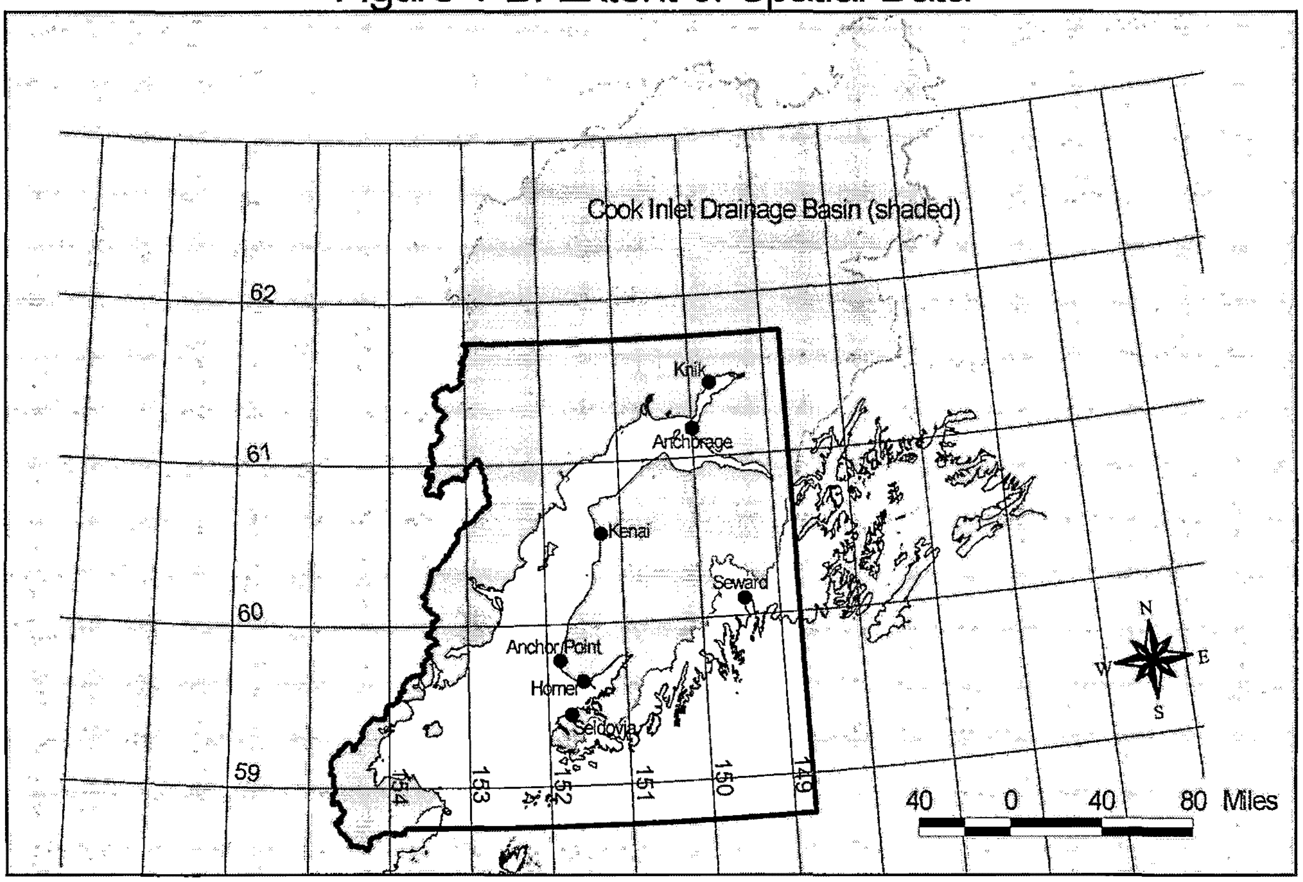


Figure 1-B: Extent of Spatial Data



include Homer, Anchor Point, Kachemak City, Kachemak Selo, Halibut Cove, Seldovia, Port Graham, Nanwalek, and adjacent areas.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Our original Year 1 proposal included fairly aggressive outreach efforts to inform the communities of this project and provide opportunities for public input. We believed a high level of community involvement would both improve the information base presented in the product, and increase stakeholder ownership and use of the product. However, since the Trustee Council staff recommended that we focus on the GIS and annotated bibliography aspect of the proposal, this element was scaled back. Information collection will be largely limited to more traditional scientific and professional sources of information.

PROJECT DESIGN

As noted previously, the proposed project is part of a larger cooperative effort between ADFG and NOAA/CSC to develop an ecological characterization for Lower Cook Inlet and the Kachemak Bay Watershed. The following narrative summarizes aspects of the project that would be funded through EVOS Restoration funds— collecting GIS spatial data and preparing the annotated bibliography.

The proposal to the CSC was prepared with an understanding that we would seek additional resources and partners to create the most comprehensive and useful product. The ecological characterization is an ambitious project that will have extensive utility for many audiences. However, the primary "target audience" (i.e., the audience guiding the development of the project) consists of researchers and managers, including full consideration of EVOS information and information management needs. The Trustee Council has goals and objectives in common with those of the NERR characterization project. Thus the Trustee Council is a logical partner in this endeavor. The Council's involvement would be cost effective by jointly addressing specific EVOS restoration, research, and monitoring needs. Council participation will, in part, result in (1) a more comprehensive product; (2) an update of existing information; and (3) collection and synthesis of more detailed and site-specific spatial information on the human, biological, and physical elements of the ecosystem.

A. Objectives

Project components that coincide with Trustee Council funded objectives include:

1. Collecting existing GIS data and developing a PC-based GIS for the Kachemak Bay/Lower Cook Inlet ecosystem. This tool will benefit research, monitoring, resource management and planning.

2. Developing GIS applications to demonstrate the utility of this tool for management, research, monitoring, education, and restoration.
3. Developing an annotated bibliography and research summaries for the Kachemak Bay/Lower Cook Inlet ecosystem.
4. Publishing ecosystem information, information needs, and GIS data and applications on a compact computer disk (CD) and, as appropriate, on the Internet.

EVOS-funded project staff will focus on collecting existing GIS data, developing new GIS data, developing an annotated bibliography, and publishing this information.

B. Methods

Project Framework: The ecological characterization will present information through three components: (1) the ecosystem description; (2) the GIS/spatial data; and (3) annotated bibliography/research synthesis. EVOS-funded project staff will focus on the 2nd and 3rd components, which are further subdivided below.

1. *GIS/Spatial Data Component*: The GIS database and its demonstration component will contain digitized spatial data and associated metadata (i.e., a description of the data types and quality). Providing spatial information (i.e., GIS layers) on habitats, natural resources, physical processes, human uses, roads, land use, management status, and other features will allow managers and researchers to better analyze problems from an ecosystem perspective. The GIS demonstrations will show how to use this tool to investigate questions specific to Kachemak Bay. For example, the GIS demonstrations will address topics such as land use planning or fisheries management for this area. In addition to the research, management, and modeling applications, providing visual data will have educational benefits for the community. With the Trustee Council's support, the community will also contribute to the product by bringing their knowledge of the region into the GIS.

   Progress Update: ADFG has completed an initial inventory of available spatial data for the Kachemak Bay/Lower Cook Inlet Area. This information does not have the high resolution that the local residents can provide, and that researchers and managers need. Data capture has focused on the Kachemak Bay Watershed, but we are also capturing data to analyze ecological relationships between the Bay, Cook Inlet, and the Northern Gulf of Alaska (see Figure 1B). The GIS component has taken substantially longer than anticipated, due to an unexpectedly large amount of time required to both clean the data and create metadata that is FGDC compliant. Enclosure 1 summarizes the GIS data captured by the time of this proposal .

2. *Annotated Bibliography*: This component will include a searchable, partially annotated bibliography of ecological information available for the region, including EVOS-funded research. It will greatly increase access to and use of this information. The bibliography will include journal articles, unpublished reports, EVOS project reports, gray literature, and major public documents concerning the watershed and

resources in the area. All of the documents will be searchable by key words, author, title and date.

Progress Update: All free databases (approx. 25) have been searched and citations entered into a Procite database. The KBNERR and Homer Public Library have gleaned all pertinent references. The ADFG library search will be complete by the end of April, 1999. Next, we will search other smaller libraries in Homer. To date, approximately 400 citations have been entered, with 70 annotations. Databases that require fees will be searched by end of May, 1999.

3. *Research Synthesis*: This section will summarize current research, monitoring and restoration projects in the region. Better access to this information will increase its effect, and promote an ecosystem perspective among characterization users. These summaries will also facilitate better coordination among organizations working in the Bay.

   Progress Update: PIs at USFWS, ADFG, the Center for Alaska Coastal Studies, Cook Inlet Keeper, and Cook Inlet RCAC have been interviewed. Once summaries are complete for those projects, interviews will continue with the principle investigators from USGS, Coble Geophysical, City of Homer, Pratt Museum and SeeMore Wildlife Systems.

4. *Database Design:* ADFG and CSC will design the characterization database to provide for easy access, data analysis, and updates. This database will also work with the search software of the bibliography and the GIS/spatial data component. The database design must also accommodate the Internet and CD interfaces.

   Progress Update: The database framework is in place. Project staff are filling in the information.

5. *Interviews*: In this project, we will interact with the scientific and management communities to collect the most recent, accurate, and site specific information available. We will supplement the published information by interviewing researchers and managers—i.e., university, agency, and other EVOS researchers who are conducting studies in the Kachemak Bay area. ADFG project staff will collect most of this information [note: the contractor under (b) below (i.e., CSC funded aspect of the project) will assist in collecting historical information].

   Progress Update: Interviews have begun and should be completed by late summer.

<u>*Year 2 Tasks – FY00*</u> Efforts in FY00 will focus on the following tasks:

1. <u>Completion of GIS Data Collection and Metadata Development</u>

We initially anticipated completing all the data collectionwould be completed by September 1999. In actuality, we found that the work load associated with collecting and "cleaning" the data, as well as developing FGDC compliant metadata, was substantially greater than anticipated. ADFG will be compiling hundreds of data sets for inclusion in the characterization, all of which require various levels of modification to create a clean, easy-to-use product. Some of the problems we encountered include:

Spatial Data Collection and Cleaning: To develop a spatial database on GIS, we had to collect existing data from multiple sources. These sources often utilized software programs different from those used in this project (ArcInfo and ArcView). Data conversions are rarely perfect, and require a lot of "cleaning" (e.g., correcting or closing arcs, edge matching, reformatting or clarifying attribute data for easy access and use) before it can be utilized. This cleaning is essential to produce a user-friendly product.

Development of Metadata: ADFG will develop Federal Geographic Data Committee (FGDC) compliant metadata (to the extent that available information will allow) for all data layers captured or developed as part of this ecological characterization. We have found that the vast majority of the existing data layers did not have adequate metadata, in fact many did not have any metadata at all. Metadata documentation is necessary to define the type and accuracy of each data source, along with its limitations. Developing this metadata will benefit other ongoing and future EVOS projects that utilize these data sets. Metadata collection will be coordinated with the CIMMS project and agency projects that may be establishing metadata.[1]

ADF&G is requesting an additional three months of time for our GIS specialist in FY00 to develop more complete FGDC compliant metadata.

2. <u>Completion of CD, Internet Products, Project Evaluation, and Maintenance Plan</u>

It is essential that project staff continue to work with the CSC to review products, conduct the product evaluation, and complete the other tasks listed below. We estimate that $35.0K of FY00 EVOS funds will allow us to complete these tasks. The EVOS contribution will cover approximately one fourth of the associated costs, the balance of which will be provided through NOAA funds.

Development of CD/Internet Products: The information collection and synthesis phases will be approximately 60 percent completed at the end of FY99. September 30, 1999, also marks the end of the two-year Coastal Management Fellowship project. The fellow will be brought on the project as staff or a contractual basis to assist in completing the project. As part of the cooperative agreement, the CSC is responsible for incorporating

[1] The development of FGDC compliant metadata is a huge undertaking, one that will require extensive coordination with multiple groups and data custodians. With additional funding and cooperation with CIMMS and other GIS projects, we are hoping to complete compliant data (within the extent of locatable information) for all data layers in the CD and associated products.

the information compiled by ADFG into the CD/Internet products. The anticipated completion date is April 2000.

Reproduction and Distribution of CDs: As part of the cooperative agreement, CSC will produce a limited number of copies of the CD. Depending on the number desired by the Trustee Council staff for their PIs, additional funding may be necessary to reproduce additional CDs.

Production of the Paper Copy: In the needs assessment, several respondents recommended that a paper copy of the ecological characterization be produced. As part of the EVOS project, ADFG will provide the Trustee Council with a hard copy of the bibliography. GIS data will be available to CD users and the general public through the KBNERR web page. A paper copy of other parts of the characterization will be developed as time and finding allows.

Product Evaluation: ADFG and CSC intend to conduct an evaluation of the product before it is distributed. Appropriate refinements will be made before the product is released.

Maintenance Plan: ADFG intends to develop a product that can be maintained over time. ADFG will develop a plan to update and maintain key portions of the characterization. This plan will identify potential future uses, provide for ongoing product evaluation, and recommend further work.

Coordinate With Other EVOS Projects: ADFG will collect and synthesize information from other EVOS projects and make it available to the EVOS stakeholders. Our ability to achieve this will depend on the willingness of EVOS project staff to coordinate and share information for public dissemination.

C. Cooperating Agencies, Contracts, and other Agency Assistance

Agency Requesting Funding: ADFG is the only Trustee Council agency requesting funding. NOAA/NOS/CSC is a cooperating agency, but will fund its participation from other sources.

Contractors:The Coastal Management Fellowship is being administered through the Alaska Sea Grant Office through the University of Alaska/Fairbanks. A total of $12K will be provided to the Alaska Sea Grant Office through a Reimbursable Services Agreement to cover three months of the Fellow's time. This time will be devoted to overall project coordination, and to the GIS/spatial data and annotated bibliography components of this project.

SCHEDULE

A. Measurable Project Tasks for FY00 (limited to tasks funded in part by EVOS)

1st Quarter:
- Collect and capture existing spatial data, incorporate into the GIS.
- Digitize new spatial data.
- Develop metadata for existing and new GIS data.
- Place GIS spatial data and associated metadata on the KBNERR web page.
- Add entries to bibliography.
- Provide narrative and spatial information to CSC as it is completed.

2nd Quarter:
- Collect and capture existing spatial data, incorporate into the GIS.
- Digitize new spatial data.
- Develop metadata for existing and new GIS data.
- Place GIS spatial data and associated metadata on the KBNERR web page.
- Add entries to bibliography

3rd Quarter:
- Develop draft CD product.
- User evaluation of the product
- Train select managers, researchers, and users of the product.
- Attend 11th Annual Workshop and associated meetings.

4th Quarter:
- Continue developing the CD.
- User evaluation of the product.
- Develop product maintenance plan.
- Develop Internet product/interface.

B. Project Milestones and Endpoints (tasks funded in part by EVOS)

1st Quarter:
- Complete clipping and cleaning of existing spatial data.
- Complete establishment of metadata for existing spatial data.
- Continue digitizing new spatial data
- Achieve 90% completion of Bibliography.
- Continue to provide spatial and other data to CSC.

2nd Quarter:
- Distribute sections for review.
- Complete capture of existing GIS spatial data (with metadata).
- Finish digitizing new spatial data (with metadata)
- Complete final bibliography .

- Provide all data and components to CSC.

3rd Quarter:
- Begin review and evaluation of draft product with users.
- Peer review of draft narrative and spatial data completed.
- Begin GIS training of select users.
- Participate in Annual EVOS Workshop.

4th Quarter:
- Complete CD.
- Begin development of Internet Product (ADFG will coordinate with CSC).
- Complete user training.
- Complete user evaluation and make appropriate modifications.

C. Completion Date

We anticipate a completion date of September 30, 2000. However, it may take longer to successfully place a version of the characterization on the Internet .

PUBLICATIONS AND REPORTS

The ecological characterization will be published in electronic media (CD and the Internet). ADFG will provide the Trustees Council office with 200 copies of the CD.

PROFESSIONAL CONFERENCES

ADFG is requesting funding for one person to present a paper on this project at the Coastal Society meeting during the summer of 2000.

NORMAL AGENCY MANAGEMENT

Neither ADFG nor NOAA requires development of a characterization. All aspects of this project – the Coastal Management Fellowship project, the NSDI project and the cooperative agreement with NOAA – were funded through a competitive process. Through this proposal, we are seeking funding to complete the characterization and address needs of the EVOS restoration effort.

COORDINATION AND INTEGRATION WITH THE RESTORATION EFFORT

Coordination with the EVOS Restoration Effort: ADFG has begun coordinating with restoration projects on several fronts. We have initiated coordination with the APEX project (\163), which has devoted significant effort to Kachemak Bay/Lower Cook Inlet. We will work with project staff to define their data needs (i.e., what spatial data or other information can we provide to assist the modeling or other aspects of their project), and will incorporate their project findings in the characterization.

We will continue to coordinate with EVOS projects (APEX , CIMMS and Mariner Park Restoration Project) to include the most up-to-date information in the characterization. Four of our EVOS-funded staff presented a poster at the 1999 annual EVOS workshop in Anchorage. We will also make a presentation at the 2000 annual EVOS workshop.

Other Funds/Major Contributors: ADFG has secured substantial financial resources and established cooperative agreements in this project. These are detailed below.

FY99 and FY00 Contributions

NOAA/CSC Coastal Management Fellowship: The CSC is providing funds to support a Fellowship position in ADFG's Habitat and Restoration Division. The Fellowship will end October 1999. The approximate NOAA contribution (21 months) is $64,000.

NOAA/CSC – ADFG Cooperative Agreement: On April 1, 1998, the CSC and ADFG entered into a two-year cooperative agreement to "Develop an Ecological and Socioeconomic Characterization of Kachemak Bay, Alaska." In this agreement, ADFG will receive $140,000 for each of two years, or $280,000, to collect, synthesize, and analyze data. We are presently in the second year of this agreement (April 99 to March 00), which includes partial funds for two Habitat Biologist I's, a Fish and Game Technician, an GIS specialist, and a student intern for the GIS work.

In addition to the funding provided to ADFG above, the CSC will contribute its own staff time to the characterization project. The CSC will be responsible for producing the final CD and Internet products. The Center has budgeted for approximately 1 full-time-equivalent (FTE) in year one and 2 FTE's in year two. The CSC will also reproduce and distribute several hundred copies of the CD. No precise estimate of this CSC contribution has been established, but it will likely exceed $150,000 before project completion.

Project Management: Approximately 1.5 months of ADFG staff time) during the first six months of this project (October 97 to September 98) was devoted to project management. This amounts to approximately $10,000.

Kachemak Bay NERR: The Kachemak Bay NERR was officially designated by NOAA on February 12, 1999. Both the Kachemak Bay NERR Manager and Research Coordinator will assist in reviewing and advising this project, and they will eventually assume the responsibility for project management. The KBNERR Research Coordinator is expected to be hired by July, 1999. This staff person will lead an effort to further define and prioritize information needs and future research and monitoring projects. The Research Coordinator will work with researchers and the general public through a "Research and

Monitoring Advisory Group" that will be set up by the developing NERR. The ecological characterization will indentify remaining information, research, and monitoring needs. We estimate that this task will take approximately two months of staff time in FY00, or about $12,000.

PRINCIPAL INVESTIGATOR

Glenn A. Seaman
Manager, Kachemak Bay NERR
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Qualifications:

From 1975 to 1980, Glenn worked with marine mammal research in Northern and Western Alaska for ADFG and NMFS. Responsibilities included: (1) collecting field biological samples and data from pinnipeds and cetaceans in coastal villages from Nome to Kaktovik; (2) completing lab analysis of specimens; (3) conducting aerial surveys; and (4) assisting in preparing publications.

Since 1980, Glenn has functioned as ADFG's coordinator with the Alaska Coastal Management Program (ACMP). In that capacity, he was responsible for overseeing the development and implementation of the ACMP. He has gained an extensive understanding of the Alaska Coastal Management Program and coordinated the department's involvement in many planning, policy, and implementation issues. He has gained a very good understanding of regulatory agency needs. As the ACMP coordinator, he oversaw development of the department's ACMP budget and completion of all Section 309 studies. Two of the more notable 309 projects were the Kenai River Cumulative Impact Study, which assessed cumulative impacts and developed a comprehensive GIS for the Kenai River (Liepitz 1994, Seaman 1995); and the state-wide aquatic habitat restoration and enhancement studies (Parry et al 1993, Parry and Seaman 1994).

