Kametolook River Coho Salmon Subsistence Project

Project Number:	02247
Restoration Category:	General Restoration
Proposer:	J. McCullough, L. Scarbrough/ADFG
Lead Trustee Agency:	ADFG
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	Cont'd
Duration:	6th yr. 6 yr. project
Cost FY 02:	$30.8
Cost FY 03:	$0.0
Geographic Area:	Alaska Peninsula
Injured Resource/Service:	Subsistence

ABSTRACT

Subsistence users from the Alaska Peninsula Native Village of Perryville have noted significant declines in the coho salmon run in the nearby Kametolook River since the oil spill. Criminal settlement funds were used in FY 96 to determine what method would best restore the river's coho salmon stock to historic levels. This project will provide funding through FY 02 for the Alaska Department of Fish and Game to try conservative and safe restoration methods. In 1997, two instream incubation boxes were installed in the upper reach of the Kametolook River. In 1998, 1999, and 2000 holding pens were also used. Due to continual low escapement of coho into the Kametolook River system, the project will be unable to achieve the goal of restoration within two life cycles of the fish. In FY 01, the project will expand to investigate nearby coho stocks as potential brood sources for rehabilitation of the Kametolook coho run.

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,

(note: no pages 2 + 3)

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 2000, 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. A subsistence salmon household survey in Perryville for both the 1999 and 2000 seasons determined that virtually no one fished the Kametolook River for subsistence salmon, because people were concerned about the fish populations.

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 (1996-2001). 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 every winter since

1997, 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 (or longer if there is a need and funding available). 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. Phase 4 will be implemented in 2001. Due to continual low escapement of coho salmon into the Kametolook River system, an expansion of the project will investigate potential genetic and pathology brood stock concerns for the transport of coho salmon eggs and/or juvenile fish from nearby streams to the Kametolook River. River systems outside of the Perryville valley (other than the Kametolook, Three Star, and Long Beach Rivers) will be investigated and if fish transport permits are granted the transport of eggs and/or juvenile coho salmon will occur.

B. Methods/ May 1996 - September 2000

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 1996 - September 1997)

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.)

January 1997- 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.)

March - May 1997- 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).

June - July, 1997- 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.

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

September 1997- 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 1997 - September 1998)

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. (A detailed trip report is available.)

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. (A detailed trip report is available.)

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 1998 - September 1999)

October 1998- 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. (A detailed trip report is available.)

October 23, 1998- 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.

October 24, 1998- 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.

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

November 1998- 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. (A detailed trip report is available.)

November 10, 1998- 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, 1998- 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, 1998- 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, 1998- 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 - 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 17-19, 1999- Jim McCullough and Lisa Scarbrough attended Chignik RPT and CRRAA meeting and provided project status report of project. A Perryville Subsistence Workgroup was created consisting of representatives from: Perryville, Chignik

commercial fisherman and ADF&G staff members to look into identifying ways (in addition to the incubation boxes) to assist with the recovery of coho salmon in the Kametolook River.

March 23-26, 1999- 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". Attended the conference and presented the poster during the scheduled poster session.

April 9, 1999- Jim McCullough and Lisa Scarbrough participated in a teleconference with the Perryville Subsistence Workgroup. The Kametolook River project was discussed.

April 29 - May 4, 1999- Lisa Scarbrough traveled to Perryville with Jim McCullough to issue subsistence salmon permits and conduct key respondent interviews. The interviews were designed to further investigate the subsistence salmon fishery in Perryville as requested by the Perryville Subsistence Workgroup. Topics discussed in the interviews were directed at trying to learn how each salmon stock contributes toward meeting the salmon needs of Perryville, and alternative subsistence resources available. Life histories were also gathered for several respondents to document stocks used over time, locations of harvests, and ways each species is processed and cooked. Jim McCullough and local assistants attempted to travel to the incubation boxes on the Kametolook River, but heavy wet snow halted the trip. (A detailed trip report is available.)

Project 00247 (October 1999 - September 2000)

September - October 1999- Local Assistant, Jerry Yagie conducted stream surveys, counting coho in upper reaches of Kametolook River. Reports information to ADF&G's Jim McCullough.

October 25, 1999- Teleconference with ADF&G and the Perryville Subsistence Workgroup. The Kametolook Coho Restoration project was discussed.

October 28, 1999- Jim Fall (ADF&G Division of Subsistence) attended the Alaska State Board of Fisheries meeting in Fairbanks and gave a status report of the Perryville Subsistence Workgroup including the Kametolook project.

November 1-5, 1999- Jim McCullough participated in a field trip to Perryville, Alaska. The purpose of the trip included: 1) survey Kametolook River's salmon escapement, 2) set up holding pens for ripening adult coho salmon, 3) captured and placed in holding pens adult coho salmon, 4) cleaned and set up the coho salmon school aquarium project and 5) met with villagers to determine how the 1999 salmon subsistence fishery was proceeding. (A detailed trip report is available.)

November 1-2, 1999- Travel for Jim McCullough from Kodiak to Perryville via Anchorage and King Salmon.

November 3, 1999- Bad weather prevented travel to the Kametolook River spawning area so Jim McCullough spent the day cleaning and setting up the school aquarium and met with the junior and high school teachers to discuss the school aquarium project.

November 4, 1999- Jerry Yagie, Jim McCullough and one high school student, Michael Shangin set up the holding pens in the spring above the Kametolook River incubation boxes. They also surveyed the Kametolook River for the presence of any fish. In the spring of 1999, about 75% of the glacial water that had been flowing into the Long Beach River changed course and began flowing into the Kametolook River. The additional flow nearly doubled the size of the Kametolook River and made extremely poor salmon survey conditions due to turbidity. They observed only 3 coho salmon immediately below the incubation box site, an additional 6 coho salmon in the main stem and 5 coho salmon in clear water tributaries. Jerry noted that in one clear tributary, where they saw only 2 sockeye and one coho salmon, he had observed 20 coho salmon about two weeks earlier. They also saw 10 sockeye salmon in the main stem of the river.

November 5, 1999- Jerry Yagie, Michael Shangin, and Jim McCullough captured 6 female and 16 male coho in the stream reach just below the incubation boxes. They kept and put in the holding pens all 6 females and 13 male coho salmon. They were surprised by this catch because we had only observed 3 salmon the previous day in this area. The glacial melt water made the survey conditions very poor.

During this trip Jim asked several people about the on-going coho salmon subsistence fishery. He was informed that fishing in Sleepy Hollow and Humpback Bay was slow while Anchor Bay and Ivan River fishing was generally good. One person said they had just returned from Chignik Lake with 96 "red" sockeye salmon from the Clark River and that their fishing partners had also taken about 100 fish each for a total of ~300 sockeye salmon. People also noted that the coho run to Ivanof was good with plenty of fish for that village. Jim returned to Kodiak, the evening of November 5.

November 9, 1999- Jerry Yagie and another person caught 3 female and 7 male coho salmon and added these to the holding pens.

November 10, 1999- Jim also presented a paper on the Kametolook project at the annual meetings of the American Fisheries Society in Anchorage.

November 15-19, 1999- Jim McCullough participated in a field trip to Perryville, Alaska. The purpose of the trip included: 1) a coho salmon egg take from the Kametolook River's salmon stock, 2) collecting biological samples from the salmon used in the egg take, 3) winterizing the holding pens and other equipment and 4) placing fertilized eggs in the incubation boxes and in the school aquarium. (A detailed trip report is available.)

November 15-16, 1999- Travel for Jim McCullough from Kodiak to Perryville via Anchorage and King Salmon.

November 17 1999- Jerry Yagie, Austin Shangin, five junior and high school students (Boris Kosbruk, Alec Phillips, Harry (JR) Kosbruk, Ryan O'Domin and Jonathan Kosbruk) and Jim McCullough collected eggs and milt from the coho salmon that had been placed in the holding pens. They also collected kidney, ovarian and genetic samples. Standard delayed fertilization techniques were used and the fertilized eggs were placed in the incubation boxes. About 400 eggs from a singe female and milt from 2 males were held back for the school aquarium. The holding pens and other equipment that was no longer needed was winterized at Jerry Yagie's house.

November 18, 1999- Jim McCullough met with the grade school and high school students that did not participate during the previous days egg take. Again using standard delayed fertilization techniques; the eggs were fertilized and added to the aquarium. Students got to watch the process and a discussion of the care of the eggs and aquarium followed. Jim returned to Anchorage that evening arriving about 8:30 p.m.

November 19, 1999- Jim McCullough dropped off the kidney and ovarian samples at the ADF&G lab and the genetic samples at the US Fish and Wildlife lab in Anchorage. He returned to Kodiak that evening.

November 1999 - May 2000- Jerry Yagie continued to conduct bi-monthly trips to the instream incubation boxes to check their condition. He provided telephone reports to the ADF&G staff.

January 2000- Jim McCullough presented a paper at Annual EVOS Restoration Workshop in Anchorage summarizing the Kametolook project. His presentation emphasized the project's community involvement. The poster created for the EVOS 10th annual conference in 1999 was displayed again at 2000 annual workshop.

April 4, 2000- Jim McCullough participated in a teleconference for the Chignik RPT and CRRAA meeting and provided project status report of the project.

April 2000- Jim McCullough and Lisa Scarbrough (PI's) met via teleconference April 6 to discuss the progress of the project and identify measurable tasks for FFY-2001. Prepared project DPD for 2001 funding.

Project 01247 (October 2000 - September 2001)

September - October 2000- Local assistant, Jerry Yagie conducted stream surveys, counting coho in upper reaches of Kametolook River. Reports information to ADF&G's Jim McCullough.

November 2000- Jim McCullough traveled to Perryville November 1-5 and assisted by local assistants Jerry Yagie and Andrew Shangin surveyed Kametolook River's salmon escapement, set up net holding pens, captured and placed adult coho salmon into holding pens, cleaned and set up the coho salmon school aquarium, and met with the community to determine how the 2000 subsistence salmon fishery was proceeding. (A detailed trip report is available.)

Jim returned to Perryville November 13-18 and harvested eggs and milt from salmon held in the holding pens, added fertilized eggs to the egg boxes and school aquarium, and winterized holding pens and other equipment. Additional ripe salmon were not found and no biological samples were collected due to few salmon available for sampling and kidney sample requirements were satisfied in 1999. (A detailed trip report is available.)

December 2000 - May 2001- Local assistants make monthly trips to incubation boxes to inspect condition of boxes and eggs. ADF&G analyze commercial and subsistence harvest dada for community of Perryville.

March 2001- Jim McCullough met with Chignik Regional Aquaculture Association (CRAA) and Perryville Subsistence work group to discuss project and other potential restoration techniques. March 12-14, 2001 (Anchorage).

April 2001- Jim McCullough attended Kodiak ADF&G staff meeting in part to discuss the project.

April 5, 2001- Teleconference with CRAA consultant, ADF&G pathology, genetics and fish transport permit staff on restoration techniques and requirements for obtaining coho eggs or fry from other river systems and transporting them to Kametolook River.

SCHEDULE

A.1. Measurable Project Tasks remaining for FY 01 (May 2001 - September 2001)

May - September 2001:

-Chignik Regional Planning Team will meet in Chignik. A status report of the Kametolook Project will be given and Perryville Subsistence Workgroup will meet.

-Apply for FRP permits to collect coho salmon pathology and genetic samples from potential brood source streams (Ivanof, Smokey Hollow, and Ivan Rivers) for

future FTP permits for eggs and/or juvenile fish transport from area rivers to the Kametolook River.

-Conduct stream surveys and genetic/pathological work in area river systems for FTP requirements to transport coho eggs and/or juvenile fish to Kametolook River in fall of 2001 and 2002.

-Complete annual report 01247

A.2. Measurable Project Tasks for FY 02 (October 2001 - September 2002)

October 2001:

-Local Perryville assistants will conduct stream surveys for coho salmon in Kametolook River, and report findings to ADF&G.

-Two ADF&G personnel will travel to Perryville to work with PV assistants and conduct stream surveys of Kametolook River, capture adult coho salmon (assisted by 2 or 3 Perryville residents), and will place the salmon in holding pens until they are ripe. In addition, they will start or continue with stream surveys and genetic/ pathological work in local area river systems for FTP requirements to transport coho eggs and/or juvenile fish to Kametolook River and egg boxes.

-Consult with teachers and set up school aquarium and obtain school FTP.

-Perform maintenance of instream incubation system and school aquarium.

November - December 2001:

-Two ADF&G staff travel to Perryville to meet with Perryville personnel and conduct escapement surveys.

-Perform a coho salmon egg take (Kametolook and another nearby river if FTPs allows), 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.

-Meet with Chignik RPT/CRAA and the Perryville SubsistenceWorkgroup to discuss the Kametolook Project.

December 2001 - May 2002:

-Perryville assistants make monthly trips to incubation boxes to inspect condition of boxes and eggs.

-ADF&G analyze subsistence and commercial harvest data.

-Attend EVOS annual restoration workshop. Anchorage.

-Attend Chignik Subsistence Workgroup meeting. Anchorage.

-Attend Board of Fisheries meeting to discuss Kametolook project. Anchorage or Kodiak.

April - May 2002:

-Meeting with assessment team to evaluate the project.

-Write FY 01 annual report.

-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 boxes for fry release.
-Sanitize boxes after fry leave.
-Students release aquarium fry into Kametolook River.

June - September 2002:
-Regional Planning Team and Perryville Subsistence Workgroup meeting in Chignik Bay to review success of the project and evaluate if need to continue project and look for other sources of funding.
-Write FY-02 annual report and final project report to EVOS Trustee Council.

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 including 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.

In 1999 and 2000, virtually no one from Perryville chose to catch any of their subsistence coho from the Kametolook River to help with the rehabilitation of it's salmon runs. In addition, Chignik commercial fisherman delivered two loads of fresh coho salmon (approximately 600 fish) to Perryville residents in August of 1999 (given mostly to the elders). This delivery was greatly appreciated, and also took some of the pressure off of the Kametolook River. This action was in part due to recommendations made by the Perryville subsistence workgroup which consists of representatives of Perryville subsistence users, Chignik commercial fisherman, and ADF&G staff. The workgroup was created in 1999 and continues to meet (as recommended by the Alaska State Board of Fisheries) in order to assist Perryville with the rehabilitation of their declining coho salmon stocks (in addition to this incubation box project). These actions as well as other options will be evaluated and discussed with the community annually on a regular basis.

At the start of this project in 1997 and through 2000, the ADF&G team expected the stream side incubation boxes, in conjunction with some fishing restraints, and the Perryville subsistence workgroup would provide sufficient coho salmon to rehabilitate the run within two to three coho life cycles. Due to the low escapement of coho salmon into the Kametolook River system, this project will be unable to achieve this goal. In the last five years (1996-2000) the total estimated adult coho escapement has ranged from 85 (2000) to 724 (1997) fish and averaged about 289 salmon. The project's instream incubator boxes were designed to hold eggs from 60 females or use 120 total salmon. Due to the difficulty of capturing ripe female coho salmon and the low escapements we have always used less than 10 females for the annual egg take.

We are requesting an expansion of the project to investigate potential genetic and pathology brood stock sources from nearby river systems. If the scope of the project is broadened, we intend to collect coho salmon samples in the Ivanof, Smokey Hollow, and Ivan Rivers and if budgets allow, also from Humpback and Fishrack systems for pathology and genetic analysis. If fish transport permit applications are approved, we will transport eggs and/or juvenile fish to the Kametolook River to help in restoring this subsistence salmon run.

C. Completion Date

The project will be completed by September 30, 2002 due to the cut off of funding from the EVOS TC. If another funding source can be obtained after that date and the community of Perryville is still interested in participating, it is recommended that the project continue until coho salmon runs have been fully restored to satisfy the needs of Perryville subsistence users.

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 to date. These people 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 (retired), Fish Biologist III for Habitat and Restoration, Anchorage, Dave Owen (retired), Fish Biologist III, Chignik/Kodiak; George Pappas, Fish Biologist III, Chignik/Kodiak; Wayne Dolezal, Habitat Biologist III for Habitat and Restoration, Anchorage and Pete Velsco (retired), Fish Culturist II for Commercial Fisheries, Nome.

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 along with Joe Sullivan (retired) have extensive experience in fisheries restoration and enhancement with the department. George Pappas replaced Dave Owen (retired 1999) as Chignik's Area Management Biologist in 1999. Both Dave and George have had several years of experience with fisheries in Alaska. Wayne Dolezal is one of the State's leading habitat experts in Alaska. Pete Velsco (retired 1997) had several years of varied experience with instream and recirculating incubation box projects, particularly in Norton Sound. Labor (with the exception of 0.5 months/year for Lisa Scarbrough) 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

American Fisheries Society, Anchorage. November 9-11, 1999. Paper of project was presented by Jim McCullough, ADF&G, Kodiak.

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, 99247 and 00247 (in Federal Fiscal Years 1997, 1998, 1999 and 2000).

PRINCIPAL INVESTIGATORS

Jim McCullough, Fish Biologist III
Alaska Department of Fish and Game
Division of Commercial Fisheries
211 Mission Road
Kodiak, Alaska 99615
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. Co-leader 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: lisa_scarbrough@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

Jerry Yagie, Chief Community Coordinator
Perryville, Alaska
Phone: (907) 853-2261

Bill Hauser, Fish Biologist IV
Alaska Department of Fish and Game
Division of Habitat and Restoration
333 Raspberry Road

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Phone: (907) 267-2172
Fax: 267-2285
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George Pappas, Fish Biologist III
Chignik Area Management Biologist
Alaska Department of Fish and Game
Division of Commercial Fisheries and Management
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Wayne Dolezal, Habitat Biologist III
Alaska Department of Fish and Game
Division of Habitat and Restoration
333 Raspberry Road
Anchorage, Alaska 99518-1599
Phone: (907) 267-2333
Fax: 267-2285
E-mail: wayne_dolezal@fishgame.state.ak.us

Chuck McCallum, Chairman
Chignik Regional Planning Team and Chignik Regional Aquaculture Association
(and Perryville Subsistence Workgroup)
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

Budget Category:	Authorized FY 2001	Proposed FY 2002						
Personnel	$2.9	$9.8						
Travel	$6.4	$8.3						
Contractual	$11.8	$10.1						
Commodities	$0.3	$0.2						
Equipment	$0.0	$0.2	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$21.4	$28.6	Estimated FY 2003					
General Administration	$1.3	$2.2						
Project Total	$22.7	$30.8	N/A					
Full-time Equivalents (FTE)	0.5	2.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: An Environmental Assessment for all years of the project was approved in 1997. FY 2002 is the final year and evaluation of the project.

This project was originally funded by Criminal Settlement funds in 1996, and has been funded since 1997 through the EVOS TC. The budget estimate for 2002 for staff time has increased from previous years of the project due to additional time needed for writing both annual and final reports and to develop and monitor the subcontract with Perryville Village Council. In addition, due to continual low escapement of coho in the Kametolook River system, this year the project would like to test other coho runs as potential brood sources and transport coho eggs or juvenile fish from streams outside Kametolook River to aid in restoration of the Kametolook coho run (if FTP permits allow). This will require additional travel, field time and labor from a F&W Technician to assist the PI for genetic and pathological sampling, capturing fry and/ or harvesting eggs and transporting to the Kametolook River. The school aquarium also needs to be replaced (the original glass tank cracked in 2000).

FY02

Project Number: 02247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: April 10, 2001/Revise[illegible]

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2002
Name	Position Description					
						0.0
Lisa Scarbrough	Subsistence Resource Specialist II (logistics/ report writing annual and final)	16K	1.5	5.7	0.0	8.6
						0.0
						0.0
To be determined	Fish and Wildlife Tech II / Kodiak (assist with genetic sampling/ egg take)	9D	0.5	2.4	0.0	1.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.0	8.1	0.0	
					Personnel Total	$9.8

Travel Costs:	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2002
Description					
					0.0
					0.0
* Kodiak to Anchorage	0.4	5	13	0.1	3.3
Anchorage to Perryville	0.8	4	18	0.1	5.0
					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
			Travel Total		$8.3

FY02

Project Number: 02247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Agency: Alaska Department of Fish and Game

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs:		Proposed FY 2002
Description		
4A Linkage	1) Contract with Native Village of Perryville (Perryville wages/ gasoline/ ATV or boat use/ insurance/ Village Admin. Fee (10%)	9.8
	2) Shipping costs aquarium and misc. maintenance supplies/ to Perryville, via USPS or Peninsula Airways	0.3
When a non-trustee organization is used, the form 4A is required.	**Contractual Total**	$10.1

Commodities Costs:	Proposed FY 2002
Description	
Purchase of general maintenance supplies for incubation boxes/ egg take equipment/ fish holding pens temperature instruments/ school aquarium/ film development etc.	0.2
Commodities Total	$0.2

FY02

Project Number: 02247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Agency: Alaska Department of Fish and Game

FORM 3B
Contractual & Commodities DETAIL

'Prepared: April 10, 2001/Revise[illegible]

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2002
			0.0
			0.0
school aquarium (R)			0.2
			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**	$0.2

Existing Equipment Usage: Description	Number of Units	Inventory Agency
None		

FY02

Project Number: 02247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Agency: Alaska Department of Fish and Game

FORM 3B
Equipment
DETAIL

Budget Category:	Authorized FY 2001	Proposed FY 2002						
Personnel	$6.2	$5.4						
Travel	$1.2	$0.0						
Contractual	$4.4	$4.7						
Commodities	$0.0	$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$11.8	$10.1	Estimated FY 2003					
Indirect								
Project Total	$11.8	$10.1	$0.0					
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY02

Project Number: 02247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Name: Perryville Village Council/ Peninsula Airways

FORM 4A
Non-Trustee
SUMMARY

'Prepared: April 10, 2001/Revise[illegible]

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2002
						0.0
						0.0
	To be determined	Perryville/ Project Facilitator and Assistants				5.4
						0.0
						0.0
	Note: Approximately 54 days of work @ about $100.00/ day labor					0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	0.0	0.0	0.0	
					Personnel Total	$5.4

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2002
						0.0
						0.0
	none					0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$0.0

FY02

Project Number: 02247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Name: Perryville Village Council/ Peninsula Airways

FORM 4B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed FY 2002
Description	
Perryville contract: Approximately 45 days of ATV or skiff use @ $50.00/ day (wet)	2.3
Perryville Village Administrative fee at 10% of contract (not including insurance costs)	0.8
Insurance for workman's compensation and general liability required of Perryville as contractor of the project by the State of Alaska	1.3
Air freight costs to Peninsula Airways to ship school aquarium and other project supplies to Perryville	0.3
Contractual Total	$4.7

Commodities Costs:	Proposed FY 2002
Description	
None	
Commodities Total	$0.0

FY02

Project Number: 02247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Name: Perryville Village Council/ Peninsula Airways

FORM 4B
Contractual & Commodities DETAIL

'Prepared: April 10, 2001/Revise

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 2002
Description			
None			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number of Units
Description	
None	

FY02

Project Number: 02247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Name: Perryville Village Council/ Peninsula Airways

FORM 4B
Equipment
DETAIL

02258

approved TC 8-6-01

Project Management

Project Number:	02250
Restoration Category:	Research, Monitoring and General Restoration
Proposer:	All
Cost FY 02:	$181,700

ABSTRACT

Project management represents those costs incurred by the state and federal Trustee agencies in fulfilling their responsibility to ensure that individual projects are managed consistent with the Memorandum of Agreement and Consent Decree, the Restoration Plan, and Trustee Council authorization. Tasks performed by project managers include coordinating activities between principal investigators and the Restoration Office, reviewing project expenditure activity, assisting in the development of project proposals, and tracking project reports.

INTRODUCTION

The FY 02 proposal for project management reflects Trustee Council guidance to continue reductions in overall programmatic and administrative costs consistent with the reduced restoration program. In FY 01, the Trustee Council authorized a Work Plan budget of approximately $6.0 million inclusive of project management costs of $284,300. In FY 02, it is anticipated that the Trustee Council will approve a work plan budget of approximately $5 million inclusive of project management costs of $181,700. A decision on whether or not any project management funds will be provided once funding has shifted to GEM (FY 03 and beyond) has not yet been made.

NEED FOR THE PROJECT

The project manager provides a link between the Restoration Office and the principal investigators. Project managers are to:

- Attend the annual Restoration Workshop;
- Attend Restoration Work Force meetings (roughly 4 a year);
- Ensure that projects are implemented consistent with the Trustee Council Procedures and/or state and federal procedures, including NEPA compliance;
- Monitor projects to ensure they meet their stated goals, objectives and schedules consistent with the funding authorized;
- Administer contracts that implement approved projects, including reviewing and approving invoices;
- Submit quarterly project reports to the Restoration Office, and ensure that annual and final reports and other contract deliverables are acceptable;
- Facilitate the printing/distribution of project reports to ARLIS; and
- Track the inventory of equipment purchased with Joint Trust Funds.

COMMUNITY INVOLVEMENT

Project managers for each project are available to the public to answer questions and provide information on the restoration projects they manage. Project managers also work with the Community Involvement Coordinator and Community Facilitators (see Project /052) as appropriate to address community involvement goals.

PROJECT DESIGN

A. Objectives

The role of the project manager is to ensure that projects funded by the Trustee Council are accomplished on time and consistent with the legal and regulatory requirements governing each project and Trustee Council procedures.

B. Methods

Project managers track project expenditures and status information and provide progress updates to the Restoration Office.

C. Cooperating Agencies, Contracts and other Agency Assistance

Organizational and administrative structures vary by agency. Certain projects have multiple agencies involved; others do not. Some projects involve contracts; others do not. In some cases, an agency's project management functions are accomplished in whole or in part by the agency liaison funded through the Project 02100/Restoration Work Force budget. In other cases, project management funds are provided in addition to liaison funding to support the management of numerous or complex projects.

SCHEDULE

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

October 10-12:	Attend Annual Workshop
October 31:	Submit prior year fourth quarter expenditure and project status information to the Restoration Office.
December 31:	Submit updated inventory of equipment purchased with Joint Trust Funds to the Restoration Office.
January 31:	Submit first quarter expenditure and project status information to the Restoration Office.
April 15:	Submit Detailed Project Descriptions and detailed budgets for FY 2003 proposals to the Restoration Office.
April 30:	Submit second quarter expenditure and project status information to the Restoration Office.
July 31:	Submit third quarter expenditure and project status information to the Restoration Office.

B. Project Milestones and Endpoints

Not applicable to this project.

C. Completion Date

Funding for project management will likely be provided each year in which restoration projects are funded. Once the transition is made in FY 03 to funding through the Restoration Reserve, the need for project management funds will be reassessed.

PUBLICATIONS AND REPORTS

The project manager's role is to ensure timely completion of annual and/or final projects reports. They do not prepare reports themselves.

PROFESSIONAL CONFERENCES

All project managers are required to attend the Annual Restoration Workshop.

NORMAL AGENCY MANAGEMENT

The project managers perform tasks specific to the *Exxon Valdez* oil spill restoration program that are not part of normal agency management.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Project managers facilitate communication among projects as well as between researchers and the Restoration Office.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

Not applicable to this project.

PROPOSED PRINCIPAL INVESTIGATOR, IF KNOWN

Not applicable to this project.

Approved TC 5-6-01

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Agency Req FY 02	ED Rec FY 2002	ED REC FY 02 AGENCY TOTALS					
				ADEC	ADF&G	ADNR	USFS	DOI	NOAA
				$10.3	$60.6	$8.6	8.7	$36.2	$57.3
Personnel	$247.2	$235.5	$158.0						
Travel	$0.0	$0.0	$0.0						
Contractual	$0.0	$0.0	$0.0						
Commodities	$0.0	$0.0	$0.0						
Equipment	$0.0	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$247.2	$235.5	$158.0						
General Administration	$37.1	$35.3	$23.7						
Project Total	$284.3	$270.8	$181.7						
Full-time Equivalents (FTE)	0.0	0.0	0.0						

Comments:

2002

Prepared:7/27/01

Project Number: 02250
Project Title: Project Management
Lead Agency: All

FORM 2A
MULTI-TRUSTEE
AGENCY
SUMMARY

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Agency Req. FY 02	ED Rec FY 2002
Personnel	$16.6	$41.3	$8.9
Travel			
Contractual			
Commodities			
Equipment			
Subtotal	$16.6	$41.3	$8.9
General Administration	$2.5	$6.2	$1.4
Project Total	$19.1	$47.5	$10.3
Full-time Equivalents (FTE)			

LONG RANGE FUNDING REQUIREMENTS

NOTE: GA has been increased from $1.2 to $1.4 to accommodate rounding elsewhere in budget.

Personnel Costs:			FY 2001 Months	ED Rec FY 2002 GS/Range/	Months	Monthly		Proposed
Name	Position Description		Budgeted	Step	Budgeted	Costs	Overtime	FY 2002
								0.0
Marianne See			2.0	26E	1.0	8.3		8.3
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
	Subtotal	0.0	2.0		1.0	8.3	0.0	$8.3

2002

Project Number: 02250
Project Title: Project Management
Agency: Alaska Department of Environmental Conservation

FORM 3A
PROJECT
MANAGEMENT

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Agency Req FY 02	ED Rec FY 2002
Personnel	$80.2	$68.6	$52.7
Travel			
Contractual			
Commodities			
Equipment			
Subtotal	$80.2	$68.6	$52.7
General Administration	$12.0	$10.3	$7.9
Project Total	$92.2	$78.9	$60.6
Full-time Equivalents (FTE)			

LONG RANGE FUNDING REQUIREMENTS

Personnel Costs:			FY 2001 Months	ED Rec FY 2002 GS/Range/	Months	Monthly		Proposed
Name	Position Description		Budgeted	Step	Budgeted	Costs	Overtime	FY 2002
								0.0
W. Hauser	Liaison/Project Manager		6.5		5.5	6.8		37.4
C. Slater	Liaison		1.0		0.0	0.0		0.0
C. Rozen	Librarian		4.0		2.5	6.1		15.3
								0.0
								0.2
								0.0
								0.0
								0.0
								0.0
		Subtotal	0.0	11.5		8.0	12.9	0.0	$52.7

2002

Project Number: 02250
Project Title: Project Management
Agency: Alaska Department of Fish and Game

FORM 3A
PROJECT
MANAGEMENT

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Agency Req FY 02	ED Rec FY 2002
Personnel	$14.8	$15.0	$7.5
Travel			
Contractual			
Commodities			
Equipment			
Subtotal	$14.8	$15.0	$7.5
General Administration	$2.2	$2.3	$1.1
Project Total	$17.0	$17.3	$8.6
Full-time Equivalents (FTE)			

LONG RANGE FUNDING REQUIREMENTS

			FY 2001	ED Rec FY 2002				
Personnel Costs:			Months	GS/Range/	Months	Monthly		Proposed
Name	Position Description		Budgeted	Step	Budgeted	Costs	Overtime	FY 2002
Carol Fries	Natural Res. Manager II		2.0	20	1.0	7.5		0.0 7.5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
	Subtotal	0.0	2.0		1.0	7.5	0.0	$7.5

2002

Project Number: 02250
Project Title: Project Management
Agency: Alaska Department of Natural Resources

FORM 3A
PROJECT
MANAGEMENT

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Agency Req FY 02	ED Rec FY 2002
Personnel	$10.6	$19.0	$7.6
Travel			
Contractual			
Commodities			
Equipment			
Subtotal	$10.6	$19.0	$7.6
General Administration	$1.6	$2.9	$1.1
Project Total	$12.2	$21.9	$8.7
Full-time Equivalents (FTE)			

LONG RANGE FUNDING REQUIREMENTS					

Personnel Costs:			FY 2001 Months	ED Rec FY 2002 GS/Range/	Months	Monthly		Proposed
Name	Position Description		Budgeted	Step	Budgeted	Costs	Overtime	FY 2002
								0.0
B. McElmurry	Program Manager		2.0		0.0	0.0		0.0
K. Holbrook	Program Manager		0.0		1.0	7.6		7.6
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
	Subtotal	0.0	2.0		1.0	7.6	0.0	$7.6

2002

Project Number: 02250
Project Title: Project Management
Agency: United States Forest Service

FORM 3A
PROJECT
MANAGEMENT

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Agency Req FY 02	ED Rec FY 2002
Personnel	$44.0	$31.5	$31.5
Travel			
Contractual			
Commodities			
Equipment			
Subtotal	$44.0	$31.5	$31.5
General Administration	$6.6	$4.7	$4.7
Project Total	$50.6	$36.2	$36.2
Full-time Equivalents (FTE)			

LONG RANGE FUNDING REQUIREMENTS

				FY 2001	ED Rec FY 2001				
Personnel Costs:				Months	GS/Range/	Months	Monthly		Proposed
Name	Position Description			Budgeted	Step	Budgeted	Costs	Overtime	FY 2002
									0.0
D. Irons	Project Manager - FWS			2.0	GS-12	0.0	0.0		0.0
D. Bohn	Project Manager - USGS			5.0	GS-12	5.0	6.3		31.5
									0.0
									0.0
									0.0
									0.0
									0.0
									0.0
									0.0
		Subtotal	0.0	7.0		5.0	6.3	0.0	$31.5

2002

Project Number: 02250
Project Title: Project Management
Agency: United States Department of the Interior

FORM 3A
PROJECT
MANAGEMENT

FY 02 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Agency Req FY 02	ED Rec FY 2002
Personnel	$81.0	$49.8	$49.8
Travel			
Contractual			
Commodities			
Equipment			
Subtotal	$81.0	$49.8	$49.8
General Administration	$12.2	$7.5	$7.5
Project Total	$93.2	$57.3	$57.3
Full-time Equivalents (FTE)			

LONG RANGE FUNDING REQUIREMENTS

			FY 2001	ED Rec FY 2002				
Personnel Costs:			Months	GS/Range/	Months	Monthly		Proposed
Name	Position Description		Budgeted	Step	Budgeted	Costs	Overtime	FY 2002
								0.0
								0.0
B. Wright	Project Manager		9.0		0.0	0.0		0.0
A. Moles	Project Manager		0.0	GS13-4	6.0	8.3		49.8
TBD	Fisheries Biologist		1.0		0.0	0.0		0.0
								0.0
								0.0
								0.0
								0.0
								0.0
	Subtotal		10.0		6.0	8.3	0.0	$49.8

2002

Project Number: 02250
Project Title: Project Management
Agency: National Oceanic and Atmospheric Administration

FORM 3A
PROJECT
MANAGEMENT

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

Sockeye Salmon Stocking at Solf Lake

Project number:	02256b
Restoration Category:	General Restoration
Proposer:	USFS
Lead Trustee Agency:	USFS
Cooperating Agencies:	none
Alaska Sea Life Center:	No
Duration:	7th year, 7-year project
Cost FY 2002:	$15,500
Cost FY 2003:	
Geographic Area:	Prince William Sound
Injured Resource:	Subsistence/Sockeye Salmon

ABSTRACT

This project is designed to benefit subsistence users of Western Prince William Sound. Solf Lake has been recognized for many years as a site 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 proved unsuccessful. 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 and outlet flow control structures were completed in 1997 and 1998. The reconstruction of the fishway in the eastern channel was completed in the summer of 2000 and returning adult salmon to Solf Lake will be monitored starting in 2001to evaluate the improvements.

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 final year of a seven-year project to restore sockeye salmon (*Oncorhynchus, nerka*) runs to Solf Lake. Construction on control structures at the two outlets of Solf Lake are completed and the stocking and rearing of sockeye salmon fry is continuing. Reconstruction of the fishway was completed in the summer of 2000 and monitoring of returning adults will be conducted in 2001.

The funding request in this proposal is for an additional year of monitoring the adult returns to Solf Lake to evaluate the performance of the structural improvements and stocking success. Approval of this proposal will also provide funding for completion of a final report on the Solf Lake Project. The first returns from the first stocking in 1998 are expected in May and June of 2001; at that time the fishway will be evaluated for fish passage effectiveness and spawning habitat utilization by returning fish. An additional year of observations will strengthen the results on the success of the project.

Solf Lake has long been recognized as an opportunity to reestablish a sockeye salmon run in Prince William Sound. 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. 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 outlet streams. The work consisted of improving the eastern outlet and partially damming the western outlet. The diversion weir 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 m in length, with an average gradient of 23 percent (Figure 2). Stocking of the lake never occurred after the improvements due to higher priority projects for both the USFS and ADF&G.

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 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. The Pellissier and Somerville (1987) survey also documented that

water was flowing through the western outlet due to an incomplete seal by the diversion weir. Three minor barriers to fish passage were identified in the eastern channel.

ADF&G recommends stocking based on their zooplankton studies and added that the instability of the macrozooplankton community in barren lakes when faced with predation necessitates stocking programs based on a conservative approach. Close evaluation and experimenting with stocking strategies will ameliorate significant impacts to the macrozooplankton community. Major reasons for the disparity of response to stocking barren lakes include; inherent low productivity of these lakes; macro zooplankton abundance, composition, and ability to adapt to predation; stocking density; lake morphology and variability in the indirect effects of predation in individual lakes. Based on limnological information the stocking levels at Solf Lake could be as high as 400,000 fry. While Solf Lake is most likely capable of supporting stocking at this level, it was decided to take a more conservative approach to stocking.

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 return and the assumption that there will be a high fry to adult survival.

With the exception of 1986 prior to stocking activity, *Diaptomus* have 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) consisted primarily of the cladoceran form *Bosmina* and very small numbers of *Daphnia*. The 2000 stocking level of 116,500, 0.42g., sockeye fry did not appear to have a significant influence on (TMZ) and the abundance as indicated by an increase in *Diaptomus* density by 22% and a 4.5% increase in biomass. Results indicate *Bosmina* decline in density by 39% and in biomass by 45% from pre-stocking means. Similarly a decline in *Cyclops* by 57% and 63% respectively were also observed. All of the observations in 2000 fall within the range of pre-stocking observations and are therefore not considered to be significant see Figures 3 and 4.

Fishless lakes are susceptible to overgrazing by large numbers of obligate planktivores, i.e. sockeye fry, resulting in steep declines in macrozooplankton numbers and biomass. 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. There was no observed significant difference between macrozooplankton biomass and density from pre-stocking and post-stocking means. In April the Project Investigator reviewed the macrozooplankton results from 2000 and determined that current stocking levels are still supported at Solf Lake.

Personnel from the Main Bay Hatchery successfully collected 121,000 green eggs from Coghill brood stock and reared them at their Main Bay facility. Overall, survival of green eggs to released fry was 96.3%. This resulted in the release of 116,500, 0.42 g fry into Solf Lake on June 15, 2000. Of the total number of fry released into Solf Lake all were marked with a thermal otolith mark sequence of 1:1.3,2.2. The expected return from the release of the BY99 Coghill stock sockeye to Solf Lake is expected to be 4,400. Approximately 60% of these should return as four-year-olds in 2003. The remaining 40% may return as five-year-old in 2004.

On June 16 personnel from ADF&G conducted a hydroacoustic survey of Solf Lake; surveying several transects perpendicular to the longitudinal axis of the lake. There were essentially no targets (fish) recorded during the entire survey. In September Forest Service crewmembers fished a floating fyke net overnight near the inlet streams of the lake and captured 27 Dolly Varden but no sockeye.

The reason for the lack of fish targets during the hydroacoustic survey and no sockeye being captured during fyke net sampling remains unknown. The hydroacoustic survey was conducted within a few days of stocking, during this time a barrier net was in place at the diversion weir to prevent any outmigration, and the eastern outlet was closed for construction purposes. Both ADF&G and Forest Service Crews observe several small groups of fry, usually numbering less than 50 swimming around the margins of the lake, however no large groups, at least not enough to account for 116,500 fry were seen exiting the lake or as mortalities. It is possible, that no fry were observed during the hydroacoustic survey due to the gregarious nature of recently stocked fry and the survey being conducted so shortly after the time of stocking. The survey may have missed a few large groups of fish not yet dispersed throughout the lake or fry aggregating very near the shoreline. Additionally fyke netting in the fall may not have captured any sockeye fry, if they emigrated as age-0 smolt, as has been proposed in previous reports. Starting in 2001 stocking procedures will include retention of sockeye fry in temporary holding pens near the lakes inlet streams for two weeks to allow time for fry to acclimate and for observation of possible mortalities.

Cook Inlet Aquaculture Association (CIAA) has documented age-0 sockeye salmon smolts emigrating from their lake stocking programs; from 1990-1995, estimates of age-0 smolt emigrating Chelatna Lake (Susitna River basin) have ranged from less than 1% to 62% of the total outmigration (Fandrei 1995), and in Bear Lake (Seward) age-0 smolt estimates for 1990-1994 have ranged from less than 1%, up to 98% in one year (Hetrick and Prochazka 1998). At this time it is uncertain what the effects of this early emigration will have on ocean survival and consequently the number of returning adults to Solf Lake.

This early outmigration is expected to discontinue as the available zooplankton is reduced and fry growth rates decrease and stabilize, however given the results from the macrozooplankton sampling this situation has not yet occurred. Increasing future stocking levels to decrease growth

rates will have to be discussed with ADF&G and the RPT if returning adult in 2001 indicate low ocean survival rates.

The Regional Forest Service Engineer and the Trustee Council approved the final design for the fishway to be installed in 2000 in the spring of the same year. The constructed fishway varied only slightly from the approved design in location and orientation of the Steep Passes and concrete headwalls. Construction specifications detailed in the final design were adhered to the greatest extent possible. Excavation of the 60-foot trench through bedrock went extremely well, primarily due to the expertise of the Forest Service Blasters and construction crew. Because the integrity of the bedrock was maintained during trench construction and a watertight seal created, a concrete liner was not required. Time did not allow for an as-built survey but will be planned for in 2001 and should be available for inclusion in the final report.

Both the diversion weir at the western outlet and the control structure on the eastern outlet has been successfully completed and are working properly. During the 2000 field season both structures were inspected for serviceability. After a full 3 years of exposure to the rigorous weather of Prince William Sound the structures remain operational showing little sign of wear.

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 current observations, along with 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 provide food for the tables of subsistence users in Western Prince William Sound.

Cost benefit calculation for subsistence resources are difficult to place a monetary value on, given that the nature of these resources are more intrinsic and cultural. This project will provide a subsistence resource to local communities in perpetuity.

If this project were to be evaluated as a commercial enhancement activity the resultant harvest would be approximately 4,500 fish/yr. This would result in an annual harvest of 27,000 lb. of sockeye salmon. Assuming an ex-vessel price of $1.75/lb. and a 2.5 multiplier to adjust for retail value providing an $118,125 /yr. cash benefit. This information is provided purely to demonstrate a cash benefit to substance users, however does not capture the intrinsic and cultural values this project will provide.

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), 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 figure 1.

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

Phase 1. Feasibility phase. The four components to this objective are:

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 existing habitat improvement structures to ensure adequate conditions for adult migration (completed).

Phase 2. Implementation phase. There are three objectives to this phase:

1. Design and construct necessary improvements to the outlet channel and dam to ensure adequate passage for adult salmon migration (completed).
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 smolt out-migration to ensure appropriate stocking levels (discontinued).

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 2001 will continue to evaluate the success of the stocking program and improvements made at Solf Lake. In FY00 the Trustees elected not to continue funding ADF&G's involvement in the Solf Lake project, consequently subsequent stocking levels will have to be based on previously collected data and adult returns. Their methodologies are presented here to provide background to the information they previously collected in support of the project.

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 2001 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 as

potential stocks for Solf Lake. At least four years of fry transplants would be required to establish a sockeye salmon run. Recent discussions with PWSAC indicate that there will be no brood stock available in 2001 for Coghill fish. This is a result of the loss of the BY98 Coghill fish at the Main Bay Hatchery facility and therefore no stocking will occur at Solf Lake in 2002.

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, 1999 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. Discussions with the State Geneticist and the RPT have indicated that since the return at Solf is expected to be small and isolated from other stocks the stock and that the switch presents no concerns.

Monitoring (1998 and beyond): Limnological data was collected to evaluate the affect of the stocking program on the plankton population. This monitoring included 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).

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 and thermal otolith marking will be used to monitor the adult population. Hydroacoustic and tow-net surveys were conducted by ADF&G on Solf Lake at approximately 12 transects perpendicular to the longitudinal axis of the lake to enumerate fry abundance. 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 that has been needed to provide access to the lake for returning adults. Construction of the fishway at the eastern channel in 2000 is complete however returning fish should be monitored closely to determine the success of the improvements.

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 diverts flow at the impassable western outlet, required extensive reconstruction to provide adequate flow for fish passage at the lakes eastern outlet, this work was completed in 1998. The eastern outlet, that would provide fish access to the lake also required reconstruction of the "irrigation type" control weir, this work was completed in 1997.

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 height and velocity barriers that ranged in size from 1.5 to 2.5 meters. The fishway in the eastern outlet was completed in the summer of 2000 and was designed to provide sockeye salmon passage into Solf Lake. The design called for two Alaska Steep Passes one 30 feet, another 40 feet in length, installed at a 22% slope. Each Steep Pass required a concrete head wall and support piers. The upper pass spills into an excavated section of bedrock forming a watertight trench. Additionally, step pools were created by the installation of intermittent notched concrete weirs, to further facilitate fish passage.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

Personnel from the ADF&G Limnology Lab in Soldotna previously conducted the limnological data collection. ADF&G also completed 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 FY02

January:	Attend Annual Restoration Workshop.
Jan - April:	USFS. Prepare for field season, hire crew.
Jan - April:	USFS. Prepare and submit Annual Report.
April - July:	USFS. Evaluate fishway and monitor returning adult salmon.
October:	USFS. Prepare final report.

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 through 2001 however for reasons previously stated no stocking will occur in 2002.

Tentative schedule and measurable end points for phase 2:

Oct - Dec. FY01:	Determine appropriate brood stock and potential stocking levels. Coordinate with PWSAC and the PWS RPT for production planning.
FY98 - FY02:	Submit annual reports
FY01 - FY02:	Enumerate adult returns and evaluate fishway.
FY02:	Prepare and submit final report.

C. Completion Date

The project completion date for fieldwork will be at the end of FY2002. This will be the final year of monitoring. The final report will be prepared and submitted by December 15th 2002.

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 FY02.

PROFESSIONAL CONFERENCES

At this time, there are no plans to present this project at professional conferences.

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 the project 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.

PROPOSED PRINCIPAL INVESTIGATOR

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

PRINCIPAL INVESTIGATOR

The principal investigator of this project will be 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.

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.

LITERATURE CITED

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Seitz, J. and J.A. Fall. 1995. Tatitlek. 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.

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.

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Figure # 1. Solf Lake Location Map.

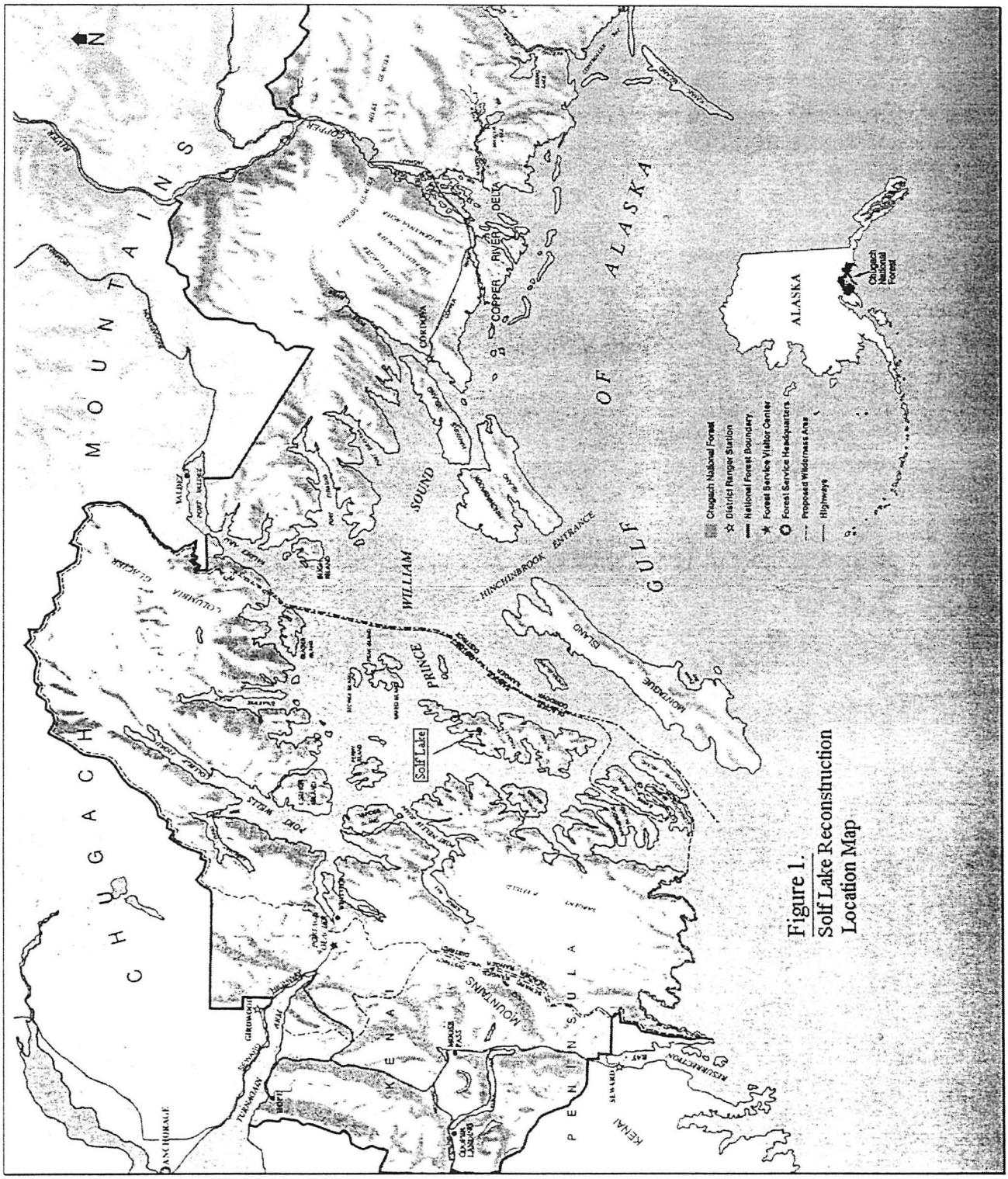


Figure 1.
Solf Lake Reconstruction
Location Map

Figure # 2. Solf Lake Site Plan

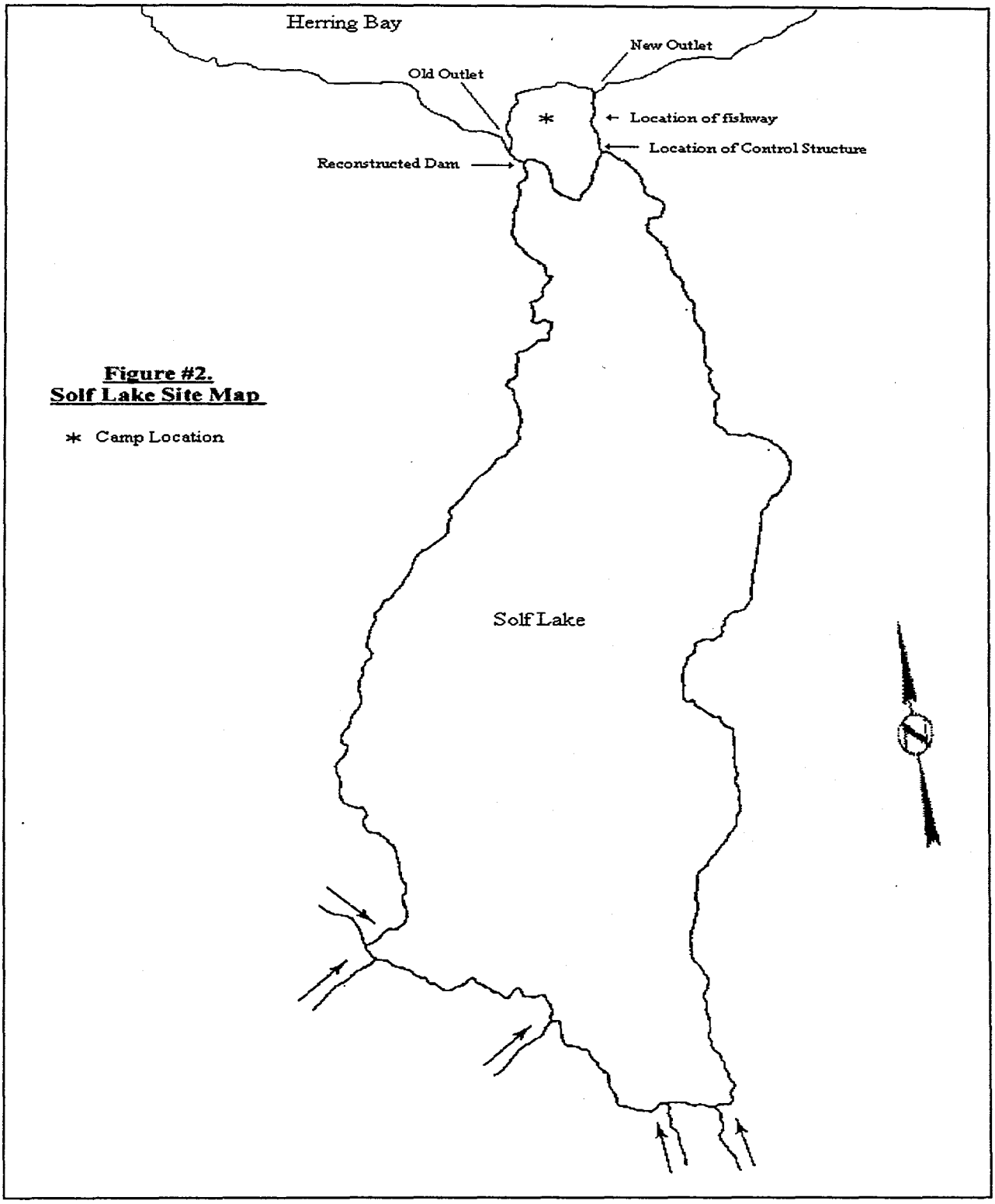


Figure # 3. Macrozooplankton Composition by Density.