Since 1994, Glenn has led the state's effort to establish a National Estuarine Research Reserve in Alaska. He has been the project manager for the Kachemak Bay Ecological Characterization Project since its inception. He is also the mentor for the NOAA/CSC Coastal Fellow. In October 1998, Glenn was appointed the Manager of the Kachemak Bay NERR. In this capacity, Glenn is the logical project manager for this project.

Glenn has proven his coordination abilities and consistently produces high quality products on time. He will continue to be responsible for overall project management. He will participate in a number of the meetings with EVOS researchers, coordination meetings with CSC, the 10th Annual workshop, and be responsible for overall project administrative responsibilities. Glenn's time will will not be charged to the EVOS project.

OTHER KEY PERSONNEL

This project represents a team effort. Based on initial planning and the CSC's experience with other characterization projects, the project requires a minimum of four dedicated staff (not including GIS support in Anchorage) during the intensive information collection and synthesis phases (i.e., FY99). EVOS funding has enabled the project to realize the full complement of four staff now dedicated to the project in Homer: the NOAA Coastal Fellow, a Fish and Game Technician, and two Habitat Biologists.

The characterization project is linked to EVOS restoration goals, as it promotes an ecosystem-based approach to restoration, research, and monitoring. The project will also greatly benefit other management and research agencies. With EVOS funding, staff time will focus on collecting, summarizing, and synthesizing information on injured resources and services in Kachemak Bay/Lower Cook Inlet area.

Bridget Callahan/Coastal Management Fellow – Bridget was selected as the Coastal Management Fellow to provide the primary coordination/leadership function for the Kachemak Bay Ecological Characterization Project. Bridget is responsible for overall project design, providing leadership and direction to the Homer project staff, coordinating with the CSC staff, and coordinating efforts with advisory groups, project partners, and the public. CSC has provided funding for all but $12,000 (about 3 months) of the fellowship.

Curtis Smith/Research Analyst II – Curtis has been the GIS specialist and modeler assigned to this project since inception. With substantial experience in several aspects of GIS and data conversion, he is responsible for the GIS component of the project.

Lisa Thomas/ Habitat Biologist I – Lisa joined the characterization project staff in November 1999. Previously, she was on staff at USGS/BRD where she served as liaison to the Trustee Council and was a member of the EVOS Restoration Work Force. She was also the Assistant Coordinator for the Prince William Sound and Glacier Bay Ecosystem Initiatives where she developed various information products for natural resource managers. Her duties on the characterization are to develop a strategy for the bibliography, annotate the bibliographic references, and interact with PIs to develop summaries of research, monitoring and restoration programs in the watershed.

LITERATURE CITED

Alaska Department of Fish and Game, 1998. Proposed Kachemak Bay National Estuarine Research Reserve: Draft Environmental Impact Statement/Draft Management Plan. 114pp plus Appendices.

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Exxon Valdez Oil Spill Trustee Council, 1994. Exxon Valdez Oil Spill Restoration Plan. Anchorage, Alaska. 74pp.

Liepitz, Gary S., 1994. An Assessment of the Cumulative Impacts of Development and Human Uses on Fish Habitat in the Kenai River. Technical Report No. 94-6. Alaska Department of Fish and Game, Habitat and Restoration Division, Anchorage.

Olmi, G., Fowler, C., Smith, C., Callahan, B. and G. Seaman. 1998. Establishing a Shared Spatial Data Resource for Kachemak Bay, Alaska. Paper presented at the meeting of The Coastal Society, Williamsburg, Virginia, July 1998.

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Parry, Betsy L. and G. A. Seaman. 1994. Restoration and Enhancement of Aquatic Habitats in Alaska: Case Study Reports, Policy Guidance, and Recommendations. Alaska Department of Fish and Game, Habitat and Restoration Division, Anchorage.

Seaman, Glenn A., 1995. The Continued Assessment and Management of Cumulative Impacts on Kenai River Fish Habitat. Technical Report No. 95-6. Alaska Department of Fish and Game, Habitat and Restoration Division, Anchorage.

South Carolina Department of Natural Resources, U.S. Department of Commerce, National Oceanic and Atmospheric Administration Coastal Services Center and National Geophysical Data Center. 1996. Ecological Characterization of Otter Island, South Carolina; A prototype for interactive access to coastal management information. Charleston, SC: U.S. Department of Commerce, National Oceanic and Atmospheric Administration Coastal Services Center. NOAA CSC/7-96/001.

Inventory of Spatial Data Layers for the Kachemak Bay Ecological Characterization Project

Description	Category	Priority	Data Captured/ Clipped	Pre-existing Metadata	[1] Metadata Captured/ Completed	Date Created or Modified	Custodian	Type
Aerial Bird Surveys	Biological Factors	1		Some			USFWS	
Anadromous Streams (1996)	Biological Factors	1	Yes | Yes	Outdated	Yes | Yes	96	ADFG	Line
Anadromous Streams (1996) - shapfile (point)	Biological Factors	1	Yes | Yes	Outdated	Yes | Yes	96	ADFG	Point
Bald Eagle Nest Locations and Productivity	Biological Factors	1		Some			USFWS	
Bald Eagle Nests	Biological Factors	1	Yes | Yes	Outdated	Yes | No	91, 96	USFWS	Point
Bird Concentration Areas (All Seasons)	Biological Factors	1	Yes | No			98		Polygon
Bird Concentration Areas (Fall)	Biological Factors	1	Yes | Yes	Some	Yes | Yes	84, 94	NOAA	Polygon
Bird Concentration Areas (Spring)	Biological Factors	1	Yes | Yes	Some	Yes | Yes	84, 94	NOAA	Polygon
Bird Concentration Areas (Summer)	Biological Factors	1	Yes | Yes	Some	Yes | Yes	84, 94	NOAA	Polygon
Bird Concentration Areas (Winter)	Biological Factors	1	Yes | Yes	Some	Yes | Yes	84, 94	NOAA	Polygon
Dungeness Crab Areas	Biological Factors	1	Yes | No					Polygon
Forest Damage Survey 1989	Biological Factors	1	Yes | Yes	Some	Yes | Yes	98	ADNR	Polygon
Forest Damage Survey 1990	Biological Factors	1	Yes | Yes	Some	Yes | Yes	98	ADNR	Polygon
Forest Damage Survey 1991	Biological Factors	1	Yes | Yes	Some	Yes | Yes	98	ADNR	Polygon
Forest Damage Survey 1992	Biological Factors	1	Yes | Yes	Some	Yes | Yes	98	ADNR	Polygon
Forest Damage Survey 1993	Biological Factors	1	Yes | Yes	Some	Yes | Yes	98	ADNR	Polygon
Forest Damage Survey 1994	Biological Factors	1	Yes | Yes	Some	Yes | Yes	98	ADNR	Polygon
Forest Damage Survey 1995	Biological Factors	1	Yes | Yes	Some	Yes | Yes	98	ADNR	Polygon
Forest Damage Survey 1996	Biological Factors	1	Yes | Yes	Some	Yes | Yes	98	ADNR	Polygon
Forest Damage Survey 1997	Biological Factors	1	Yes | Yes	Some	Yes | Yes	98	ADNR	Polygon
Forest Health Management Report	Biological Factors	1				96	USFS	
Forest Type Groups	Biological Factors	1	Yes | Yes	Some				Grid
Groundfish	Biological Factors	1	Yes | No			98	ADFG	Polygon
Halibut Areas	Biological Factors	1	Yes | No				AMCC	Polygon
Herring	Biological Factors	1	Yes | No	Some		84, 94, 98	NOAA	Polygon
Interim Land Cover Map (Kenai Quad)	Biological Factors	1	Yes | Yes				USGS	Grid
Interim Land Cover Map (Seldovia Quad)	Biological Factors	1	Yes | Yes				USGS	Grid
Kelp Areas	Biological Factors	1	Yes | No					Polygon
King Crab Areas	Biological Factors	1	Yes | No					Polygon
KNWR "Dogs"	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Bald Eagles	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Bears	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Beavers	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Black Bears	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Canada Geese	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Canvasback	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Caribou	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Coyotes	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Cranes	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Fish	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Golden Eagles	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Greater White-Fronted Geese	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Grizzly Bears	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Lynx	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon

Description	Category	Priority	Data Captured/ Clipped	Pre-existing Metadata	[1] Metadata Captured/ Completed	Date Created or Modified	Custodian	Type
KNWR Mallard	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Marten	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Mink	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Mountain Goats	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Muskrats	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Mustelids	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Otters	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Peregrine Falcons	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Pintails	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Predators	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Red Foxes	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Seal Haulouts	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Sheep	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Shorebirds	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Snow Geese	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Trumpeter Swans	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Tundra Swans	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Ungulates	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Wolverines	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
KNWR Wolves	Biological Factors	1	Yes | Yes	Some	Yes | No		USFWS	Polygon
Land Cover - KNWR Project (Kenai Quad)	Biological Factors	1	Yes | No				USGS	Grid
Land Cover - KNWR Project (Seldovia Quad)	Biological Factors	1	Yes | No				USGS	Grid
Marbled and Kittlitze Murrelet Surveys	Biological Factors	1		Some		83-96	Wildland Rsrc. Enterp.	
Marine Mammal Concentration Areas (Fall)	Biological Factors	1	Yes | Yes	Some	Yes | Yes	84, 94	NOAA	Polygon
Marine Mammal Concentration Areas (Spring)	Biological Factors	1	Yes | Yes	Some	Yes | Yes	84, 94	NOAA	Polygon
Marine Mammal Concentration Areas (Summer)	Biological Factors	1	Yes | Yes	Some	Yes | Yes	84, 94	NOAA	Polygon
Marine Mammal Concentration Areas (Winter)	Biological Factors	1	Yes | Yes	Some	Yes | Yes	84, 94	NOAA	Polygon
National Wetland Inventory (Sel. and Ken. Quads)	Biological Factors	1	Yes | Yes	Yes	Yes | No	varies	USFWS	Polygon
NMFS Trawl Data	Biological Factors	1	Yes | No	Some	Yes | No		NMFS	Point
Otter Areas	Biological Factors	1	Yes | No					Polygon
Pacific Cod Areas	Biological Factors	1	Yes | No					Point
Razor Clams	Biological Factors	1	Yes | No	Outdated		84, 93, 98	NOAA	Polygon
Rockfish Areas	Biological Factors	1	Yes | No					Point
Sablefish Areas	Biological Factors	1	Yes | No					Point
Sea Otter and Pelagic Sea Bird Transects	Biological Factors	1	Yes | No	Some	Yes | No		ADNR	
Seabird Catalog - EVOS Database	Biological Factors	1	Yes | Yes	Some	Yes | No	96	USFWS, ADNR	Point
Seabird Colony Catalog - USFWS	Biological Factors	1	Yes | No	Some	Yes | No	98	USFWS	Point
Seal / Sea Lion Haulout Sites	Biological Factors	1	Yes | Yes	Some	Yes | No	93	NOAA	Point
Shorebird Concentration Areas	Biological Factors	1	Yes | No			98		Polygon
Shrimp Areas	Biological Factors	1	Yes | No					Polygon
Spruce Beetle Activity on Kenai Peninsula - 1972	Biological Factors	1	Yes | Yes	Some	Yes | No	98	ADNR	Polygon
Spruce Beetle Activity on Kenai Peninsula - 1973	Biological Factors	1	Yes | Yes	Some	Yes | No	98	ADNR	Polygon
Spruce Beetle Activity on Kenai Peninsula - 1974	Biological Factors	1	Yes | Yes	Some	Yes | No	98	ADNR	Polygon
Spruce Beetle Activity on Kenai Peninsula - 1977	Biological Factors	1	Yes | Yes	Some	Yes | No	98	ADNR	Polygon

Description	Category	Priority	Data Captured/ Clipped	Pre-existing Metadata	[1] Metadata Captured/ Completed	Date Created or Modified	Custodian	Type
Spruce Beetle Activity on Kenai Peninsula - 1978	Biological Factors	1	Yes | Yes	Some	Yes | No	98	ADNR	Polygon
Spruce Beetle Activity on Kenai Peninsula - 1979	Biological Factors	1	Yes | Yes	Some	Yes | No	98	ADNR	Polygon
Spruce Beetle Activity on Kenai Peninsula - 1980	Biological Factors	1	Yes | Yes	Some	Yes | No	98	ADNR	Polygon
Spruce Beetle Activity on Kenai Peninsula - 1981	Biological Factors	1	Yes | Yes	Some	Yes | No	98	ADNR	Polygon
Spruce Beetle Activity on Kenai Peninsula - 1982	Biological Factors	1	Yes | Yes	Some	Yes | No	98	ADNR	Polygon
Spruce Beetle Activity on Kenai Peninsula - 1983	Biological Factors	1	Yes | Yes	Some	Yes | No	98	ADNR	Polygon
Spruce Beetle Activity on Kenai Peninsula - 1984	Biological Factors	1	Yes | Yes	Some	Yes | No	98	ADNR	Polygon
Spruce Beetle Activity on Kenai Peninsula - 1985	Biological Factors	1	Yes | Yes	Some	Yes | No	98	ADNR	Polygon
Spruce Beetle Activity on Kenai Peninsula - 1986	Biological Factors	1	Yes | Yes	Some	Yes | No	98	ADNR	Polygon
Spruce Beetle Activity on Kenai Peninsula - 1987	Biological Factors	1	Yes | Yes	Some	Yes | No	98	ADNR	Polygon
Spruce Beetle Activity on Kenai Peninsula - 1988	Biological Factors	1	Yes | Yes	Some	Yes | No	98	ADNR	Polygon
Spruce Beetle Activity on Kenai Peninsula - 1989	Biological Factors	1	Yes | Yes	Some	Yes | No	98	ADNR	Polygon
Spruce Beetle Activity on Kenai Peninsula - 1990	Biological Factors	1	Yes | Yes	Some	Yes | No	98	ADNR	Polygon
Stellar Sea Lion Locations	Biological Factors	1		Some	Yes | No	95	Natl. Marine Fish. Srv.	
Tanner Crab Areas	Biological Factors	1	Yes | No					Polygon
Vegetation Classes	Biological Factors	1	Yes | No					Grid
1:250,000 DRG - Kenai	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:250,000 DRG - Seldovia	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai A1	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai A2	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai A3	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai A4	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai A5	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai A7	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai A8	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai B1	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai B2	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai B3	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai B4	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai B6	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai B7	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai B8	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai C1	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai C2	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai C3	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai C4	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai C5	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai C6	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai C7	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai C8	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai D1	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai D2	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai D3	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai D4	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image

Description	Category	Priority	Data Captured/ Clipped	Pre-existing Metadata	[1] Metadata Captured/ Completed	Date Created or Modified	Custodian	Type
1:63,360 DRG - Kenai D5	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai D6	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai D7	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Kenai D8	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia A3	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia A4	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia A5	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia A6	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia B1	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia B2	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia B3	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia B4	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia B5	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia B6	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia C1	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia C2	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia C3	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia C4	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia C5	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia D1	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia D2	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia D3	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia D4	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia D5	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
1:63,360 DRG - Seldovia D8	Digital Raster Graphic	1	Yes | Yes	Yes	Yes | Yes	97	USGS	Image
ADEC Contaminated Sites	Environmental Quality	1	Yes | No				ADEC	Point
ADEC Wastewater Permits	Environmental Quality	1	Yes | No				ADEC	Point
EPA Envirofacts Point Coverage	Environmental Quality	1	Yes | No	Some	Yes | No	97	EPA	Point
NPDES Data	Environmental Quality	1	Yes | No				EPA	Point
Permitted Discharges to Water Bodies	Environmental Quality	1	Yes | No				EPA	Point
Permitted Filling of Wetland (?)	Environmental Quality	1	Yes | No				Corps of Engineers	Point
RCRA Hazardous Waste Data	Environmental Quality	1	Yes | No	Some	Yes | No	98	EPA	Point
Superfund Sites	Environmental Quality	1	Yes | No	Some	Yes | No	96	EPA	Point
Toxic Release Inventory Data	Environmental Quality	1	Yes | No	Some	Yes | No		EPA	Point
Place Names	Geographical Factors	1		Some		93	Rsrc. Data Inc.	
Place Names Annotation (feature names repeated)	Geographical Factors	1	Yes | Yes			96	ADNR	Polygon
Place Names Annotation (features labeled once)	Geographical Factors	1	Yes | Yes			96	ADNR	Polygon
Place Names as Points	Geographical Factors	1	Yes | Yes	Some	Yes | No	94	USGS	Point
Towns	Geographical Factors	1	Yes | Yes			95	ADNR	Point
Beikman Map of Geologic Units	Geological Factors	1	Yes | Yes	Some	Yes | Yes	97	USGS	Polygon
Exploratory Soil Survey	Geological Factors	1	Yes | No	Some	Yes | No	95	NRCS	Polygon
KPB Parcel Data	Human Factors	1	Yes | No			97	KPB	Polygon
Borough Maintained Roads and Travel Corridors	Human Factors	1				current		
Cleared Areas	Human Factors	1					NRCS	

Description	Category	Priority	Data Captured/ Clipped	Pre-existing Metadata	[1] Metadata Captured/ Completed	Date Created or Modified	Custodian	Type
DCRA Comm. Profiles 1997	Human Factors	1	Yes | Yes					Point
EVOS Projects	Human Factors	1	Yes | Yes			96	ADNR	Region
Spatial Extent of KBEC Project	Human Factors	1	Yes | Yes			98	ADFG	Polygon
State Maintained Roads and Travel Corridors	Human Factors	1				current		
Timber Cutting/Units	Human Factors	1				ongoing		
Timber Harvest	Human Factors	1	Yes | No	Outdated		95	ADNR	Polygon
Timber Roads	Human Factors	1	Yes | No			ongoing		Line
Digital Line Graphs (DLG's) Hydrography	Hydrology	1		Yes			USGS	Line
Flow Info of Drainage into Kach. Bay	Hydrology	1				10-20 yrs to present		
Glaciers	Hydrology	1	Yes | Yes			91, 94	ADNR	Polygon
Groundwater	Hydrology	1					USGS	Point
Hydrography	Hydrology	1				current		
Hydrography - 1:63360	Hydrology	1		Some	Yes | No	91-94	ADNR	
Lakes and Names	Hydrology	1	Yes | Yes			91, 94, 95	ADNR	Polygon
Precipitation	Hydrology	1	Yes | Yes	Some	Yes | Yes	97	USGS/WRD	Polygon
Rivers and Lakes	Hydrology	1	Yes | No			50, 85	ADNR	Polygon
Rivers and Names	Hydrology	1	Yes | Yes			91, 94, 95	ADNR	Line
Approx. Kachemak Bay Watershed Boundary	Physical Factors	1	Yes | Yes			97	ADFG	Line
Bathymetric Contours	Physical Factors	1		Some	Yes | No	90	Interrain Pacific	
Bathymetry	Physical Factors	1	Yes | No	Some	Yes | No	90	ADNR	Polygon
Bathymetry - Maj. Contours and Depth Range	Physical Factors	1		Some	Yes | No	90	Interrain Pacific	
Coast (Exxon)	Physical Factors	1	Yes | Yes	Some	Yes | No	89	ADNR	Line
Coast (State - 1998)	Physical Factors	1	Yes | Yes	Some	Yes | Yes	98	ADNR	Line
Coast (State - 1998) - shapefile (poly)	Physical Factors	1	Yes | Yes	Some	Yes | Yes	98	ADNR	Polygon
Coast (State - from EVOS CD)	Physical Factors	1	Yes | Yes	Some	Yes | Yes	89	ADNR	Line
Currents Cook Inlet	Physical Factors	1	Yes | Yes			93	NOAA	Polygon
Currents Cook Inlet - shapefile (line)	Physical Factors	1	Yes | Yes			93	NOAA	Line
Digital Elevation Model (300 m)	Physical Factors	1	Yes | Yes	Yes	Yes | No	97	USGS	Grid
Digital Elevation Model (47 m) - Seldovia	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia A3	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia A4	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia A5	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia A6	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia B1	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia B2	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia B3	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia B4	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia B5	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia B6	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia C1	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia C2	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia C3	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia C4	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia C5	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid