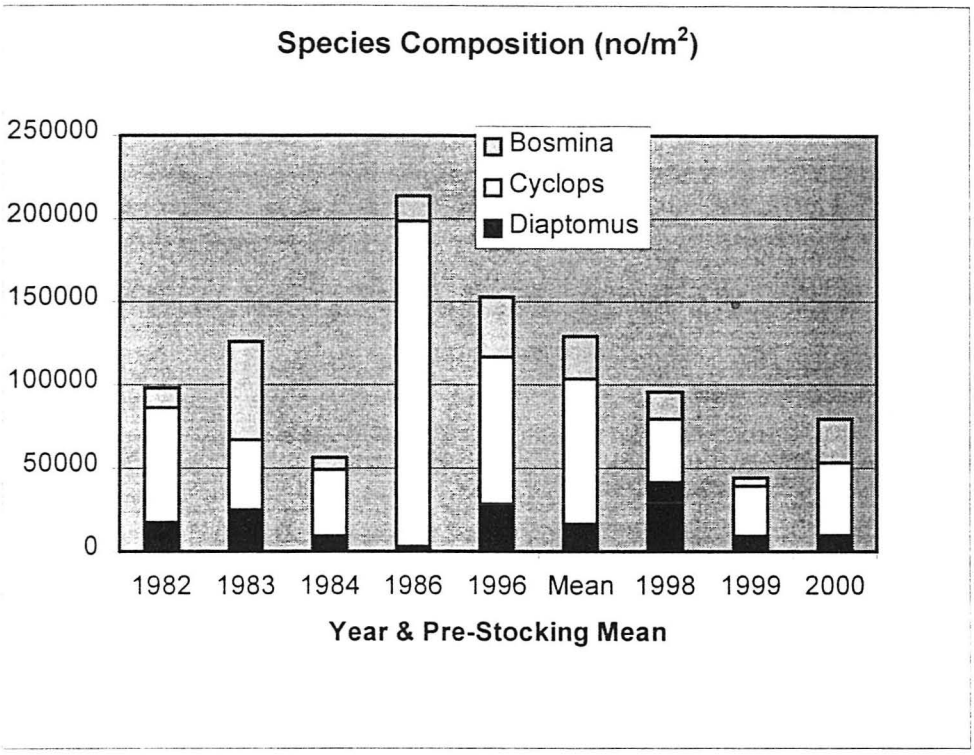
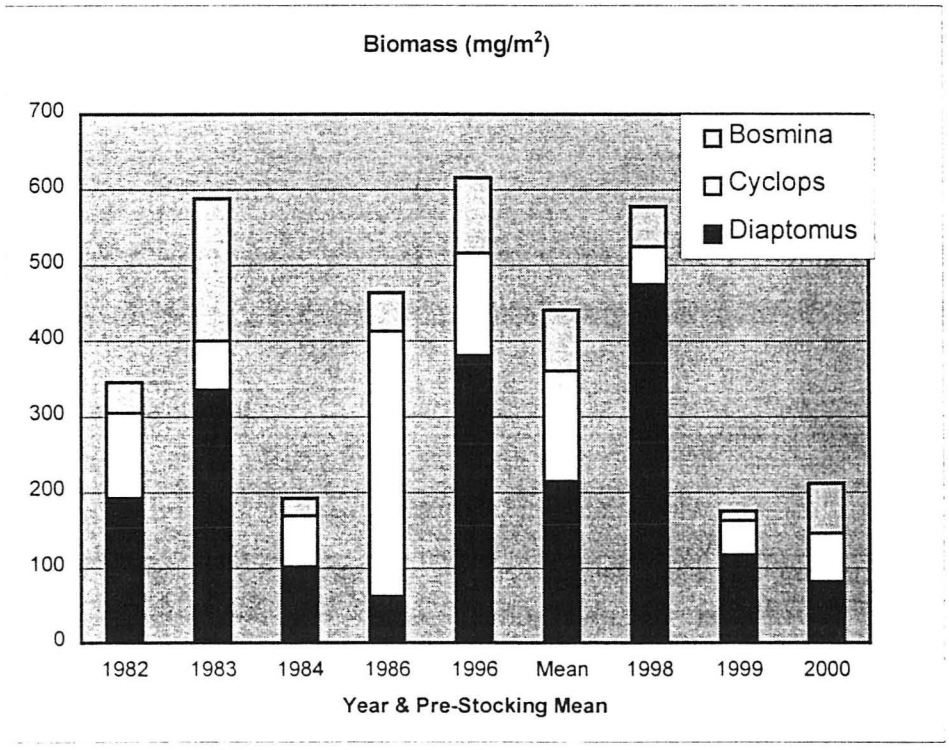


Figure # 4. Macrozooplankton Biomass (mg/m2).



Revision 6-01
Approved TC 8-6-01

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002
Personnel	$9.2	$11.1
Travel	$0.0	$2.7
Contractual	$6.6	$0.0
Commodities	$0.3	$0.0
Equipment	$0.0	$0.0
Subtotal	$16.1	$13.8
General Administration	$1.8	$1.7
Project Total	$17.9	$15.5
Full-time Equivalents (FTE)		0.3
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

			Estimated FY 2002	FY2003	
				~~$4.5~~	

Dollar amounts are shown in thousands of dollars.

Comments: This covers administrative cost for report preparation and monitoring of adult salmon returns and fishpass effectiveness.

FY02

Prepared:

Project Number: 02256b
Project Title: Sockeye salmon stocking: Solf Lake
Agency: USFS

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2002
Project Investigator	Fish Biologist	GS-9	0.5	4.2		2.1
Field Crew Supervisor	Fish Technician	GS-9	1.5	4.2		6.3
Seasonal	Fish Technician	GS-5	1.5	1.8		2.7
Seasonal						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		3.5	10.2	0.0	
					Personnel Total	$11.1

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2002
Charter Flights	0.6	4			2.4
Camp Food			15	0.02	0.3
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.7

FY02

Prepared:

Project Number: 02256b
Project Title: Sockeye salmon stocking: Solf Lake
Agency: USFS

FORM 3B
Personnel
& Travel
DETAIL

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Contractual Costs:	Proposed FY 2002
Description	
Egg Take, Incubation, Marking and Release. PWSAC Contract at Main Bay	
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed FY 2002
Description	
Commodities Total	$0.0

FY02

Prepared:

Project Number: 02256b
Project Title: Sockeye salmon stocking: Solf Lake
Agency: USFS

FORM 3B
Contractual & Commodities DETAIL

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

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

Existing Equipment Usage: Description	Number of Units	Inventory Agency
Forest Service Landing Craft	1	USFS

FY02

Project Number: 02256b
Project Title: Sockeye salmon stocking: Solf Lake
Agency: USFS

FORM 3B
Equipment
DETAIL

Prepared:

approved TC 8-6-01

The Exxon Valdez Trustee Hydrocarbon Database and Interpretation Service

Project Number:	02290
Restoration Category:	Service Project
Proposer:	Bonita D. Nelson and Jeffrey W. Short NMFS, Auke Bay Laboratory ABL Program Manager: Dr. Stan Rice
Lead Trustee Agency:	NOAA
Cooperating Agencies:	None
Alaska SeaLife Center:	No
Duration:	Service Ongoing
Cost FY 02:	35,000
Cost FY 03:	35,000
Geographic Area:	Not Applicable
Injured Resource/Service:	Maintenance of the Trustee hydrocarbon database, archival of environmental samples, interpretative services

ABSTRACT

This project is an on-going service project providing data and sample archiving services for all samples collected for hydrocarbon analysis in support of *Exxon Valdez* Oil Spill Trustee Council projects. These data represent samples collected since the oil spill in 1989 to the present and include environmental and laboratory Response (National Resource Damage Assessment - NRDA) and Restoration data . Additionally, we provide interpretive services for the hydrocarbon analysis, provide public releases of the hydrocarbon and pristane databases and store and maintain the hydrocarbon sample archives.

INTRODUCTION

The Auke Bay Laboratory provides data and sample archiving services for all samples collected for hydrocarbon analysis in support of *Exxon Valdez* Trustee Council projects. These data represent samples collected since the oil spill in 1989 to the present and include environmental and laboratory Response and Restoration data . Additionally, we provide interpretive services for the hydrocarbon analyses. Currently, the database contains results of the hydrocarbon analysis of more than 15,500 samples and collection information from more than 50,000 sediments, tissues, water, or oil samples. The primary purpose of this project is to maintain the integrity of the database, incorporate new data and continue hydrocarbon data interpretive services. This year we are proposing to continue the this task. The second purpose is to make the results of the hydrocarbon analyses (including pristane analysis) available to principal investigators, resources managers and to the public, including FOIA requests. This service is expected to have activity as long as hydrocarbon data are collected. The third purpose of this project is to maintain the integrity of archived samples in freezers many of which have not yet been analyzed for hydrocarbons.

The Trustee hydrocarbon database not only contains sample collection and hydrocarbon analyses information, but also has data concerning sample shipping and location information as well as lists of other database identifiers (such as species and location codes). A public version of this database containing the sample collection and environmental hydrocarbon sample analyses was released in 1996 (*Exxon Valdez* Oil Spill of 1989: State/Federal Trustee Council Hydrocarbon Database 1989-1995 -EVTHD) . Updating the database and the public release is an on-going program. Samples from pink salmon projects (01454, 01456) , coal/oil seep project (01599) , and SCAT (01543) will be added in FY2002.

The hydrocarbon interpretive service is designed specifically for investigators and managers. This includes: (1) identification of the probable sources of the hydrocarbons observed in the samples, (2) evaluation of new hydrocarbon data for evidence of systematic bias, (3) hydrocarbon data editing according to consistent criteria. Recently interpretation has grown to include identification of potential hydrocarbon sources (e.g. coal) for the background hydrocarbon signal in PWS. This is a continuation of project 01290 and previously funded under TS#1, 93090, 94290, 95290, 96290 , 97290, 98290, 99290 and 00290.

NEED FOR THE PROJECT

A. Statement of Problem

The Trustee hydrocarbon database is a dynamic structure which requires updating and maintenance. Currently, the database contains an inventory of the Trustee hydrocarbon sample collection and provides for retrieval of hydrocarbon analyses by principal investigators and managers. This project is designed to provide easy access to the Trustee hydrocarbon database

and ensure the accuracy of the data. The volume of data contained in the database suggests that other users will benefit from access, particularly as more data is added and long term monitoring projects come on line via the GEM management plan.

B. Rationale/Link to Restoration

Archiving of the Trustee hydrocarbon sample data will ensure that these data are available to principal investigators, government agencies, and the interested public on a timely basis. The database allows direct comparison of restoration and NRDA data, and contains an inventory of hydrocarbon samples and information about their collection, storage and analysis. The continued use of the methods for hydrocarbon data evaluation and interpretation developed for the *Exxon Valdez* NRDA samples will insure direct comparability of future with previous samples. This will substantially increase the probability that temporal trends in these data will be detected when actually present. Principal investigators will be able to get assistance with chemical interpretation of hydrocarbon results from their project or other projects that relate to their project when needed. Since most investigators are not chemists, this type of assistance is usually required for proper interpretation of hydrocarbon results. Application of the petroleum weathering model developed under this project (Short and Heintz, 1997) has been used to compare coal samples and Katalla seep with Prince William Sound background samples, and has identified coal as the a biologically non-available source, in contrast to researchers sponsored by EXXON, who have identified the source as Katalla seep oil.

C. Location

While this project resides at the Auke Bay Laboratory, Juneau , Alaska, the service provided serves the entire spill area. The public release of the database is available on the internet.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Community involvement includes and extends beyond the spill area. Science centers, public schools, native corporations, universities, environmental organizations and other concerned groups will have access to the database with guidelines on how the data can be used.

PROJECT DESIGN

A. Objectives

1. Continue maintenance of the Trustee hydrocarbon database by updating the database with new information and continue the sample archiving procedures developed under NRDA.

2. Continue interpretation of hydrocarbon data, including new data produced for principal investigators and resources managers and for syntheses products as needed.

3. Maintain Pristane database for Trustee funded project.

4. Provide public release of the data via CD-Rom and on the internet.

5. Extend the use of the petroleum weathering model by using it as a tool for identifying potential sources of petroleum that contribute to the background signal identified in Constantine Harbor.

6. Implement a long-term archiving plan for the Trustee hydrocarbon database PWSOIL and provide information for FOIA requests.

B. Methods

Data associated with hydrocarbon samples are added to the existing Trustee hydrocarbon database. The samples and data currently reside at the Auke Bay Laboratory of NMFS. Incoming samples are inventoried and stored in laboratory freezers, and sample collection information is entered into the database. Samples are released for hydrocarbon analysis after ABL receives a written request from the responsible project leader. Hydrocarbon data, reported by the analytical laboratory, are matched to the sample collection information and all the data are checked for errors and electronic copies are sent to principal investigators or other requesters. An updated version of the public release of the database will be developed in Visual Basic software using *Exxon Valdez* Oil Spill of 1989: State/Federal Trustee Council Hydrocarbon Database 1989-1995 (EVTHD) as a template and will include data collected from Trustee funded projects including sampling and analytical quality control procedures .The product is updated annually.

The petroleum weathering model developed under this project has been used to reject the hypothesis that the hydrocarbons comprising the background PAH source are derived from the Katalla oil seep. Analysis of sediment and mussel samples collected from locations near the Katalla oil seep as well as coal deposits east of PWS supports the conclusion that PAH derived from coal characterize the background hydrocarbon signal (Short et al., 1999). We will continue to use this information and analyses when necessary to demonstrate the generality of the weathering model with other oil sources and the absence of a similar weathering process in coal.

The Auke Bay Laboratory will continue to keep all environmental samples collected for hydrocarbon analysis under all phases of the oil spill process frozen in locked storage.

The pristane database will be maintained in ACCESS software. Information from samples collected under Trustee project 195 will be combined with data from the Trustee hydrocarbon database where applicable to provide a complete data set of pristane related information.

C. Contracts and Other Agency Assistance

No contracts are anticipated

SCHEDULE

A. Measurable Project Tasks for FY02

Samples will be stored and data analyzed throughout fiscal year. Release of the updated public version of the database software: Exxon Valdez Oil Spill of 1989: State/Federal Trustee Council Hydrocarbon Database 1989-1995.

B. Project Milestones and Endpoints

April 15: Annual report in the form of updated release of hydrocarbon data software.

The primary objective of this project is to provide an ongoing service, consequently there are few set milestone dates or endpoints.

C. Completion Date

This is an ongoing service project to be completed when samples are no longer collected for hydrocarbon analysis and the Trustee Council terminates this service.

PUBLICATIONS AND REPORTS

The public release of the hydrocarbon database for projects funded in FY00 will be available on or about 15 April, 2002 in the form of the annual report .Data are submitted as soon as they are available from the chemistry laboratory.

PROFESSIONAL CONFERENCES

One meeting is required, an annual Quality Assurance Control meeting attended by ABL's Senior Analytical Chemist. The results of an international calibration exercise by participant is reviewed for the integrity and credibility of chemical analyses. This meeting usually occurs in the Washington D.C. area, and is sponsored by National Institute of Standards and Technology (NIST).

NORMAL AGENCY MANAGEMENT

NOAA/NMFS has statutory stewardship for most living marine resources; however, if the oil spill had not occurred, NOAA would not be conducting this project. NOAA/NMFS proposes to make a significant contribution (as stated in the proposed budget) to the operation of this project, making it truly cooperative.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project is a continuation of NRDA database and chemical interpretation work.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

This ongoing service project has no significant project design or schedule differences from the project funded in FY01, it is a continuation of the same service. The project has been downsized, as the input volume has decreased somewhat, although interpretation services will probably increase.

PROPOSED PRINCIPAL INVESTIGATOR

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NMFS Auke Bay Laboratory
11305 Glacier Highway
Juneau, Alaska 99801
907-789-6071
907-789-6094
bonita.nelson@noaa.gov

PRINCIPAL INVESTIGATORS

Bonita D. Nelson

Education:
BS 1979, University of Illinois, Urbana (Ecology, Ethology , Evolution)
MS 1986, University of Alaska-Juneau (Fisheries)

Other Experience:
Database manager of the Trustee hydrocarbon data for 6 years. Responsibilities include: supervision of data entry of sample and analytical data; processing and dissemination of data after interpretation by chemist; database management including data retrieval for production of the public versions of the database. Nelson has designed and managed databases as well as analyzed data for the radio telemetry program at the Auke Bay Laboratory for 15 years.

Jeffrey W. Short

Education:
BS, 1972 University of California, Riverside (Biochemisty & Philosophy)
MS, 1982, University of California, Santa Cruz (Physical Chemistry)

Other Experience:

1989 - Present: Established and managed the hydrocarbon analysis facility at ABL to analyze hydrocarbon samples generated by the *Exxon Valdez* NRDA effort (about 20% of these samples were analyzed at ABL).
1989 - 1992 : Principal Investigator, Exxon Valdez project Air/Water #3; Determination of petroleum hydrocarbons in seawater by direct chemical analysis and through the use of caged mussels deployed along the path of the oil spill.
1991 - 1992 : Principal Investigator, Exxon Valdez project Subtitle #8 ; Development of computer-based statistical methods for global examination of sediment and mussel hydrocarbon data produced for the Exxon Valdez NRDA effort for systematic bias, and for identification of probable sources of hydrocarbons. In addition, this project produced both hard-copy and computer display maps of all the sediment and mussel hydrocarbon data.

LITERATURE CITED

Short, J. W., K.A. Kvenvolden, P.R. Carlson, F. D. Hostettler, R. J. Rosenbauer, & B. A. Wright, 1999. Natural Hydrocarbon Background in Benthic Sediments of Prince Willaim Sound, Alaska: Oil vs Coal. Environ. Sci. Technol. 33:34-42.

Short, J. W., and R. A. Heintz. 1997. Identification of *Exxon Valdez* oil in sediments and tissues from Prince William Sound and the Northwestern Gulf of Alaska based on a PAH weathering model. Environ. Sci. Technol. 31:2375-2384.

Approved TC 8-6-01

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002
Personnel		$24.1
Travel		$2.2
Contractual		$0.0
Commodities		$5.1
Equipment		$0.0
Subtotal	$0.0	$31.4
General Administration		$3.6
Project Total	$0.0	$35.0
Full-time Equivalents (FTE)		0.3
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 2003					
$35.0					

Dollar amounts are shown in thousands of dollars.

Comments:

This project is ongoing to support the maintenance of the samples collected for hydrocarbon analyses sorting and archiving of samples and interpretation of chemical data as well as public releases of the data and FOIA requests.

NOAA Contribution: Research Chemist, Jeff Short .5 mo. @9.9 mo, Analytical Chemist, Marie Larsen .5 mo @6.9/mo for a total contribution of 8.5K.

FY02

Prepared:4/1/01

Project Number: 02290
Project Title: Hydrocarbon Database
Agency: NOAA

FORM 3A
TRUSTEE
AGENCY
SUMMARY

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2002
Bonita Nelson	Fishery Biologist	11	2.8	6.7		18.8
Jacek Maselko	Fishery Biologist	9	1.0	5.3		5.3
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Subtotal			3.8	12.0	0.0	
					Personnel Total	$24.1

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2002
Quality Control meeting for research chemist, Marie Larsen	1.0	1	2	0.2	1.4
EVOS workshop	0.4	1	2	0.2	0.8
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.2

FY02

Prepared:4/1/01

Project Number: 02290
Project Title: Hydrocarbon Database
Agency: NOAA

FORM 3B
Personnel
& Travel
DETAIL

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

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

Commodities Costs:	Proposed FY 2002
Description	
Software & supplies	2.7
disposal of samples	2.4
Commodities Total	$5.1

FY02

Prepared:4/1/01

Project Number: 02290
Project Title: Hydrocarbon Database
Agency: NOAA

FORM 3B
Contractual & Commodities DETAIL

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

Existing Equipment Usage: Description	Number of Units	Inventory Agency
Computers, freezers		

FY02

Prepared:4/1/01

Project Number: 02290
Project Title: Hydrocarbon Database
Agency: NOAA

FORM 3B
Equipment
DETAIL

Revision 7-10-01
Approved TC 8-6-0

Toward Long-Term Oceanographic Monitoring of the Gulf of Alaska Ecosystem – A Bridge To GEM

Project Number:	01340
Restoration Category:	Monitoring
Proposer:	University of Alaska Fairbanks
Lead Trustee Agency:	ADFG
Cooperating Agencies:	none
Alaska SeaLife Center:	no
Duration:	2 years
Cost FY 02:	$77,816.00
Geographic Area:	Resurrection Bay/Gulf of Alaska shelf
Injured Resource/Service:	All organisms and services

ABSTRACT

Interannual variations in temperature, salinity and their vertical distribution on the northern Gulf of Alaska shelf reflect environmental changes that might affect this marine ecosystem. This variability needs to be quantified and understood based on long time series such as the 30-year record at hydrographic station GAK1 near Seward. This project maintains this time series, quantifies the variability and seeks to understand it. It will also begin to document interannual variations in near-surface (upper 20 m) stratification and the timing of the spring bloom on the inner shelf. The data and associated analyses are suggested as being an important component to the development of the GEM program.

INTRODUCTION

This proposal seeks support to complete analysis on the four years of GAK 1 hydrographic and mooring measurements that have been supported by EVOS since November 1997. These data have maintained the 30-year (1970 – present) time series of conductivity-temperature versus depth (CTD) data collected at hydrographic station GAK1 on the northern Gulf of Alaska shelf. EVOS support for this program began in November 1997 with monthly cruises to station GAK1. These are presently scheduled to continue through September 2001. The monthly data are being supplemented with hourly (or shorter) measurements of temperature and conductivity at six depths using instruments moored at station GAK1. Weingartner (1999, 2000, and 2001) gives a more complete description and analysis of the data collected thus far. However, the principal findings to date are:

1. The anomalous summer 1997 warming (amounting to 1-2°C above normal) was confined to the upper 40 m of the ocean. That warming was mainly a result of anomalously clear skies and low winds during the summer of 1997.
2. The abnormally large El Niño-related winter 1998 warming (~2°C) occurred throughout the entire 250 m depth of the shelf. The return to near normal temperatures beginning last May and continuing through the present is being documented.
3. The abnormally large El Niño-related winter 1998 freshening (amounting to a vertically averaged salinity decrease of 0.15 psu) over the upper 200 m of the shelf. Freshening ceased in May and, below 200 m, was replaced with the saltiest waters ever observed at this location. These high salinity waters are enriched in nutrients and potentially available to phytoplankton in the surface layers.
4. A return to near normal temperatures in the summer after May 1998.
5. The integral time scales for temperature and salinity at GAK1 are about 1 month, which implies that the monthly values (which comprise the historical data set) are not severely aliased.
6. Within-month temperature and salinity variance computed from the moored instruments is no greater than the interannual variability based on the monthly data from the historical record.
7. Variations in freshwater forcing and the baroclinic transport of freshwater are large on seasonal, interannual, and interdecadal time scales. On average freshwater transport increases fivefold between spring and fall. Alaska Coastal Current freshwater transport in spring 1998 (during the 1997-98 El Niño) was twice that of spring 1999.
8. A first order description of seasonal variations in freshwater transport of the Alaska Coastal Current shows that these variations are accounted for by the annual cycles of: 1) coastal discharge and 2) the Ekman onshore transport of relatively fresh surface waters. Their sum accounts for the annual cycle of the baroclinic component of the freshwater transport within the Alaska Coastal Current. This transport primarily occurs within the upper 150m of the water column and within 35 km of the coast.
9. The Alaska Coastal Current could significantly influence the marine ecosystem on the southeast Bering Sea. Our preliminary estimate is that the Alaska Coastal Current contributes about 25% of the Bering Sea freshwater supply. Therefore, improved understanding of

environmental variability of the Gulf of Alaska ecosystem could improve our understanding of changes in the Bering Sea ecosystem.

10. Time series of coastal discharge estimates based on Royer's (1982) method, measured discharge, the leading EOF of precipitable water over the Northeast Pacific Ocean, and coastal salinity data all suggest a decrease in freshwater discharge into the northern Gulf of Alaska from the late 1950s through the mid-1970s. Discharge increased from the mid-70s through the early-80s; coincident with the regime shift of the 1970s and with the PDO (Mantua, 1997; Overland et al., 1999). These findings add to other suggestions of a freshening across the North Pacific Ocean basin since the 1970s (Wong et al., 1999).
11. Monthly anomalies in the PDO index are coherent with Royer's monthly discharge anomalies at periods of 2 - 4 years suggesting a possible relationship to El Niño events.
12. Monthly sea level anomalies at Seward Alaska are significantly correlated with monthly anomalies of vertically integrated (0-200m) salinity and the 0/200db dynamic height. Hence sea level could serve as a proxy for shelf salinity variations here and perhaps elsewhere in the Gulf of Alaska. The Gulf of Alaska watershed and coastal ocean are severely undersampled with respect to precipitation, river discharge, and salinity. Long-term time series of these are lacking and even the future maintenance of existing discharge and weather stations is uncertain. There is a need to develop proxy variables that can be used to reliably estimate runoff and coastal salinity. A goal of this EVOS program is to determine if sea level can serve as a proxy for ocean salinity variations.
13. There is a promising correlation emerging between GAK 1 dynamic height (0/200 db) and the freshwater and mass transport as computed from the cross-shore density field in the Alaska Coastal Current. This suggests that the GAK 1 data could be used as an index for these variations.
14. We continued our investigations into the reasons for the anomalously low-salinity shelf water observed during the winter of 1998 and suggest that this was a consequence of several factors. First, there was above average seasonal (fall and winter) coastal discharge from Alaska. Second, there was also above average discharge from the Pacific Northwest as represented by the discharges from the Fraser River in British Columbia and the Columbia River in Oregon in the preceding summer and early fall. Third, there was anomalously strong seasonal coastal downwelling around the coastal Gulf of Alaska. These factors enhanced one another in several ways. The high runoff diluted inner shelf waters and strengthened the cross-shelf density gradients. These gradients, in conjunction with the strong cyclonic wind stress, enhanced the alongshore extent and strength of the coastal current. The anomalously strong downwelling would also have enhanced trapping of freshwater against the coast and augmented coastal freshening by increasing the onshore transport of low-salinity surface waters. Furthermore, our results suggest that the simultaneous occurrence of all of these anomalies is unusual because 1997-98 was the only year since 1970 in which all of these anomalies coincided.

We propose to complete one remaining objective and then to combine our results into a final report and a manuscript for publication in the peer-reviewed literature.

NEED FOR THE PROJECT

A. Statement of Problem

The GAK1 monthly time series illustrates some of the very large interannual and interdecadal variability of the high latitude North Pacific. From the greater sampling rate provided by the moored time series, shorter period variations are being detected and quantified and used to determine temporal aliasing problems associated with the monthly sampling. The results are enhancing interpretations of the historical data and place the magnitude of previous anomalies in a better statistical framework. Moreover, the time series could serve as a proxy for transport in the Alaska Coastal Current. Variability in the marine environment, as reflected in ocean temperatures and salinities, and, if possible, shelf circulation, need to be quantified to understand the structure of, and changes in, the northern Gulf of Alaska marine ecosystem. The data will also support ongoing efforts to assess the recovery of marine species and services affected by the oil spill. Indeed, several EVOS-supported investigators underscored the need to understand natural climate variability and its influence on the recovery of species injured by the oil spill (Purcell et al., 1999; Piatt and Irons, 1999; Duffy, 1999; Anderson et al., 1999).

B. Rationale/Link to Restoration

This monitoring proposal provides an information service to current and future investigators working in the Gulf of Alaska and adjacent waters needing information on environmental variability. The information will help assess recovery and restoration progress by allowing these issues to be analyzed within the context of the long-term variability of the physical environment. The GAK1 data set provides some of that information and the proposed measurements will enable continuation of these efforts by collecting time series at GAK1 of:

1. Monthly temperature and salinity at every meter throughout the water column using a conductivity–temperature–depth (CTD) instrument.

2. Hourly temperature and salinity at several fixed depths distributed throughout the water column.

This information will assist in:

1. Understanding thermohaline variability on time scales ranging from the tidal to the interdecadal.

2. Interpreting historical data sets for use in retrospective studies.

3. Configuring a cost-effective, long-term monitoring program.

4. Designing process studies necessary to develop ecosystem models for this shelf.

C. Location

The fieldwork will be conducted at Station GAK1 at the mouth of Resurrection Bay. Both the CTD work and the mooring deployment and recovery operations will be conducted from the Seward Marine Center using the 25-foot vessel, *Little Dipper*. All data collected as part of this program will be available to those desiring it via files on the internet. The monthly CTD data will be combined with the existing historical data that are on the Institute of Marine Science webpage: *http://www.ims.alaska.edu:8000/gak1/gak.dat*.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

We do not see any overt connection to traditional ecological knowledge. However, the most expedient way to share these data with both the public and scientific communities is via the internet. Such a link will allow easy access to the data for those working at the community level and with traditional ecological knowledge. We are seeking cost-effective ways to relay this data onshore in near real-time, possibly in conjunction with the Alaska SeaLife Center. If technical obstacles can be overcome, we will seek a future upgrade to the GAK1 mooring so that these (and possibly other) data can be transmitted directly to Seward for immediate use and display via the Internet.

PROJECT DESIGN

A. Objectives

There are two objectives at the heart of this program. First, we want to continue the 30-year time series at station GAK1 through a combination of monthly CTD measurements and through yearlong deployments of a mooring containing temperature and conductivity (T/C) recorders. We view the maintenance of this time series as essential to the broader goals of GEM. Second, we want to contribute to the design of a cost-effective monitoring program for the Gulf of Alaska shelf. The sampling schemes complement one another with one providing high vertical resolution at monthly time scales and the other providing high temporal but relatively low vertical resolution. Our generic goal of ecosystem monitoring is a long-term undertaking requiring multiple and multi-disciplinary efforts, however, the proposed modest effort constitutes one essential step toward that goal. Toward this broader goal we envision the GAK 1 mooring as eventually incorporating a diverse suite of biophysical sensors that will contribute toward ecosystem monitoring in the Alaska Coastal Current domain of the Gulf of Alaska. Thus, we are requesting a modest upgrade to the present suite of T/C recorders to will include an additional T/C recorder coupled with a fluorometer and transmissometer. In the near future, we anticipate expanding the suite of sensors to include automated chemical sensors capable of collecting time series of nitrate, acoustical sensors that can detect zooplankton and fish, and other bio-optical sensors useful in quantifying primary production. Many of these techniques are being tested now or under development. We plan to await the outcome of these tests before incorporating such instrumentation on the GAK 1 mooring. The mooring is also available for the deployment of instruments of interest to other users as a community service. For example, this year we have incorporated prototype halibut tags, under development by USGS-BRD scientists, onto the mooring. The mooring could also serve as a platform for passive acoustic recordings of marine

mammals and/or ambient environmental noise. The latter could become a future issue in this region as recreational and commercial boat traffic increases.

To guide our immediate efforts we formulated several project-specific objectives, several of which are continuing as discussed in our annual reports (Weingartner, 1999; 2000; 2001). These are:

1. Determine the rate of change of water mass properties (temperature and salinity) and the phasing of these changes at different depths. Some of these features, which are not resolved by monthly sampling, reflect important changes whose timing could be significant to the ecosystem. The data files will be made available on the time series homepage for downloading and as a graphical display. Key events will be highlighted and discussed as part of the graphical display.
2. Determine the basic statistical properties of the moored data and how variances in temperature, salinity, and dynamic height are distributed over depth and seasonally. Are there distinct vertical "modes" of variability that change with season? These results will also be summarized in a file containing textual, tabulated, and graphical information and will be accessible via the time series homepage.
3. Determine the timing of the onset of stratification in the upper ocean in spring and its relation to the onset of the spring bloom.

B. Methods

Funds are requested to monitor Gulf of Alaska temperature and salinity through FY 02. We propose to collect data at GAK 1 in two ways: monthly CTD profiles throughout the water column and hourly measurements of temperature and salinity at selected depths. Seven times a year (March, April, May, July, August, October, and December) these measurements will be made from the *R/V Alpha Helix* while this vessel is supporting the GLOBEC program. In the remaining months we will use the Institute of Marine Science's 25-foot *Little Dipper* and collect CTD profiles with a Seabird SBE-25 internally-recording CTD deployed from the vessel's winch. The sensors on this CTD are calibrated annually by the manufacturer. Field checks on the conductivity sensor are made from bottle salinities collected during each cast and analyzed on the salinometer at the Seward Marine Center. This procedure allows detection of CTD drift between calibrations by the manufacturer. The historical salinity data have an accuracy of ~0.01 or better using this instrument and these procedures. Temperatures are accurate to within 0.005°C.

The monthly sampling will be complemented by hourly measurements from temperature/conductivity recorders (Seabird MicroCats; SBE model 37-SM) incorporated in a taut-wire, subsurface mooring at GAK1. The mooring can be deployed and recovered by the *Little Dipper* during the CTD cruises (or during one of the GLOBEC cruises time permitting). Throughout the first four years of this program we have deployed six instruments collecting at nominal depths of 30, 50, 100, 150, 200, and 250 meters. We propose to add a seventh instrument at 10 m depth, to collect temperature, salinity, fluorescence and transmissivity data in the near-surface layer throughout the year. (The instrument is a SeaCat, SBE-16 and is similar to a MicroCat except that it can mate with additional sensors, e.g., the optical sensors). There are

several reasons for the proposed addition. First, in conjunction with the instrument at 30 m depth, the instrument at 10 m depth will allow us to assess the seasonal development of stratification in the upper ocean. Second, near-surface temperatures might be very useful in understanding salmon recruitment based upon the work of Willette et al. (1999) since the juvenile fish occupy the upper 10 m of the water column while on the shelf (Boldt and Haldorson, 2000). Third, the addition of the fluorometer and transmissometer will allow us to determine the timing of the spring bloom (based on fluorescence) and its relationship to the development of upper ocean stratification and seasonal changes in suspended sediment load (transmissivity). With the proposed change the instrument distribution covers the near-surface (10 - 30 m), the upper ocean (30–100 m), mid-depth (150–200 m) and bottom (200–250 m) of the water column. While results from the first year indicate that mooring motion is unimportant, we monitor this with a pressure sensor on the uppermost (10 m depth) SeaCat. Our prior experience with these and similar instruments (SeaCats) indicate that temperature and salinity drifts are generally <0.02°C and <0.03 psu/year, respectively.

The mooring design and fabrication consists of three steps prior to deployment. First, the manufacturer calibrates all of the instruments prior to deployment. (This step is usually completed 6 – 9 months prior to deployment). Second, analyze the mooring response to the ambient current field. This procedure optimizes the distribution of our flotation and minimizes current-induced mooring diving. Our past experience indicates that our shallowest instrument (at 20 m depth) dives by no more than 1 m under the ambient currents. Second, all of our T/C recorders are turned on and run for about 5 days in a continuous flow-through seawater tank at the Seward Marine Center. This serves as a pre-deployment check on the instruments wherein we check that the clocks and sampling intervals are correct and that the temperature and conductivity sensors on each instrument differ from one other by no more than the manufacturer's stated accuracy.

The analyses of the data sets are straightforward.

Objective 1 is largely concerned with temporal aliasing issues associated with monthly sampling. Among the important processes that might be aliased are the summer onshelf influx of dense bottom water, changes in upper ocean stratification throughout the year as a consequence of winds and runoff, and the response of the thermohaline structure of the water column to synoptic scale forcing by the wind.

Objective 2 will be achieved by examining the empirical orthogonal functions (EOFs) of the temperature and salinity time series. The EOFs decompose the system variance into a set of linearly independent functions, with each describing a unique spatial and temporal structure. For the mooring data the system variance would be that computed from the salinity (or temperature) time series at all depths. Six EOF modes will result from the analysis because six depths are sampled. The modes are ordered according to the proportion of the total system variance that each comprise. Thus the first mode accounts for the greatest fraction of system variance and the sixth mode accounts for the smallest proportion. Often, only a few modes are required to describe the system variance, and the significance of a given mode will be assessed following Overland and Preisendorfer (1982). The spatial structure of a mode describes the distribution of amplitude with depth, while its temporal structure describes how the mode varies through time. The EOFs

are useful in consolidating large and complicated data sets into smaller correlated subsets that facilitate physical interpretation. They might also contribute to future monitoring design by suggesting times and/or depths that are either over- or under-sampled. In the latter case, the EOFs could identify potential temporal or spatial aliasing problems.

Objective 3 will be achieved by examining the fluorometer and transmissometer record in conjunction with the density differences determined using the instruments at 10 and 30 m depth. Our analysis will also use the weather data collected by the NOAA meteorological installation at Pilot Rocks, about 20 km south of GAK 1. This weather station is representative of wind and air temperatures on the inner shelf and the data are available over the Internet.

We will also prepare a final report (manuscript for publication in the peer-reviewed literature). Many of our initial analyses are completed except for working up the final year of data (being collected now) and a remaining objective. That objective is to compare simple atmospheric pressure patterns or indices with long term precipitation and/or stream flow measurements from around the gulf. Pressure patterns over the Northern Hemisphere have been reconstructed back to 1900. However, there is only one virtually continuous streamflow record for the northern Gulf of Alaska since ~1920 and continuous precipitation records date to 1930. Thus quantifying decadal scale variability is hampered by the lack of precipitation and discharge records. If proxies for these variables can be established then a surrogate discharge time series for the gulf can be reconstructed for the past 100 years. I anticipate that pressure patterns favoring northward atmospheric transport into the Gulf of Alaska might be highly correlated with regional runoff and precipitation. If such an index results then it would serve as a proxy for discharge variability dating to the early 1900s. Note that we are not trying to duplicate other indices (such as the PDO), which characterize hemispheric scales but rather to construct a more local (e.g., Gulf of Alaska) index that would be a better predictor of regional precipitation variations. I will use~40 years of monthly atmospheric precipitable water and atmospheric pressure indices obtained from the NCEP/NCAR reanalyzed meteorological fields interpolated onto a 2.5° grid between 65°-35°N and 160°-120°W. The purpose is to construct statistical relationships between atmospheric pressure indices and precipitable water and stream discharge. (Precipitable water data are available from: http://www.cdc.noaa.gov./cdc/data.nmc.reanalysis.html#surface) and streamflow data are obtainable from the USGS website: http://2o-nwisw.er.usgs.gov/nwis-w/AK/. I have used some of these data in a different analysis (Weingartner, 2000). We will also use Royer's Gulf of Alaska discharge time series in this analysis.

SCHEDULE

A. Measurable Project Tasks for FY 02 (October 1, 2001 – March 30, 2003)

October 15, 2001:	Monthly CTD surveys scheduled at mid-month; update homepage as CTD data are processed and edited; prepare wind fields and acquire meteorological fields.
November–December 2001:	Deploy mooring (the mooring will be deployed as soon as instruments can be delivered from the manufacturer) during this month's CTD sampling.
January – July, 2002	Complete post-calibration and data processing; prepare report and manuscript, covering the first 4 years of this program,

September 2002:	Recover mooring, send instruments for post-calibrations, begin data processing.
March 2003:	A report will be prepared by the end of March.

B. Project Milestones and Endpoints

The data collected as part of this project will be available to a broad community of users. We anticipate that some will want "immediate" access to it. This desire often conflicts with the goal (and required time) of producing data of the highest possible quality. In the past, the final CTD data have generally been placed online about 4 months after collection. The final edited temperature and salinity data from the mooring should be ready within five months after instrument recovery. The delays arise because of post-calibration procedures (performed by the manufacturer) and data editing requirements (performed at the Institute of Marine Science). We intend to make much of the data, along with preliminary results, available for rapid dissemination. From a practical point of view this approach is prudent because for many users the differences between the raw and the final edited product are insignificant. We will attach appropriate warnings concerning data quality to both preliminary and final data products. Thus, we anticipate making most of the data available on the homepage one month after recovery of the mooring. However, data will not be released if there are severe concerns regarding its quality unless and until such concerns are resolved. In addition to these general considerations, we anticipate the following project milestones:

1. The first objective is to examine rates of change of water mass properties (temperature and salinity) and the phasing of these changes at different depths. This work is largely descriptive and will begin immediately after instrument recovery. Graphical data displays will be made available within 4 months of recovery. These will include textural information indicating features of interest. Displays will be updated periodically as new findings emerge. Eventually these results will be merged with those of the third objective.

2. The second objective pertains to basic statistical results and provides the modal description of system variance. The results will be made available in both preliminary and final fashion. These calculations are straightforward and the results and preliminary interpretations would be made available within two months of mooring recovery. When the final data product is ready, we will update the GAK1 CTD homepage describing these statistics and their relevance to historical GAK1 data.

C. Completion Date

This project will be completed by March or July 2003.

PUBLICATIONS AND REPORTS

One manuscript will be submitted in FY 02. Data and results will be provided via Internet as indicated above.

PROFESSIONAL CONFERENCES

We have presented some of our prior findings at national conferences in conjunction with our GLOBEC work. In the past year this has included annual EVOS workshop as well as the Ocean Sciences meeting (January 2000, San Antonio) and the Eastern Pacific Ocean Conference (EPOC; September 2000, Sidney, British Columbia). In each case we have melded the GAK 1 results with GLOBEC results where appropriate and have acknowledged the support of EVOS as well as NSF and NOAA. I anticipate that we will continue to do the same in the future. However, I am not seeking funds from EVOS for travel and attendance at the national meetings, as I will use GLOBEC funds to cover these costs.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

We have discussed aspects of the GAK1 historical data with several investigators supported by the Trustee Council. Many have expressed interest in these data and know how to access it. Other scientists are aware of these data through papers and meetings, (e.g., the American Geophysical Union which serves primarily the U.S. oceanographic community and the North Pacific Marine Science Organization [PICES] composed of marine scientists from around the Pacific Rim). Though we have discussed in previous sections how we would make these data available, we welcome advice from the Trustee Council on additional ways to share these data with other investigators and/or the public.

Several scientists are co-investigators on a GLOBEC proposal whose results would complement this proposal. The UAF investigators (Coyle, Hopcroft, Haldorson, Whitledge, Weingartner) along with Royer (Old Dominion University) have funding from the NSF NOAA GLOBEC program to examine the Gulf of Alaska shelf ecosystem for the period October 2000 –December 2004. This work includes seven R/V *Alpha Helix* cruises spaced throughout the year to examine the cross-shelf hydrography (including nutrients) and the distribution of phytoplankton, primary production, zooplankton and fish (mainly juvenile salmon and forage fish) in relation to the physical environment. Costs for the GAK 1 data collection are shared with the GLOBEC program insofar as seven of the monthly cruises to GAK 1 will be undertaken by GLOBEC. Thus we are requesting support for only five *Little Dipper* cruises. Further, Hopcroft's GLOBEC work includes estimating zooplankton growth rates and production based on changes in zooplankton age-frequency composition at GAK 1. He will conduct several *Little Dipper* cruises during the year in addition to those described above. He will also collect CTD profiles as well during his cruises (following the same procedures as discussed above); thereby increasing the number of profiles available to this project. Other GLOBEC investigators (Strom, Western Washington; Dagg; Louisiana State; Napp, NOAA) will be investigating zooplankton dynamics in 2001 and 2003 in the northern Gulf of Alaska and we anticipate that the GAK 1 data will be of use to them as well. Finally, NOAA-PMEL will deploy several moorings over the middle and outer shelf south of GAK 1 (along the Seward Line). Data from these in conjunction with the GAK 1 data set should provide a better understanding of synoptic and seasonal changes over this shelf. Finally, the long-term ARGO program will begin deploying ALACE floats (CTD profiling drifters) in the Gulf of Alaska basin (H. Freeland, Institute of Ocean Sciences, Sydney, BC) this year. The GAK 1 monitoring and the ARGO program will eventually afford a better understanding of how climate variability affects this shelf and basin.

We see these programs as highly complementary in several ways. First, the cross-shelf hydrography will provide a basis for comparison with variations observed at GAK1. Second, a

sufficient number of cross-shelf dynamic height *gradients* (proportional to the ocean transport) would be available (~90 at the conclusion of the GLOBEC program) to examine the correlation between this gradient and dynamic height at GAK1. This result will help determine if dynamic height at a single station can provide an index of transport in the Alaska Coastal Current. Third, a comprehensive nutrient data set will be made available for establishing the type of correlations alluded to in the introduction. If significant correlations are obtained at several depths in the water column, then the GAK1 data would be a proxy indicator of historical variations in nutrient concentrations (for some depths).

The effort described in this proposal takes a modest but important step toward achieving the goal of long-term, comprehensive ecosystem monitoring. There are compelling scientific and logistical reasons for believing that GAK1 will be a long-term site and that the sampling will eventually expand to include other disciplines. Resurrection Bay and the adjacent ocean are paradigmatic for much of the Gulf of Alaska shelf, and this area is easily accessible by marine scientists at Seward. Although our understanding of chemical cycling and biological processes on this shelf is limited at the moment, programs such as SEA, APEX, and GLOBEC will provide substantial new information for these disciplines. Results from these programs and those anticipated from the work proposed herein will contribute to the design of a comprehensive long-term monitoring strategy. Additional impetus for expanding the monitoring activities at GAK1 will occur as programs at the Alaska SeaLife Center evolve.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

We propose to add 1 SeaCat, SBE-16 to the mooring at a depth of 10 m. It will contain a fluorometer, transmissometer and pressure gauge to monitor diving. The reasons for the proposed addition are: 1) to begin to assess the interannual variation in the seasonal development of stratification and timing of the spring bloom over the inner shelf and 2) because near-surface temperatures might be useful in understanding juvenile salmon survival (Willette et al., 1999) since these fish inhabit the upper 10 m of the water column on the shelf (Boldt and Haldorson, 2000).

PROPOSED PRINCIPAL INVESTIGATOR

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Toward Long-Term Oceanographic Monitoring of the Gulf of Alaska Ecosystem – A Bridge To GEM

Project Number:	01340
Restoration Category:	Monitoring
Proposer:	University of Alaska Fairbanks
Lead Trustee Agency:	ADFG
Cooperating Agencies:	none
Alaska SeaLife Center:	no
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INTRODUCTION

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1. The anomalous summer 1997 warming (amounting to 1-2°C above normal) was confined to the upper 40 m of the ocean. That warming was mainly a result of anomalously clear skies and low winds during the summer of 1997.
2. The abnormally large El Niño-related winter 1998 warming (~2°C) occurred throughout the entire 250 m depth of the shelf. The return to near normal temperatures beginning last May and continuing through the present is being documented.
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4. A return to near normal temperatures in the summer after May 1998.
5. The integral time scales for temperature and salinity at GAK1 are about 1 month, which implies that the monthly values (which comprise the historical data set) are not severely aliased.
6. Within-month temperature and salinity variance computed from the moored instruments is no greater than the interannual variability based on the monthly data from the historical record.
7. Variations in freshwater forcing and the baroclinic transport of freshwater are large on seasonal, interannual, and interdecadal time scales. On average freshwater transport increases fivefold between spring and fall. Alaska Coastal Current freshwater transport in spring 1998 (during the 1997-98 El Niño) was twice that of spring 1999.
8. A first order description of seasonal variations in freshwater transport of the Alaska Coastal Current shows that these variations are accounted for by the annual cycles of: 1) coastal discharge and 2) the Ekman onshore transport of relatively fresh surface waters. Their sum accounts for the annual cycle of the baroclinic component of the freshwater transport within the Alaska Coastal Current. This transport primarily occurs within the upper 150m of the water column and within 35 km of the coast.
9. The Alaska Coastal Current could significantly influence the marine ecosystem on the southeast Bering Sea. Our preliminary estimate is that the Alaska Coastal Current contributes about 25% of the Bering Sea freshwater supply. Therefore, improved understanding of

environmental variability of the Gulf of Alaska ecosystem could improve our understanding of changes in the Bering Sea ecosystem.

10. Time series of coastal discharge estimates based on Royer's (1982) method, measured discharge, the leading EOF of precipitable water over the Northeast Pacific Ocean, and coastal salinity data all suggest a decrease in freshwater discharge into the northern Gulf of Alaska from the late 1950s through the mid-1970s. Discharge increased from the mid-70s through the early-80s; coincident with the regime shift of the 1970s and with the PDO (Mantua, 1997; Overland et al., 1999). These findings add to other suggestions of a freshening across the North Pacific Ocean basin since the 1970s (Wong et al., 1999).
11. Monthly anomalies in the PDO index are coherent with Royer's monthly discharge anomalies at periods of 2 - 4 years suggesting a possible relationship to El Niño events.
12. Monthly sea level anomalies at Seward Alaska are significantly correlated with monthly anomalies of vertically integrated (0-200m) salinity and the 0/200db dynamic height. Hence sea level could serve as a proxy for shelf salinity variations here and perhaps elsewhere in the Gulf of Alaska. The Gulf of Alaska watershed and coastal ocean are severely undersampled with respect to precipitation, river discharge, and salinity. Long-term time series of these are lacking and even the future maintenance of existing discharge and weather stations is uncertain. There is a need to develop proxy variables that can be used to reliably estimate runoff and coastal salinity. A goal of this EVOS program is to determine if sea level can serve as a proxy for ocean salinity variations.
13. There is a promising correlation emerging between GAK 1 dynamic height (0/200 db) and the freshwater and mass transport as computed from the cross-shore density field in the Alaska Coastal Current. This suggests that the GAK 1 data could be used as an index for these variations.
14. We continued our investigations into the reasons for the anomalously low-salinity shelf water observed during the winter of 1998 and suggest that this was a consequence of several factors. First, there was above average seasonal (fall and winter) coastal discharge from Alaska. Second, there was also above average discharge from the Pacific Northwest as represented by the discharges from the Fraser River in British Columbia and the Columbia River in Oregon in the preceding summer and early fall. Third, there was anomalously strong seasonal coastal downwelling around the coastal Gulf of Alaska. These factors enhanced one another in several ways. The high runoff diluted inner shelf waters and strengthened the cross-shelf density gradients. These gradients, in conjunction with the strong cyclonic wind stress, enhanced the alongshore extent and strength of the coastal current. The anomalously strong downwelling would also have enhanced trapping of freshwater against the coast and augmented coastal freshening by increasing the onshore transport of low-salinity surface waters. Furthermore, our results suggest that the simultaneous occurrence of all of these anomalies is unusual because 1997-98 was the only year since 1970 in which all of these anomalies coincided.

We propose to complete one remaining objective and then to combine our results into a final report and a manuscript for publication in the peer-reviewed literature.

NEED FOR THE PROJECT

A. Statement of Problem

The GAK1 monthly time series illustrates some of the very large interannual and interdecadal variability of the high latitude North Pacific. From the greater sampling rate provided by the moored time series, shorter period variations are being detected and quantified and used to determine temporal aliasing problems associated with the monthly sampling. The results are enhancing interpretations of the historical data and place the magnitude of previous anomalies in a better statistical framework. Moreover, the time series could serve as a proxy for transport in the Alaska Coastal Current. Variability in the marine environment, as reflected in ocean temperatures and salinities, and, if possible, shelf circulation, need to be quantified to understand the structure of, and changes in, the northern Gulf of Alaska marine ecosystem. The data will also support ongoing efforts to assess the recovery of marine species and services affected by the oil spill. Indeed, several EVOS-supported investigators underscored the need to understand natural climate variability and its influence on the recovery of species injured by the oil spill (Purcell et al., 1999; Piatt and Irons, 1999; Duffy, 1999; Anderson et al., 1999).

B. Rationale/Link to Restoration

This monitoring proposal provides an information service to current and future investigators working in the Gulf of Alaska and adjacent waters needing information on environmental variability. The information will help assess recovery and restoration progress by allowing these issues to be analyzed within the context of the long-term variability of the physical environment. The GAK1 data set provides some of that information and the proposed measurements will enable continuation of these efforts by collecting time series at GAK1 of:

1. Monthly temperature and salinity at every meter throughout the water column using a conductivity–temperature–depth (CTD) instrument.

2. Hourly temperature and salinity at several fixed depths distributed throughout the water column.

This information will assist in:

1. Understanding thermohaline variability on time scales ranging from the tidal to the interdecadal.

2. Interpreting historical data sets for use in retrospective studies.

3. Configuring a cost-effective, long-term monitoring program.

4. Designing process studies necessary to develop ecosystem models for this shelf.

C. Location

The fieldwork will be conducted at Station GAK1 at the mouth of Resurrection Bay. Both the CTD work and the mooring deployment and recovery operations will be conducted from the Seward Marine Center using the 25-foot vessel, *Little Dipper*. All data collected as part of this program will be available to those desiring it via files on the internet. The monthly CTD data will be combined with the existing historical data that are on the Institute of Marine Science webpage: *http://www.ims.alaska.edu:8000/gak1/gak.dat*.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

We do not see any overt connection to traditional ecological knowledge. However, the most expedient way to share these data with both the public and scientific communities is via the internet. Such a link will allow easy access to the data for those working at the community level and with traditional ecological knowledge. We are seeking cost-effective ways to relay this data onshore in near real-time, possibly in conjunction with the Alaska SeaLife Center. If technical obstacles can be overcome, we will seek a future upgrade to the GAK1 mooring so that these (and possibly other) data can be transmitted directly to Seward for immediate use and display via the Internet.

PROJECT DESIGN

A. Objectives

There are two objectives at the heart of this program. First, we want to continue the 30-year time series at station GAK1 through a combination of monthly CTD measurements and through yearlong deployments of a mooring containing temperature and conductivity (T/C) recorders. We view the maintenance of this time series as essential to the broader goals of GEM. Second, we want to contribute to the design of a cost-effective monitoring program for the Gulf of Alaska shelf. The sampling schemes complement one another with one providing high vertical resolution at monthly time scales and the other providing high temporal but relatively low vertical resolution. Our generic goal of ecosystem monitoring is a long-term undertaking requiring multiple and multi-disciplinary efforts, however, the proposed modest effort constitutes one essential step toward that goal. Toward this broader goal we envision the GAK 1 mooring as eventually incorporating a diverse suite of biophysical sensors that will contribute toward ecosystem monitoring in the Alaska Coastal Current domain of the Gulf of Alaska. Thus, we are requesting a modest upgrade to the present suite of T/C recorders to will include an additional T/C recorder coupled with a fluorometer and transmissometer. In the near future, we anticipate expanding the suite of sensors to include automated chemical sensors capable of collecting time series of nitrate, acoustical sensors that can detect zooplankton and fish, and other bio-optical sensors useful in quantifying primary production. Many of these techniques are being tested now or under development. We plan to await the outcome of these tests before incorporating such instrumentation on the GAK 1 mooring. The mooring is also available for the deployment of instruments of interest to other users as a community service. For example, this year we have incorporated prototype halibut tags, under development by USGS-BRD scientists, onto the mooring. The mooring could also serve as a platform for passive acoustic recordings of marine

mammals and/or ambient environmental noise. The latter could become a future issue in this region as recreational and commercial boat traffic increases.

To guide our immediate efforts we formulated several project-specific objectives, several of which are continuing as discussed in our annual reports (Weingartner, 1999; 2000; 2001). These are:

1. Determine the rate of change of water mass properties (temperature and salinity) and the phasing of these changes at different depths. Some of these features, which are not resolved by monthly sampling, reflect important changes whose timing could be significant to the ecosystem. The data files will be made available on the time series homepage for downloading and as a graphical display. Key events will be highlighted and discussed as part of the graphical display.
2. Determine the basic statistical properties of the moored data and how variances in temperature, salinity, and dynamic height are distributed over depth and seasonally. Are there distinct vertical "modes" of variability that change with season? These results will also be summarized in a file containing textual, tabulated, and graphical information and will be accessible via the time series homepage.
3. Determine the timing of the onset of stratification in the upper ocean in spring and its relation to the onset of the spring bloom.

B. Methods

Funds are requested to monitor Gulf of Alaska temperature and salinity through FY 02. We propose to collect data at GAK 1 in two ways: monthly CTD profiles throughout the water column and hourly measurements of temperature and salinity at selected depths. Seven times a year (March, April, May, July, August, October, and December) these measurements will be made from the *R/V Alpha Helix* while this vessel is supporting the GLOBEC program. In the remaining months we will use the Institute of Marine Science's 25-foot *Little Dipper* and collect CTD profiles with a Seabird SBE-25 internally-recording CTD deployed from the vessel's winch. The sensors on this CTD are calibrated annually by the manufacturer. Field checks on the conductivity sensor are made from bottle salinities collected during each cast and analyzed on the salinometer at the Seward Marine Center. This procedure allows detection of CTD drift between calibrations by the manufacturer. The historical salinity data have an accuracy of ~0.01 or better using this instrument and these procedures. Temperatures are accurate to within 0.005°C.

The monthly sampling will be complemented by hourly measurements from temperature/conductivity recorders (Seabird MicroCats; SBE model 37-SM) incorporated in a taut-wire, subsurface mooring at GAK1. The mooring can be deployed and recovered by the *Little Dipper* during the CTD cruises (or during one of the GLOBEC cruises time permitting). Throughout the first four years of this program we have deployed six instruments collecting at nominal depths of 30, 50, 100, 150, 200, and 250 meters. We propose to add a seventh instrument at 10 m depth, to collect temperature, salinity, fluorescence and transmissivity data in the near-surface layer throughout the year. (The instrument is a SeaCat, SBE-16 and is similar to a MicroCat except that it can mate with additional sensors, e.g., the optical sensors). There are

several reasons for the proposed addition. First, in conjunction with the instrument at 30 m depth, the instrument at 10 m depth will allow us to assess the seasonal development of stratification in the upper ocean. Second, near-surface temperatures might be very useful in understanding salmon recruitment based upon the work of Willette et al. (1999) since the juvenile fish occupy the upper 10 m of the water column while on the shelf (Boldt and Haldorson, 2000). Third, the addition of the fluorometer and transmissometer will allow us to determine the timing of the spring bloom (based on fluorescence) and its relationship to the development of upper ocean stratification and seasonal changes in suspended sediment load (transmissivity). With the proposed change the instrument distribution covers the near-surface (10 - 30 m), the upper ocean (30–100 m), mid-depth (150–200 m) and bottom (200–250 m) of the water column. While results from the first year indicate that mooring motion is unimportant, we monitor this with a pressure sensor on the uppermost (10 m depth) SeaCat. Our prior experience with these and similar instruments (SeaCats) indicate that temperature and salinity drifts are generally <0.02°C and <0.03 psu/year, respectively.