Description	Category	Priority	Data Captured/ Clipped	Pre-existing Metadata	[1] Metadata Captured/ Completed	Date Created or Modified	Custodian	Type
Digital Elevation Model (47 m) - Seldovia D1	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia D2	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia D3	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia D4	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia D5	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Digital Elevation Model (47 m) - Seldovia D8	Physical Factors	1	Yes | Yes	Yes	Yes | No	98	USGS	Grid
Elevation	Physical Factors	1						
Fire Fuels - BEHAVE System	Physical Factors	1						
Fire Fuels - CFDRS System	Physical Factors	1						
Fire Fuels - NFDRS System	Physical Factors	1						
Hypsography	Physical Factors	1	Yes | No	Some	Yes | No		ESRI	
Kachemak Bay Watershed Boundary	Physical Factors	1	Yes | Yes			98	CIK	Line
Shoretype - Environmental Sensitivity Index	Physical Factors	1	Yes | Yes	Some	Yes | Yes	90	ADNR, MMS, NOAA	Line
Hydrography and Anadromous Streams - EVOS	Physical/Biological Factors	1		Some		88, 89, 91	???	
Ecoregions of Alaska	Biological Factors	2	Yes | Yes	Some	Yes | Yes	96	USGS	Polygon
Ecoregions of Alaska - shapefile (line)	Biological Factors	2	Yes | Yes	Some	Yes | Yes	96	USGS	Line
Major Ecosystems of Alaska Map	Biological Factors	2	Yes | Yes	Some	Yes | Yes	91	USGS	Polygon
ADEC Monitoring Stations	Environmental Quality	2		Some			ADNR	
Cook Inlet Shoreline Oiling (Fall 89, Spring 90)	Environmental Quality	2	Yes | Yes	Some	Yes | No	89, 90	ADNR	Line
Cook Inlet Shoreline Oiling (Spring 91)	Environmental Quality	2	Yes | Yes	Some	Yes | No	91	ADNR	Line
Cook Inlet Shoreline Oiling (Summer 89)	Environmental Quality	2	Yes | Yes	Some	Yes | No	89	ADNR	Line
NOAA HAZMAT On-Scene Spill Model	Environmental Quality	2		Some			USFWS	
Preliminary Hydrocarbon Sites - EVOS	Environmental Quality	2		Some			ADNR	
Sediment Hydrocarbon Analysis	Environmental Quality	2	Yes | Yes			89, 95	NOAA	Point
Tissue Hydrocarbon Analysis	Environmental Quality	2	Yes | Yes			89, 95	NOAA	Point
Cities, Towns and Villages	Geographical Factors	2		Some			Rsrc. Data Inc.	
Township / Range	Geographical Factors	2	Yes | Yes	Some	Yes | No	93, 94, 95	ADNR	Polygon
USGS Topographic Quad (1:250000)	Geographical Factors	2	Yes | Yes	Some	Yes | No	93	ADNR	Polygon
USGS Topographic Quad (1:63360)	Geographical Factors	2	Yes | Yes	Some	Yes | No	93	ADNR	Polygon
Mineral Terranes / Mineral Deposit Areas	Geological Factors	2		Yes		95	BLM	
Surficial Geology	Geological Factors	2	Yes | No				CIK	Polygon
Fire Management Option Boundaries	Human Factors	2		Some	Yes | No			
Fire Protection Area Boundaries	Human Factors	2						
Census Results 1994	Human Factors	2	Yes | Yes					Point
Critical Habitat Area	Human Factors	2						
Detailed Land Status (Cook Inlet)	Human Factors	2	Yes | No			93	ADNR	Polygon
Digital Line Graphs (DLG's) Roads	Human Factors	2					USGS	Line
EVOS Foodsites, Subsistence	Human Factors	2		Some		94	ADFG	
Fed Conservation System Units	Human Factors	2	Yes | No	Some	Yes | No	91 freq updates	ADNR	Polygon
Federal Wilderness Designations	Human Factors	2	Yes | No			93, updated 95	ADNR	Polygon
Habitat Acquisition - Large Parcels	Human Factors	2	Yes | No			96	ADNR	Polygon
Habitat Acquisition - Small Parcels	Human Factors	2	Yes | No			96	ADNR	Polygon
Habitat Acquisition - Small Parcels (Pts.)	Human Factors	2	Yes | No			96	ADNR	Point
Infrastructure (other than Kenai Peninsula)	Human Factors	2	Yes | Yes				ADNR	Line

Description	Category	Priority	Data Captured/ Clipped	Pre-existing Metadata	[1] Metadata Captured/ Completed	Date Created or Modified	Custodian	Type
Intertidal Study Sites - EVOS Database	Human Factors	2		Some		91	ADNR	
Land Status	Human Factors	2	Yes | No			94,95	ADNR	Polygon
Legislative Designated Areas	Human Factors	2	Yes | No	Some	Yes | No	93, 95	ADNR	Polygon
National Parks	Human Factors	2						
Port Graham / English Bay AMSA Boundary	Human Factors	2						
Roads (Kenai Peninsula)	Human Factors	2	Yes | Yes			92	ADNR	Line
Seal Harvest Data - EVOS	Human Factors	2		Some		94	ADFG	
Socioeconomic	Human Factors	2	Yes | Yes			90, 94	NOAA	Line
Socioeconomic - shapefile (point)	Human Factors	2	Yes | Yes			90, 94	NOAA	Line
State Game Refuges	Human Factors	2						
State Parks	Human Factors	2						
Wildlife Refuge Boundary	Human Factors	2						
100yr Flood Plan	Physical Factors	2						
Fire History	Physical Factors	2	Yes | No	Some	Yes | No	97	AFS	Polygon
Flood Way	Physical Factors	2						
Flood Zone A	Physical Factors	2						
Flood Zone B	Physical Factors	2						
HUC's for Alaska - shapefile (line)	Physical Factors	2	Yes | Yes	Yes	Yes | No	94	USGS	Line
Hydrologic Unit Codes (HUC) for Alaska	Physical Factors	2	Yes | Yes	Yes	Yes | No	94	USGS	Polygon
Isohalines	Physical Factors	2	Yes | No				CIK	Line
Beach Segments - EVOS	Environmental Quality	3		Some		90	ADNR	
City Limits	Geographical Factors	3						
National Geodetic Survey Monuments	Geographical Factors	3		Some		94	ADNR	
Sections	Geographical Factors	3	Yes | Yes	Some	Yes | No	93, 94, 95	ADNR	Polygon
UTM Zones	Geographical Factors	3	Yes | Yes	Some	Yes | No	95	ADNR	Polygon
Earthquakes	Geological Factors	3	Yes | No					Point
Faults	Geological Factors	3	Yes | No					Line
Solid Waste Landfills	Human Factors	3	Yes | No				ADEC	Point
Advisory Planning Commission	Human Factors	3				current		
Airports	Human Factors	3		Some		92	Rsrc. Data Inc.	
ANCSA Regional Corporation Boundaries	Human Factors	3	Yes | Yes	Some	Yes | No	92	ADNR	Polygon
Archaeology Preliminary Sites (EVOS)	Human Factors	3		Some			ADNR	
Borough / REAA Boundaries	Human Factors	3	Yes | No	Some	Yes | No	92, 94, 95, 96	ADNR	Polygon
Election District Boundaries for 1994	Human Factors	3	Yes | Yes	Some	Yes | No	95	ADNR	Polygon
EVOS Affected Area	Human Factors	3	Yes | Yes			93	ADNR	Polygon
Fishing Districts - EVOS Database	Human Factors	3		Some		91, 92	ADNR	
Game Management Units	Human Factors	3		Some		94	ADFG	
Gravel Pits	Human Factors	3						
Right of Way	Human Factors	3					ADOT	
Coastal Zone Boundaries	Physical Factors	3		Some		95	ACZM	
Coastal Zone District Boundaries	Physical Factors	3		Some		95	ACZM	
Latitude / Longitude Degrees	Physical Factors	3	Yes | Yes	Some	Yes | No	92	ADNR	Line
Permafrost	Physical Factors	3	Yes | Yes	Some	Yes | No	96	USGS	Polygon
Winter Ice	Physical Factors	3	Yes | Yes			83	NOAA	Line

Description	Category	Priority	Data Captured/ Clipped	Pre-existing Metadata	[1] Metadata Captured/ Completed	Date Created or Modified	Custodian	Type
1964 Earthquake Displacement	Geological Factors	4	Yes / Yes	Some	Yes / No	64, 65	ADNR	Polygon
Gas Fields	Human Factors	4	Yes / No				Enstar	Polygon
Military Sites	Human Factors	4	Yes / No				EPA	Point
Oil and Gas Pipelines	Human Factors	4	Yes / No				Enstar	Line
Oil Platforms	Human Factors	4	Yes / No				Enstar	Point
AK Native Languages/Groups	Human Factors	4	Yes / Yes					Polygon
Chugach National Forest	Human Factors	4						
Digital Line Graphs (DLG's) Pipe	Human Factors	4		Yes			USGS	Line
Ferry Ports	Human Factors	4	Yes / Yes			95	ADNR	Point
Gas Pipelines	Human Factors	4						
Historical Transportation Routes	Human Factors	4		Some		95	ADNR	
Marine Highways	Human Factors	4	Yes / Yes			91, 95	ADNR	Line
Oil and Gas Fields	Human Factors	4						
Oil and Gas Leases	Human Factors	4				current		
Oil and Gas Rigs	Human Factors	4						
Oil and Gas Units	Human Factors	4						
Oil and Gas Wells	Human Factors	4						
Oil Pipelines	Human Factors	4						
Summits	Physical Factors	4	Yes / Yes					Point
Aquatic Rsrcs. Information Management Sys.	Biological Factors	?				97	BLM	
Lake Clark Intertidal Transects	Biological Factors	?	Yes / No				NPS	Line
Lake Clark Marsh Vegetation	Biological Factors	?	Yes / No	Some	Yes / No	95	NPS	Polygon
Lake Clark Raptor Nests	Biological Factors	?	Yes / No	Some	Yes / No	97	NPS	Point
Lake Clark Seabird Colonies	Biological Factors	?	Yes / No				NPS	Point
Lake Clark Seal Colonies	Biological Factors	?	Yes / No	Some	Yes / No	97	NPS	Point
Integrated Coastline - EVOS Database	Environmental Quality	?		Some	Yes / No	90	ADNR	
Coordinate System of 1927	Geographical Factors	?		Some		95	ADNR	
Some Cultural Features	Human Factors	?				being collected		
Filled Water Features	Hydrology	?						
Miscellaneous Labels	Kenai Borough Flood Plan	?						
Miscellaneous Lines	Kenai Borough Flood Plan	?						
Digital Chart of the World (DCW)	Multiple Themes	?	Yes / No	Some	Yes / No	92	ESRI	
Geographic Info. System Database Summary	Multiple Themes	?					ADNR	
Graphical Resource Database	Multiple Themes	?	Yes / n/a	Some		95	Alyeska Pipeline Co.	Varies
Southcentral Regional Database	Multiple Themes	?		Some		82	ADNR	
Physiographic Divisions	Physical Factors	?	Yes / No	Some	Yes / No	96	USGS	Polygon
Surface Sand + Local	Physical Factors	?				being collected		

[1] There are 78 data layers with completed metadata records available for downloading from the KBEC web site - http://www.state.ak.us/adfg/kbec/

[2] The wetlands inventory includes: Kenai River Contiguous Wetlands, Wetlands Palustrine, Wetlands Estuarine, Wetlands Lacustrine, Wetlands Riverine, USFWS data

[3] Flood Zones cover populated areas: Anchor River, Homer Spit area, Seldovia area

[4] Not tied with Zones A and B yet. Floating images to be tied to physical points later this year.

[5] All data from Cook Inlet Keeper GIS Atlas is clipped to Cook Inlet watershed boundary.

Description	Category	Priority	Data Captured/ Clipped	Pre-existing Metadata	[1] Metadata Captured/ Completed	Date Created or Modified	Custodian	Type

[6] Clipped and projected DRG's obtained from National Park Service.

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$36.6						
Travel		$4.4						
Contractual		$4.6						
Commodities		$1.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$46.6			Estimated FY 2001	Estimated FY 2002		
General Administration		$5.8						
Project Total	$0.0	$52.4			$0.0	$0.0		
Full-time Equivalents (FTE)		0.8						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: ADFG originally underestimated the cost in FY99 of the developing the GIS component of this project, including data collection, cleaning, and development of Federal Geographic Data Committee-compliant metadata standard (i.e., the national metadata standard). Supplemental funds are needed for data collection, cleaning, and the establishment of FGDC compliant metadata. These funds are necessary to produce a more complete and useful product for managers, researchers, and other data users. A total of $52.4 are requested in FY00 to:

(1) to complete the GIS component at the level originally proposed ($12.6, three months of our GIS specialist), presenting the project at a professional conference ($1.4), and purchasing 200 sets of the CDs of the Ecological Characterization for distribution to EVOS Principle Investigators ($1.4), and associated administrative costs (an additional $2.0) -- subtotal of $17.4; and
(2) assist in the development of the final CD and Internet products -- subtotal of $35.0 (the previously estimated amount for year 2 funds).

This project includes substantial cost sharing, with other partners contributing more than 75% of the project. EVOS Trustee Council is critical to the successful completion of the project and the development of a more comprehensive, useable product. Trustee Council involvement will also ensure the the project is integrated with the overall EVOS restoration effort.

FY00

Prepared:

Project Number: 00278
Project Title: Development of an Ecological Characterization and Site Profile for Kachemak Bay/Lower Cook Inlet
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2000 EXXON VALDEZ TRUS... COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
Bridget Callahan	Habitat Biologist II	16A	2.0	4.2		8.4
Lisa Thomas	Habitat Biologist I	14A	2.0	3.6		7.2
Curtis Smith	Research Analyst II	16A	2.0	4.2		8.4
						0.0
Curtis Smith (capture/cleanup)	Research Analyst II	16A	3.0	4.2		12.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		9.0	16.2	0.0	
					Personnel Total	$36.6

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
Annual Restoration Workshop (two people)	0.2	2	4	0.1	0.8
Technical Review S Sessions (two people/two days)			2	0.1	0.2
Four Round Trips Between Homer and Anchorage	0.2	4	12	0.1	2.0
Coastal Society Meeting	0.9	1	5	0.1	1.4
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$4.4

FY00

Prepared:

Project Number: 00278
Project Title: Development of an Ecological Characterization and Site Profile for Kachemak Bay/Lower Cook Inlet
Agency: ADFG

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed
Description	FY 2000
Telephones	2.0
Photocopying (publications, reports, etc.)	1.2
200 sets of CDs to provide to Trustee Council Staff for Distribution to Principle Investigators	1.4
When a non-trustee organization is used, the form 4A is required. Contractual Total	$4.6

Commodities Costs:	Proposed
Description	FY 2000
Office Supplies, photos, maps	1.0
Commodities Total	$1.0

FY00

Prepared:

Project Number: 00278
Project Title: Development of an Ecological Characterization and Site Profile for Kachemak Bay/Lower Cook Inlet
Agency: ADFG

FORM 3B
Contractual &
Commodities
DETAIL

2000 EXXON VALDEZ TRU.... COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

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

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY00

Project Number: 00278
Project Title: Development of an Ecological Characterization and Site Profile for Kachemak Bay/Lower Cook Inlet
Agency: ADFG

FORM 3B
Equipment
DETAIL

Prepared:

SEABIRD–OCEANOGRAPHIC RELATIONSHIPS IN THE NORTHERN GULF OF ALASKA: INTEGRATION WITH NSF/NOAA STUDY "GLOBEC"
Submitted Under the BAA

Project Number:	00287
Restoration Category:	Research
Proposer:	ABR, Inc.
Lead Trustee Agency:	
Cooperating Agencies:	
Alaska SeaLife Center:	no
Duration:	1st year, 1-year project
Cost FY00:	$154,100 (including publication of results)
Cost FY01:	$0
Cost FY02:	$0
Geographic Area:	Northern Gulf of Alaska (Pye Islands to Hinchinbrook Entrance)
Injured Resource/Service:	Several species of seabirds; secondarily, marine mammals

ABSTRACT

I propose to conduct a study of seabirds in the Northern Gulf of Alaska (Aialik Bay to Montague Island) by using a ship-of-opportunity sampling platform that is being used by the NSF/NOAA project "GLOBEC" (Global Ocean Ecosystem Dynamics), which also will provide access to an extensive series of oceanographic data. This proposed study is designed to identify ecological processes affecting temporal (seasonal and interannual) and geographic variability in the distribution and abundance of seabirds, including several species that were injured by the *Exxon Valdez* oil spill. It also will be useful to the restoration program by providing data on the year-round status of seabird populations and the processes that influence variability in their numbers.

INTRODUCTION

This study will use an available ship-of-opportunity platform to investigate temporal (seasonal and interannual) and geographic (cross-shelf) patterns of distribution and abundance of seabirds in the Northern Gulf of Alaska (GOA). The Trustee Council will benefit from this study in three ways. First, this study will provide quantitative information on bird communities in the first part of the GOA where the oil went after it left Prince William Sound. Second, I have been offered free space on a ship that is being used for the NSF/NOAA program "GLOBEC" (Global Ocean Ecosystem Dynamics), which is a project that during years 1998-2000 will study temporal and geographic variations in thermohaline, chemical, and biological structure of the Northern GOA shelf (Appendix 1). The overall thrust of the GLOBEC study is to determine ecosystem-level causes (particularly climatic variability) of successful versus unsuccessful recruitment in juvenile salmon. Second, I will provide to this study an extensive data-set that I will have collected for this study over the period 1997–1999. This additional data-set will provide information on interannual variability in the distribution and abundance of seabirds and marine mammals.

The goal of this study will be to identify ecological processes affecting temporal and geographic variability in the distribution and abundance of seabirds by capitalizing on data generated by the GLOBEC study. The proposed research described here is designed to provide new information on the causes of temporal and geographic variability in the distribution and abundance of these seabird species. I believe that this information will be important for effective conservation and management of these species.

The primary reasons for this study are: (1) it will collect ecological data on a diverse suite of seabird resources, including several that the *Exxon Valdez* Oil Spill Trustee Council concluded were injured by the spill (*Exxon Valdez* Oil Spill Trustee Council 1999); (2) these data can be used, not just to examine temporal and geographic variations in distribution, abundance, and species composition of these seabird species, but to examine the effects of ecological processes on those variations; (3) it will describe the natural variability of the ecosystem, particularly with respect to seabirds; and (4) it will be useful in establishing criteria for ecosystem-level monitoring. I also will be able to collect supplementary data on the distribution and abundance of marine mammals, some of which (e.g., Killer Whale) were identified as having been injured by the spill (*Exxon Valdez* Oil Spill Trustee Council 1999). Finally, this is the first opportunity for systematic seasonal and interannual sampling of the cross-shelf distribution of seabirds in the Northern GOA.

NEED FOR THE PROJECT

A. Statement of Problem

This study will examine the distribution and abundance of seabirds and marine mammals in the Northern GOA and will attempt to relate variability in that distribution and abundance to variability in ecosystem-level properties. This variability will be examined temporally (both seasonal and interannual variability) and geographically (i.e., cross-shelf variability). This project also will describe systematically for the first time the seasonal and interannual patterns of occurrence of seabird and marine mammal species on the northern GOA shelf, which was the first place where oil leaving Prince William Sound went. From data collected so far, several species of seabirds and marine mammals that were recorded as being impacted by the *Exxon Valdez* oil spill occur in this region during the winter (e.g., common murre, pigeon guillemot, Kittlitz's murrelet, killer whale), with common murres apparently constituting an important component of this wintering community and a significant percentage of the entire Northern-GOA population of Kittlitz's murrelets wintering out here (Day, unpubl. data). The strength of this proposed study is that it will be used to develop an understanding of those processes that cause variability in the at-sea distribution and abundance of seabirds and that it will lead to a long-term data set that will be examined for the study of variability, yet will cost little because of my ability to use a ship-of-opportunity for sampling and an extensive oceanographic data set for interpreting my data-set in an ecological context.

In addition to the practical applications of learning about the at-sea ecology of seabirds in the area where most of the mortality occurred, understanding the causes for temporal and geographic variability in seabird distribution at sea is one of the greatest challenges facing marine bird researchers. Understanding such variability also is important in determining why and how seabirds may or may not recover from injury such as that following an oil spill: after all, the sea is where they secure food, not only for themselves but also for any young that they produce.

The strength of this proposed study is that it will be used to develop an understanding of those processes that cause variability in the at-sea distribution and abundance of seabirds and that it will lead to a long-term data set that will be examined for the study of variability, yet will cost little because of my ability to use a ship-of-opportunity for sampling and an extensive oceanographic data set for interpreting my data-set in an ecological context. Most importantly, this study will collect data on a large suite of seabird species (and, to a lesser extent, marine mammals), including several species that were impacted by the oil spill.