The mooring design and fabrication consists of three steps prior to deployment. First, the manufacturer calibrates all of the instruments prior to deployment. (This step is usually completed 6 – 9 months prior to deployment). Second, analyze the mooring response to the ambient current field. This procedure optimizes the distribution of our flotation and minimizes current-induced mooring diving. Our past experience indicates that our shallowest instrument (at 20 m depth) dives by no more than 1 m under the ambient currents. Second, all of our T/C recorders are turned on and run for about 5 days in a continuous flow-through seawater tank at the Seward Marine Center. This serves as a pre-deployment check on the instruments wherein we check that the clocks and sampling intervals are correct and that the temperature and conductivity sensors on each instrument differ from one other by no more than the manufacturer's stated accuracy.

The analyses of the data sets are straightforward.

Objective 1 is largely concerned with temporal aliasing issues associated with monthly sampling. Among the important processes that might be aliased are the summer onshelf influx of dense bottom water, changes in upper ocean stratification throughout the year as a consequence of winds and runoff, and the response of the thermohaline structure of the water column to synoptic scale forcing by the wind.

Objective 2 will be achieved by examining the empirical orthogonal functions (EOFs) of the temperature and salinity time series. The EOFs decompose the system variance into a set of linearly independent functions, with each describing a unique spatial and temporal structure. For the mooring data the system variance would be that computed from the salinity (or temperature) time series at all depths. Six EOF modes will result from the analysis because six depths are sampled. The modes are ordered according to the proportion of the total system variance that each comprise. Thus the first mode accounts for the greatest fraction of system variance and the sixth mode accounts for the smallest proportion. Often, only a few modes are required to describe the system variance, and the significance of a given mode will be assessed following Overland and Preisendorfer (1982). The spatial structure of a mode describes the distribution of amplitude with depth, while its temporal structure describes how the mode varies through time. The EOFs

are useful in consolidating large and complicated data sets into smaller correlated subsets that facilitate physical interpretation. They might also contribute to future monitoring design by suggesting times and/or depths that are either over- or under-sampled. In the latter case, the EOFs could identify potential temporal or spatial aliasing problems.

Objective 3 will be achieved by examining the fluorometer and transmissometer record in conjunction with the density differences determined using the instruments at 10 and 30 m depth. Our analysis will also use the weather data collected by the NOAA meteorological installation at Pilot Rocks, about 20 km south of GAK 1. This weather station is representative of wind and air temperatures on the inner shelf and the data are available over the Internet.

We will also prepare a final report (manuscript for publication in the peer-reviewed literature). Many of our initial analyses are completed except for working up the final year of data (being collected now) and a remaining objective. That objective is to compare simple atmospheric pressure patterns or indices with long term precipitation and/or stream flow measurements from around the gulf. Pressure patterns over the Northern Hemisphere have been reconstructed back to 1900. However, there is only one virtually continuous streamflow record for the northern Gulf of Alaska since ~1920 and continuous precipitation records date to 1930. Thus quantifying decadal scale variability is hampered by the lack of precipitation and discharge records. If proxies for these variables can be established then a surrogate discharge time series for the gulf can be reconstructed for the past 100 years. I anticipate that pressure patterns favoring northward atmospheric transport into the Gulf of Alaska might be highly correlated with regional runoff and precipitation. If such an index results then it would serve as a proxy for discharge variability dating to the early 1900s. Note that we are not trying to duplicate other indices (such as the PDO), which characterize hemispheric scales but rather to construct a more local (e.g., Gulf of Alaska) index that would be a better predictor of regional precipitation variations. I will use~40 years of monthly atmospheric precipitable water and atmospheric pressure indices obtained from the NCEP/NCAR reanalyzed meteorological fields interpolated onto a 2.5° grid between 65°-35°N and 160°-120°W. The purpose is to construct statistical relationships between atmospheric pressure indices and precipitable water and stream discharge. (Precipitable water data are available from: http://www.cdc.noaa.gov./cdc/data.nmc.reanalysis.html#surface) and streamflow data are obtainable from the USGS website: http://2o-nwisw.er.usgs.gov/nwis-w/AK/. I have used some of these data in a different analysis (Weingartner, 2000). We will also use Royer's Gulf of Alaska discharge time series in this analysis.

SCHEDULE

A. Measurable Project Tasks for FY 02 (October 1, 2001 – March 30, 2003)

October 15, 2001:	Monthly CTD surveys scheduled at mid-month; update homepage as CTD data are processed and edited; prepare wind fields and acquire meteorological fields.
November–December 2001:	Deploy mooring (the mooring will be deployed as soon as instruments can be delivered from the manufacturer) during this month's CTD sampling.
January – July, 2002	Complete post-calibration and data processing; prepare report and manuscript, covering the first 4 years of this program,

September 2002:	Recover mooring, send instruments for post-calibrations, begin data processing.
March 2003:	A report will be prepared by the end of March.

B. Project Milestones and Endpoints

The data collected as part of this project will be available to a broad community of users. We anticipate that some will want "immediate" access to it. This desire often conflicts with the goal (and required time) of producing data of the highest possible quality. In the past, the final CTD data have generally been placed online about 4 months after collection. The final edited temperature and salinity data from the mooring should be ready within five months after instrument recovery. The delays arise because of post-calibration procedures (performed by the manufacturer) and data editing requirements (performed at the Institute of Marine Science). We intend to make much of the data, along with preliminary results, available for rapid dissemination. From a practical point of view this approach is prudent because for many users the differences between the raw and the final edited product are insignificant. We will attach appropriate warnings concerning data quality to both preliminary and final data products. Thus, we anticipate making most of the data available on the homepage one month after recovery of the mooring. However, data will not be released if there are severe concerns regarding its quality unless and until such concerns are resolved. In addition to these general considerations, we anticipate the following project milestones:

1. The first objective is to examine rates of change of water mass properties (temperature and salinity) and the phasing of these changes at different depths. This work is largely descriptive and will begin immediately after instrument recovery. Graphical data displays will be made available within 4 months of recovery. These will include textural information indicating features of interest. Displays will be updated periodically as new findings emerge. Eventually these results will be merged with those of the third objective.

2. The second objective pertains to basic statistical results and provides the modal description of system variance. The results will be made available in both preliminary and final fashion. These calculations are straightforward and the results and preliminary interpretations would be made available within two months of mooring recovery. When the final data product is ready, we will update the GAK1 CTD homepage describing these statistics and their relevance to historical GAK1 data.

C. Completion Date

This project will be completed by March or July 2003.

PUBLICATIONS AND REPORTS

One manuscript will be submitted in FY 02. Data and results will be provided via Internet as indicated above.

PROFESSIONAL CONFERENCES

We have presented some of our prior findings at national conferences in conjunction with our GLOBEC work. In the past year this has included annual EVOS workshop as well as the Ocean Sciences meeting (January 2000, San Antonio) and the Eastern Pacific Ocean Conference (EPOC; September 2000, Sidney, British Columbia). In each case we have melded the GAK 1 results with GLOBEC results where appropriate and have acknowledged the support of EVOS as well as NSF and NOAA. I anticipate that we will continue to do the same in the future. However, I am not seeking funds from EVOS for travel and attendance at the national meetings, as I will use GLOBEC funds to cover these costs.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

We have discussed aspects of the GAK1 historical data with several investigators supported by the Trustee Council. Many have expressed interest in these data and know how to access it. Other scientists are aware of these data through papers and meetings, (e.g., the American Geophysical Union which serves primarily the U.S. oceanographic community and the North Pacific Marine Science Organization [PICES] composed of marine scientists from around the Pacific Rim). Though we have discussed in previous sections how we would make these data available, we welcome advice from the Trustee Council on additional ways to share these data with other investigators and/or the public.

Several scientists are co-investigators on a GLOBEC proposal whose results would complement this proposal. The UAF investigators (Coyle, Hopcroft, Haldorson, Whitledge, Weingartner) along with Royer (Old Dominion University) have funding from the NSF NOAA GLOBEC program to examine the Gulf of Alaska shelf ecosystem for the period October 2000 –December 2004. This work includes seven R/V *Alpha Helix* cruises spaced throughout the year to examine the cross-shelf hydrography (including nutrients) and the distribution of phytoplankton, primary production, zooplankton and fish (mainly juvenile salmon and forage fish) in relation to the physical environment. Costs for the GAK 1 data collection are shared with the GLOBEC program insofar as seven of the monthly cruises to GAK 1 will be undertaken by GLOBEC. Thus we are requesting support for only five *Little Dipper* cruises. Further, Hopcroft's GLOBEC work includes estimating zooplankton growth rates and production based on changes in zooplankton age-frequency composition at GAK 1. He will conduct several *Little Dipper* cruises during the year in addition to those described above. He will also collect CTD profiles as well during his cruises (following the same procedures as discussed above); thereby increasing the number of profiles available to this project. Other GLOBEC investigators (Strom, Western Washington; Dagg; Louisiana State; Napp, NOAA) will be investigating zooplankton dynamics in 2001 and 2003 in the northern Gulf of Alaska and we anticipate that the GAK 1 data will be of use to them as well. Finally, NOAA-PMEL will deploy several moorings over the middle and outer shelf south of GAK 1 (along the Seward Line). Data from these in conjunction with the GAK 1 data set should provide a better understanding of synoptic and seasonal changes over this shelf. Finally, the long-term ARGO program will begin deploying ALACE floats (CTD profiling drifters) in the Gulf of Alaska basin (H. Freeland, Institute of Ocean Sciences, Sydney, BC) this year. The GAK 1 monitoring and the ARGO program will eventually afford a better understanding of how climate variability affects this shelf and basin.

We see these programs as highly complementary in several ways. First, the cross-shelf hydrography will provide a basis for comparison with variations observed at GAK1. Second, a

sufficient number of cross-shelf dynamic height *gradients* (proportional to the ocean transport) would be available (~90 at the conclusion of the GLOBEC program) to examine the correlation between this gradient and dynamic height at GAK1. This result will help determine if dynamic height at a single station can provide an index of transport in the Alaska Coastal Current. Third, a comprehensive nutrient data set will be made available for establishing the type of correlations alluded to in the introduction. If significant correlations are obtained at several depths in the water column, then the GAK1 data would be a proxy indicator of historical variations in nutrient concentrations (for some depths).

The effort described in this proposal takes a modest but important step toward achieving the goal of long-term, comprehensive ecosystem monitoring. There are compelling scientific and logistical reasons for believing that GAK1 will be a long-term site and that the sampling will eventually expand to include other disciplines. Resurrection Bay and the adjacent ocean are paradigmatic for much of the Gulf of Alaska shelf, and this area is easily accessible by marine scientists at Seward. Although our understanding of chemical cycling and biological processes on this shelf is limited at the moment, programs such as SEA, APEX, and GLOBEC will provide substantial new information for these disciplines. Results from these programs and those anticipated from the work proposed herein will contribute to the design of a comprehensive long-term monitoring strategy. Additional impetus for expanding the monitoring activities at GAK1 will occur as programs at the Alaska SeaLife Center evolve.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

We propose to add 1 SeaCat, SBE-16 to the mooring at a depth of 10 m. It will contain a fluorometer, transmissometer and pressure gauge to monitor diving. The reasons for the proposed addition are: 1) to begin to assess the interannual variation in the seasonal development of stratification and timing of the spring bloom over the inner shelf and 2) because near-surface temperatures might be useful in understanding juvenile salmon survival (Willette et al., 1999) since these fish inhabit the upper 10 m of the water column on the shelf (Boldt and Haldorson, 2000).

PROPOSED PRINCIPAL INVESTIGATOR

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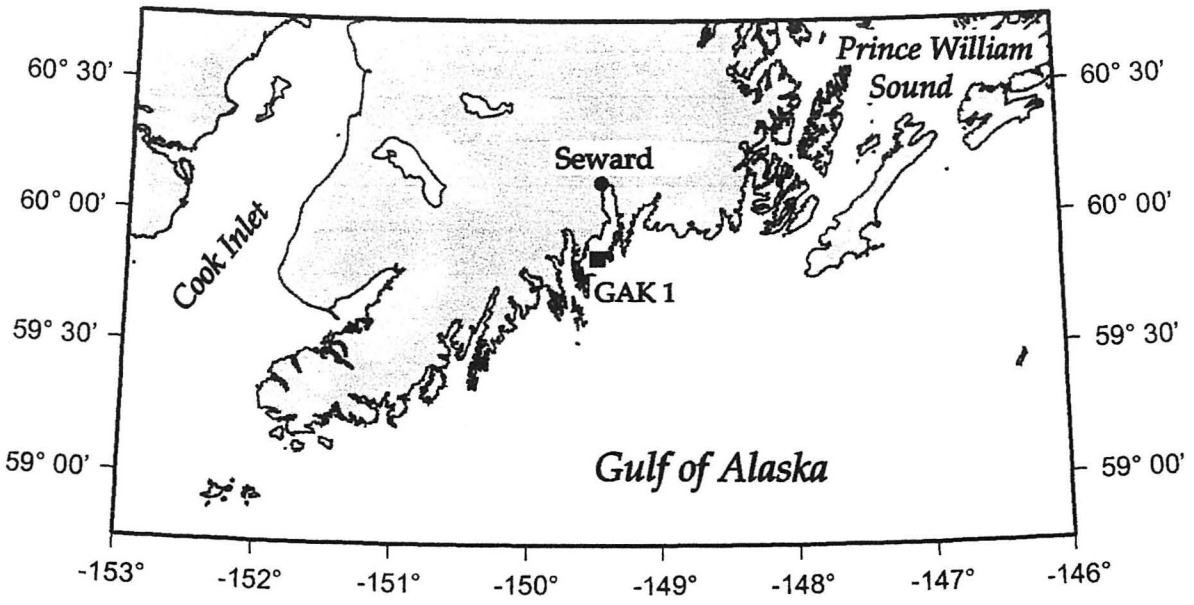

Figure 1. Map showing location of hydrographic station GAK1 in relation to Prince William Sound, Cook Inlet and Seward.

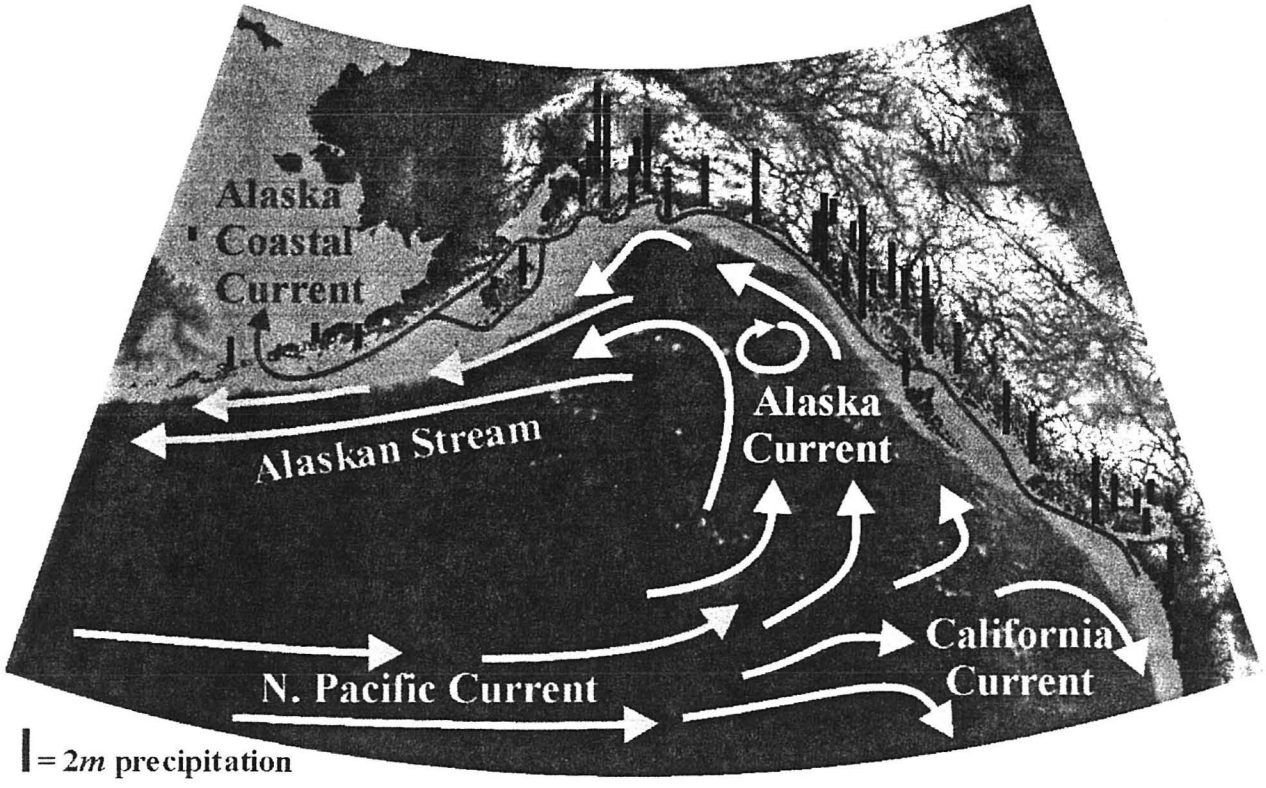

Figure 2. Schematic of the circulation of the Northeast Pacific and Gulf of Alaska. The vertical bars are the mean annual precipitation amounts at selected National Weather Service coastal sites and in the interior of the Gulf of Alaska. The latter is from Baumgartner and Reichel (1975).

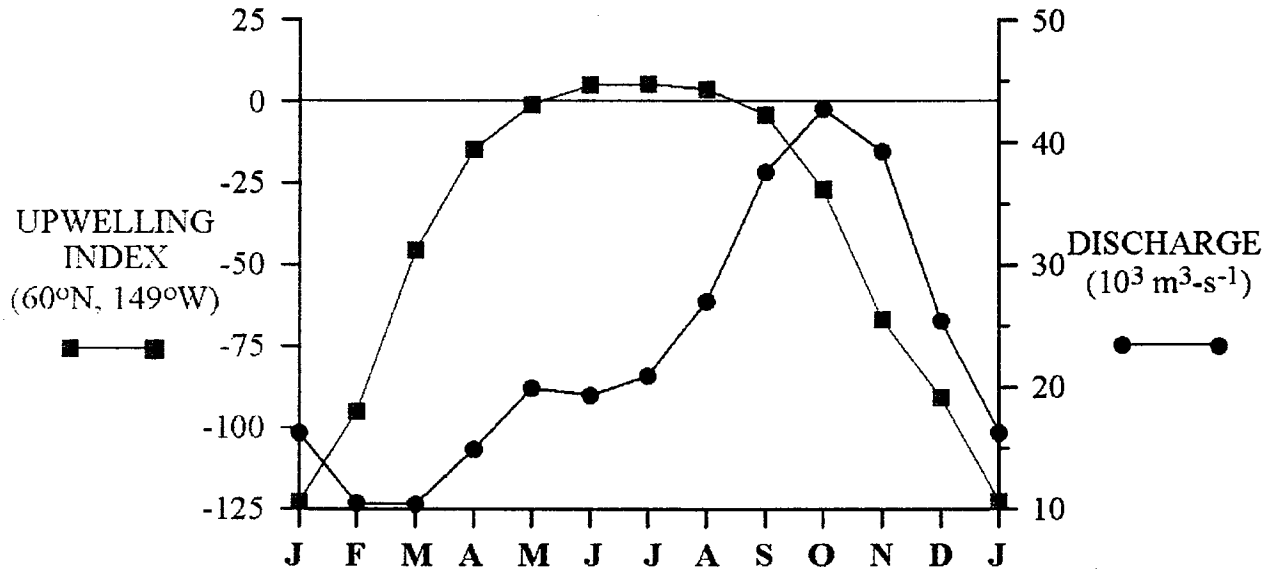

Figure 3. Mean monthly values of the upwelling index (from 1946–1995) and the estimated freshwater discharge (from 1930–1992) into the Gulf of Alaska using the hydrology model of Royer (1982).

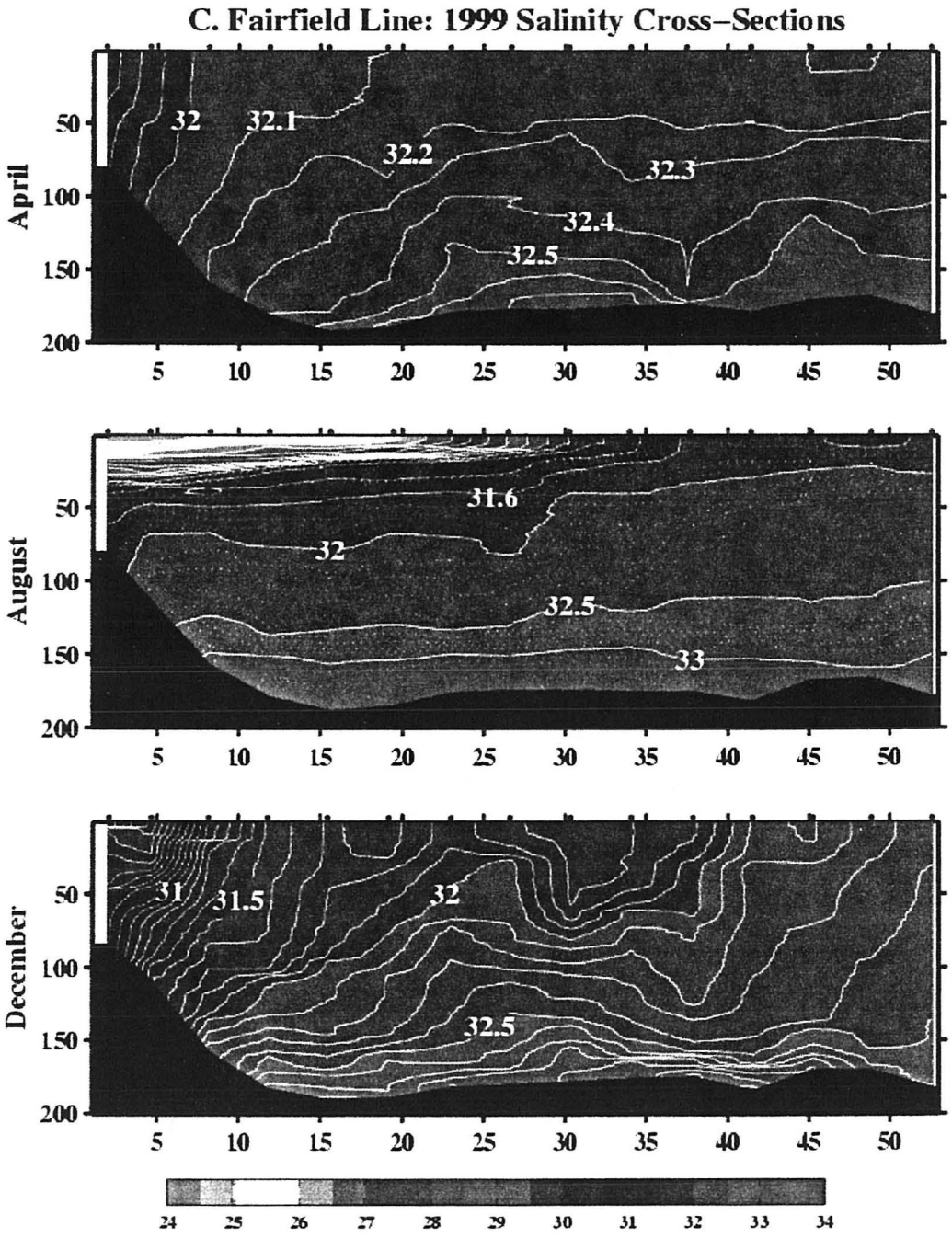

Figure 4. Contours of salinity as a function of depth and cross-shore distance for April, August and December 1999. The data were collected along a transect near Cape Fairfield (north on the left) in the northern Gulf of Alaska and approximately 30 km east of GAK 1.

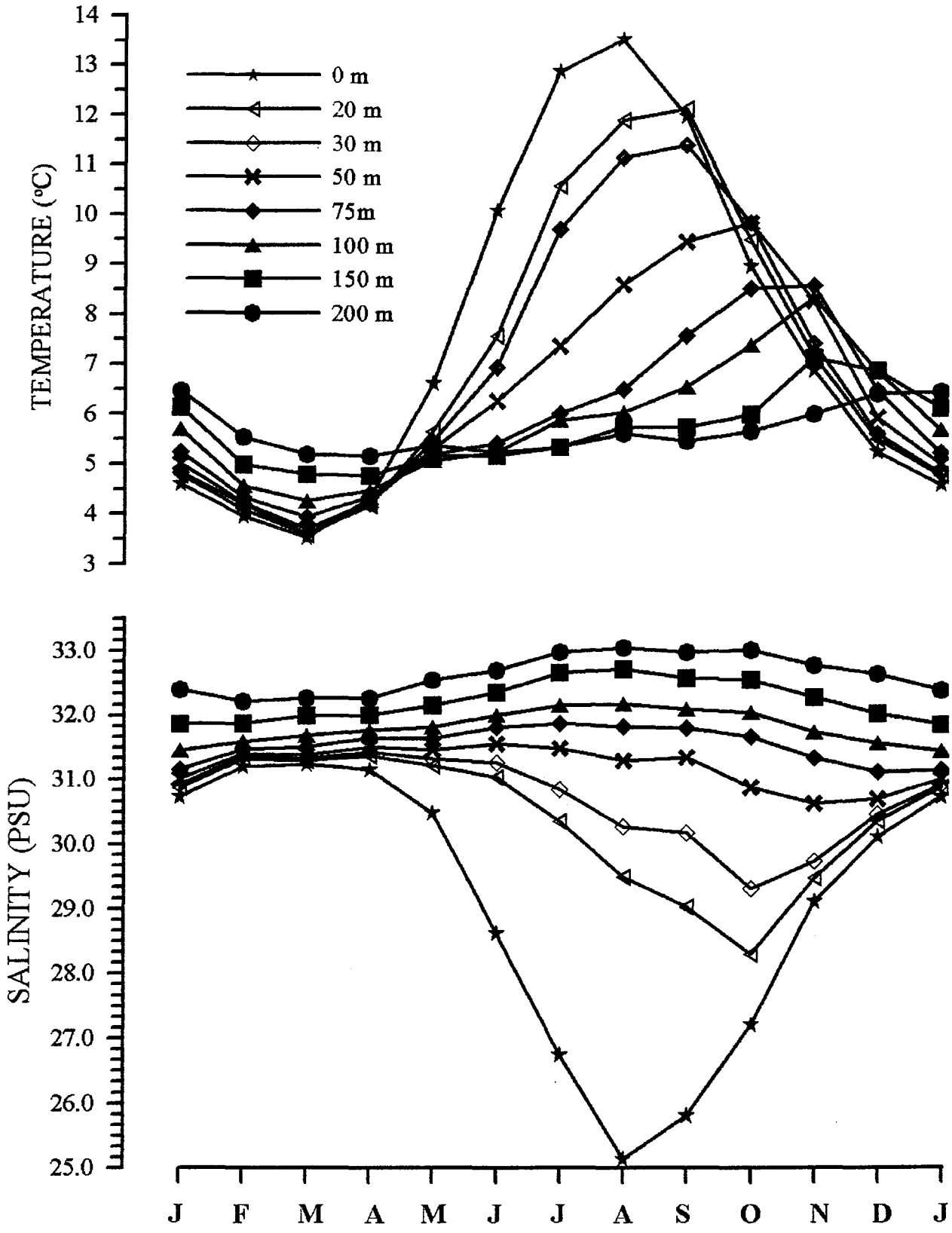

Figure 5. Mean monthly temperature (upper) and salinity (lower) at GAK1 as a function of depth. The means are computed from data collected between 1970 and 1999.

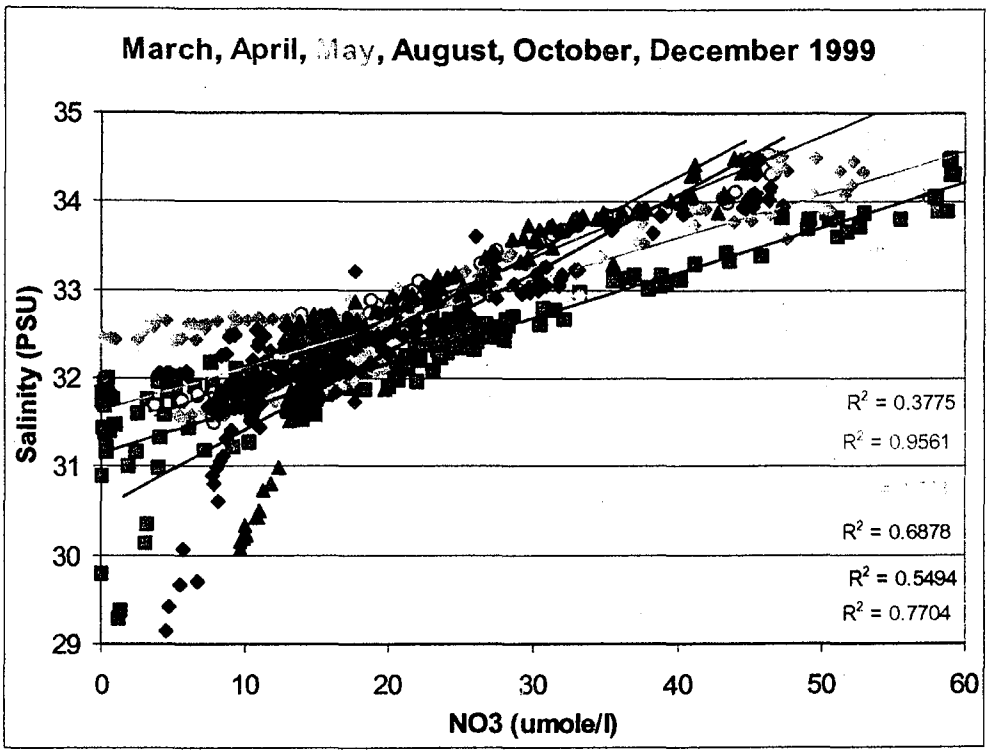

Figure 6. NO_3–salinity scatter plot from the shelf and slope of the northwest Gulf of Alaska (from Childers, pers. comm.).

PRINCIPAL INVESTIGATOR

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EDUCATION

Ph.D. Physical Oceanography, 1990, North Carolina State University
M.S. Physical Oceanography, 1980, University of Alaska
B.S. Biology, 1974, Cornell University

MEMBERSHIPS

American Geophysical Union; American Meteorological Society

PUBLIC SERVICE

Member, Science Steering Committee, NSF - Arctic System Science-Ocean Atmosphere Ice Interaction (OAII) component
Member, Science Steering Committee, NSF - ARCSS-OAII Shelf-Basin Initiative
Member, Science Steering Committee, NSF - ARCSS-Human Dimensions of the Arctic component
Member, UNOLS - Fleet Improvement Committee

PROFESSIONAL EXPERIENCE

Assistant Professor; Institute of Marine Science, School of Fisheries and Ocean Sciences, U. of Alaska Fairbanks, Alaska; 11/93 - present
Research Associate; Institute of Marine Science, School of Fisheries and Ocean Sciences, U. of Alaska Fairbanks, Alaska; 9/91 - 10/93
Postdoctoral Student; Institute of Marine Science, School of Fisheries and Ocean Sciences, U. of Alaska Fairbanks, Alaska; 7/88 - 8/91
Graduate Research Assistant; Department of Marine, Earth and Atmospheric Sciences, North Carolina State U.; Raleigh, North Carolina; and Department of Marine Science, U. of South Florida; St. Petersburg, Florida; 8/84 - 10/88

PROFESSIONAL INTERESTS

Physical oceanography of the Arctic and North Pacific Ocean and the adjacent shelves, biophysical linkages in oceanography; public education.

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Weingartner, T. J., K. Aagaard, D. J. Cavalieri, and Y. Sasaki. Winter baroclinic processes on the northeast Chukchi Sea shelf.

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OTHER KEY PERSONNEL

Mr. David Leech is the Seward based mooring and marine technician responsible for the design and deployment of the mooring. He will also conduct the monthly CTD sampling from the *Little Dipper*. Mr. Seth Danielson is the computer programmer who will assist in data processing, analyses, and maintenance of the web page. Both are employees of the Institute of Marine Science.

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approved TC 8-6-01

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

Budget Category:	Authorized FY 2001	Proposed FY 2002
Personnel		$0.0
Travel		$0.0
Contractual		$72.7
Commodities		$0.0
Equipment		$0.0
Subtotal		$72.7
General Administration		$5.1
Project Total		$77.8
Full-time Equivalents (FTE)		0.4
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 2003					
$31.0					

Dollar amounts are shown in thousands of dollars.

Comments:

FY02

Prepared: 10 july 2001

Project Number: 01340
Project Title: Toward Long-Term Oceanographic Monitoring of the Gulf of Alaska Ecosystem – A Bridge To GEM
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Budget Category:	Authorized FY 2001	Proposed FY 2002
Personnel		$31.1
Travel		$0.5
Contractual		$8.5
Commodities		$3.1
Equipment		$15.0
Subtotal		$58.2
Indirect		$14.5
Project Total		$72.7
Full-time Equivalents (FTE)		0.4
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
Estimated FY 2003					
$31.0					
Dollar amounts are shown in thousands of dollars.					

Comments:

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

FY02

Prepared: 10 july 2001

Project Number: 01340
Project Title: Toward Long-Term Oceanographic Monitoring of the Gulf of Alaska Ecosystem – A Bridge To GEM
Name: Thomas J. Weingartner

FORM 4A
Non-Trustee
SUMMARY

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

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2002
	Weingartner, T.	PI/Associate Professor	1.5	6.8		10.2
	Danielson, S.	Analyst Programmer	1.8	5.6		9.8
	Leech, D.	Technician	1.8	5.4	1.7	11.1
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	5.1	17.8	1.7	
					Personnel Total	$31.1

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2002
	Fairbanks to Anchorage	258.0	1	2	121.0	0.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$0.5

FY02

Prepared: 10 july 2001

Project Number: 01340
Project Title: Toward Long-Term Oceanographic Monitoring of the Gulf of Alaska Ecosystem – A Bridge To GEM
Name: Thomas J. Weingartner

FORM 4B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed
Description	FY 2002
Little Dipper: 2 half days @ $208/half day (Jun, Sep)	0.4
Little Dipper: 3 days @ $416/day (Jan, Feb, Nov)	1.3
CTD calibration	0.6
Microcat calibration (7 @ $600 ea.)	4.2
Shipping (R/T Seward-Seattle: CTD and Micri/cats	1.0
Page Charges	1.0
Contractual Total	$8.5

Commodities Costs:	Proposed
Description	FY 2002
Batteries, O-rings, vane assembly parts	2.0
Shackles, sling links, thimbles	0.5
Standard seawater (5 @ $30/vial)	0.2
Mooring anchor and lashing chain	0.4
Commodities Total	$3.1

FY02

Prepared:10 july 2001

Project Number: 01340
Project Title: Toward Long-Term Oceanographic Monitoring of the Gulf of Alaska Ecosystem – A Bridge To GEM
Name: Thomas J. Weingartner

FORM 4B
Contractual & Commodities DETAIL

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

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 2002
Description			
1 SeaCat with transmissometer, fluorometer and pressure gauge			15.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$15.0

Existing Equipment Usage:	Number of Units	
Description		

FY02

Prepared: 10 july 2001

Project Number: 01340
Project Title: Toward Long-Term Oceanographic Monitoring of the Gulf of Alaska Ecosystem – A Bridge To GEM
Name: Thomas J. Weingartner

FORM 4B
Equipment
DETAIL

Approved TC 8-6-01
Revised 5-18-01

The *Exxon Valdez* Oil Spill: Guidance for Future Research Activities

Project Number:	02360-BAA
Restoration Category:	Research
Proposer:	C. Elfring/Polar Research Board, NRC
Lead Trustee Agency:	NOAA
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	Cont'd
Duration:	3rd yr. 3 yr. project
Cost FY 02:	$90.1
Cost FY 03:	$0.0
Geographic Area:	All
Injured Resource/Service:	All

ABSTRACT

The National Research Council's Polar Research Board and Board on Environmental Studies and Toxicology have appointed a special committee to review the scope, content, and structure of the Trustee Council's two GEM documents, the draft Science Program and the draft Monitoring and Research Plan. To date, the committee has provided guidance in two documents: a November 2000 letter commenting on the schedule and process by which the draft Monitoring and Research Plan would be developed and a February 2001 Interim Report providing detailed comments on the draft science program, including missions, goals, administration, scale, data management, and community involvement elements. The committee's next and final task will be to prepare a final report analyzing whether the Monitoring and Research Plan is complete, scientifically sound, and meets the expectations of the Trustee Council. This task will be conducted when the draft plan is available for review. As currently scheduled, the committee will receive the draft plan in August and hold a meeting to begin our review September 18-19, 2001. The committee will spend the fall preparing its final report. The report is expected to go to outside review in January 2002 and be delivered to the Trustee Council in April 2002.

INTRODUCTION

The National Research Council (NRC) proposes to continue the committee appointed to provide outside guidance to the development of the program and review the scope, content, and structure of the Gulf of Alaska Ecosystem Monitoring Program. To date, the committee has provided guidance in two documents: a November 15, 2000, letter report commenting on the schedule and process by which the draft science plan would be developed and a February Interim Report providing detailed comments on underlying foundation of the program, including mission, goals, administration, scale, data management, and community involvement elements. The committee's next and final task will be to prepare a final report analyzing whether the Research and Monitoring Plan is complete, scientifically sound, and meets the expectations of the Trustee Council. This task will be conducted as soon as the draft science plan is available for review.

This study is being conducted by a committee of 12 volunteer experts, supported by NRC staff. The committee has met 3 times to date, for the purposes of gathering information and preparing the letter report and interim report. The committee is expected to meet 2-3 more times to understand, discuss, and review the draft science plan. This proposal seeks support for this activity in the amount of $84,236 for year three of its activities.

NEED FOR THE PROJECT

A. Statement of the Problem

The Exxon Valdez Oil Spill Trustee Council is progressing in its process of developing, reviewing, and adopting a Science Program and a Research and Monitoring Plan and the National Research Council's Committee to Review the Gulf of Alaska Ecosystem Monitoring Program stands ready to continue to provide outside scientific guidance to this process. The Trustee Council's vision for the future is to implement long-term monitoring and related research that permit improved understanding of the origins and consequences of biological changes in the northern Gulf of Alaska. The vision includes effectively communicating those understandings to all parties concerned with the management and use of birds, fish, shellfish, mammals, and other organisms.

As background, in 1989 the T/V Exxon Valdez spilled 11 million gallons of crude oil into Prince William Sound in Alaska. In 1991, the U.S. District Court approved a civil settlement that required Exxon Corporation to pay the United States and the State of Alaska $900 million over 10 years to restore the resources injured by the spill and compensate for the reduced or lost services (human uses) the resources provide. Under the court-approved terms of the settlement, a Trustee Council of three federal and three state members was formed to administer the funds. The mission of the Council has been to return the environment to a "healthy, productive, world-renowned ecosystem" by restoring, replacing, enhancing, or acquiring the equivalent of natural resources injured by the spill and the services provided by those resources.

Funds from the Exxon Valdez Oil Spill Trustee Council (EVOS) have been disbursed for

almost 10 years, at first for damage assessment activities (approximately 1989-1991) and then in relation to identified important "resource clusters," or communities/resources affected by the oil spill (1992 to present). During the course of its existence, the Trustee Council has pursued independent, non-government agency peer review of its projects, encouraged and funded publication in peer reviewed scientific journals, and fostered interdisciplinary collaboration essential to ecosystem oriented studies. Many other scientific studies conducted by entities not associated with the Trustee Council are relevant to the NRC committee's efforts.

As the Trustee Council plans a strategy for continued research and monitoring in perpetuity in the region, it must consider options for building on the now-large base of scientific knowledge made possible in part by Trustee Council studies. The final payment from the Exxon Corporation will arrive in 2002, after which activities will be funded solely out of the Restoration Reserve, which was created from portions of the Exxon Corporation payments saved over the previous 10 years. The trust will fund a scientific program and research and monitoring plan to guide future resource management activities, and independent peer review of scientific content is considered essential.

B. Rationale/Link to Restoration

An independent assessment of the proposed Science Program and Research and Monitoring Plan is important to help the Trustee Council plan for the wise and sustainable use of funds contained in the Restoration Reserve trust fund and to ensure that decision-makers plan the best possible strategy for continued, long-term research and monitoring.

C. Location

This project is a review of the draft Science Program and Research and Monitoring Plan the Exxon Valdez Oil Spill Trustee Council is preparing to guide long-term research and monitoring in the northern Gulf of Alaska, and thus deals with many locales.

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

The committee has done outreach to communities as we have collected information, holding both our main meetings in Alaska and including many guest speakers and opportunities for anyone to speak. We have counted on the Trustee Council staff to be sure that the Public Advisory Group and the community liaisons have been kept informed of our activities and received copies of our reports. The study itself will have no direct impacts on the communities. When the final report is available, a summary will be made widely available, copies will be available through the National Academy Press, and the report will be posted in full on the National Academy of Sciences website. Current project information, including committee appointments and announcements of meetings, is also always available on the website.

PROJECT DESIGN

A. Objectives

This activity is designed to provide independent scientific guidance to the Trustee Council, research community, and public as the Trustee Council develops a comprehensive plan for a long-term, interdisciplinary research and monitoring program in the northern Gulf of Alaska. Specifically, the committee's overall charge is to:

- Gain, through briefings and literature review, familiarity with the relevant body of scientific knowledge, including but not limited to that developed by the research and monitoring activities sponsored by the Trustee Council in the past.

- Convene one or more information-gathering meetings in Alaska where researchers, the public, and other interested people can convey their perspectives on what the research and monitoring plan should accomplish.

- Review the general strategy proposed in the draft Science Program (which includes information on the social and political context, mission, approach, and scientific background) and make suggestions for improvement.

- Review -- once it is available -- the draft Research and Monitoring Plan, including the scope, structure, and quality of the approach proposed for a long-term research and monitoring program in the northern Gulf of Alaska. This will include whether the conceptual foundation provides an adequate basis for long-term research and monitoring, and whether the research and monitoring plan adequately addresses gaps in the knowledge base and existing uncertainties. The committee will also address broader issues related to overall effectiveness of the Trustee Council's program and plan for guiding continued efforts to understand biological change in the Gulf of Alaska.

The committee conveys its guidance in the form of reports. It has produced two reports so far, a letter report in November 2000 and a short interim report in February 2001. Once the draft Research and Monitoring Plan is available, the committee will provide a final report containing more comprehensive comments and recommendations to guide the Trustee Council and the public in decision-making about the design and implementation of a long-term research and monitoring strategy for Prince William Sound and the northern Gulf of Alaska.

B. Methods

This study is being conducted by a multidisciplinary committee of 12 members, who are experts in a variety of relevant fields such as ecology, biological oceanography, fisheries biology, intertidal communities, marine mammal biology, ornithology, population dynamics, environmental assessment, cold water oil spill chemistry and impacts, environmental restoration, and long-term research and monitoring. Committee members serve as volunteers, receiving only reimbursement for travel and direct expenses. The committee was selected by the Academy to bring disciplinary expertise and a diversity of experience and perspectives; no members will have ties to parties involved in related litigation. All members will be subject to standard NRC procedures regarding bias and conflict of interest. The committee conducts its work at meetings and via email and conference calls.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

Not applicable.

SCHEDULE

A. Measurable Project Tasks

FY 2000 (October 1, 1999 – September 30, 2000)

November 1999:	Funds awarded. Informed that availability of GEM plan would be delayed until spring 2000.
January – March 2000:	Committee selection process (nominations, investigate suitability, interviews).
April 2000:	Committee slate announced and posted for public comment period. Draft Science Program conveyed to committee.
June 15-17 2000:	First meeting: orientation and introductory briefings. Public sessions. Plan study strategy. Anchorage, AK
October 5-7 2000:	Second meeting: continued information-gathering activities, deliberations. Anchorage, AK
November 2000:	Delivered letter report

FY 2001(October 1, 2000 – September 31, 2001)

December 7-8, 2000:	Third meeting: deliberations, conclusions & recommendations; finalized interim report. Washington DC
Dec - Feb 2000/01:	Interim report to outside review; response to review; Academy approval process.
February 2001:	Interim report delivered
April 3, 2001:	Committee chair and one member to Trustee Council meeting to discuss Interim Report.
August 15, 2001:	Expect delivery of draft Science Plan

September 18-19, 2001:	Fourth meeting: conduct information-gathering activities and deliberate on draft Science Plan. Identify strengths and weaknesses; make writing assignments.

FY 2002 (October 1, 2001 – January 31, 2002)

November 1-3, 2001:	Fifth Meeting: report-writing workshop; finalize conclusions and recommendations.
Early 2002	Sixth meeting: editorial subgroup to work on final report, either before or after outside review as needed.
January 2002:	Report prepared for Academy outside review process. Review occurs.
February 2002:	Response to review
March 2002:	Final revisions; Academy approval process
April 2002:	Report delivery (prepublication copies) with dissemination activities as needed.
June 30, 2002:	Published volume available.

B. Project Milestones and Endpoints

See schedule, above.

C. Completion Date

The committee's final report will be delivered to the Trustee Council in April 2002, based on the committee receiving the draft Science Plan on August 15, 2001. Delays may result if the draft is provided off-schedule. This is a delay from the original target of January 2002, caused by a three month change in when EVOSTC is providing the draft science plan to the committee for review. The delivery of the final published report will be in lieu of the required April 15, 2002 annual report.

PUBLICATIONS AND REPORTS

According to standard Academy operating procedures, no drafts or portions of the report will be conveyed; the final report will be submitted after it has completed the full Academy review process. Reports resulting from this effort shall be prepared in sufficient quantity to ensure their distribution to the sponsor and to other relevant parties in accordance with Academy policy. Reports will be made available to the public without restrictions.

PROFESSIONAL CONFERENCES

This proposal contains a request for travel funds for the committee chair (or a delegated committee member) and study director to attend the annual Restoration Workshops.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project will help the Trustee Council in its efforts to synthesize the lessons learned from the extensive research efforts conducted to date, and apply those lessons to the draft science plan.

PROPOSED PRINCIPAL INVESTIGATOR

This study is being conducted by a volunteer committee composed of scientists with expertise in ecology, biological oceanography, fisheries biology, intertidal communities, marine mammal biology, ornithology, population dynamics, environmental assessment, cold water oil spill chemistry and impacts, environmental restoration, and long-term research and monitoring. The committee will be put together using standard NRC procedures to identify and select candidates. Final selection of members remains the responsibility of the Executive Office of the National Research Council.

The staff officer responsible for the activity will be:

Chris Elfring, Director
Polar Research Board (HA 454)
National Research Council
National Academy of Sciences, National Academy of Engineering
2101 Constitution Avenue NW
Washington, DC 20418
202-334-3426
202-334-1477
celfring@nas.edu

Additional staffing will be provided by:

David Policansky, Associate Director
Board on Environmental Science & Toxicology
National Research Council
National Academy of Sciences, National Academy of Engineering
2101 Constitution Avenue NW
Washington, DC 20418

OTHER KEY PERSONNEL

This activity will be conducted by a committee of experts appointed specifically for the described tasks, following normal Academy procedures. These committee members are responsible for the substantive content of their advice. Oversight for the study will be provided by the Polar Research Board and all other regular levels of Academy oversight.

approved 8-6-01

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002	LONG RANGE FUNDING REQUIREMENTS					
Personnel		$0.0						
Travel		$0.0						
Contractual		$84.2						
Commodities		$0.0						
Equipment		$0.0						
Subtotal		$84.2	Estimated FY 2003					
General Administration		$5.9						
Project Total		$90.1						
Full-time Equivalents (FTE)		0.0						
			Dollar amounts are shown in thousands of dollars.					
Other Resources								

Comments:

FY02

Prepared: 4/2/01

Project Number: 02360-BAA
Project Title: Guidance for Future Research Activities
Agency: NOAA

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002						
Personnel	$89,621.0	$30,543						
Travel	$102,586.0	$7,948						
Contractual	$16,744.0	$16,086						
Commodities	$1,200.0	$100						
Equipment	$0.0	$0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$210,151.0	$54,677				Estimated FY 2003		
Indirect	$105,829.0	$29,559						
Project Total	$315,980.0	$84,236				$0		
Full-time Equivalents (FTE)	0.9	0.6						
			Dollar amounts are shown in thousands of dollars.					
Other Resources								

Comments:
Under contractural please note that we have included copying, technology, postage, phone charges, and meeting expenses. These are NOT necessarily contracted out.
Office supplies have been included under commodities.
Dissemination costs are included for the interim report which includes an editor, copies and postage.

NOTE: Due to change in project timeline, there will be a carryover of from FY01 to FY02.

FY02

Project Number: ~~00~~ 02360
Project Title: Exxon Valdez Oil Spill Study
Name: The National Academies/Polar Research Board

FORM 4A
Non-Trustee
SUMMARY

Prepared: 4/2/2001

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2001
	Chris Elfring	Director, PRB	5.0	1983.4		9,917.0
	David Policansky	Sr. Staff Officer, BEST	5.0	906.6		4,533.0
	Robert Greenway	Project Assistant	5.0	1076.2		5,381.0
	Toni Greenleaf	Administrative Associate	5.0	174.6		873.0
		Salary Adjustments for above				911.0
		Fringe Benefits for above @ 26.50%				5,728.0
						0.0
	Editor/TBD	Editor (10 days)	0.0			3,200.0
						0.0
						0.0
						0.0
		Subtotal	20.0	4140.8	0.0	
					Personnel Total	$30,543.0

Travel Costs:			Ticket	Round	Total	Daily	Proposed
	Description		Price	Trips	Days	Per Diem	FY 2001
	Anchorage	Workshop in Winter 2001 (2 committee/2staff)	1000.0	4	20	140.0	6,800.0
			0.0	0	0	0.0	0.0
	TBD	Chair and Staff to discuss strategy for the committee					0.0
		report (Domestic rates negotiated	1148.0	1			1,148.0
		with ONR/combine air and per diem)					0.0
							0.0
							0.0
							0.0
							0.0
						Travel Total	$7,948.0

FY02

Project Number: 00360
Project Title: Exxon Valdez Oil Spill Study
Name: The National Academies/Polar Research Board

FORM 4B
Personnel
& Travel
DETAIL

Prepared: 4/2/2001

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Contractual Costs:	Proposed
Description	FY 2001
Photocopies	709.0
Postage/Delivery	740.0
Technology/Communications	2,042.0
Report (Final)	12,595.0
Contractual Total	$16,086.0

Commodities Costs:	Proposed
Description	FY 2001
Office Supplies	100.0
Commodities Total	$100.0

FY02

Project Number: 00360
Project Title: Exxon Valdez Oil Spill Study
Name: The National Academies/Polar Research Board

FORM 4B
Contractual & Commodities DETAIL

Prepared: 4/2/2001

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

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

Existing Equipment Usage:	Number of Units	
Description		

FY02

Project Number: 00360
Project Title: Exxon Valdez Oil Spill Study
Name: The National Academies/Polar Research Board

FORM 4B
Equipment
DETAIL

Prepared: 4/2/2001

Revision 9-14-01
approved TC 8-6-0

Planning for Long-Term Monitoring in the Nearshore: Designing Studies to Detect Change and Assess Cause

Project Number:	02395
Restoration Category:	Research
Proposer:	Kachemak Bay Research Reserve and Coastal Resources Assoc.
Lead Trustee Agency:	ADF&G
Cooperating Agencies:	USDOI
Duration:	1 year
Cost FY 02:	$63,600
Cost FY 03:	None
Cost FY 04:	None
Geographic Area:	Gulf of Alaska
Injured Resource/Service:	Intertidal and subtidal communities, sea otters, harlequin ducks, sediments, mussels, clams, archeological resources

ABSTRACT

The goal of this proposal is to produce a draft nearshore monitoring plan that provides a framework for future monitoring that focuses on tractable components of the nearshore, and is statistically sensitive to temporal and spatial change. The process we will use to create this plan will be to: 1) formulate hypotheses with respect to potential changes to the nearshore environment, 2) identify systems and approaches to detect changes on varying temporal and spatial scales and 3) draft a plan for nearshore monitoring that can be incorporated into the Gulf Ecosystem Monitoring (GEM) plan. An initial concept will be developed by the Principal Investigators that includes consideration of existing programs in the lower 48 (e.g. PICES and PISCO) and Alaska (e.g. long-term monitoring programs conducted by the Prince William Sound and Cook Inlet RCACs). This plan will then be reviewed by a panel of 4 to 5 independent experts in nearshore marine ecology representing various interests and disciplines. A revised plan will be produced and presented to agencies, stakeholders, and other interested parties at a workshop held in conjunction with the annual EVOS Trustee Council meeting in January 2002. This plan will present alternatives for monitoring in the nearshore. A final plan will then be adopted and presented to the Trustee Council.

INTRODUCTION

The goal of our proposed study is to develop a design for monitoring the nearshore habitat as part of a future GEM program. It is our intent to develop a cost-effective nearshore monitoring program that is statistically sensitive to temporal and spatial changes. Planning a long-term monitoring effort is no trivial task, and advanced planning will help insure that the program gets started on a path that will persist (and no doubt be refined) over time and will provide meaningful insights into how the Gulf of Alaska (GOA) ecosystem functions.

We will design a nearshore monitoring program appropriate for detecting changes that may occur within the nearshore system. The nearshore is explicitly considered as a part of the Draft GEM program presented by the Trustee Council and is a necessary and useful component of any marine monitoring program within the GOA because:

- It is a unique "triple interface" between air, land, and sea and provides an important link between these systems.
- It is particularly vulnerable to a variety of anthropogenic disturbances on a scale ranging from global climate change to localized effects of shoreline development.
- Communities in the nearshore are appropriate for cost-effective study because they are accessible, many of the organisms are sessile or of limited mobility, and there is a well-developed understanding of ecological processes that occur there, allowing development of testable hypotheses.

While much of the focus of the draft plan will likely be on the animals and plants that live in the intertidal zone, we will also consider incorporating components of the nearshore subtidal zone for monitoring, as well as larger mobile predators such as sea otters (*Enhydra lutris*). These are nearshore predators that rely upon intertidal and subtidal resources, are widely distributed throughout the northern GOA, have proven to be important sentinels of the health of nearshore systems, and have a history of ecological research in the GOA that facilitates definition of hypotheses and interpretation of data (e.g. Monson *et al.* 2000). In addition, we will consider incorporation of coastal oceanography, especially as it applies to the transport of larval stages and a mediator of linkages between oceanic and coastal environments. The plan will consider excellent research models such as the PICES and PISCO that have made great strides in establishing such linkages.

The final product of this study will be a draft plan (or alternative plans) that can be used as a framework for a nearshore component of the more broadly-scoped GEM program. The process we will use to develop this plan will be to identify hypotheses with respect to natural and anthropogenic sources of variation in the nearshore, identify sub-systems and metrics that may be sensitive and powerful tools for addressing these hypotheses.