B. Rationale/Link to Restoration

There are at least 12 reasons why this study is important. First, most of the avian mortality (particularly of murres, but also of many other species) after the *Exxon Valdez* oil spill is believed to have occurred in the Northern GOA, rather than in Prince William Sound (Piatt et al. 1990, Ford et al. 1996, Piatt and Ford 1996). Second, breeding seabird colonies are both larger and more numerous in the Northern GOA than in Prince William Sound (USFWS Seabird Colony Catalog, electronic version), as generally are seabird at-sea densities (Day, unpubl. data). In spite of these facts, however, the amount of effort dedicated to post-spill research in the GOA was a fraction of that dedicated in Prince William Sound. Third, knowing where seabirds occur at different times of the year will enable one to predict those species that probably will be affected by an oil spill. For example, if a spill occurs at the shelf-break off of Hinchinbrook Entrance, one would predict that species concentrated downstream, along the shelf-break within the study area, will be affected more than inshore species will be. Fourth, this study will collect ecological data on a diverse suite of seabird resources that the *Exxon Valdez* Oil Spill Trustee Council concluded were injured by the spill (*Exxon Valdez* Oil Spill Trustee Council 1999), including common loon, cormorants (any or all of three species), common murre, pigeon guillemot, marbled murrelet, and Kittlitz's murrelet, as well as even recording the endangered Short-tailed Albatross. In fact, common murres appear to be a dominant species over the inner and central continental shelf in this region, and Kittlitz's murrelets appear to winter in this sector of the GOA shelf in substantial numbers, with perhaps the entire Prince William Sound population occurring here at that time (Day, unpubl. data). Fifth, this study will provide the first systematic, year-round, and interannual surveys of seabird and marine mammal populations on the shelf of the northern GOA. Sixth, the three years of data collected for this study (including data collected in 1998 and 1999) possibly will lead to another five consecutive years of data collection (funded by NSF and NOAA), thus potentially providing one of the temporally longest sets of at-sea data on seabirds ever collected in one part of Alaska. Seventh, this study also will be able to collect supplementary data on the distribution and abundance of marine mammals, some of which (e.g., killer whale) were found to have been injured by the spill (*Exxon Valdez* Oil Spill Trustee Council 1999). Eighth, this study would enable one to collect data as a long time-series that would enhance one's understanding of the patterns of variability in at-sea communities of seabirds. Understanding these patterns of natural variability in at-sea populations of seabirds will enable realistically measurable recovery criteria to be developed. Determining the natural variability of the system, particularly with respect to seabird abundance, will enable one to measure better what constitutes "recovery" of a species (i.e., take into account the natural "noise" in the system) and to determine what are meaningful recovery and monitoring criteria. Ninth, this study will capitalize on the findings of other GLOBEC researchers to identify causes and sources of this variability in the at-sea distribution and abundance of seabirds. Tenth, because the overall goals of the GLOBEC program are (a) to understand the effects of climate variability and climate change on the distribution, abundance, and production of marine organisms and (b) to incorporate this knowledge into diagnostic and prognostic models (Appendix 1), identifying these relationships may help in the future prediction of seabird distribution, abundance, and productivity in the face of global change, thus enhancing one' ability to manage these resources. Eleventh, this study will examine the seasonal and interannual importance to seabirds of oceanographic frontal structures, which tend to concentrate not only marine organisms and their seabird predators, but also floating pollutants such as oil and marine debris (Bourne and Clark 1984). Twelfth, because the first year of the study (1997–1998) was conducted during the large El Niño event that affected most of the North Pacific, subsequent years also will provide a nice contrast to help one understand the effects of such events on at-sea bird communities.

C. Location

This study will be conducted in the open waters of the continental shelf of the northern GOA, from the Pye Islands to Hinchinbrook Entrance. Because Seward is the home port for the cruises, it will be the primary community that will realize financial benefits from this study. To my knowledge, no communities will be affected by this project other than financially.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Community involvement will encompass the use of Seward as a home port for the research cruises. This is the home port of the R/V *Alpha Helix*, which is the University of Alaska's oceanographic research vessel. When requested, I will provide articles and photographs for the Trustee Council Newsletter and will be available to make public presentations of this study at appropriate forums. (I already have assisted Jody Seitz of Cordova with interviews about Kittlitz's Murrelets for public radio stations throughout the spill-affected area.) These articles and presentations will disseminate information on the objectives and major findings of this study to the general public.

My understanding is that seabirds on the open continental shelf of the Northern GOA play no role in subsistence use by local Natives in Prince William Sound (M. Vlasoff, pers. comm.). I would, however, draw on any local information that is available on these species on the open shelf and, especially, to be able to collect samples from any seabirds that are killed there for subsistence use.

Although no communities would be directly involved in this study, local communities such as Seward would benefit because they are involved in tourist-based industries. These industries are involved in wildlife viewing, with seabird viewing in particular playing a major part in that industry.

PROJECT DESIGN

A. Objectives

The overall goal of this study is to understand better the causes of temporal (seasonal and interannual) and geographic (cross-shelf) variability in the distribution and abundance of seabirds (and, secondarily, marine mammals) in the Northern GOA shelf. Specifically, it aims to relate quantitatively this variability in seabird abundance and distribution to oceanographic parameters, including the thermohaline, chemical, and biological structures of the Northern GOA shelf. The specific objectives of the proposed research program are:

1. To measure and describe temporal (seasonal and interannual) and geographic (cross-shelf) variation in seabird distribution and abundance on the Northern GOA shelf.

2. To relate these patterns of temporal and geographic variation to patterns of contemporaneously collected physical and biological characteristics.

3. To examine the ecological importance to birds of fronts at the outer edge of the Alaska Coastal Current and at the shelf-break.

4. To relate the observed natural variability in seabird populations to an assessment of recovery.

B. Methods

This study proposes using a ship-of-opportunity to collect at-sea transect data that will be used to examine the distribution and abundance of seabirds on the shelf of the Northern GOA during 6 cruises/year. (See letter of support offer from GLOBEC researchers in Appendix 2.) These data will be collected as standard at-sea transect samples as developed by the USFWS and others.

The GLOBEC cruises will be conducted during six periods of biological interest in the region:

- March (upward migration of oceanic zooplankton to surface layers);
- April (spring phytoplankton bloom);
- May (maximal biomass of oceanic copepods in surface layers);
- July/August (juvenile salmon first enter the sea);
- October (juvenile salmon prepare to leave the shelf and enter the Alaska Gyre); and

- December (minimal biological activity).

Each cruise has budgeted enough time to sample the Seward Line of standardized oceanographic stations, which have been sampled irregularly since the mid-1970s (i.e., around the time of the marine regime shift); on that line, Station GAK1 has been sampled nearly continuously for 29 years. Additional station lines (primarily to the east) also are sampled, when possible. These latter station lines are laid out between the Seward Line (which lies off the mouth of Resurrection Bay) and Hinchinbrook Entrance and include (so far) lines south from Cape Fairfield, Cape Suckling, and Cape Cleare, two lines off of the southern entrance of Montague Strait, and two lines south from central and eastern Montague Island. This oceanographic sampling is envisioned to be adjusted to some extent for conditions that are met on each particular cruise; however, the Seward Line always will be sampled on each cruise.

Through the GLOBEC program, I will have access to the following oceanographic data:

- CTD (conductivity, temperature, and depth) data collected at a series of fixed stations that are 10 km apart on the inner half of the shelf and 15 km apart on the outer half;
- ADCP (Acoustic Doppler Current Profiler) data on water-column velocity profiles of currents (continuously collected);
- Through-hull surface property values of sea-surface temperature, salinity, and fluorescence (continuously collected);
- Nutrients and primary productivity (collected at a series of fixed stations);
- Zooplankton and micronekton species composition and biomass collected with CalVET, MOCNESS, and bongo nets (collected at a series of fixed stations);
- Hydroacoustically measured biomass of zooplankton and micronekton (continuously collected); and
- Biomass, species composition, and energy content of fishes (primarily salmon, but also forage fishes) collected with MOCNESS and mid-water trawls (collected at a series of fixed stations; the mid-water trawling will be conducted during the July/August and October cruises only).

During each cruise, I will sample at-sea densities of seabirds with standardized seabird transects (Tasker et al. 1984, Gould et al. 1989, van Franeker 1994). The preferred method is the "snapshot method," which has less bias in density estimates of flying birds, particularly tubenosed birds (albatrosses, fulmars, shearwaters, petrels, and storm–petrels), than do other methods (van Franeker 1994). (Tubenosed birds are common in the sampling area at certain times of the year [Day, unpubl. data].) Transects will be 300 m wide as the ship moves ahead in a fixed and known direction at a fixed and known speed. Then, for analyses, I will calculate the density of birds for each transect by dividing the total count by the total area sampled (trackline length × 0.3 km total width). Initial ("raw") transect units in the field will be 5 min long, with data recorded by minute, as the ship travels between each pair of fixed oceanographic stations or runs between station lines. This is the approximate scale at which the finest-scale data (hydroacoustic biomass of zooplankton) of interest will be collected by the GLOBEC study. Then, for later analyses, these "raw" transect samples can be collapsed into larger "analytical" transect units, depending on the scales at which the other oceanographic data are summarized; because they will have been collected by the minute, the data can be analyzed by minute, if necessary. Such a flexible data collection/analytical program will enable one to examine the distributional data at the scales at which I find oceanographic features of interest (also see Haney and Solow 1992).

I will evaluate three primary hypotheses about seabirds, with additional hypotheses generated by the results of the field work:

H_0 1: There is no temporal (seasonal and interannual) variation in seabird distribution and abundance; if there is, it is independent of seasonal and annual variation in physical and biological oceanographic features.

This is the primary line of investigation of the GLOBEC study and will be an emphasis of this study. I will use the transect data in a series of analyses that will test whether there is seasonal and/or interannual variation in seabird distribution and abundance. As described above, I will test the temporal data at the scales that are most appropriate (i.e., pooling the raw data into larger analytical data sets as needed). At this time, I envision analyzing for temporal differences with a three-way MANOVA on ranked (if necessary) data, with habitat (i.e., water mass), season, and year as the treatments and the species or functional groups as the dependent variables. If pseudoreplication appears to be a problem with the data sets (see Hurlbert 1984), I might explore testing for differences with paired-sample tests (e.g., MANOVAs that use differences in densities between sampling periods as the sampling unit). These tests that use changes in numbers of birds may be used in a "before-after" type of analysis to examine changes in abundance among seasons and years (Stewart-Oaten et al. 1986, Murphy et al. 1997). The use of changes in densities (rather than testing with actual densities) between periods (with 1998 being labeled the "before" period and subsequent years being the "after" periods) results in independent data sets that minimize problems caused by pseudoreplication (Stewart-Oaten et al. 1986, Wiens and Parker 1995).

To examine whether there are relationships between seabird distribution and abundance and physical/biological oceanographic features, I will work with the GLOBEC researchers to use their data products for determining which scales to use in the analyses. First, I will plot seasonal (and interannual) variations in various oceanographic measurements and seabird distribution and abundance and interpret trends visually. Second, I will use a multivariate technique (e.g., MANOVA, MANCOVA, PCA) to test for relationships between multiple oceanographic measurements (e.g., water-column structure [strength of stratification, presence of fronts and other structures]; mixed-layer depth; biomass of zooplankton, micronekton, and fishes) and abundance measurements of multiple seabird species. I envision conducting these analyses on two seabird data sets: individual species and functional groups (guilds). In terms of the latter, I will assign each species to functional groups involving primary feeding method (e.g., surface feeding, pursuit diving) and primary prey type (e.g., zooplankton, fishes, squids) before conducting the analyses.

H_0 2: There is no geographic (cross-shelf) variation in seabird abundance; if there is, it is independent of geographic variation in physical and biological oceanographic features.

This is the secondary line of investigation of the GLOBEC study. I will use the transect data in a series of analyses that will test whether there is geographic variability in seabird distribution and abundance. As described above, I will test the geographic data at the scales that are most appropriate. I will use the oceanographic data to stratify the cross-shelf zone into a series of oceanographic habitats that can be used to test for differences in seabird distribution and abundance. Such habitat stratification has been used successfully in many other seabird–oceanography studies (e.g., Wahl et al. 1989, Haney 1991, Day 1992). At this time, I predict that there will be at least three habitat strata: the Alaska Coastal Current (extending from shore to ≤25 km offshore), the mid-shelf region (whose ecology is poorly understood at this time), and the oceanic region (from around the shelf break to over the continental slope and including at least part of the Alaska Current). Although published literature indicates that densities of zooplankton and larval fishes in Shelikov Strait often are higher in the Alaska Coastal Current than in surrounding areas (Incze and Ainaire 1994, cited in Napp et al. 1996; Napp et al. 1996), my impression from six winter cruises so far is that densities of zooplankton, fishes, and seabirds are highest in the inner half of the mid-shelf water and much lower in the Alaska Coastal Current. Densities also appear to be fairly high around the shelf-break front during most cruises.

Again, I will use the GLOBEC data products for determining which scales to use in the analyses. I will plot cross-shelf variations in various oceanographic measurements and seabird abundance and interpret differences visually. I also will test for differences in habitat use with a multi-factor MANOVA on ranked (if necessary) seabird data. As described in the temporal tests (above), habitat would be one of the factors included in the MANOVA. I also will use the guild data in a similar multi-factor MANOVA.

H_0 3: There is no association between seabird abundance and the location and strength of oceanographic fronts and other physical structures; if there is, it is independent of geographic variation in physical and biological oceanographic features.

Seabirds exhibit variability in at-sea distribution and foraging with respect to oceanographic features: fronts of various types (e.g., Schneider 1982, Haney 1985b; Haney and McGillivary 1985a, b; Harrison et al. 1990, Schneider et al. 1990, Day 1992, Hunt et al. 1996, Mehlum et al. 1998; but also see Loggerwell and Hargreaves 1996, and Mehlum et al. 1996), frontal eddies (Haney 1986a, b), internal waves (Haney 1987), upwelling (either within cyclonic eddies or bathymetrically driven; Haney 1985a), pycnocline topography (Haney 1991), and water masses (e.g., Wahl et al. 1989, Haney 1991, Day 1992, Ribic et al. 1992). Fronts tend to be areas of enhanced productivity and concentration of both zooplankton and larval fishes and squids (e.g., Owen 1981, Munk et al. 1995, Sabatés and Olivar 1996), and seabirds appear to be "physical oceanographers" that are highly efficient at locating such structures. Hence, I will examine the association between seabirds and other physical structures, when possible, in addition to examining the association between seabirds and frontal structures.

I specifically will investigate the importance of these fronts to seabirds on a seasonal and interannual basis. I will use the GLOBEC data products for determining which scales to use in the analyses and will plot cross-shelf variations in various oceanographic measurements and seabird distribution and abundance and interpret differences visually. I also will test for relationships between seabird abundance and the distance from the center of each front with correlation analyses (e.g., Spearman rank correlation; see Day 1992: 36–45).

In addition to the hypothesis testing, I will use the seabird data to conduct power analyses. These analyses will examine the questions: "Given the variance in the data and the sampling scheme that is set up, how small a change in seabird abundance can one detect?" and "Given the variance in the data, how many samples would one need to detect an X% change in abundance?" These calculations will be made at the end of the study, with all three years of data combined. Hence, they will provide insights into criteria that will be useful in ecosystem monitoring.

Although it will not be a primary focus of this study, I also will be able to collect supplementary data on the distribution and abundance of marine mammals concurrently with the seabird data. Because the emphasis will be on seabird data, however, I probably will be unable to collect marine mammal data on standardized surveys. Instead, I will record any marine mammals seen out to the horizon. Such opportunistic data provide relative numbers that are adequate for interannual comparisons, however (Baretta and Hunt 1994).

As an example of the kinds of data that will be available for this study, Figure 1 shows the vertical structure of the water column along the Seward Line during the first GLOBEC cruise in October 1997. There are three primary features along this line: (1) the Alaska Coastal Current from Stations 1 to 3, with a strong salinity and density front at its outer edge; (2) the inner edge of the large Alaska Stream from Stations 9 (the shelf break) to 13; and (3) the poorly understood and sluggish Mid-shelf Water between these two large current systems.

Figure 2 shows an example of data that I was able to collect on the same GLOBEC cruise. The plot is of uncorrected seabird abundance along the Seward Line, which is the primary sampling location for this study. Data points represent individual 5-min transects and are uncorrected for sampling area; because they have not been proofed or corrected and because a few data are off-transect records, these results should be considered to be preliminary at this time. From the individual plots, one can see (1) the concentration of all birds of all species combined at the microscale surface convergence between Stations 3 and 4 and in what is probably the shelf-break front at the inner edge of the Alaska Stream (top); (2) the concentration of fork-tailed storm-petrels in what is probably the shelf-break front at the inner edge of the Alaska Stream (middle); and (3) the concentration of Dall's porpoises in the outer edge of the Alaska Coastal Current and in the front separating that current from the mid-shelf water (bottom). Hence, these preliminary results suggest that there is extensive geographic variability in total seabird abundance and in the abundance of at least some individual species.

Figure 3 shows another example of data along the Seward Line that I was able to collect on the same GLOBEC cruise. In these plots, one can see: (1) the concentration of northern fulmars in the Alaska Coastal Current, in the convergence between Stations 3 and 4, and near what may be a small front near Station 12 (top); (2) the concentration of common murres in the Mid-shelf Water, with peak numbers occurring at the convergence between Stations 3 and 4 (middle); and (3) the non-overlapping distribution of the tufted puffin, which was restricted to the outer shelf and (primarily) the Alaska Stream (bottom).

Figure 4 shows an example of fish data along the Seward Line that were collected during the October 1998 cruise (L. J. Haldorson, University of Alaska, Juneau, AK; unpubl data). In these plots, the CPUE for all fish species combined is shown on the top, and catch per unit effort (CPUE) for selected species groups is shown on the bottom. In both plots, CPUEs are highest in the inner half of the mid-shelf water. This region qualitatively appears to consist of some sort of physical structure, such as an eddy, that seems to be fairly stationary in both time and space. Hence, although this cruise occurred at a time that is different from the above data, similar across-shelf patterns are present.

Although not shown here, data from the March and April 1998 cruises showed dramatic differences from the October 1997 cruise (Day, unpubl. data). For example, species diversity along the Seward Line was high (21 species) in October 1997 but low (only ~8 species) in March 1998 and increasing in April 1998 (~15 species) and May 1998 (~21 species), then decreasing again the following winter (~15 species in December 1998); species richness on the Seward Line in March 1999 was only ~7 species, a number nearly identical to that for March 1998 and suggestive of a pronounced seasonal/annual pattern in species richness. In addition, species evenness clearly had changed from October 1997 to spring 1998, in that the distribution of common murres was restricted to the inner half of the shelf in October, whereas they had become dominant across the shelf and probably represented ~75% of all birds seen in March and ~50% of all seen across the entire Seward Line in April. In addition, they occupied essentially the entire shelf in March and April, whereas tufted puffins were absent at that time, having moved farther offshore, into the deep North Pacific. Clearly, there are oceanographic and ecological reasons for such seasonal and geographic changes in both species diversity and the abundance and distribution of individual species.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

I will have free use (ship-of-opportunity) of a research vessel that is being used by the Institute of Marine Sciences (IMS), University of Alaska, Fairbanks, for the GLOBEC studies. All field and office work will be conducted by ABR, Inc. The Trustees Council will need to pay an outside agency for a Program Manager and for general administration. (These management costs will be funded directly from the Trustee Council to the agency, which is how my other Trustee-funded contracts were set up. Hence, that management money is not listed on the enclosed budget.)

SCHEDULE

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

Mar 2000:	First cruise (emphasis: upward migration of oceanic zooplankton)
Apr 2000:	Second cruise (emphasis: spring phytoplankton bloom)
May 2000:	Third cruise (emphasis: maximal biomass of oceanic copepods)
July/August 2000:	Fourth cruise (emphasis: juvenile salmon first at sea)
Oct 2000:	Fifth cruise (emphasis: juvenile salmon prepare to leave the shelf)
Dec 2000:	Sixth cruise (emphasis: minimal biological activity)
Mar-Dec 2000:	Keypunch data and QA/QC (after each cruise)
Dec 2000–Jan 2001:	Data analysis
Jan-Apr 2001:	Preparation of Final Report
January–February 2001:	Presentation of paper at scientific meeting
15 April 2001:	Submit Final Report

B. Project Milestones and Endpoints

1. "To measure and describe temporal (seasonal and interannual) and geographic (cross-shelf) variation in seabird distribution and abundance on the Northern GOA shelf." Densities will be estimated and will be tested for seasonal and geographic differences during each year of

the study (FY00). Interannual differences will be tested during the one year of the study with data collected that year (FY00) and the two earlier years.