The process of refining a draft nearshore monitoring plan will be an interactive one in which the Trustee Council, peer reviewers, and stake holders will have input. We will first develop a conceptual framework for a draft plan. This will be presented to a panel of 4 or 5 independent experts in various disciplines of nearshore ecology for comment. These panel members have not

been selected, but we anticipate they will include persons that have expertise in nearshore ecology and monitoring, but that do not have an interest in pursuing such work as part of the GEM program. Our hope is to include persons with varying interests and points of view (e.g. top-down vs. bottom up approaches, oceanographic influences, biomarkers, and ecological modeling). The panel will be convened to discuss the initial concepts for monitoring. The Principal Investigators will develop a draft plan based on this initial meeting, and the plan will be presented to the panel for further review and comment. Existing nearshore monitoring programs (e.g., PICES, PISCO, EPA EMAP, NOAA National Status and Trends, Prince William Sound and Cook Inlet RCAC) will be identified as a possible means of leveraging any work that may eventually be sponsored by the Trustees. The draft plan will then be presented to stakeholders, agency personnel, and other interested parties in a workshop to be held in conjunction with the annual EVOS Trustee Council meetings in January 2002.

NEED FOR THE PROJECT

A. Statement of Problem

A draft Gulf Ecosystem Monitoring (GEM) program has been developed that will likely serve as a blueprint for future GOA monitoring sponsored by the Trustee Council. The draft GEM program recognizes the value of the nearshore and specifically identifies the need for monitoring this portion of the GOA system. However, few specifics are given as to which parts of the nearshore are to be monitored or how the monitoring will be conducted. As with the development of any program of this scope, the devil is often in the detail, and the success of a nearshore monitoring program will depend on careful planning. This project will provide a framework from which a successful plan can be developed and implemented.

B. Rationale/Link to Restoration

The future GEM program will provide a long-term legacy of the EVOS restoration effort. This will assist managers in making reasoned decisions that will lead to long-term efforts to restore and preserve injured resources. Foremost among those injured resources are those in the nearshore zone that this proposal addresses.

C. Location

The final report will be a draft plan for nearshore monitoring to be conducted throughout the Gulf of Alaska.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Community representatives and Native villagers will be asked to review the nearshore monitoring program and to participate in workshops. A total of $5,000 will be set aside for

provide travel funds for these community participants to review and discuss results at the January 2002 workshop.

PROJECT DESIGN

A. Objectives

The objective of the proposed study is to produce a draft nearshore monitoring plan that provides a framework for cost-effective monitoring of nearshore habitats and the resources that they support.

B. Methods

Overview of the process

The draft plan for nearshore monitoring in GEM will be developed through a series of steps as follows:

1. Identify hypotheses with respect to potential changes in the nearshore.
2. Identify systems that are appropriate for detecting change.
3. Based on the above, develop a preliminary draft plan or alternative plans.
4. Present this plan to a panel of independent experts.
5. Revise the plan and provide to panel members for further review and comment.
6. Present the plan to stakeholders, agencies, and other interested parties in a workshop.
7. Finalize the draft plan and present it to the EVOS Trustee Council.

The project will be directed by conducted by Drs. Thomas Dean, Carl Schoch, and Ginny Eckert. The work will be administered ~~jointly~~ by the Alaska Department of Fish and Game ~~and the Biological Resources Division of the U.S. Geological Survey~~.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

This proposal is being submitted by the Alaska Department of Fish and Game ~~and USGS~~, who will fund contracts to the Kachemak Bay Estuarine Research Reserve and Coastal Resources Associates respectively.

SCHEDULE

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

Measurable tasks for FY-02 include:

- Presentation of the plan to the Trustee Council and others in a January 2002 workshop
- Completion and presentation of a draft plan to the Trustee Council by March 31, 2001

B. Project Milestones and Endpoints

Milestones for the project are as follows:

August 2001	Obtain Funding
November , 2002	Convene expert panel
December 15, 2002.	Complete draft plan
January, 2002	Present preliminary plan at a workshop (citizen review)
March 31, 2002	Complete revision of plan and present to the Trustee Council

C. Completion Date

It is anticipated that the project will be completed by April 2002.

PUBLICATIONS AND REPORTS

A final report will be presented to the Trustee Council that outlines the plan for monitoring of nearshore resources as part of GEM.

PROFESSIONAL CONFERENCES

No funding is being requested for attendance at professional conferences in FY01.

NORMAL AGENCY MANAGEMENT

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

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Under the coordination and integration of restoration effort section, the proposed work relies on analysis of data collected across a number of EVOSTC-funded studies and will require integration and coordination as other potential aspects of the GEM plan are conceived. As described in the introduction, this research relies on incorporation of data from other Trustee sponsored research, including the CHIA, NOAA-HAZMAT and NVP studies. Proposed efforts include use of the results of those studies to aid decisions in designing a cost-effective,

sustainable, nearshore monitoring plan. We do not anticipate purchasing equipment under this project and will likely use equipment purchased previously under those EVOSTC projects identified above. Proposed research and data collection and analysis, where necessary, will follow previously established protocols and standards.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

None

PROPOSED PRINCIPAL INVESTIGATORS

Thomas A. Dean
Coastal Resources Associates, Inc.
1185 Park Center Dr., Ste. A
Vista, CA 92083
(760) 727-2004
Fax (760) 727-2207
Coastal_Resources@compuserve.com

G. Carl Schoch
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ginny.eckert@uas.alaska.edu

BIOGRAPHICAL SKETCHES FOR PRINCIPAL INVESTIGATORS

Dr. Thomas A. Dean, Ph.D. University of Delaware, is President of the ecological consulting firm Coastal Resources Associates, Inc. (CRA) in Vista, CA. Dr. Dean has over 20 years of experience in the study of nearshore ecosystems, and has authored over 30 publications, including several dealing with impacts of the *Exxon Valdez* oil spill on nearshore plants and animals. He has extensive experience in long-term monitoring studies, and has played a major role in both intertidal and subtidal EVOS investigations since 1989.

Dr. G. Carl Schoch is the Science Coordinator for the Kachemak Bay Research Reserve in Homer, Alaska (a NOAA National Estuarine Research Reserve). He has a Ph.D. in Oceanography from the College of Oceanic and Atmospheric Sciences at Oregon State University (1999) and continues to work with his post-doc advisors (Lubchenco and Menge) as a

Senior Fellow for the Partnership for Interdisciplinary Studies of the Coastal Ocean (PISCO) studying marine ecosystem dynamics. His research interests are in the linkages and interactions between physical and biological components of the marine nearshore and continental shelf ecosystems. His current research projects include studying larval distributions and forces affecting recruitment, monitoring the variability of primary productivity as a function of ocean climate, and investigating kelp bed community dynamics. He serves as the science advisor for the Olympic Coast National Marine Sanctuary Advisory Council, and is the chair of their Research Advisory Committee. He also serves as the technical advisor to the Sanctuary Marine Conservation Working Group, consulting on the design and development of a marine reserve network on the outer coast of Washington. He also consults to the Washington Department of Natural Resources on intertidal habitat modeling in Puget Sound and Georgia Straits.

Dr. Ginny Eckert received her undergraduate degree in Biology from Dartmouth College in Hanover, New Hampshire. She received her master's degree in Zoology from the University of Florida in Gainesville and her Ph.D. in Ecology from the University of California in Santa Barbara. She is currently an Assistant Professor of Biology at the University of Alaska Southeast in Juneau where she teaches Ecology, Marine Ecology, Invertebrate Zoology and Introductory Biology. Her research interests include the reproductive and larval ecology of marine invertebrates and their implications for management and conservation. She is currently studying recruitment of Dungeness crabs in Glacier Bay, growth and movement of sea cucumbers in Southeast Alaska, and the reproductive biology of snow crabs from the Bering Sea.

Revision 4-01
Approved 8-6-01

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002
Personnel		$11.5
Travel		$13.4
Contractual		$34.6
Commodities		$0.0
Equipment		$0.0
Subtotal	$0.0	$59.5
General Administration		$4.1
Project Total	$0.0	$63.6
Full-time Equivalents (FTE)		0.3
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 2003					

Dollar amounts are shown in thousands of dollars.

Comments:

FY03

Prepared:

Project Number: 02395
Project Title: Planning for Long-term Monitoring in the Nearshore
Agency: ADF&G

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2002
Name	Position Description					
Dr. Carl Schoch	KBRR Science Coordinator	18B	1.0	5.5		5.5
Kim Donohue	Admin Clerk II	8A	2.0	3.0		6.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		3.0	8.5	0.0	
					Personnel Total	$11.5

Travel Costs:	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2002
Description					
Travel and Per Diem for Panelist and Co-Pi's for Fall Monitoring Wksp					8.4
Travel and Per Diem for Community members at Winter/Spring Wksp					5.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$13.4

FY03

Prepared:

Project Number: 02395
Project Title: Planning for Long-term Monitoring in the Nearshore
Agency: ADF&G

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed
Description	FY 2002
Honoraria for Panelist on for Fall Workshop ($500/day for two days, five people)	5.0
4A Linkage For Coastal Resources Assoc.	23.6
4A Linkage For Dr. Ginney Eckert, UAF	6.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$34.6

Commodities Costs:	Proposed
Description	FY 2002
Commodities Total	$0.0

FY03

Prepared:

Project Number: 02395
Project Title: Planning for Long-term Monitoring in the Nearshore
Agency: ADF&G

FORM 3B
Contractual &
Commodities
DETAIL

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

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

FY03

Project Number: 02395
Project Title: Planning for Long-term Monitoring in the Nearshore
Agency: ADF&G

FORM 3B
Equipment
DETAIL

Prepared:

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

Budget Category:	Authorized FY 2001	Proposed FY 2002
Personnel		$12.0
Travel		$1.8
Contractual		$0.0
Commodities		$0.0
Equipment		$0.0
Subtotal	$0.0	$13.8
Indirect		$9.8
Project Total	$0.0	$23.6
Full-time Equivalents (FTE)		0.1
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
Estimated FY 2003					

Dollar amounts are shown in thousands of dollars.

Comments:
Coastal Resources Inc.:
Indirect Costas calsulated as follows
Indirect Costs =Overhead + General and Administraive costs + Fee
Overhead = 59% of personnel costs
G&A + 12.85% of personnel + overhead + other direct (excluding contractual)
Fee = None

FY03

Prepared:

Project Number: 02395
Project Title: Planning for Long-term Monitoring in the Nearshore
Agency: Coastal Resources Assoc.

FORM 4A
Non-Trustee
SUMMARY

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

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2002
[redacted]	T. Dean	Biologist	1.5	8.0		12.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	1.5	8.0	0.0	[redacted]
					Personnel Total	$12.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2002
[redacted]	Round Trip San Diego to Anchorage	0.6	2	6	0.1	1.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$1.8

FY03

Prepared:

Project Number: 02395
Project Title: Planning for Long-term Monitoring in the Nearshore
Agency: Coastal Resources Assoc.

FORM 4B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed FY 2002
Description	
Contractual Total	$0.0

Commodities Costs:	Proposed FY 2002
Description	
Commodities Total	$0.0

FY03

Project Number: 02395
Project Title: Planning for Long-term Monitoring in the Nearshore
Agency: Coastal Resources Assoc.

FORM 4B
Contractual & Commodities
DETAIL

Prepared:

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

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

Existing Equipment Usage:	Number of Units	
Description		

FY03

Project Number: 02395
Project Title: Planning for Long-term Monitoring in the Nearshore
Agency: Coastal Resources Assoc.

FORM 4B
Equipment
DETAIL

Prepared:

Budget Category:	Authorized FY 2001	Proposed FY 2002	
			8.0

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

Personnel		$6.0						
Travel		$0.0						
Contractual		$0.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$6.0	Estimated					
Indirect			FY 2003					
Project Total	$0.0	$6.0						
Full-time Equivalents (FTE)		0.1						
			Dollar amounts are shown in thousands of dollars.					
Other Resources								

Comments:

FY03

Prepared:

Project Number: 02395
Project Title: Planning for Long-term Monitoring in the Nearshore
Agency: University of Alaska Fairbanks

FORM 4A
Non-Trustee
SUMMARY

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FY 2002
S	Dr. Ginny Eckert	UAF Faculty	1.0	6.0		6.0
	(see attached indirect cost waiver)					0.0

[redacted]						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal	[redacted]	1.0	6.0	0.0	[redacted]
					Personnel Total	$6.0

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

FY03

Prepared:

Project Number: 02395
Project Title: Planning for Long-term Monitoring in the Nearshore
Agency: University of Alaska Fairbanks

FORM 4B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed
Description	FY 2002

Contractual Total	$0.0

Commodities Costs:	Proposed FY 2002
Description	
Commodities Total	$0.0

FY03

Prepared:

Project Number: 02395
Project Title: Planning for Long-term Monitoring in the Nearshore
Agency: University of Alaska Fairbanks

FORM 4B
Contractual & Commodities DETAIL

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 2002
Description			
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0

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

Existing Equipment Usage:	Number of Units	
Description		

FY03

Project Number: 02395
Project Title: Planning for Long-term Monitoring in the Nearshore
Agency: University of Alaska Fairbanks

FORM 4B
Equipment
DETAIL

Prepared:

Alaska Salmon Shark Assessment

Approved TC 8-16-

Project Number:	02396
Restoration Category:	Research
Proposer:	J. Rice, L. Hulbert/NOAA
Lead Trustee Agency:	NOAA
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	Cont'd
Duration:	3rd yr. 3 yr. project
Cost FY 02:	$28.8
Cost FY 03:	$0.0
Geographic Area:	Prince William Sound
Injured Resource/Service:	Pacific salmon, Pacific herring, rockfish

ABSTRACT

This project will fund a closeout year of data analysis and manuscript preparation for this two year study of salmon sharks in Prince William Sound. Funding will cover analysis and final write-up of (a) data transmitted from satellite tags deployed on salmon sharks that will be scheduled to transmit during winter and spring of 2002, (b) data transmitted from satellite tags deployed on salmon sharks that will transmit when sharks frequent surface waters during summer, and (c) stomach samples collected during 2001 field sampling and pre-arranged stomach sample collections from the Copper River gillnet fleet and the Prince William Sound salmon seine fleet during the 2001 commercial fishing season. The funding will also cover FY 02 Argos time, NOAA Joint Tariff Agreement costs for satellite tag data recovery, and contracted data analysis. The final report will describe salmon shark movements, habitat utilization, regional fidelity, and diet composition from data collected during the project.

INTRODUCTION

The salmon shark, *Lamna ditropis,* is one of the predominant shark species in coastal Gulf of Alaska (GOA), yet very little is known of their movements, regional fidelity, or diet composition. The ecological role of salmon sharks in PWS will depend upon seasonal patterns of these parameters. Since FY 00 we have been investigating salmon shark diet through stomach collections and analyses, and salmon shark movements and fidelity to Prince William Sound (PWS) through use of two types of satellite transmitters. This research is yielding previously unknown information on salmon shark prey preference, prey switching, and seasonal habitat utilization in PWS and the GOA. Important stomach contents and satellite tag data describing these behaviors will be recovered in FY 02. Funding is needed to collect and synthesize this data for final manuscript preparation.

Data transmitted from satellite tags deployed in FY00 prove that the tagging works, and are yielding previously inaccessible information that are necessary to study salmon shark movements and ecology. In contrast, conventional tag-and-recapture efforts are not yielding much information because there are no shark fisheries for tag recoveries, and as indicators of movement and behavior have limited resolution. To date, of the 223 salmon sharks tagged with spaghetti tags in 1999 and 2000, only one has been recaptured. Utilization of satellite telemetry technologies provide state-of-the-art methods to acquire otherwise unattainable data on the movements, seasonal residency, regional fidelity, and ecology of these apex fish predators in PWS and GOA ecosystems.

Seasonally diverse salmon shark diet data are needed to assess the ecological role of salmon sharks in PWS and GOA ecosystems. Cooperation has been established with commercial and sport fishermen and various agencies to acquire seasonally and regionally diverse salmon shark stomach samples in the GOA. These efforts are ongoing and will continue through FY 01 and into FY 02.

Synthesis of historical salmon shark distribution and abundance data in the north Pacific from literature and bycatch databases was completed in FY 01. This work documents increasing salmon shark abundance in the GOA because of their importance as predators not only to Pacific salmon, but also to other economically and ecologically important species in the region. We reviewed potential influences leading to a sudden increase in salmon shark abundance in the Northeast Pacific beginning in the mid 1990s, including; the 1992 moratoria on all large-scale pelagic driftnet fishing on the high seas; salmon shark bycatch demographics and distribution records in the North Pacific, and; trophic regime shifts and increasing Pacific salmon production occurring in the GOA beginning in the 1980s. We suggest that a convergence of factors are resulting in the increasing importance of salmon sharks as predators in the changing ecology of the GOA.

Understanding the ecology and impact of sharks on the predator/prey dynamics of PWS requires research on TWO shark species; salmon sharks (*Lamna ditropis*) and Pacific sleeper sharks (*Somniosus pacificus*). The evidence of increasing numbers occurs for both species. These species have different biologies, although little is known about the diet and migration of either species. Salmon sharks are caught in salmon fisheries; sleeper sharks are not. Sleeper sharks are caught often in long line gear; salmon sharks are not. Parallel but independent will be sleeper shark

studies conducted by the NMFS using Stellar Sea Lion funds beginning in March 2001. Although the present evidence is meager, there is growing evidence of predation by sleeper sharks on marine mammals. This EVOS study will focus on salmon sharks, and at this time, is projected to be the last and only directed study on salmon sharks.

Progress to date

In FY 00 satellite tags, data archival tags, and spaghetti tags were deployed on salmon sharks. During the FY 00 field season we also collected side-looking and down-looking hydroacoustic data along stratified random line transects and aerial survey counts in Port Gravina.

In FY 01 we completed a draft manuscript of historical salmon shark distribution and abundance data synthesized from literature and analysis of bycatch databases from North Pacific fisheries. This work was performed to investigate evidence of changing salmon shark population trends. During FY 01 field work, nine PAT (pop-up archival transmitting) satellite tags and three SPOT2 (smart position-only transmitting) tags will be deployed on salmon sharks. Three PAT tags will be programmed to pop-up on each of three dates: October 1, 2001; February 1, 2002; and July 1, 2002. The tags provide large-scale geographic movement data, time spent at depth, time spent at temperature, and seasonal PWS and GOA residency information. SPOT2 tags are bolted to the sharks dorsal fin and transmit high resolution movement data to ARGOS satellites when the tag breaks the waters surface. The SPOT tags are providing information on salmon shark regional fidelity, seasonal PWS residency, and large and small scale spatial and temporal movements. Salmon shark stomachs will also be collected during the July 2001 field season, and from contributions from pre-arranged sources in FY 01 and FY 02.

In FY 02 we will retrieve and analyze satellite tag data, finish salmon shark stomach contents analyses, and synthesize a final report from satellite tag and salmon shark diet data collected in FY 00, FY 01, and FY 02. The will be no field season component in FY 02.

NEED FOR THE PROJECT

A. Statement of the Problem

The ecological role of sharks in PWS and their affects on the recovery of spill-injured resources in the region will vary with temporal and spatial patterns of movement. Salmon shark seasonal residency patterns, movements, and diet in PWS and the GOA have not been described.

Large numbers of sharks coupled with high food consumption to support above ambient body temperatures indicates that shark predation may be dominant and directly limit other key species (salmon, herring, rockfish, sablefish). Salmon shark body temperature averages 26.5^{0}C (80^{0}F) (Goldman 1999 unpublished data) and may be the highest of any shark. Because of this and the cold waters they inhabit in the GOA, salmon sharks likely possess a high metabolism and high daily ration. Eighteen salmon shark stomachs collected in late July and early August, during peak pink salmon returns, contained as many sablefish as salmon and also contained herring and rockfish (Hulbert 1999 unpublished data). In regions of high abundance, salmon sharks have the potential to

affect the recovery of oil spill injured species, including Pacific herring, Pacific salmon, and rockfish.

Salmon sharks inhabiting Alaskan waters have low fecundity, long life, and slow maturation. Once sharks reach a dominance level in the community they are likely to continue that dominance for a long time. Observations suggest salmon sharks may be a dominant predator in PWS now and for some time into the future, but we do not understand the significance of this role to other species and the ecosystem.

B. Rationale

This research will provide a valuable contribution to the understanding of shark ecology in the GOA and PWS and will document predator/prey interactions in the region. This information is needed to further the understanding of the ecological role of sharks in PWS and their effects on the recovery of spill injured resources in the region.

Pop-up archival transmitting (PAT) tags, and smart position-only transmitting (SPOT2) tags were successfully demonstrated by the project in FY00 and FY01 for monitoring the movements and diving behavior of salmon sharks. Data from satellite tags and opportunistic aerial observations will continue to be collected and analyzed in FY01 and FY02 to describe salmon shark movements, migrations, regional fidelity, and critical feeding areas.

Shark stomachs will be collected during directed sampling efforts, pre-arranged cooperation from commercial and sport fishermen, and from NMFS and ADF&G biologists. Efforts to collect and analyze seasonally diverse diet samples will be emphasized in an effort to describe prey switching when spawning aggregations of Pacific salmon are not present.

The project will also synthesize historical salmon shark distribution and abundance in the north Pacific from published literature and analysis of bycatch databases. This work is needed to investigate whether evidence of salmon shark population trends are revealed.

C. Location

Prince William Sound and Gulf of Alaska

COMMUNITY INVOLVEMENT AND TRADITIONAL KNOWLEDGE

A traditional and local knowledge component has been incorporated in this study. People from Cordova, Chenega, and Tatitlik have been and will continue to be asked to contribute their knowledge of shark temporal abundance and distribution. Community members may also be hired to recover PAT tags if they "pop-up" in PWS.

PROJECT DESIGN

A. Objectives

FY 01: Deploy satellite tags, collect seasonally diverse salmon shark stomach samples for diet analyses, and analyze historical salmon shark bycatch dat in the North Pacific Ocean.

FY 02: Retrieve and analyze satellite tag data, finish stomach analyses, and synthesize a final report. The final report will include salmon shark movements, movements, regional and seasonal fidelity to PWS and the GOA, and historical bycatch and population trends.

B. Methods

Data will be analyzed and manuscripts prepared by the investigators who were primarily responsible for the research.

C. Cooperating Agencies and Volunteers

Alaska Department of Fish and Game port samplers will collect salmon shark stomachs and tissue samples.

University of Alaska Fairbanks (Evelyn Brown) will provide opportunistic PWS aerial salmon shark observations.

Cordova Air will provide opportunistic PWS aerial salmon shark observations.

SCHEDULE

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

August- November 2001	Organize and analyze stomach data, and SPOT2 satellite tag data (position only tags) when available
December 2001- July 2002	Retrieve, analyze, and synthesize satellite tag data as available; analyze salmon shark stomach contents from contributions to the project from pre-arranged sources
August- September 2002	Analyze stomachs and satellite tag data, complete reports/manuscripts

C. Completion Date

September, 2002	Final Report (Date of final report allows for analysis of satellite tag data transmissions from SPOT tags which are likely to transmit during summer months when the sharks are active in surface waters and PAT tags which will be programmed to transmit during winter and spring, 2002.)

D. Budget Summary

Budget Category:	**FY02**
Personnel	$15.0
Travel	$ 1.4
Contractual	$10.0
Commodities	$ 0.0
Equipment	$ 0.0
Subtotal	$26.4
General Administration	$ 3.0
Project Total	$29.4

PUBLICATIONS AND REPORTS

A final report detailing results and accomplishments of the research will be accompanied by: A draft salmon shark seasonal diet manuscript; a draft salmon shark spatial and temporal movement manuscript; and report detailing the results of salmon shark historical distribution and abundance synthesis.

NORMAL AGENCY MANAGEMENT

NOAA/NMFS has statutory stewardship for most living marine resources; however, if the oil spill had not occurred, NOAA would not be conducting this project. NOAA/NMFS proposes to make a significant contribution (as stated in the proposed budget) to the operation of this project, making it truly cooperative.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The information gathered in this study may be useful to understanding the lack of recovery of some non-recovering species (harbor seals, Pacific herring).

PRINCIPAL INVESTIGATOR

Jeep Rice
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FAX (907)789-6094
E-MAIL: Jeep.Rice@noaa.gov

OTHER KEY PERSONNEL

Lee Hulbert, NMFS, Auke Bay Laboratory

Approved TC 6-6-01

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

Budget Category:	Authorized FY 2001	Proposed FY 2002
Personnel	$28.2	$15.0
Travel	$2.2	$0.8
Contractual	$22.2	$10.0
Commodities	$26.6	$0.0
Equipment	$0.0	$0.0
Subtotal	$79.2	$25.8
General Administration	$5.8	$3.0
Project Total	$85.0	$28.8
Full-time Equivalents (FTE)	0.5	0.25
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 2003					
$0.0					

Dollar amounts are shown in thousands of dollars.

Comments: Comments: This close-ourt year of the will analyze data produce a final report on investigations of salmon shark seasonal residency, movements, and trophic interactions in the eastern Gulf of Alaska (GOA) and Prince William Sound (PWS). State-of-the-art satellite tag data will be used to describe salmon shark movements and migrations, diet, and critical feeding areas and depths.

NOAA Contribution: Lee Hulbert 1 mo @ 5K, Dr. Stan Rice 1 mo @13K for a total NOAA contribution of 18K.

FY02

Prepared:7/9/01

Project Number: 02396-CLO
Project Title: Alaska Salmon Shark Assessment Project
Agency: NOAA

FORM 3A
TRUSTEE
AGENCY
SUMMARY

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2002
L. Hulbert		GS9	3	5		15.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		3.0	5.0	0.0	
					Personnel Total	$15.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2002
	0				0.0
					0.0
RT Juneau to Anchorage (Lee Hulbert, EVOS workshop)	0.4	1	2	0.2	0.8
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.8

FY02

Prepared:4/12/01

Project Number: 01396
Project Title: Alaska Salmon Shark Assessment Project
Agency: NOAA

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed FY 2002
Description	
Contract to analyze data	5.0
Argos time and Joint Tariff Agreement	5.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$10.0

Commodities Costs:	Proposed FY 2002
Description	
Commodities Total	$0.0

FY02

Prepared:4/12/01

Project Number: 01396
Project Title: Alaska Salmon Shark Assessment Project
Agency: NOAA

FORM 3B
Contractual & Commodities DETAIL

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

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

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY02

Prepared:4/12/01

Project Number: 01396
Project Title: Alaska Salmon Shark Assessment Project
Agency: NOAA

FORM 3B
Equipment
DETAIL

TC approved 8-6-01

Assessment of Spot Shrimp Abundance in Prince William Sound

Project Number:	02401
Restoration Category:	General Restoration
Proposer:	C. Hughey/ Valdez Native Tribe, C. O'Clair/ NOAA
Lead Trustee Agency:	NOAA
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	Cont'd
Duration:	4th yr. 4 yr. project
Cost FY 02:	$25.5
Cost FY 03:	$0.0
Geographic Area:	Prince William Sound
Injured Resource/Service:	Spot shrimp, subsistence

ABSTRACT

This project is estimating the abundance of spot shrimp and determining the structure of the spot shrimp population in Prince William Sound. It augments current Alaska Department of Fish and Game (ADF&G) surveys to determine whether the spot shrimp population is recovering from depletion. Project results and those of ADF&G in 1999 and 2000 indicate a cessation in the apparent decline of spot shrimp abundance in western Prince William Sound that had taken place between 1992 to 1998, and a slight increase in the number and weight of spot shrimp per pot in 1999 compared to 1998. The increase was markedly greater in 2000. FY 02 will fund closeout, produce manuscripts, and provide input into the development of a shrimp management plan with ADF&G.