2. "To relate these patterns of temporal and geographic variation to patterns of contemporaneously collected physical and biological characteristics." Relationships will be tested, both among seasons within years and during the same season among years, during the one year of the study, with data collected that year (FY00) and the two earlier years.

3. "To examine the ecological importance to birds of fronts at the outer edge of the Alaska Coastal Current and at the shelf-break." Relationships between the location of fronts and the abundance of seabirds will be tested, both among seasons within years and during the same season among years, during the one year of the study with data collected that year (FY00) and the two earlier years.

4. "To relate the observed natural variability in seabird populations to previous assessments of impact and recovery." At the end of the study, analysis of variability and power calculations will be done for each year separately and for all years of the study combined (i.e., FY00).

C. Completion Date

Sampling for the project will be completed in FY00. Data analysis and preparation of the Final Report and publications will be completed in FY00.

PUBLICATIONS AND REPORTS

I will submit a Final Report to the Chief Scientist no later than 15 April 2001. This Final Report will synthesize results from the study. I also will prepare one or more manuscripts reflecting the results of this study. I envision that these manuscripts generally will be written with one or more of the GLOBEC researchers as co-authors.

PROFESSIONAL CONFERENCES

To save money, I do not plan to attend a scientific conference in FY00.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

I hope to be able to integrate the results of this study with those of the SEA study and the APEX study. My understanding is that SEA will be ended and that APEX will be in the final year of its funding by the time this project begins, so the chances for extensive interaction and integration may be small. Further, those projects are concentrated on the summer months, whereas most of the data collected for this study are collected during the winter, making many comparisons difficult. In addition, the SEA study was entirely concentrated within Prince William Sound, as was most of the APEX study, whereas this study will be conducted in the Northern GOA. Nevertheless, I will have a great opportunity to build on some of their findings.

The NSF/NOAA oceanographic study GLOBEC is co-funding this proposed study. It will provide an oceanographic platform (at the cost of $12,500/day) and an extensive set of oceanographic data that will cost ~$1,500,000 and take 3 years to collect.

This project will describe the natural variability of the system, particularly with respect to seabirds, enabling one to know better what natural variability in patterns of abundance are. Knowing this variability will enable researchers to predict better what sorts of differences might be detected in the wake of a large ecological perturbation, such as the *Exxon Valdez* oil spill or a large El Niño. Further, knowing this variability and its causes may affect interpretations of what constitutes "recovery" of a species (i.e., if determining recovery is an objective, one need to know what is the natural "noise" in the system is, since impact analysis involves comparing "signal-to-noise" ratios).

Although the *Exxon Valdez* Oil Spill Trustee Council expressed interest in this study in FY98, funding was not allocated for the first and second years of this project. Because of the importance of collecting as many data as possible so that the time-series is as extensive as possible, ABR has funded four cruises of data collection so far (October 1997 and March, April, and May 1998), and the Principal Investigator (RHD) has funded the December 1998 and March 1999 cruises and will fund at least the April, May, October, and December 1999 cruises. Hence, ABR and RHD will have invested a great deal of money and time in co-funding this study. Thus, in addition to the strong co-funding component in the form of ship-of-opportunity sampling coming from NSF and NOAA, there will be a strong co-funding component coming from both ABR and the Principal Investigator. Consequently, I will have the strongest and most complete data set available for testing these hypotheses.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

This is a proposed 1-year project. Hence, there are no proposed changes in this year. Please note that the budget includes additional time and money for analyses of the extensive data set that already will have been collected in 1997–1999 (~11 cruises worth of data). Additional time also has been budgeted for necessary coordination and synthesis of oceanographic information that will help to determine the direction of some of the analyses. This coordination will occur with other investigators on the GLOBEC study.

PRINCIPAL INVESTIGATOR

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PRINCIPAL INVESTIGATOR AND KEY PERSONNEL

Dr. Robert H. Day will be the Principal Investigator for the project. Bob has conducted research on seabirds, marine ecology, impacts of marine pollution, and marine conservation topics in Alaska and the North Pacific since 1975. His research topics have included the biology of poorly known seabirds in Alaska; the ecology of seabirds at sea in relation to oceanography (the topic of his Ph.D. dissertation); the ingestion of plastic pollutants by seabirds in Alaska; the mortality of seabirds in the high-seas drift-gillnet fishery of the North Pacific; and the distribution, abundance, and decomposition of plastic pollution and other marine debris in the North Pacific. Recently, he conducted several years of research on impacts of the *Exxon Valdez* oil spill on habitat use by marine-oriented birds and on bird communities (sponsored by Exxon Company, USA) and on the ecology of Kittlitz's Murrelet (sponsored by the *Exxon Valdez* Oil Spill Trustee Council). Dr. Day also has provided expert consultation to the USFWS as a member of the Spectacled Eider Endangered Species recovery Team, as an author of the Draft Steller's Eider Recovery Plan, and as a reviewer of the Short-tailed Albatross listing proposal.

Dr. Day is employed by ABR, Inc., Environmental Research and Services (formerly Alaska Biological Research, Inc.). ABR is an Alaskan-owned small business—headquartered in Fairbanks since its formation in 1976—that specializes in environmental research and services. During more than two decades of operation in Alaska, ABR has served a variety of clients, including private industry, state and federal government agencies, and the University of Alaska. During this time, ABR has developed a reputation for conducting objective research that provides the basis for sound management decisions. ABR remains committed to the goals of providing timely, accurate, and cost-effective information to those who manage or develop our natural resources.

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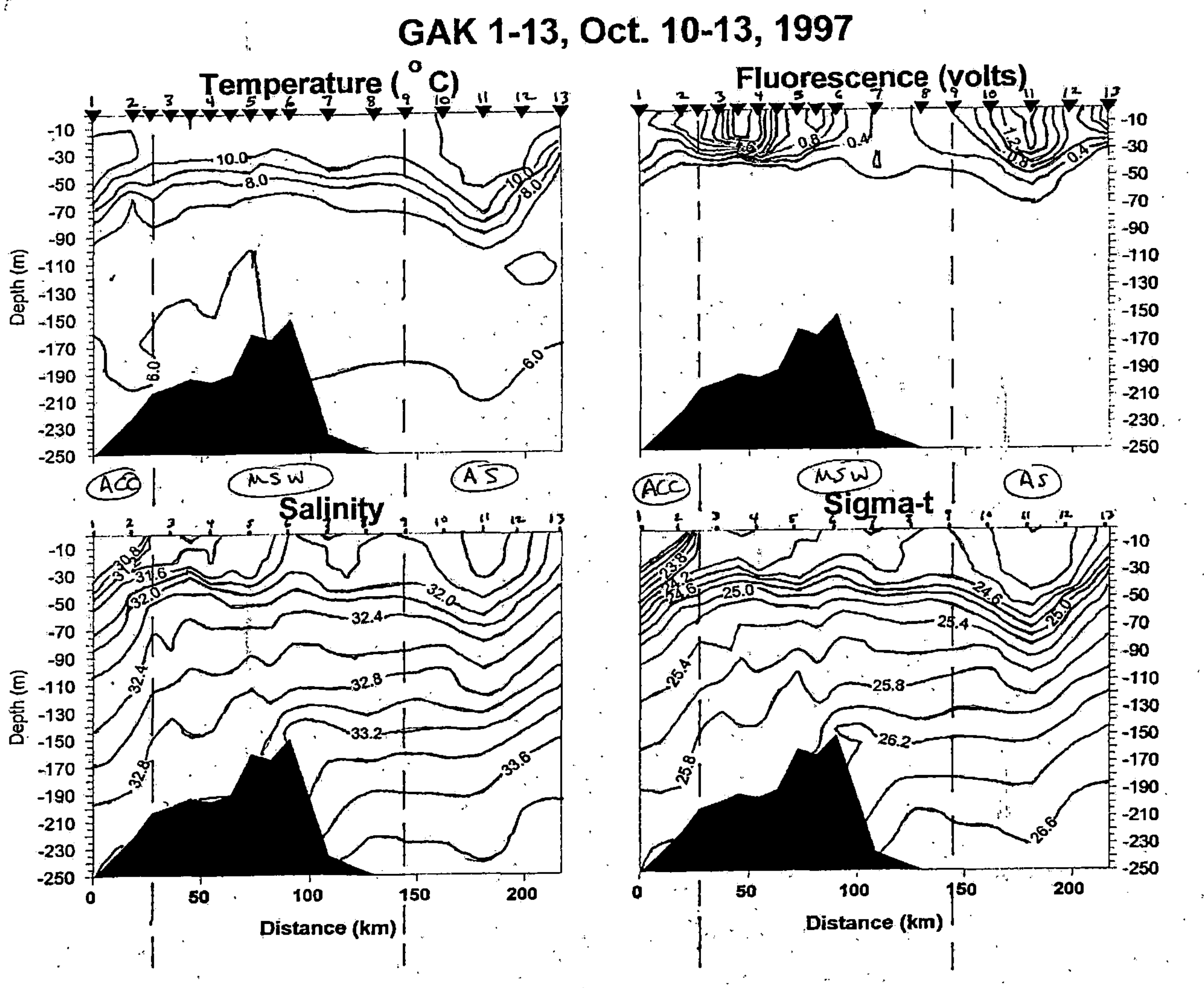


Figure 1. Vertical cross-sections of temperature, salinity, density (sigma-t), and fluorescence along the Seward Line, October 1997 (T. Weingartner, University of Alaska, Fairbanks, unpubl. data). Data are plotted with inshore on the left end of the plots. Abbreviations are: ACC = Alaska Coastal Current; MSW = Mid-shelf Water; AS = Alaska Stream. Inshore is on the left side of this plot.

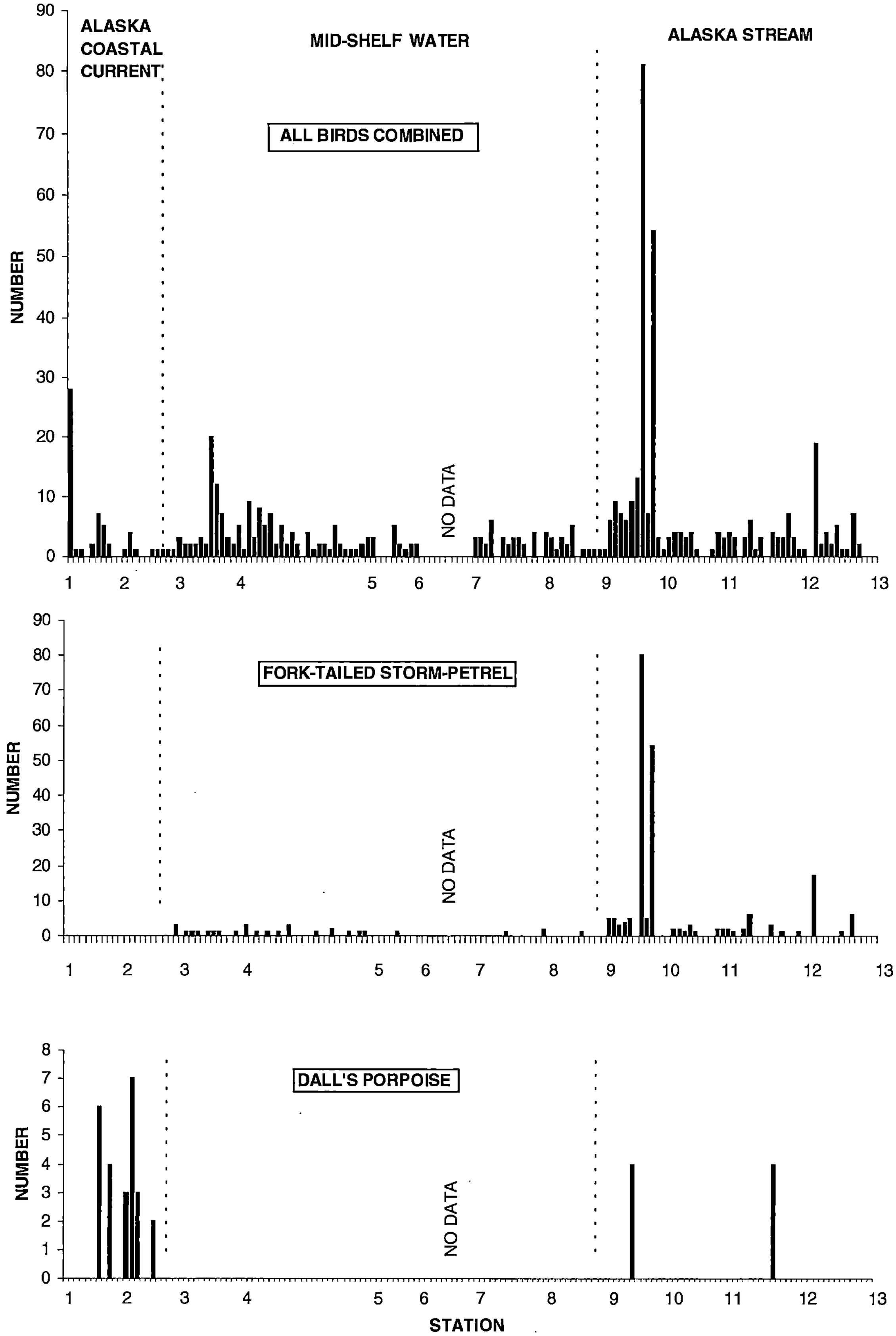


Figure 2. Cross-shelf distribution and abundance of all seabird species combined, fork-tailed storm-petrels, and Dall's porpoises along the Seward Line, October 1997. Data are preliminary and are not to be cited. Inshore is on the left side of this plot.

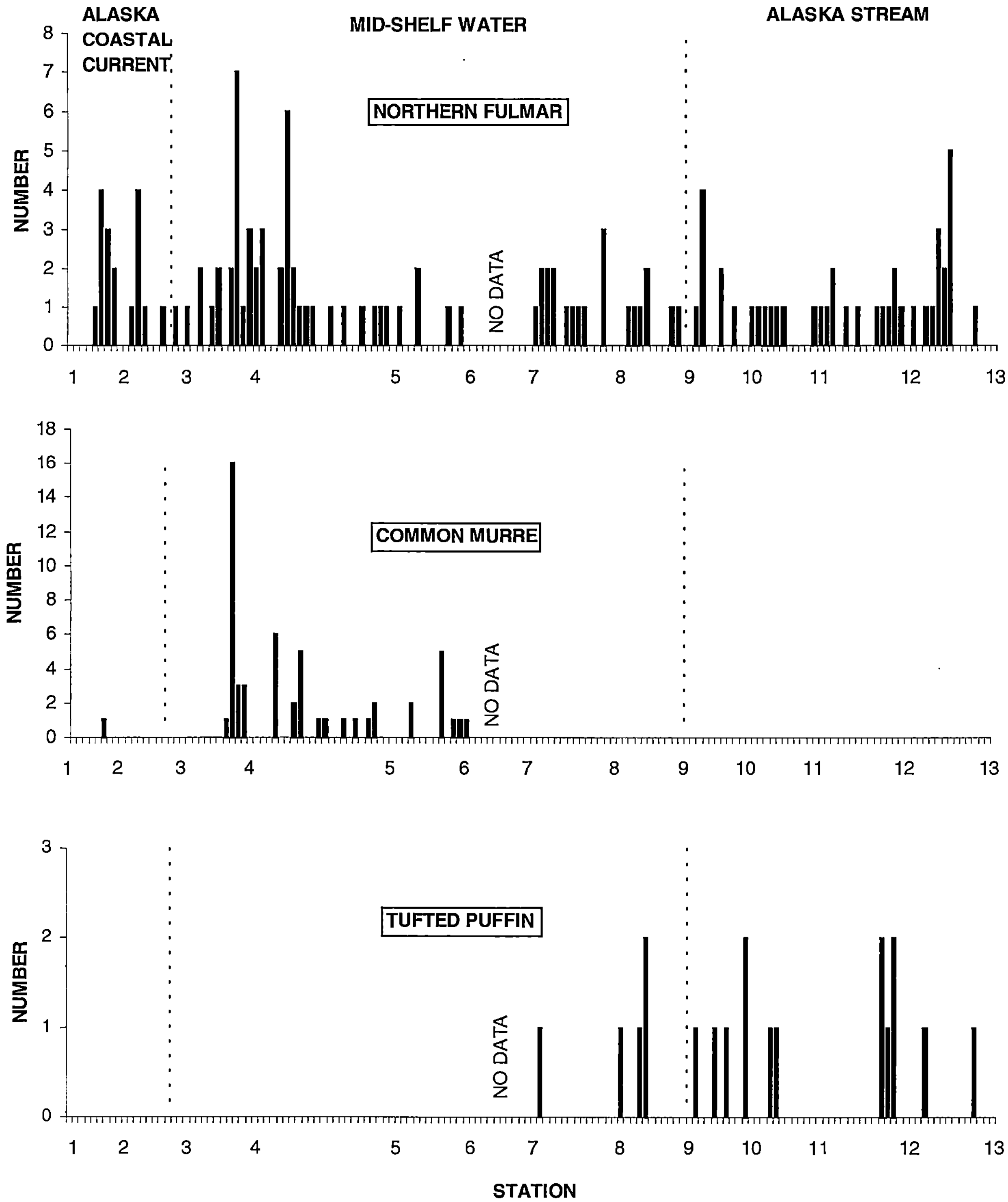


Figure 3. Cross-shelf distribution and abundance of northern fulmars, common murres, and tufted puffins along the Seward Line, October 1997. Data are preliminary and are not to be cited. Inshore is on the left side of this plot.

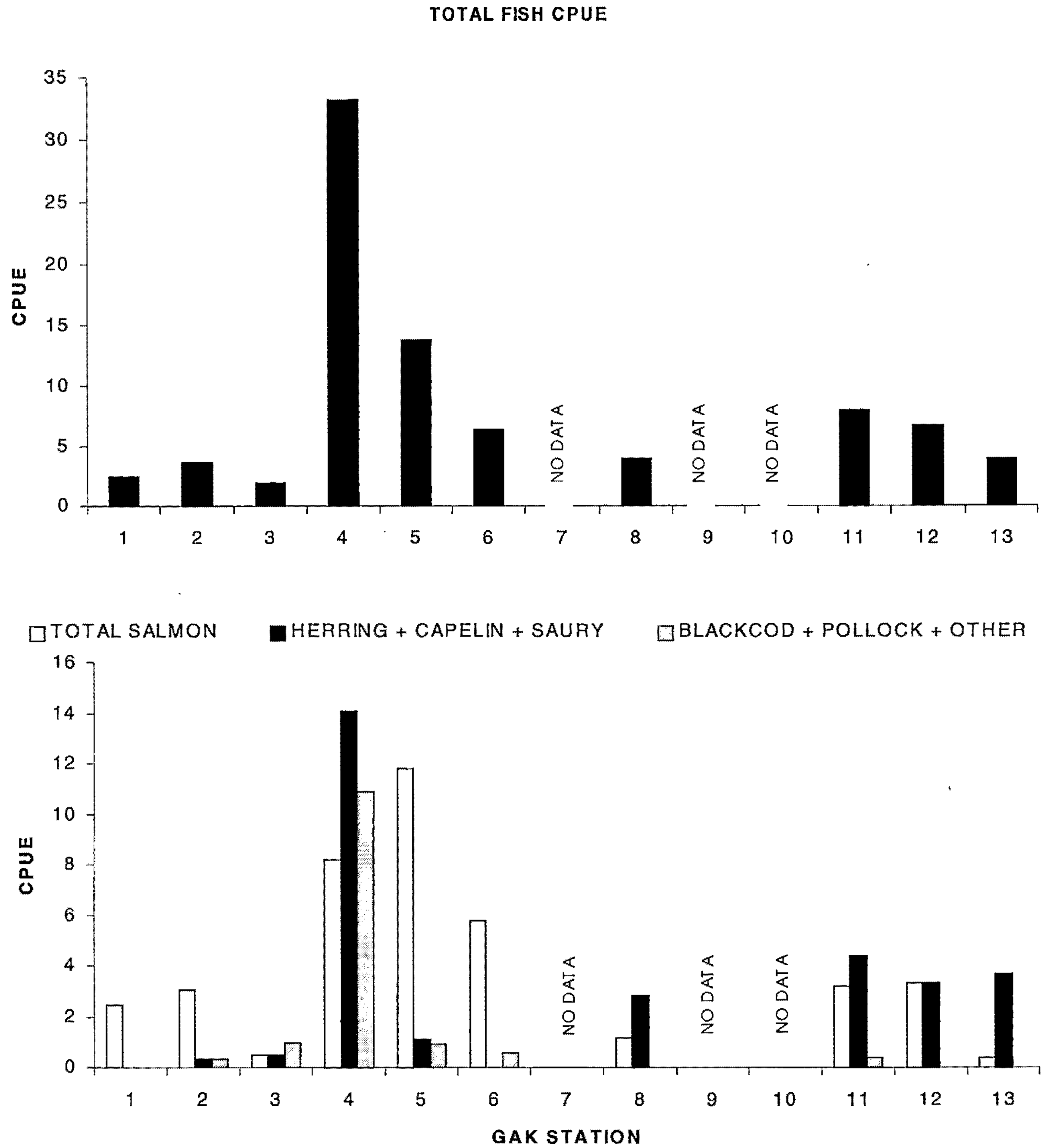


Figure 4. Cross-shelf distribution and abundance of all fish species combined and of three ecological groups along the Seward Line, October 1998 (L. J. Haldorson, University of Alaska, Juneau, AK; unpubl. data). Data are preliminary and are not to be cited. Inshore is on the left side of this plot.

APPENDIX 1. "GLOBEC" PROPOSAL SUBMITTED TO NSF BY INSTITUTE OF MARINE SCIENCES, UNIVERSITY OF ALASKA, FAIRBANKS

1. INTRODUCTION

Climate change and its potential effects on ecosystems are of international concern. In response to this issue the Global Ocean Ecosystem Dynamics (GLOBEC) program addresses the physical and biological interactions linking ecosystem alterations to climate change. The GLOBEC program goals are: 1) to understand the effects of climate variability and climate change on the distribution, abundance and production of marine organisms, and 2) to incorporate this understanding into diagnostic and prognostic models. To achieve these goals the U.S. GLOBEC Scientific Steering Committee prepared the Northeast Pacific Implementation Plan (U.S. GLOBEC Report Number 17, 1996) outlining the required studies for the U.S. west coast and Alaska. One aspect of this plan involves the development of a long-term monitoring program. This proposal describes a monitoring program for the northern Gulf of Alaska (GOA) in accordance with the GLOBEC implementation plan.

The GOA shelf supports a diverse ecosystem that includes several commercially important fisheries such as crab, shrimp, pollock, salmon and halibut (OCSEAP Staff, 1986; Anon., 1993). In aggregate these stocks imply that the gulf is among the world's largest fisheries, with annual catches exceeding 300 g 1000 m^{-3} (Brodeur and Ware, 1992). The mechanisms that underlie this high productivity are not known and, in fact, are somewhat enigmatic because the GOA shelf is a coastal "downwelling" shelf. By contrast, the rich fisheries along the eastern boundaries of the Pacific Ocean are supported by vigorous, wind-driven coastal upwelling whereby the euphotic zone is regularly replenished with nutrients advected from depth.

Intriguingly, the relative dominance of the commercially important fish species changed in the mid-1970s: crab and shrimp declined while salmon and groundfish populations increased (Albers and Anderson, 1985; Blau, 1986; Hollowed et al., 1994; Thompson and Zenger, 1994; Francis and Hare, 1994). These population shifts coincided with the beginning of a decadal North Pacific change in the atmosphere and ocean (Trenberth and Hurrell, 1994). From the human perspective these alterations required the commercial fishing industry to invest substantially in infrastructure adjustments so as to remain economically viable. Subsequent changes in this ecosystem followed in the 1980s with substantial declines in populations of sea lions (Merrick et al., 1987) and puffins (Hatch and Sanger, 1992). Dramatic though this "regime shift" was, Parker et al. (1995) show evidence that the abundance of halibut and other commercially important species varies on decadal time scales in conjunction with northern North Pacific Ocean temperatures (e.g., Royer, 1993). These correlations and the regime shift suggest that the GOA ecosystem is sensitive to climate variations on time scales ranging from interannual to interdecadal; however, the specific mechanisms linking climate to ecosystem alterations are unknown. Elucidation of these mechanisms requires an understanding of the seasonal cycle of the principal physical, chemical and biological variables. To date such a description is largely lacking for the GOA shelf.

Our monitoring plan will obtain a multi-year data set that will lead to a better understanding of the seasonal cycle and interannual variability in the physical-chemical structures and biological productivity of this shelf. It will include occupation of station GAK1, for which there exists a 26-year CTD time series (Royer, 1996). Further, our program is designed to yield information essential in guiding: 1) the interpretation of historical data sets that will be used by investigators in retrospective studies, 2) the design of a cost-effective long-term monitoring program, and 3) the design of process specific studies necessary to develop ecosystem models for this shelf. As outlined in Section 3, our monitoring program is formulated around several specific objectives. In Section 2, we provide background information on the GOA shelf which summarizes the present state of knowledge about the GOA ecosystem.

2. BACKGROUND

2.1 Physical Oceanography

The alongshore flow on the shelf and slope of the GOA is in the cyclonic sense on average (Reed and Schumacher, 1986). Flow over the continental slope consists of the Alaska Current, a relatively broad, diffuse flow in the north and northeast GOA, and the Alaskan Stream, a swift, narrow, western boundary current in the west and northwest GOA (Figure 1). Together these currents comprise the poleward limb of the North Pacific Ocean's subarctic gyre and provide the oceanic connection between the GOA shelf and the Pacific Ocean. Reed and Schumacher (1986) suggest that flow in the Alaskan Stream is relatively constant year round. However, Musgrave et al. (1992) and Okkonen (1992) show that sometimes the Alaskan Stream captures large eddies or forms prominent meanders and Royer (1981a) suggests that the seasonal signal in baroclinic transport is less than 10% of the mean flow. In the northeast gulf, the "Sitka Eddy" (Tabata, 1982) occasionally forms and slowly propagates westward across the GOA. To the extent that these low-frequency features impinge on the shelfbreak they could contribute to the shelf circulation and exchange of water masses.

The most striking feature of the shelf circulation is the Alaska Coastal Current (Figure 1), a swift (0.2–1.8 m s^{-1}), coastally constrained flow, typically found within 35 km of the coast, (Royer, 1981b; Johnson et al., 1988; Stabeno et al., 1995). This current persists throughout the year and circumscribes the GOA shelf for at least ~2500 km from where it originates on the northern British Columbia shelf (or possibly the Columbia River depending on the season) to where it enters the Bering Sea in the western gulf (Figure 1). In contrast to the coastal current, the shelf flow between the offshore edge of the coastal current and the shelfbreak is weaker and more variable (Niebauer et al., 1981). The source of this variability is uncertain, but potential mechanisms include separation of the coastal current as it flows around coastal promontories (Ahlnes et al., 1987), baroclinic instability of the coastal jet (Barth, submitted; Mysak et al., 1981) or meandering of the Alaska Current along the shelfbreak (Niebauer et al., 1981).

The dynamics of the basin and the shelf are closely coupled to the Aleutian Low pressure system. Storm systems propagate eastward into the GOA and are blocked by the mountain ranges of Alaska and British Columbia. Thus the regional winds are strong and cyclonic and the precipitation rates are very high. The positive wind-stress curl forces cyclonic circulation in the deep GOA, while on the shelf these winds impel an onshore surface Ekman drift and establish a cross-shore pressure gradient that forces the Alaska Coastal Current. The high rates of precipitation, which can be as great as 8 m yr^{-1}, cause an enormous freshwater flux (~20% larger than the average Mississippi River discharge) that feeds the shelf as a "coastal line source" extending from southeast Alaska to Kodiak Island (Royer, 1982). The seasonal variability in winds (represented in Figure 2 as the upwelling index) and freshwater discharge (Figure 2) are large. The mean monthly "upwelling index" at locations on the GOA shelf is negative in most months, indicating the prevalence of coastal convergence (e.g., this index is a measure of the strength of cyclonic wind stress in the GOA). As implied by Figure 2, cyclonic winds are strongest from November through March and feeble or even weakly anticyclonic in summer when the Aleutian Low is displaced by the North Pacific High (Royer, 1975; Wilson and Overland, 1986). The seasonal runoff cycle (Figure 2) exhibits slightly different phasing from the winds: it is maximum in early fall, decreases rapidly through winter when precipitation is stored as snow, and attains a secondary maximum in spring due to snowmelt (Royer, 1982).

The shelf hydrography and circulation vary seasonally and are linked to the annual cycles of wind and freshwater discharge. Figure 3 contrasts the cross-shore salinity structure (which mimics density on the GOA shelf) in April and September, 1983. In April, the stratification and the offshore front, defined here to be the surface intersection of the 32.0 isohaline, are relatively weak. By contrast, in September a 25 km wide wedge of strongly stratified water lies adjacent to the coast and is bounded on the offshore side by a prominent front. Royer et al. (1979) showed that surface drifters released on the shelf seaward of the front drifted onshore in accordance with Ekman dynamics. Upon encountering the front the drifters moved in the alongfront (e.g. ~westward) direction consistent with the geostrophic tendency implied by the cross-shore density distributions of Figure 3. Royer et al. (1979) hypothesized that ageostrophic offshore spreading of the dilute surface layer occurred on the inshore side of the front. In their analysis of currents measured inshore of the front, Johnson et al. (1988) found that this is indeed the case and that surface offshore flow was positively (and significantly) correlated with discharge.

These studies imply that near-surface waters converge from either side of the front. This pattern of cross-shelf circulation would tend to accumulate plankton which might then attract foraging fish. Moreover, the front and region inshore of it might be an area of enhanced productivity because entrainment (Royer et al., 1979; Johnson et al., 1988) and/or frontal instability (Barth, submitted) could resupply the surface layer with nutrients from depth. Royer (1979) also showed that monthly coastal sea level variations at Seward are in-phase with, and have nearly the same amplitude as, the local dynamic height. This was not expected given the difference in sampling techniques: the sea level records were sampled hourly and then averaged into monthly means, whereas the dynamic heights were from hydrographic measurements at a single station occupied several months apart. Further, Royer (1979) found that sea-level and precipitation anomalies were well-correlated. These results suggest examining the relationship between monthly or seasonal characteristics of the cross-shelf dynamic height gradients, winds and freshwater discharge. A firm relationship among these factors may allow the calculation of alongshelf baroclinic transport (on monthly or longer time scales) from a single hydrographic station or mooring at the coast. The result would be enormously useful for model evaluation (and perhaps data assimilation) and in retrospective studies. The alongshore transport appears to be important in advecting zooplankton to important juvenile fish foraging areas (see Section 2.3).

Figure 3 also indicates that near-bottom salinities are higher in fall than spring. Xiong and Royer (1984) showed that, on average, maximum bottom salinities occur in fall and are nearly coincident with minimum surface salinities and maximum inshore stratification (Figure 4). Although the surface waters are diluted by coastal discharge (which peaks in fall), the source of the high salinity water is the onshore intrusion of slope water (Figure 5) in response to the seasonal relaxation (or reversal) in downwelling (Royer, 1975, 1979).

Royer's (1996) analysis of monthly anomalies from the GOA shelf shows very low-frequency (interdecadal) variations in bottom water salinity that imply interannual variability in the onshore flux of slope water and/or differences in slope water properties. We argue below that these differences likely result in differences in the onshore flux of nutrients to the GOA shelf.

2.2 Primary Productivity and Nutrient Cycles

There are few primary production measurements from the GOA and those that exist are from widely varying locations and times. While Sambrotto and Lorenzen (1986) and Parsons (1986) concluded that the largest production rates occur on the shelf, there are no data on interannual variability. A nearly complete lack of nutrient data, particularly from the shelf (Reeburgh and Kipphut, 1986), is an additional limitation to understanding production. The major nutrient source to the shelf is probably the deep ocean because nutrient concentrations in the coastal runoff are very low (Sambrotto and Lorenzen, 1986). Such low concentrations are not unexpected given the steep, mountainous coastline and the extensive snowfields. The shelf euphotic zone, especially in inshore waters, probably becomes nutrient depleted, but we emphasize that this is speculation at this time (Reeburgh and Kipphut, 1986).

Although little is known about surface nutrient concentrations, there are suggestions of large year-to-year differences in subsurface nutrient concentrations. Incze and Ainair (1994) showed large interannual differences in nutrient concentrations at depths >150 m along one section in Shelikof Strait (in the western GOA) occupied each spring between 1985–1989. Because of the unique bathymetry of this area, it is unclear if these differences apply to other GOA shelf regions. However, the interannual salinity variations shown by Royer (1996) imply variability in deep water nutrient concentrations, as indicated from the WOCE P17N section of May–June 1993. These nutrient data are the only synoptic deep ocean and shelf nutrient data available for the northern GOA. Figure 6 shows the salinity-NO_3 relationship using data from between 125 and 450 m depth at stations within the Alaskan Stream and on the western shelf. This depth interval covers the range of bottom water salinities observed by Royer (1996) and Xiong and Royer (1984). The correlation appears to be good and we note that a change in salinity from 32.0 to 33.0 involves nearly a doubling in the NO_3 concentration. If salinity-macronutrient relationships can be statistically quantified for the shelf, then it might be possible to use the 26-year salinity time series from GAK1 as a proxy for subsurface nutrient concentrations.

2.3 Zooplankton

Zooplankton are a critical link in the transfer of energy from primary producers to apex predators. Any process influencing the abundance and distribution of zooplankton can ultimately impact on fisheries. Zooplankton are therefore a critical component of any monitoring study that attempts to relate long-term climate variations to fish production.

The zooplankton community on the shelf of the Gulf of Alaska is dominated by a combination of oceanic and neritic herbivorous and omnivorous copepod stocks (Cooney, 1986a, 1986b; Incze et al., 1996). The major oceanic species include *Neocalanus plumchrus*, *N. flemingeri*, *N. cristatus*, *Eucalanus bungii* and *Metridia pacifica*. Neritic taxa are dominated by *Pseudocalanus* spp. and *Calanus marshallae*, with lesser amounts of *Acartia* spp., *Centropoges abdominalis* and *Calanus pacificus*. In addition to copepods, a number of micronektonic species contribute substantially to the overall density of forage for fish on the GOA shelf. The euphausiid species include primarily *Thysanoessa inermis*, *T. spinifera* and *Euphausia pacifica*, with lower densities of *Thysanoessa raschii*, *T. longipes*, *T. inspinata*, *Tessarabrachion oculatum* and *Euphausia pacifica*. Amphipods include *Cyphocaris challengeri*, *Parathemisto pacifica*, and *Primno macropa* (Incze et al., 1996). Oceanographic conditions affecting the transport and production of these taxa influence their absolute and relative densities and distribution over the shelf, and thus their availability to fish predators.

During spring and summer, 25–78% of the copepod biomass over the shelf is dominated by the oceanic species complex (Cooney, 1986a, 1986b; Incze et al., 1996). The distribution of oceanic relative to neritic copepods is determined to a large extent by cross-shelf transport (Cooney, 1986a) and water mass type (Incze et al., 1996; Napp et al., 1996). Although most of the copepod biomass in lower Shelikof Strait occurred consistently in the Alaska Coastal Current from 1986–1989, there was a fourfold (3–12 g C m^{-2}) interannual variation in maximum biomass (Incze et al., 1996; Napp et al., 1996). Zooplankton biomass on the shelf outside of Prince William Sound in May 1996 varied by up to an order of magnitude, with maximum values occurring in the shelf water offshore of the Alaska Coastal Current (Figure 7).

In addition to late copepodid stages of the major copepod taxa, the early naupliar stages are the primary forage for the first-feeding larval stages of a variety of fish. Based on water temperature, copepod development rates and flow rates of the Alaska Coastal Current, copepods producing the major cohort of naupliar stage larvae available to first-feeding pollock larvae in Shelikof Strait originated during February–March on the shelf off of Prince William Sound and east of GAK1 (Napp et al., 1996; Incze and Ainaire, 1994). Nauplii consumed by first-feeding fish larvae are produced primarily by the neritic zooplankton community. Therefore, pre-bloom conditions on the north central GOA shelf may crucially influence survival of larval fish further downstream (west and south) near Kodiak Island.

No data are available on interannual differences in zooplankton biomass for the north central GOA shelf. However, a multi-year data set of zooplankton settled volumes measured during April and May near Ester Island, in the southern end of Prince William Sound, is available. The zooplankton community in the southern sound is influenced primarily by advection from the GOA shelf. Cooney (pers. comm.) found a significant positive correlation (Figure 8) between the logarithm of the average settled zooplankton volume for April and May and the average of the upwelling index off Hinchinbrook Entrance (Figure 2). There are a number of possible explanations for the above correlation. Oceanic species of the genus *Neocalanus* dominate zooplankton biomass in April and May, suggesting that anomalously weak springtime downwelling may enhance subsurface onshore transport of oceanic copepods from the shelfbreak. Alternatively, weakened downwelling may permit advection of nutrients onshore and into the photic zone during the spring months, thereby elevating primary production and providing a more continuous and abundant food supply to herbivorous zooplankton. An anomalously positive April–May upwelling index implies reduced wind stress, precipitation rates, cloud cover and possibly higher air temperatures. All these variables influence upper ocean stratification through wind mixing, surface heat flux and coastal discharge. Stratification influences the vertical distribution of plant cells and, along with light availability, influences primary production rates. These physical variables, through their influence on phytoplankton food quality and/or abundance, would affect zooplankton.

If cross-shelf advection is a major source of zooplankton biomass on the shelf, then conditions that enhance zooplankton biomass at the shelfbreak should also enhance shelf zooplankton densities when favorable onshore transport conditions occur. Comparisons of zooplankton densities in the GOA between 1956–1962 and 1980–1989 revealed a doubling in average biomass around the GOA perimeter since the early 1960s (Brodeur and Ware, 1992). The reason for this increase is uncertain. However, suggested hypotheses include greater primary productivity due to a rise in winter wind stress and elevated summer winds, increasing the speed of the subarctic current and displacing it northward, further into the GOA during the 1980s (Brodeur and Ware, 1992). A positive correlation between zooplankton densities and surface salinities (Frost, 1983; Wickett, 1967) implies stronger vertical mixing (Brodeur and Ware, 1992), leading to enhanced new production and better feeding conditions for herbivorous zooplankton. Primary production rates were apparently 3–4 times higher in the GOA in 1987–1988 than earlier measurements indicated (Welschmeyer et al., 1993). Although Welschmeyer et al. (1993) attributed the differences to methodology, the zooplankton and wind data cited above suggest that there might have been real decadal variation in annual production rates.

A doubling of the salmon production between the 1950s and 1980s (Rogers, 1987) indicates that salmon benefited from elevated zooplankton densities. The major environmental shift suggested by the collapse of the crustacean fishery and its replacement by a groundfish fishery in the late 1970s and early 1980s (see Introduction) could also be a consequence of enhanced zooplankton biomass because the early life history stages of demersal fishes feed on zooplankton.

2.4 Fish

The epipelagic zone of the Northeast Pacific Ocean provides the energy of production for five Pacific salmon species that spawn and are harvested in Alaskan waters. Since the 1920s, abundance of salmon in Alaska has undergone one complete cycle, with high levels in the 1930s, low in the 1960s, and a return to high abundance in the 1980s. This relatively long-term cycle may be related to harvest practices, changes in freshwater spawning habitats and changes in the marine environment. Several indicators suggest the marine environment may be a factor in abundance cycles, and that the present exceptionally high abundances of salmon may reflect long-term climatic changes that have affected the planktonic production system of the Northeast Pacific Ocean. For example, since the mid-1970s water temperatures have increased (Royer, 1989), primary and secondary production levels are higher (Brodeur and Ware, 1992), and growth rates of salmon are declining (Helle and Hoffman, 1995). Several of these indicators appear to have conflicting trends, especially the observation that salmon growth rates are declining while secondary production has increased. Processes that may be responsible for these observations include physical effects such as variability in oceanographic features that concentrate prey or the energetic demands of higher water temperatures, and biotic effects such as density dependent growth associated with competitive interactions among planktivorous fishes. Presently there is no clear understanding of what processes are controlling salmon production in the Northeast Pacific Ocean.

In the marine environment, salmon coexist with a variety of other planktivorous fishes and invertebrates. Non-salmonid species that co-occur with juvenile salmon include sablefish (*Anoplopomna fimbria*), rockfishes (*Sebastes* spp.), walleye pollock (*Theragra chalcogramma*), herring (*Clupea harengus*) and capelin (*Mallotus villosus*)

(Carlson et al., 1996). In addition, a group of diel-migrating mesopelagic fishes, such as myctophids, may be important nocturnal planktivores in near-surface waters. Inclusion of non-salmonid species in marine monitoring studies should provide increased opportunity to observe patterns important in the production of planktivorous fishes.

Typically, high latitude fishes store energy during spring and summer, whereas in the winter they reallocate energy to maintenance and reproduction (Smith et al., 1988, 1990). Juvenile salmon in the Gulf of Alaska seek feeding areas that sustain the rapid growth needed to avoid predators and gain maturity. Certain oceanographic parameters, such as fronts, currents and temperatures, play important roles in zooplankton productivity and aggregation. The effects of food limitation may be subtle and measures of feeding variability require diagnostic tools that are sensitive enough to see small differences in fish condition. Measures of whole-body energy content provide a standardized and accurate measure of fish health and growth. The amount of energy stored by fishes during seasonal growth periods has been used to determine if populations are food limited (Diana and Salz, 1990), and is an important parameter in energetics models (Wang and Houde, 1994). This approach requires documentation of energy content at the start and end of the period of interest. For this reason, YOY (young of the year) fishes are especially interesting, as they are assumed to have started the season of growth (typically spring and summer) at the same point, with very little energy. Measuring the energy storage of YOY fishes in mid-summer and end of summer should indicate how conditions in that year affected the productivity of salmonids and other planktivorous fishes.

3. PROJECT OBJECTIVES

Although decadal-scale shifts are evident or implied in physical oceanographic, zooplankton and fisheries data sets, the connections among these ecosystem components on the GOA shelf are poorly understood. GLOBEC is an integrated program involving retrospective analyses, monitoring, modeling and process studies designed to improve our understanding these connections. The general objective of our monitoring plan is to better understand the temporal (seasonal and interannual) and cross-shelf variations in the thermohaline, chemical and biological structures of this shelf. At the same time our data will help: 1) interpret historical data sets that will be used by investigators in retrospective studies, 2) design a cost-effective long-term monitoring program, 3) identify particular processes that would serve as the basis for follow-on GLOBEC process studies scheduled to begin in year four of the GLOBEC Program for the GOA shelf (U.S. GLOBEC, 1996), and 4) provide boundary conditions and/or hindcast data sets for modeling studies.

As a practical approach to achieving these generic goals we have identified the following specific objectives that guide our sampling and analysis:

1. determine the seasonal (and interannual) changes in the cross-shelf distribution of temperature, salinity, mixed-layer depth, light transmission, photosynthetically active radiation (PAR), and the concentration of chlorophyll and nutrients;
2. determine the statistical relationship between seawater salinity and nutrient concentrations on the GOA shelf and slope;
3. use water mass properties (temperature, salinity, and DO) to determine the offshore depth of upwelled water observed on the shelf;
4. determine the relationship between anomalies of dynamic height and the cross-shelf dynamic height gradient, wind, and freshwater discharge on seasonal time scales;
5. determine seasonal chlorophyll concentration and primary productivity responses to cross-shelf thermohaline structure and nutrient enrichment processes;
6. determine quantitatively and taxonomically the seasonal and cross-shelf distribution of zooplankton in relation to oceanographic features and the distribution and concentration of chlorophyll;
7. determine quantitatively the summer-fall distribution of juvenile salmonids and other small planktivorous fishes in relation to oceanographic features and the distribution of zooplankton;
8. determine the seasonal and cross-shelf energy content of small pelagic fishes, especially young of the year (YOY) salmonids, examine energy content in relation to oceanographic features, zooplankton density and composition, and existing laboratory measures of energy storage capacity; and
9. quantify the diets of small pelagic fishes, especially YOY salmonids, as a function of season and cross-shelf position and compare these diets with oceanographic features, zooplankton density and composition.

4. APPROACH

4.1 General Considerations

To attain these objectives we will sample the physical, chemical and biological parameters on identical time and space scales with the protocols developed by the GLOBEC SSC (U.S. GLOBEC, 1996). We will occupy 13 stations on the Seward Line (Figure 9) that extends across the shelf break from the coast at Seward to within the Alaska Stream. The bottom depth at most stations along this line is from 200 to over 1500 m which will allow deep ocean nutrient data to be collected. The Seward Line was frequently occupied in the 1970s as part of the Outer Continental Shelf Environmental Assessment Program (OCSEAP), so historical hydrographic data are available for comparison with our results. Six cruises per year are requested so that we can capture the seasonal cycle in the important physical and biological variables. We will sample in February/March when zooplankton migrate from depth at the shelf break and begin to be advected onshore, in April during the spring phytoplankton bloom, in May when the biomass of oceanic copepods is maximum, in July and October when YOY salmon are on the shelf, and in late November/early December when we expect biological activity to be minimal. Our sampling methods follow the protocols specified in the implementation plan (see Table 5 of U.S. GLOBEC, 1996), however, we will not sample particle size spectra using a through-hull system, deploy drifters, or observe marine birds and mammals. Under separate submission, J. Napp of NOAA/NMFS Alaska Fisheries Science Center (Seattle) is proposing to measure particle size spectra with an instrument that would be deployed with our CTD while on station. R. Day (Alaska Biological Research, Inc., Fairbanks), a seabird biologist long involved in regional seabird studies, will propose to the Exxon Valdez Oil Spill Trustee Council (EVOS) to make mammal and seabird observations during our cruises.

All oceanographic observations will be made from the R/V *Alpha Helix*, whose home port is Seward: therefore transit time to the Seward Line will be negligible. A fishing vessel configured for mid-water trawling will be chartered for two cruises in July and early October to sample YOY salmonids and juvenile fishes. The trawl vessel will work in conjunction with the R/V *Alpha Helix* so that measurements of oceanic parameters and zooplankton are obtained concurrently, thus ensuring that the data sets are compatible in time and space. The remaining four cruises (February/March, April, May and November/December) will involve only oceanographic and zooplankton sampling. We expect to spend 36 days per year at sea: with each cruise of 6 days duration. The ocean sampling should actually require ~3 days and the excess time reflects weather day budgeting. Should these days not be needed we will use the extra time to sample additional cross-shelf transects east of the Seward Line or we will occupy 25 hour time series stations.

4.2 Physical, Chemical and Phytoplankton

Shipboard hydrography will be done by Weingartner and Royer. Measurements will include CTD (Seabird 9/11 with redundant temperature and conductivity sensors), fluorometry, PAR, transmissivity, and discrete bottle samples for nutrients, chlorophyll, and dissolved oxygen, at a station spacing of ~10 km on the inner half of the shelf and at ~15 km intervals over the outer half. Continuous through-hull measurements of surface temperature, salinity, and fluorescence; and water column velocities determined with an acoustic Doppler current profiler (ADCP) will be included. The R/V *Alpha Helix* carries a 300 kHz ADCP system that can bottom track over the continental shelf. The ADCP velocity profiles and through-hull surface property values are displayed in real-time and these will help identify the location and width of the Alaska Coastal Current and the front. Together with the hydrographic cast data, these data will be used to adjust the CTD station locations during each cruise to optimize sampling for the features of interest and to guide the fish and zooplankton sampling.

The physical parameters (including transmissivity and PAR) obtained from the CTD will be used to examine seasonal and cross-shelf distribution of water masses and to aid in interpreting the distribution of biological variables. We will also compute dynamic heights and baroclinic transports for use in the retrospective study described below. The ADCP data from a single occupation of a transect, as proposed here, are not easily amenable to detiding. However, the M_2 tide is the dominant tidal constituent on this part of the GOA shelf with an amplitude of ~0.1 m s^{-1}. The dominant velocity signal on this shelf is the Alaska Coastal Current. The magnitude of both the mean speed and typical subtidal-frequency variability of the Alaska Coastal Current is several times greater than the tidal signal. To the extent that weather permits, sampling along additional transects might permit us to apply tidal removal procedures (Candela et al., 1992) to the ADCP data. The continuous ADCP and surface measurements will be used to examine small scale physical features that might be of biological importance. These parameters, when analyzed in conjunction with hydroacoustic data, are especially helpful in interpreting zooplankton patches (Coyle and Cooney, 1993; Coyle et al., 1992).

Retrospective studies of the hydrographic and climatic variability done in conjunction with this pilot monitoring program will give it spatial and temporal contexts. These studies will also determine if future monitoring can be accomplished through the use of more generally recorded environmental factors such as coastal tidal height; wind:

barometric pressure: air temperature: precipitation: cloudiness: remote sensing of sea surface temperature. color and altimetry: and volunteer observing ship measurements of ocean temperatures.

The data from the monitoring program will be added to the existing GAK1 hydrographic time series (http://www.ims.alaska.edu:8000/GAK1). which will then be the focus of the retrospective analyses. This will provide a history beginning in 1970 of the temperature and salinity variability at GAK1: from this history. changes in the density structure. mixed layer depth. heat and salt content. and dynamic height will be determined. The relationships between dynamic height and sea level observed by Royer (1979) will be reexamined using the additional 18 years of data to determine if the dynamic height and baroclinic transport on the shelf can be derived from tidal height data.

The relationship between the mixed layer depth and both sea level measurements and freshwater discharge will be examined. The regional hydrology model of Royer (1982) will be used in the retrospective studies to calculate the coastal discharge from records of air temperature and precipitation. since there is little monitoring of such fresh water flux in the GOA. The variability of the mixed layer depth is especially important to studies of primary and secondary production. since it can affect the vertical fluxes of nutrients and the depth of phytoplankton distribution (Mann and Lazier. 1991). The ability to hindcast the mixed layer depth from the freshwater discharge model would permit determination of the mixed layer depth variability back to 1931. the earliest date of the climatic records used by the model. The mixed layer depth record could then be compared to fisheries data sets during this period. such as salmon catches.

To place the Seward Line measurements in a spatial context. the historical hydrographic data for this shelf will be reexamined along with the XBT and BT data available for the region from the WOCE (World Ocean Circulation Experiment) Volunteer Observing Ship (VOS) program. More than five years of VOS coverage is now available. Interdecadal time scales will be addressed through the use of sea surface temperatures (available from Scripps since 1947). Sitka air temperatures (since 1828). upwelling indices (from the Pacific Oceanographic Group/NOAA since 1946). the North Pacific Index (from NCAR since 1900) and oceanographic buoy data (from NOAA since ca. 1975).

Whitledge is responsible for nutrient and primary productivity measurements. Nutrients will be analyzed onboard using an Alpkem Rapid Flow Analyzer (Whitledge et al.. 1981) and will conform to WOCE standards (Gordon et al.. 1993). Chlorophyll *a* concentrations will be measured at all stations to calibrate the *in vivo* fluorescence profiles. The samples will be collected from CTD upcasts using the rosette sampler. Extracted chlorophyll *a* will be determined fluorometrically on board ship (Parsons et al.. 1984). Extracted chlorophyll samples will also be used to calibrate the flow-through fluorometer by collecting discrete samples periodically from the through-hull sampling system.

Daily measurement of primary production rates will be estimated for large (>20 μm) and small (<20 μm) size classes by the modified ^{14}C-uptake technique (Evans et al.. 1987). Primary production estimates well be made at 4–6 stations along the Seward Line. Water samples inoculated with 20 μCi ^{14}C-labeled sodium bicarbonate will be incubated in 1-liter polycarbonate bottles under natural light. using an on-deck incubator. Following the incubations. both light and dark samples will be filtered and purged of labeled inorganic carbon. The residual ^{14}C activity will be determined by liquid scintillation counting to assess organic carbon release rates. Hourly and daily estimates of primary production rates will be calculated for each sampling site. Concurrent assessments of phytoplankton nutrient utilization will be performed using nutrients (nitrogen. phosphorus and silicate) and trace metals. Emphasis will be placed on iron enrichments in order to assess potential effects on primary productivity rates. Particulate carbon and nitrogen samples will be obtained for each productivity sample.

4.3 Zooplankton

Coyle will perform the zooplankton work. Zooplankton samples will be collected with a 25 cm diameter CalVET net (Smith et al.. 1985) equipped with General Oceanics digital flowmeters and 0.16 mm mesh nets. The CalVET net has the following advantages over a ring net for obtaining integrated zooplankton samples: 1) it can be hung on the CTD cable. allowing for quick and efficient deployment of gear: 2) a CTD record can be obtained concurrently with the zooplankton sample: 3) the net can be equipped with flowmeters to estimate sampling efficiency: and 4) the sample is small. thus requiring a minimum of splitting during analysis. The CalVET net will sample small. abundant zooplankton. especially early copepodid stages of calanoids (e.g., Coyle et al.. 1990).

A 0.7 m bongo net with 0.5 mm mesh and a depth recorder with an on-deck readout will be towed double obliquely from the surface to within 10 m of the bottom. The bongo net will sample large calanoids. micronekton and larval fish. It will be equipped with a General Oceanics digital flowmeter to estimate volume filtered.

Copepod nauplii will be sampled with a 10-liter Niskin bottle at four depth intervals in the upper mixed layer. The entire contents of the bottle will be filtered through a 0.05 mm mesh bag net.

All samples will be preserved in 10% formalin for later processing. As directed, separate samples will be collected, preserved in alcohol, and stored for future genetic analysis (U.S. GLOBEC, 1996). The formalin-preserved samples will be split with a Folsom splitter, consecutive fractions will be sorted for abundant taxa, and the material will be identified to the lowest taxonomic category possible. The copepods and euphausiids will be staged and the sex ratio of adults determined.

Preservation of zooplankton with formalin can markedly affect dry weight biomass estimates (Steedman, 1976; Omari and Ikeda, 1984). Because the amount of loss can vary with respect to taxa, formalin concentration, pH, duration of preservation and animal:liquid ratio, the amount of weight loss due to preservation cannot be predicted. However, minimal changes occur in copepod wet weight biomass due to formalin preservation with respect to wet weight estimates of fresh material (Omari, 1970). We will therefore measure the blotted wet weight of the formalin preserved specimens to estimate biomass. The wet weight of highly variable taxa (euphausiids, amphipods, chaetognaths, etc.) will be estimated for each sample. Average wet weight will be measured and used to estimate biomass of taxa of a constant size (e.g. copepod copepodid stages). Large gelatinous zooplankton will be counted, species composition determined and volume measured, and then discarded at sea. Data analysis will be done using an INGRES database and FORTRAN, with calls to IMSL libraries or SAS statistical packages.

Acoustic data will be collected with a Hydroacoustic Technology Inc. (HTI) model 244 split-beam system at 38, 120 and 200 kHz and a single beam at 420 kHz. The system includes a 38 kHz 10° split-beam transducer, a 120 and a 200 kHz 6° split-beam transducer, and a 420 kHz 6° single beam transducer. This frequency range should permit us to estimate densities of fish, micronekton and large calanoids. We have chosen relatively narrow beam transducers to ensure that discrete targets can be isolated for target strength measurements. We will not deploy a split beam 420 kHz transducer due to the difficulty of isolating discrete targets at reasonable ranges with high frequency transducers. The transducers will be towed beside the vessel at 6 knots in a dead-weight tow body about 4 m from the hull and 2 m below the surface. The system will collect simultaneous 20 and 40 log R data for both target strength and integration. Data will be integrated at 30–60 second time intervals and at 1 m depth intervals to produce horizontal and vertical estimates of volume scattering. All return signals are corrected for sound cone spreading and absorption of sound by seawater. Additional corrections for system calibration are applied before writing the averaged voltages to computer files. GPS positions from the ship's navigation system will be written to each record before writing the data to disk, thus permitting accurate integration of bioacoustic data with ADCP and sea surface data. All raw data will be written to digital tape, both to back the data and to permit re-analysis of selected sections during post processing. The systems will be calibrated using standard target procedures before and after each cruise (Traynor and Ehrenberg, 1990).

A 1-m^2 MOCNESS net equipped with 500 mm mesh nets will be fished during day and night, concurrently with acoustic measurements at selected sites, to identify and sample zooplankton and micronekton targets in the scattering layers. The MOCNESS system is equipped with nine nets which can be opened and closed electronically from the deck. The system simultaneously collects data on salinity, temperature, fluorescence, depth, net angle, volume sampled, time and GPS position. All data are written to a computer for later processing. The MOCNESS is fished off the stern and will sample mid-water layers from 5 m below the surface to 10 m above the bottom. MOCNESS samples will be analyzed as described above.

4.4 Fish

Haldorson and Paul are responsible for the fish studies. Planktivorous fish distribution will be assessed using a mid-water trawl equipped with a net-monitor system that provides real-time location of the net in the water column. Most of the net sampling will be at locations where the acoustic equipment has identified the presence of fishes. Acoustic sampling may not be able to identify near-surface fishes; consequently, a series of three near-surface mid-water trawl samples will be collected randomly at each of the fixed stations on the transect lines.

Once caught, fish larger than about 50 mm will be identified in the field. We will sort samples to species and measure all fish, unless net hauls contain large numbers of individuals of some species. In the case of large catches we will randomly subsample and measure 100–200 individuals of each species. Length-stratified subsamples of all fish species will be frozen and returned to the laboratory for condition and energetics studies. A second series of length-stratified subsamples will be preserved in formalin for diet studies. As directed by GLOBEC, other samples will be collected, preserved in alcohol, and stored for future genetic analysis (U.S. GLOBEC, 1996).

In the laboratory the fish will be partially thawed, just enough for handling, but not enough to lose fluids. Otoliths will be removed and stored in glycerine. The stomach will be opened and the contents removed and placed in 10% formalin. The standard length, wet weight, dry weight, whole body energy content and condition factor [CF = g wet wt x 100/(cm standard length)^3] will be determined for each individual. After freeze drying, the bodies will be placed in a convection oven at 60°C until they reach a constant weight. Individual wet and dry weight values will be used to calculate the moisture content. Dried tissues will be ground in a mill and caloric content measured by bomb calorimetry.

Condition is assessed by examining weight as a function of length. Techniques range from application of indices, such as the Fulton condition index, to comparisons of length-weight regression parameters. We will use a Fulton condition index to compare individuals of the same species in the same age class. We will also compare slopes of length-weight regressions, especially when the size range of specimens is wide enough to render the Fulton-type indices unreliable. Length-weight regressions using analysis of covariance provide the most robust approach to comparing condition among samples (Cone, 1989).

Feeding of salmonids and other planktivorous fishes will be quantified by analyses of stomach contents from formalin-preserved specimens. Ten to 15 individuals from each species-age class-sample site will be processed. The specimens will be measured for fork and standard length, and weighed. Stomachs will be excised and the contents removed and weighed. Stomach contents will be sorted and counted by prey type, with sample splitting in the case of exceptionally high numbers of prey. Prey will be identified to the lowest feasible taxon. Weight of prey types will be estimated by measuring all or a subsample of items, and using size-weight relationships from the literature.

5. SIGNIFICANCE OF THE RESEARCH AND RELATION TO OTHER PROGRAMS

The research proposed here is the first interdisciplinary program designed to understand seasonal and interannual changes in the physical-chemical structures of the Gulf of Alaska shelf and their relationship to zooplankton and planktivorous fish, especially juvenile salmon. The mechanisms that support the high productivity of this shelf are unknown and puzzling because the GOA shelf is a "downwelling" system. By providing us with an understanding of seasonal variability from an interannual perspective, this monitoring program is critical to elucidating the specific mechanisms fueling production on this downwelling shelf. The results from the research proposed here will enable us to better define a suite of easily measured variables useful in ecosystem monitoring in the future. In conjunction with the results from similar programs along the North American west coast, this set of variables will contribute towards a better understanding of the marine system of the Northeast Pacific Ocean and its response to changes in climate.

The following is a list of existing and planned programs with which data and information gathered by our monitoring program will be shared:

1) Weingartner has submitted a proposal under an ONR Broad Agency Announcement to the National Ocean Partnership Program, to deploy a buoy that would collect hourly bottom pressure, temperature and conductivity data throughout the water column, PAR and fluorescence data in the upper 50 m, and wind velocity, air temperature and pressure at the sea surface at station GAK1. The buoy will serve as a platform for additional sensors in the future and as the foundation of a long-term monitoring platform. J. Napp's shipboard measurement program is designed in part to guide the future incorporation of an acoustic sensor for zooplankton monitoring on the GAK1 mooring. The buoy will transmit data via Argos in real-time. Data from the mooring will be valuable in guiding sampling during this program and in future GLOBEC process studies on the GOA shelf. The buoy data will complement this proposal by providing information on the shorter period variability that we cannot address with the sampling plan proposed here.

2) We will compare our monitoring data from the northern shelf with measurements by the Canadians (E. Carmack, IOS, Sidney) from the British Columbian shelf in the southeast GOA. This comparison will improve our understanding of the spatial domain over which observed variations occur.

3) B. Finney (University of Alaska) is proposing to use paleorecords and stable isotopes to examine historical biological production in the GOA. We will provide him with samples of chlorophyll, fish, and zooplankton from our surveys for characterization of present-day seasonal isotopic composition of organisms on this shelf.

4) Three of us, Paul, Coyle, and Haldorson, are involved with the EVOS-supported SEA (Sound Ecosystem Assessment) and APEX (Alaska Predator Ecosystem Experiment) projects. These programs are examining primary production rates and the abundance and distribution of zooplankton, herring, YOY pink salmon, YOY pollock and other forage fish during spring and summer in Prince William Sound. Although the above studies are limited primarily to the sound and will end in 1998, the involvement of our research staff in the EVOS programs will facilitate scientific collaboration and integration of the resulting data sets gathered by EVOS and the monitoring program proposed here. The resulting integration of effort will substantially contribute to our understanding of coastal processes on the GOA shelf as a whole.

5) Our program complements the Ocean Carrying Capacity (OCC) program conducted by NMFS's Auke Bay Lab. The OCC program will work primarily in southeast Alaska, thereby extending the GOA spatial coverage. Haldorson is an external PI on the OCC program and will provide salmonid otoliths to OCC investigators along with size and condition data from those specimens.

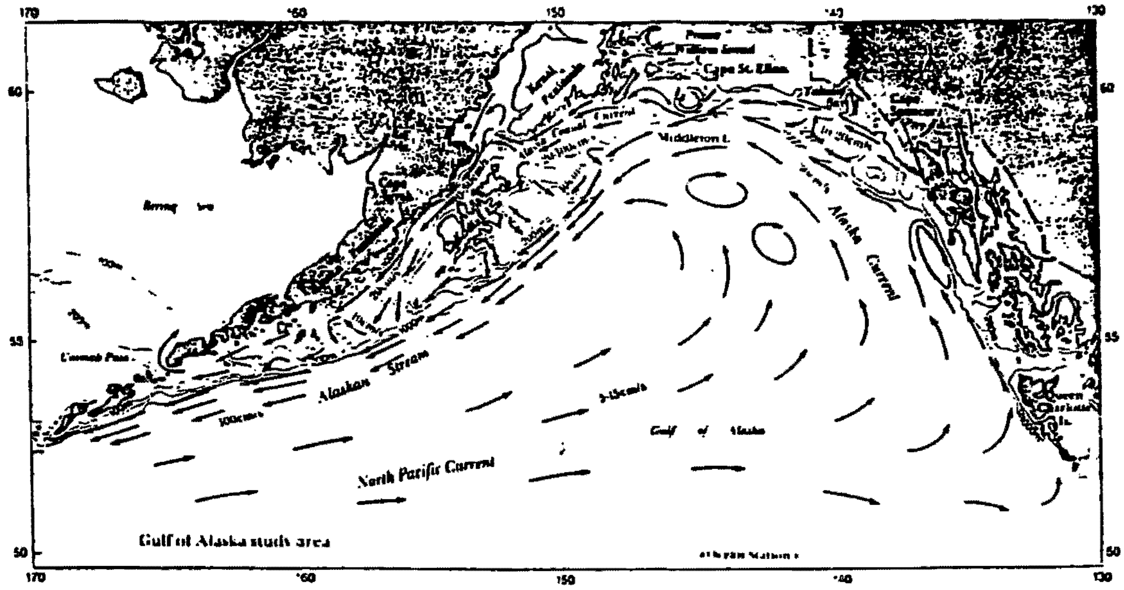


Figure 1. Schematic circulation of the Gulf of Alaska. (from Reed and Schumacher, 1986)

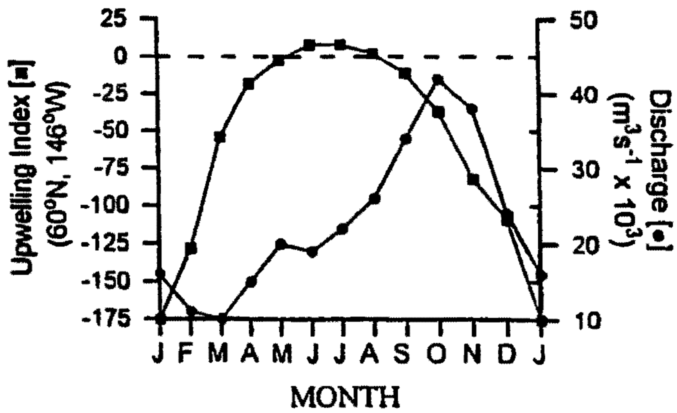


Figure 2. Mean monthly values of the upwelling index (from 1965–1992) and the estimated freshwater discharge (from 1930–1992) into the GOA using the hydrology model of Royer (1982).

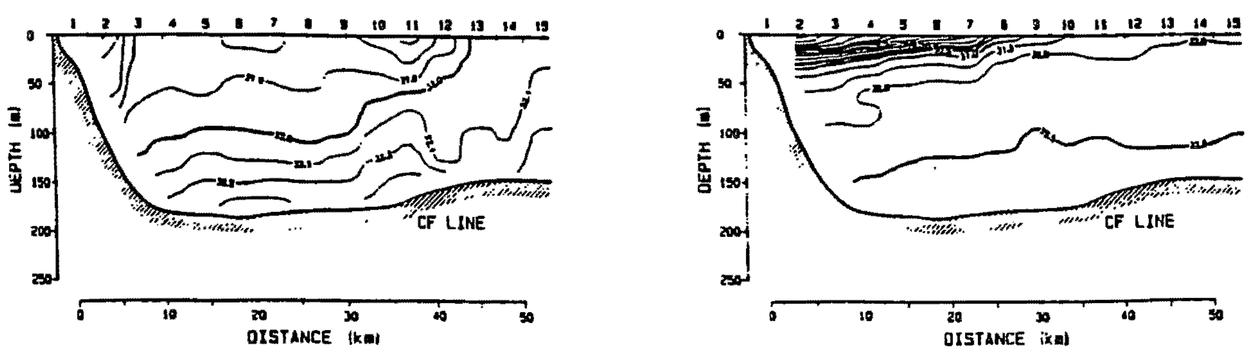


Figure 3. Cross-shelf salinity distribution in 1983; April (left) and September (right). (from Johnson et al., 1988)

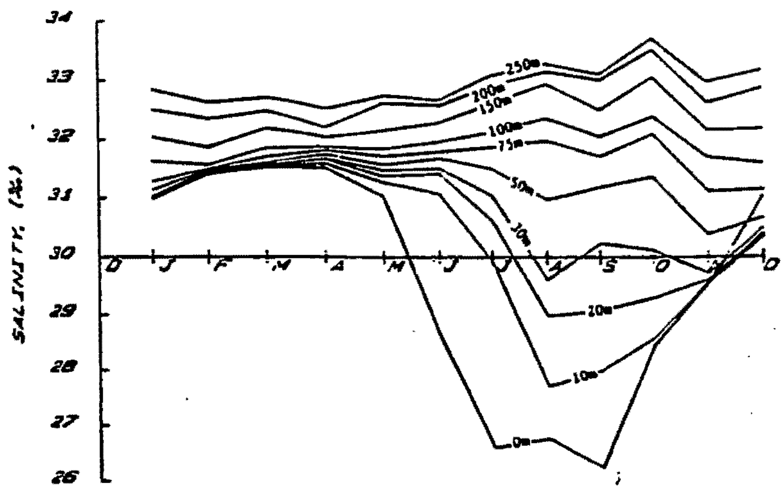


Figure 4. Mean monthly salinity at selected depths at GAK1 from 1970–1983. (from Xiong and Royer, 1984)

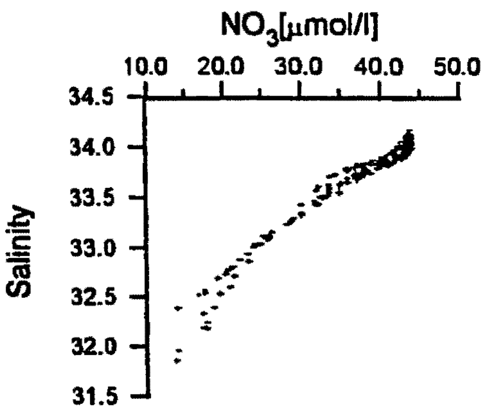
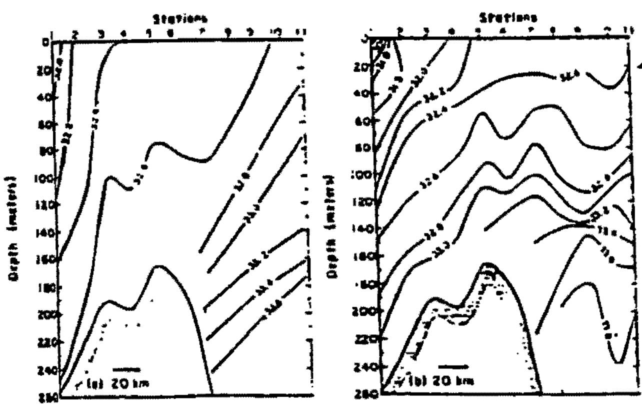


Figure 5. Vertical section of salinity along the Seward Line for winter (left and summer (right) showing inshore intrusion of saline water in summer. (from Royer, 1975)



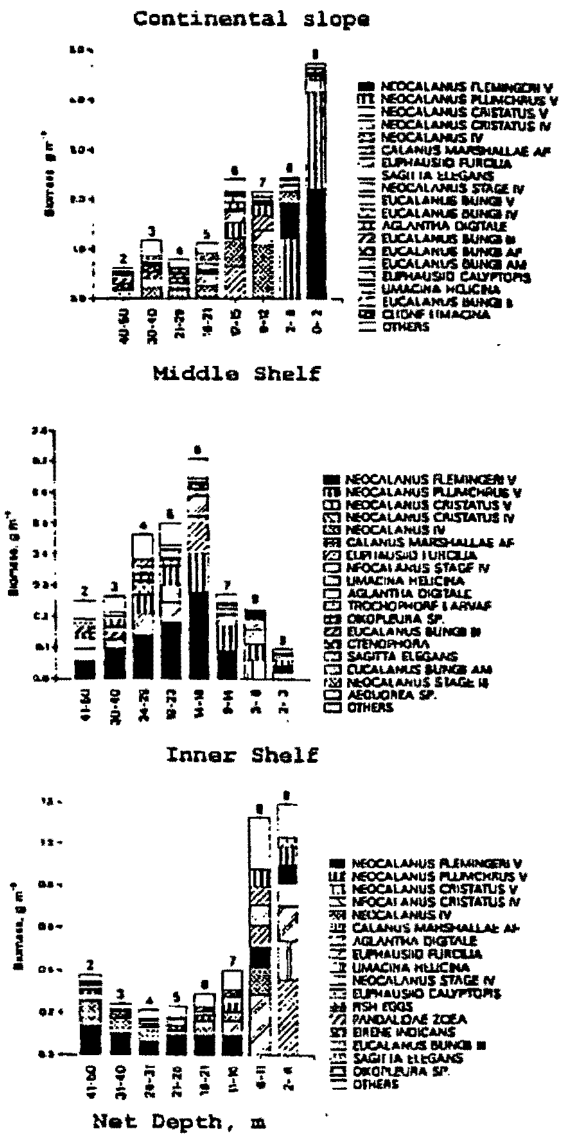


Figure 6. Salinity-NO_3 relationship from Alaska Stream and western GOA shelf stations occupied during WOCE P17N. Only data between 125 and 450 m are plotted.

Figure 7. Zooplankton abundance and taxa at various locations across the north central GOA shelf. The data were collected in May, 1996.

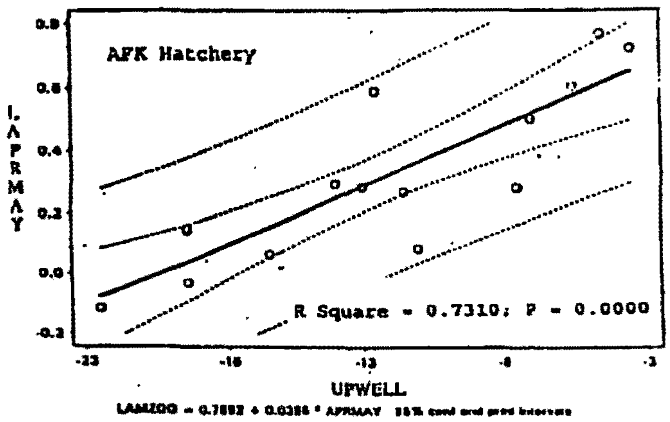


Figure 8. Regression plot of the logarithm of the April–May averaged phytoplankton settled volume against the April–May average upwelling index. (T. Cooney, pers. comm.)

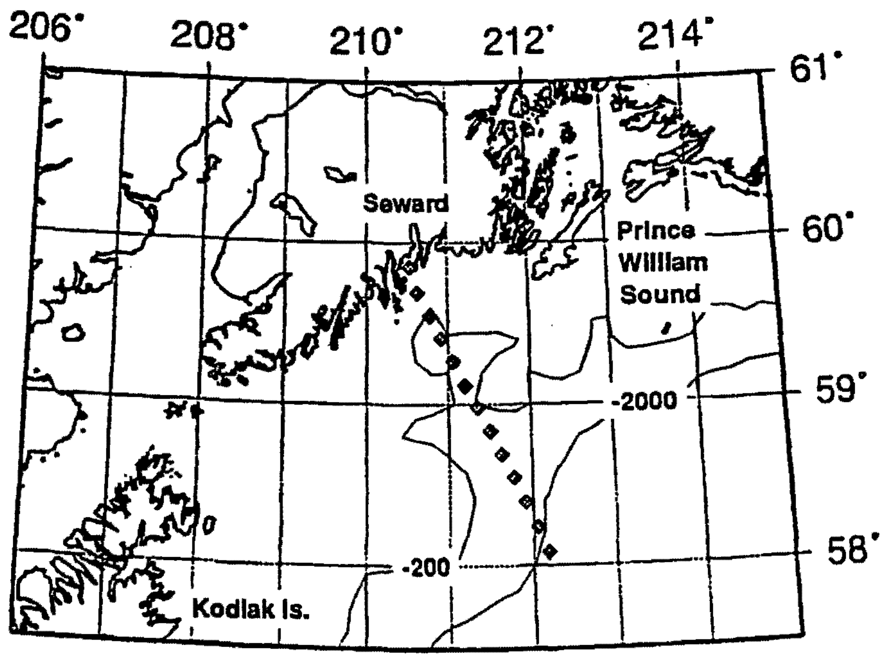


Figure 9. Location of the Seward Line with nominal locations of the proposed CTD and water sampling stations included (depths are in meters).

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APPENDIX 2. LETTER OF SUPPORT OFFER FROM GLOBEC PRINCIPAL INVESTIGATOR TO ROBERT H. DAY OF ABR

INSTITUTE OF MARINE SCIENCE

UNIVERSITY OF ALASKA-FAIRBANKS
FAIRBANKS, ALASKA 99775-1080

March 31, 1999

Dr. Robert H. Day
ABR, Inc.
Fairbanks, AK 99708

Dear Dr. Day,

On behalf of my co-investigators, I am writing to inform you that we welcome your participation in our NSF-NOAA funded GLOBEC program to the Gulf of Alaska. Your proposal to the EVOS Trustees Council, "Seabird-Oceanographic relationships in the northern Gulf of Alaska", provides an important and complementary data set to the GLOBEC program. We believe that your efforts, in conjunction with ours, will yield mutually beneficial results and a truly unique data set from the Gulf of Alaska. We are encouraged that our assessments of distinct shelf habitats and spatial scales of biological production appear to be corroborated by your seabird observations. We will support your project by providing you a berth on each of our cruises and by sharing our data with you. We look forward to this collaboration.

Sincerely,

Thomas J. Weingartner

Thomas J. Weingartner

Budget Category:	Authorized FFY 1999	Proposed FFY 2000						
Personnel	$0.0	$145.0						
Travel	$0.0	$4.6						
Contractual	$0.0	$4.3						
Commodities	$0.0	$0.2						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$154.1	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Indirect	$0.0	$0.0						
Project Total	$0.0	$154.1	N/A	N/A	N/A	N/A	N/A	N/A
Total Personnel Hours *	0	2,271						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:
ABR,Inc. has used **Hourly Rates** instead of **Monthly Costs.** The hourly rate shown is an all inclusive rate. ABR, Inc. requested permission from EVOS Trustee Council and received verbal permission from **Sandra Schubert** on April 12, 1999 to substitute fully burdened hourly rates for monthly costs and indirect costs.

Full-Time Equivalents (FTE's) have been changed to fully burdened Total Personnel Hours.

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Prepared: 4/12/1999

Project Number: 00287
Project Title: **SEABIRD-OCEANOGRAPHIC RELATIONSHIPS IN THE NORTHERN GULF OF ALASKA: INTEGRATION WITH NSF/NOAA STUDY "GLOBEC"**
Name: **ABR, Inc.**

FORM 4A
Non-Trustee
DETAIL

Personnel Costs:				* Hours	* Hourly		Proposed
Name		Position Description		Budgeted	Costs	Overtime	FFY 2000
Ritchie	R	Principal		4.0	$100.00	$0	0.4
Murphy	S	Research Coordinator		16.0	$94.00	$0	1.5
DeLong	T	Office/Contracts Manager		12.0	$69.00	$0	0.8
Day	R	Senior Scientist I		1138.0	$75.00	$0	85.4
Staff	D	Research Biologist II		891.0	$52.00	$0	46.3
Smith	M	GIS Specialist		100.0	$57.00	$0	5.7
Zusi-Cobb	A	Graphics Technician/GIS		56.0	$51.00	$0	2.9
Harshburger	D	Word Processor/Administrative Assistant		46.0	$39.00	$0	1.8
Staff		Clerk		8.0	$29.00	$0	0.2
		Subtotal		2271.0	N/A	0	
						Personnel Total	$145.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FFY 2000
EVOS Meetings in Anchorage (FAI-ANC)	275	2	5	160	1.4
Travel to/from Cruises (FAI-ANC)	275	7	0	160	1.9
Per Diem for Cruise travel (14 days @ $60/day)					0.8
Seward (7 person nights @ $40/night)					0.3
Fee (5%) on Travel Costs					0.2
				Travel Total	$4.6

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Prepared: 4/12/1999

Project Number: 00287
Project Title: **SEABIRD-OCEANOGRAPHIC RELATIONSHIPS IN THE NORTHERN GULF OF ALASKA: INTEGRATION WITH NSF/NOAA STUDY "GLOBEC"**
Name: **ABR, Inc.**

FORM 4B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed
Description	FFY 2000
1 Field Laptop Lease (1.5 months @ $350/month)-No 5% Fee on ABR Equipment Lease	0.5
2 Phone/Fax/Modem/Courier	0.1
3 Phone/Fax/Modem	0.5
4 Printing/Off-Site Photocopying	1.6
5 Publication Costs (1 paper @$1,000)	1.0
6 Slide preapration services for meetings	0.4
7 Fee (5%) on Contractual Costs (excluding ABR Equipment Lease)	0.2
Contractual Total	$4.3

Commodities Costs:	Proposed
Description	FFY 2000
1 Misc. Gear and Supplies	0.2
2 Fee (5%) on Commodity Costs	0.0
Commodities Total	$0.2

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Prepared: 4/12/1999

Project Number:
Project Title: **SEABIRD-OCEANOGRAPHIC RELATIONSHIPS IN THE NORTHERN GULF OF ALASKA: INTEGRATION WITH NSF/NOAA STUDY "GLOBEC"**
Name: **ABR, Inc.**

FORM 4B
Contractual &
Commodities
DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY2000
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 Library reference books	
2 Computer Resources	
3 GIS/Digitizing Station (s)	2
4 Office Space	
5 Equipment Storage	
6 Binoculars	2
7 Cameras	2

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Project Number:
Project Title: **SEABIRD-OCEANOGRAPHIC RELATIONSHIPS IN THE NORTHERN GULF OF ALASKA: INTEGRATION WITH NSF/NOAA STUDY "GLOBEC"**
Name: **ABR, Inc**

FORM 4B
Equipment
DETAIL

Prepared: 4/13/2000