A. INTRODUCTION

The commercial spot shrimp fishery in Prince William Sound (PWS) was closed in 1992 after a rapid decline in the commercial catch following the peak harvest of over 110 tonnes in 1986 (Trowbridge 1994, Orensanz et al. 1998). The commercial fishery remains closed and further restrictions are being implemented for the sport and subsistence fishery. Annual surveys of the abundance of spot shrimp in PWS begun in 1989 by the Alaska Department of Fish and Game (ADF&G) continue to the present. The surveys sample spot shrimp at six to eight sites in the seven major statistical reporting areas that divide the Traditional Harvest Area in western PWS (Trowbridge 1992, 1994). From 1989 to 1998 the survey catch per unit effort (CPUE) declined from 0.6 kg/pot to 0.1 kg/pot (Trowbridge 1994; ADF&G, unpublished data). Catches of the present study and those of ADF&G in 1999 averaged CPUE's of 0.3 kg/pot and 0.2 kg/pot, respectively. In 2000 the mean CPUE of our catches was 0.44 kg/pot; that of ADF&G was 0.21 kg/pot. The mean number of shrimp/pot caught by the present study increased 1.9 x between 1999 and 2000. The mean number of shrimp/pot caught by ADF&G increased 1.5 x during the same period These results indicate that the decline in spot shrimp CPUE between 1989 and 1998 did not continue into 1999 and 2000, and that there is some evidence of the beginning of recovery in the spot shrimp population in western PWS.

This proposal covers the final year of a four year study designed to augment the ADF&G annual survey data for 1999 and 2000 by adding population information from other areas in PWS. We seek to enhance our understanding of spot shrimp population dynamics by providing information on juvenile distribution, abundance, and size structure, and will ultimately aid ADF&G in developing a management plan for spot shrimp when the population recovers. In FY'99 NMFS personnel took input from the Valdez Native Tribe and former PWS commercial shrimpers to identify potential sampling sites. A preliminary, exploratory cruise was conducted in August 1999 to evaluate potential sites. The first sampling cruise of the study took place in October 1999 a week or two after the annual ADF&G cruise. The second full sampling cruise of the study took place in October 2000 and overlapped the ADF&G cruise for 2000.

NEED FOR PROJECT

A. Statement of Problem

Evidence for depletion of the spot shrimp resource in PWS after 1989 is convincing (Trowbridge 1994). The role that the *Exxon Valdez* oil spill (EVOS) may have played in the reduction of spot shrimp abundance in western Prince William Sound is unclear. Trowbridge (1992) found reduced CPUE in weight and number of spot shrimp in oiled vs unoiled areas in 1989 and 1990 in PWS. The differences in CPUE (number and weight of shrimp) did not persist into 1991. Mean size of shrimp was reduced in the oiled area in all three years. However, Trowbridge (1992) could not find conclusive evidence "that spot shrimp within PWS were themselves

affected by the EVOS" owing, in large part, to limitations in time and funding for spot shrimp damage assessment. Spot shrimp were not considered a high priority species by the EVOS damage assessment process. Lack of pre-spill abundance information coupled with confounding reductions in spot shrimp abundance prior to the spill rendered the species less favorable for a definitive damage assessment study. Trowbridge (1992) ultimately concluded that the observed abundance and structure of the spot shrimp stock in PWS in the first few years after the *Exxon Valdez* oil spill could mostly be explained by fishing pressure. Nevertheless, he hypothesized that highly sensitive shrimp larvae which were probably in the water column and near the surface during the oil spill were adversely affected by oil toxicity. No damage assessment study focused on larvae was initiated after the spill. The impact on the shrimp population after 1989 of exposure to oil of the 1989 year class in the larval stage is unknown.

Of additional concern is the increased pressure on the spot shrimp resource by sport and subsistence shrimpers as a result of greater access to western PWS following the completed access road connecting Portage and Whittier. Increased cruise ship traffic in and independent tourist visitations to western PWS in recent years may be having adverse impacts on spot shrimp habitat within PWS.

B. Rational/Link to Restoration

This project falls under the category of monitoring. We seek to assess the extent to which spot shrimp abundance has recovered since the population decline which began just prior to 1989. Although the major cause of the decline was probably overfishing rather than the EVOS, there is great interest by subsistence users of shrimp as well as sport shrimpers and individuals who fished for spot shrimp commercially in PWS prior to 1992 in the present status of the spot shrimp population in PWS. The ADF&G currently surveys spot shrimp abundance at selected locations in PWS annually. The goal of this study is first to broaden the geographical coverage and increase the amount of replication within existing major statistical reporting areas of the assessment of spot shrimp abundance in PWS. Second by focusing on the reproductive potential of females and recruitment potential as indicated by the abundance of young males and juveniles in the population we seek to determine whether the population is recovering. The results of this work should greatly enhance the information base underpinning ADF&G management decisions.

C. Location

This study focuses on 12 sites in the Traditional Harvest Area for spot shrimp in western Prince William Sound. The project includes six sites currently surveyed by ADF&G as well as six additional sites in statistical reporting areas currently surveyed. Elements of the communities of Whittier, Valdez and Cordova that are now or have in the past been associated with the sport, subsistence or commercial harvest of spot shrimp may be affected by the results of the project.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Charles Hughey of Valdez Native Tribe acts as community facilitator for the project. Shrimpers in the Valdez Native Tribe provided information on potential sampling sites. Fishers in Valdez with shrimping experience participate in the project, providing vessels and crew.

PROJECT DESIGN

Two important considerations entered into the project design. First, the project overlaps existing survey sites of ADF&G as well as samples new sites, and, to the extent possible, the project duplicates the methods that ADF&G uses in their surveys. This accomplishes two ends: 1) It allows us to compare with greater confidence our data with that previously collected by ADF&G on spot shrimp abundance in western PWS in order to determine, more convincingly, whether spot shrimp population recovery is taking place in PWS, and 2) It will be more likely to provide data of the greatest value to ADF&G for future management of the spot shrimp resource in PWS.

The second consideration is that to maximize community involvement and to make the best use of traditional ecological knowledge, shrimpers associated with the Valdez Native Tribe are encouraged participate in the project and have timely access to project results. The shrimpers had input into the selection of the additional sampling sites. Because the shrimp pots and other fishing equipment used by the present study differ in configuration from that used by ADF&G, the extent to which the project can overlap the ADF&G sites and sampling dates may permit the calculation of correction factors for comparison of the project's data with that of ADF&G.

A. Objectives

1. Estimate abundance (CPUE) of spot shrimp by weight and number of individuals (years two and three).

2. Determine the sex and size composition of spot shrimp at the study sites (years two and three).

3. Estimate spot shrimp fecundity and relative number of egg-bearing females at the study sites (years two and three).

4. Estimate juvenile abundance and compare between sites (year three).

5. Compare abundance, sex and size composition, fecundity and proportion of ovigerous females between sites and years (year three).

6. Compare abundance data and data on population structure obtained under the present project with historical data collected by ADF&G to determine if the population is recovering and to assess the potential for full recovery of the spot shrimp population in PWS (year four).

7. Work with ADF&G, using data collected from this study, to develop a spot shrimp management plan for PWS.

B. **Methods**

The methods used in the present study are modified after Trowbridge (1992, 1994). Shrimp pots were fished at six sites in northern and western PWS previously surveyed by ADF&G (Figure 1). The sampling sites were located in Unakwik Inlet, at Golden in Port Wells, in lower Culross Passage, in Herring Bay, at northeast Chenega Island and at northern Green Island. Six additional sites located in Wells Bay, Eaglek Bay, McClure Bay, near East Finger Inlet in Port Nellie Juan, northwest Perry Island and near Jackpot Island. In 2000 a site at North Squire Island was substituted for the one in Eaglek Bay.

At least two strings of shrimp pots were set at each site. Each string consisted of 11 pots spaced 18.9 m (62 ft) apart along a groundline and buoyed at both ends. Standard, round, nesting pots were used. The diameter of the base and of the top of each pot was 107 cm (42 in) and 91 cm (36 in), respectively. The frame of the pot was mild steel with a black plastic coating and covered with a tar-coated mesh having stretched openings of 2.9 cm (1 1/8 in). There were two opposing tunnels in the side of each pot which had a 7.6 cm (3 in) opening. These pots differed in configuration from those of ADF&G which are rectangular pots measuring 41 cm x 41 cm x 91 cm (16 in x 16 in x 36 in). In 1999 we interspersed pots similar in configuration to, but somewhat smaller than (33 cm x 33 cm x 81 cm) those of ADF&G to test the relative efficiency of the two pot designs. The pots were fished in the depth range 27-183 m (15-100 fm) for a minimum of 18 h at each site. In year three additional pot sets were made in the depth range 0-27 m (0-15 fm) to assess the abundance of juvenile spot shrimp. The pots were similar in design to the larger nesting pots described above but were 71 cm (28 in) in diameter and covered with mesh with 8 mm openings. Each tunnel entrance had an opening of 5 cm (2 in).

Upon retrieval of the pot strings all pandalid shrimp in each pot were speciated. Spot shrimp were counted and the catch weighed to the nearest two grams on an electronic balance. Other species of pandalid shrimp (eg. *P. eous* and *P. hypsinotus*) were counted. All non-shrimp bycatch were speciated and counted. The carapace length of all spot shrimp was measured to the nearest mm. Carapace length was measured with calipers except when catches were large in which case the shrimp were photographed with a digital camera and carapace length determined with image analysis. A subsample of each catch was collected for staging and sexing in 1999. In 2000 all spot shrimp were collected for staging and sexing. Additional observations of ovigerous spot shrimp included egg condition (eyed vs uneyed) and egg color. The egg clutches of a total of about 10 ovigerous females were sampled at each site for estimates of fecundity and the number of dead eggs in the clutch. For nonovigerous females, the presence or absence of breeding dress [characterized by "...the presence of long, simple, and plumose setae on the protopodites of pleopods" (Butler 1980)] was recorded. Breeding dress indicates a mature female.

The sampling cruises were conducted in October (the time of year when ADF&G normally conducts the annual survey) for the purposes of comparing the catch data collected by this project with that collected by ADF&G.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

This project is a partnership between the National Marine Fisheries Service, the Valdez Native Tribe with Charlie Hughey as facilitator and Prince William Sound Economic Development Council.

SCHEDULE

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

October 1 - March 31	Complete processing of egg samples and analysis of data on spot shrimp adult and juvenile abundance, sex and size composition, and relative number of egg-bearing females and fecundity of spot shrimp at the study sites in year three.
April 1 - September 30	Produce a final report. Analyse spot shrimp fecundity and juvenile abundance at the study sites in year three.

B. Project Milestones and Endpoints

June 15, 2001	Complete estimates of spot shrimp fecundity and juvenile abundance at the study sites in year two.
October 31, 2001	Complete comparison of spot shrimp abundance, sex and size composition, fecundity and proportion of ovigerous females between sites and years.
January 15, 2002	Complete comparison of the abundance data and the data on population structure obtained under the project with historical data collected by ADF&G.
April 15, 2002	Submit final report and recommendations to ADF&G for development of a PWS shrimp management plan.

C. Completion Date

September 30, 2002

PUBLICATIONS AND REPORTS

A final report will be submitted on 15 April in FY02. It is anticipated that at least two publications will derive from this project.

PROFESSIONAL CONFERENCES

Travel funds are requested for attendance of one individual at the annual Exxon Valdez Restoration Workshop in January 2002.

NORMAL AGENCY MANAGEMENT

The National Marine Fisheries Service (NMFS) does not manage shrimp resources in Alaska and has never been required by statute or regulation to survey spot shrimp populations in PWS. No project similar to the one proposed here has been conducted by NMFS in the past without funds from the Trustee Council. Spot shrimp are managed by ADF&G which conducts annual surveys in PWS to assess the status of the resource.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The Valdez Native Tribe Facilitator Charles Hughey and Prince William Sound Economic Development Council will work with NMFS scientists to successfully complete this spot shrimp project. The ADF&G will be asked to review the final report to improve the quality of it and to increase the relevance of the report to management goals.

The Prince William Sound Economic Development Council has coordinated other projects for EVOS in the past. The projects include the Chenega Bay Beach Clean-up and the five Oil Waste Management buildings in Valdez, Whittier, Cordova, Chenega Bay and Tatitlek.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

In fall 1999 and 2000 circular pots were substituted for the rectangular pots that ADF&G uses. The pots are identical to the pots that ADF&G uses in their surveys in southeastern Alaska. In 1999 the circular pots were cross-calibrated with rectangular pots similar to those used by ADF&G in Prince William Sound.

PROPOSED PRINCIPAL INVESTIGATORS

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PRINCIPAL INVESTIGATORS

Charles G. Hughey is a commercial fisherman, EVOS community facilitator for Valdez, and serves on the Alaska Fish and Game Advisory Committee.

Sue Cogswell is executive director of Prince William Sound Economic Development Council and has experience in project management.

Charles E. O'Clair will be responsible for sampling, data analysis and interpretation and report writing.

Mandy Lindeberg. will be responsible for arranging logistics (vessels, equipment, contracts, etc.), will participate in sampling, data processing, and will assist in report writing.

LITERATURE CITED

Orensanz, J. M., J. Armstrong, D. Armstrong and R. Hilborn. 1998. Crustacean resources are vulnerable to serial depletion - the multifaceted decline of crab and shrimp fisheries in the Greater Gulf of Alaska. Reviews in Fish Biology and Fisheries 8: 117-176.

Trowbridge, C. 1992. Injury to Prince William Sound spot shrimp. Final report for Exxon Valdez Oil Spill State/Federal Natural Resource Damage Assessment Subtidal Study Number 5. 141 p.

Trowbridge, C. 1994. Spot shrimp *Pandalus platyceros* surveys in the Prince William Sound management area, 1989 -1993. Regional Information Report No. 2A94-31. Alaska Department of Fish and Game. Anchorage, Alaska. 30 p.

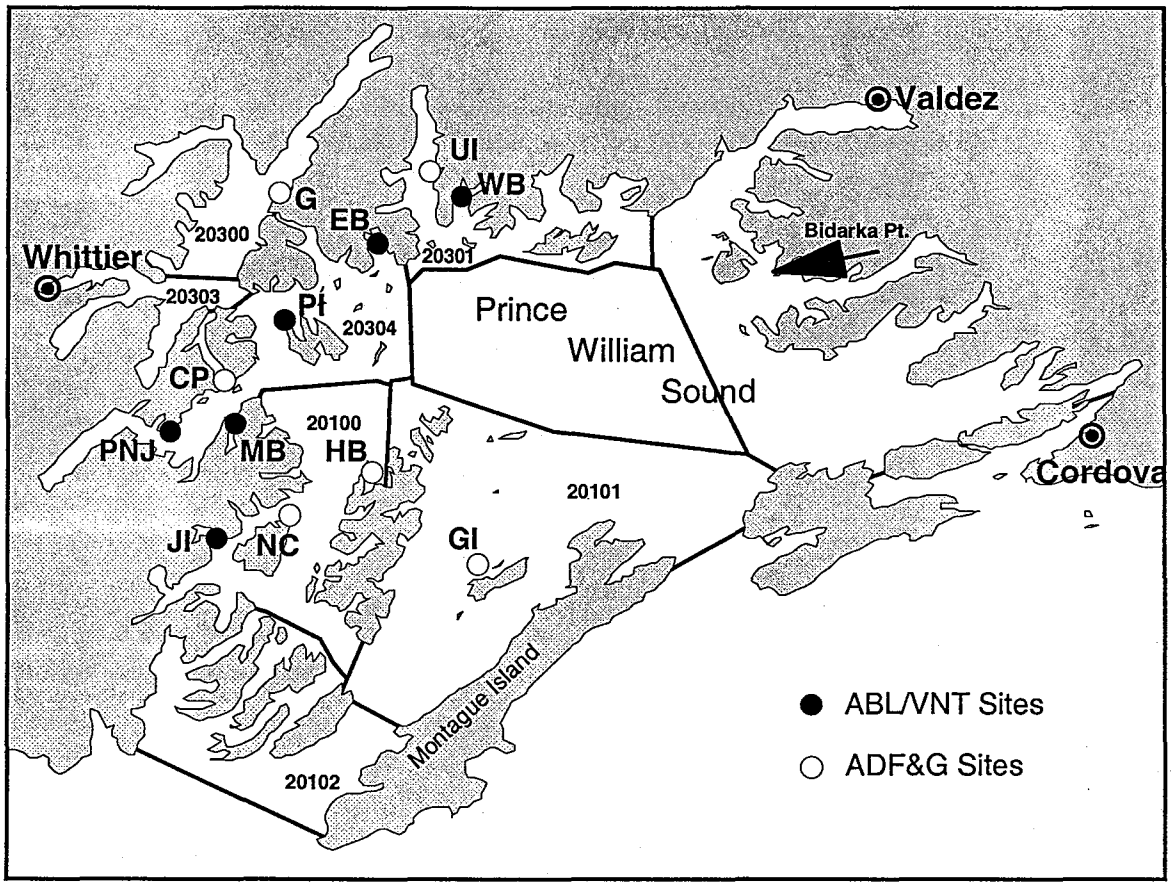

Figure 1. Location of spot shrimp study sites in Prince William Sound. The Alaska Department of Fish and Game (ADF&G) sites are those traditionally sampled during the ADF&G annual survey. The Auke Bay Lab/Valdez Native Tribe (ABL/VNT) sites were added in October 1999. The ADF&G major statistical areas for reporting commercial shellfish catch are outlined within the shaded area. (Major statistical areas are numbered.) The Traditional Harvest Area is that area west of a line drawn between Bidarka Pt. and Montague Pt. (Modified after Trowbridge 1992). Site abbreviations are: CP, Culross Passage; EB, Eaglek Bay; G, Golden; GI, Green Island; HB, Herring Bay; JI, Jackpot Island; MB, McClure Bay; NCI, North Chenega Island; PI, Perry Island; PNJ, Port Nellie Juan; UI, Unakwik Inlet; WB, Wells Bay.

Revised 7-[illegible]-01
TC approved 8-6-01

FY 02 *EXXON VALDEZ* TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002
Personnel	$35.6	$15.0
Travel	$3.5	$0.8
Contractual	$39.1	$6.0
Commodities	$1.7	$1.0
Equipment	$0.0	$0.0
Subtotal	$79.9	$22.8
General Administration	$8.1	$2.7
Project Total	$88.0	$25.5
Full-time Equivalents (FTE)	0.5	0.2
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 2003					
$0.0					

Dollar amounts are shown in thousands of dollars.

Comments:This is a closeout project.
NOAA contribution: Dr. Stan Rice, Habitat Program Manager .25 mo @3.2K

FY02

Prepared:4/12/01

Project Number: 02401
Project Title: **Assessement of Spot Shrimp Abundance in PWS**
Agency: NOAA

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2002
Mandy Lindeberg	Fisheries Research Biologist	GS / 11/1	2.5	6.0		15.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.5	6.0	0.0	
					Personnel Total	$15.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2002
RT Juneau - Anchorage	0.4	1	2	0.2	0.8
EVOS Trustee workshop					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.8

FY02

Prepared:4/12/01

Project Number: 02401
Project Title: **Assessement of Spot Shrimp Abundance in PWS**
Agency: NOAA

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed FY 2002
Description	
Temporary Labor	
Report Preparation	6.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$6.0

Commodities Costs:	Proposed FY 2002
Description	
Publication/Presentation costs	1.0
Commodities Total	$1.0

FY02

Prepared:4/12/01

Project Number: 02401
Project Title: **Assessement of Spot Shrimp Abundance in PWS**
Agency: NOAA

FORM 3B
Contractual & Commodities DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2002
			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
computer (2)		5

FY02

Prepared:4/12/01

Project Number: 02401
Project Title: **Assessement of Spot Shrimp Abundance in PWS**
Agency: NOAA

FORM 3B
Equipment
DETAIL

approved TC 8-6-01

Project Title: Testing Archival Tag Technology in Alaska Salmon

RECEIVED
APR 13 2000
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

Project Number:	02404
Restoration Category:	Research
Principal Investigator:	Dr. Jennifer L. Nielsen Alaska Biological Science Center USGS-Biological Resources Division 1011 E. Tudor Rd. Anchorage, Alaska 99503

Lead Trustee Agency:	DOI--USGS
Cooperating Agencies:	ADFG
Alaska Sea Life Center:	No
Project Duration:	2nd of 3 yrs
Cost FY 02:	$104.6
Geographic Area:	Cook Inlet
Injured Resource/Service:	Coho salmon

ABSTRACT

Archive tags with temperature, pressure, and light-geolocation sensors will be monitored for hatchery released coho salmon (*Oncorhynchus kisutch*) in Cook Inlet. Light/location relationships specific to the Gulf of Alaska developed under EVOS study #00478 (FY00) will be applied in this study of movement and migration paths for coho salmon during maturation in salt-water environments in Cook Inlet. Contemporary physical oceanographic, climatic, and bathometric data available for Cook Inlet will be incorporated into our interpretation of geolocation results and analyses of critical marine habitat and migratory pathways derived from pressure, temperature, and light sensors deployed and recovered in coho salmon. Salmon for this study will be reared in captivity (ADFG hatchery at Fort Richardson) to 1+ year of age (200-250 mm), acclimated and released in Cook Inlet as part of ADFG's Ship Creek sport-fishing hatchery release. Return and recovery of the tagged coho will be monitored as jacks at the Ship Creek weir, and in the sports fishery including a reward system for tag recoveries in the Ship Creek silver salmon derby.

Archival tags can provide estimates of geolocation, vertical movements, and ambient and internal temperatures for individual fish for long periods of time (up to 18 months for these coho). Recent tag developments allow the application of internal archive tags in smaller fish (150 mm smolt; Keith Stoodley, LOTEK Marine Technologies, Inc, personal communications), making this technology appropriate for the study of salmonids in marine environments where tag recoveries can be obtained from sport fishery, commercial harvest, and/or captures of tagged fish in spawning migrations. The opportunity to test the development and application of this tag technology for the first time in coho salmon is available in collaboration with the Alaska Department of Fish and Game's Fort Richardson hatchery production of coho salmon for release into Ship Creek.

Tagging coho reared in the hatchery environment to the required size (200 - 250 mm) will allow us to test efficiency and accuracy of this technology in the study of ocean use and movement patterns for coho salmon throughout Cook Inlet. Live releases will follow preliminary tests of initial and delayed mortality, tag retention, physiological stress, growth, and fish behavior in the hatchery environment. The first year of work has included pilot studies of tag retention, behavior, and growth for coho in captivity (e.g. hatchery). We have 277 hatchery coho on an

accelerated growth regime (current mean size = 157 mm FL) at Fort Richardson hatchery. Coho over 150 mm have been tagged with visible implant tags (VIT) to identify them as individuals. We have contracted with LOTEK for the purchase of 125 "beta" archival tags for coho smolts and 60 dummy tags of the same size. Surgical implant protocols were developed in collaboration with the University of Waterloo (Dr. Scott McKinley) in Canada. Ship Creek coho will be tagged following tag delivery expected in mid-May. A spring release experiment in the first year will be contingent on the successful implementation and retention of these tags. All surviving tagged coho will be released with the rest of the Ship Creek hatchery coho the first week in June. We will survey for early jack recoveries at the Ship Creek weir and among sport fishers from mid-July through November 2001. Monitoring the recovery of tags in the coho commercial fishery in Cook Inlet and the derby sport fishery on Ship Creek facilitates a higher probability of adult recoveries in the first 18 months of this project.

Archive tagged fish will be used to document coho salmon use of marine habitats, migration routes, contribution to the sport fishery, and hatchery/wild interactions for salmon in Cook Inlet. Information on temperature, depth (pressure), and light from archive tags can be integrated with tidal stream data, climatic data, oceanographic bathometry, stream discharge, hydrographic records, and sea surface satellite imagery to help track salmon distribution and migration routes throughout Cook Inlet. We have researched electronic records for ocean bathymetry in Cook Inlet and are developing a base map in ARC-View to use in plotting coho movements throughout Cook Inlet based on tag recoveries and archival environmental data. Our understanding of marine habitat use, forage patterns, coastal and deepwater migrations, and maturation rates will greatly enhance EVOS recovery efforts and planning in future GEM conservation efforts.

INTRODUCTION

Our previous EVOS study (#00478) is testing light-based geoposition estimates for satellite pop-up and archive tags in the Gulf of Alaska. Light sensors attached to the smaller archive tags used in this study are being designed to collect identical data for geoposition estimates. Part of this study will continue these efforts to gain accuracy of geoposition estimates on the local scale within the Gulf of Alaska and Cook Inlet and to monitor local geography, climatic, and water quality conditions leading to errors in these estimates. To that end we will complete nine months collection of *in situ* data from two tags retained on halibut in captivity at the Alaska SeaLife Center (June 2001) and from tag arrays mounted on a stationary buoy at the entrance of Resurrection Bay (November 2001). Analytical analyses of light-based data for geoposition estimates made in this study will serve as a baseline for data collected from archival tags on coho in Cook Inlet. Archival tags recovered from salmonids with different ocean movement patterns will allow us to develop accurate correction factors to adjust for light attenuation at depth and special tidal and oceanographic conditions found in Cook Inlet.

The application of archive tag technology in ocean-going fish species has been underway for several years and is an effective tool for estimates of open-ocean migration pathways and to ascertain basin-scale movements along parts of the continental shelf (Welch and Eveson 1999; R. W. Brill, personal communications). Recent developments in the architecture and size of these tags have made them appropriate for use in maturing salmon such as steelhead, sea trout, Atlantic salmon, and Arctic charr (Welch and Eveson 1999; M.A. Svenning, and F. A. Voegeli pers. comm.) J. L. Nielsen (PI) recently received a Census of Marine Life grant from the Sloan Foundation's Pacific Ocean Salmon Tracking Project (CoML POST - 2002-2004) for a field test of archival and acoustic tagging of steelhead kelts on the Kenai Peninsula. Life history investigations of oceanic behavior by salmonids will be greatly enhanced by using archive tags to

trace migratory patterns of individual fish during their development at sea. Both offshore and coastal elements will provide critically needed insight on how salmon use the ocean during their extensive migrations. Implementation of this cutting edge tagging technology will provide improved understanding into how current and anticipated climate changes may affect salmonid population dynamics. Crepuscular diving behavior has been demonstrated in many pelagic marine species using archive tags, but the mechanisms driving this behavior remain unknown, i.e. reaction to light scatter at dawn and dusk and/or a search for uniquely available prey items at depth during these intervals (B. Block et al. 1998; Lutcavage et al. 1999). It is interesting that this behavior has been documented in both the Atlantic and Pacific Oceans for multiple species, including Atlantic salmon (J. Sturlaugsson, pers. comm.) It is unknown if Pacific salmon in open seawater exhibit this behavior, and if they do how they react to long crepuscular conditions in Alaska. Use of this technology has the potential to capture the imagination of the public through an education and outreach component.

Coho salmon (*Oncorhynchus kisutch*) from the Fort Richardson fish hatchery are thought to support significant commercial, sport and subsistance fisheries. The distribution of coho post-smolts and sub-adults throughout saltwater habitats in Cook Inlet is unknown. Recent documentation of Beluga whale distributions in Cook Inlet throughout the winter suggests that coho yearlings may provide an important part of the marine food web for this region. The effect of hatchery releases of coho on natural salmonid production in Cook Inlet is also unstudied. The implementation of new tagging technologies can be used to document the distribution and migration patterns of important salmonid populations in saltwater habitats. The development of effective application and protocols for these technologies under local conditions, however, require initial studies in non-critical populations. Alaska Department of Fish and Game (ADFG) production of coho at the Fort Richardson fish hatchery provides an excellent opportunity to grow fish to required size for tagging and subsequent release into natural marine habitats (L. Peltz, ADFG, pers. comm.) We have used the Ship Creek coho stock for our initial tagging studies using salmon archive tags.

We have been able to raise 277 hatchery salmon pre-smolts in captivity to the threshold size (150 mm) necessary for successful application of archive tag. Current coho sizes 95% CI range from 153-161mm fork length and 95% CI weights range from 48-55 grams. Larger coho have been tagged with visible implant tags (VIT) to identify them as individuals (N = 46). We have contracted with LOTEK for the purchase of 125 "beta" archival tags for coho smolts and 60 dummy tags of the same size ($61,843.20). Surgical implant protocols were developed in collaboration with the University of Waterloo (Dr. Scott McKinley). In these tests dummy tags were implanted in trout of various sizes and we monitored post surgical recovery (100%) and placed tagged fish in swimming stress tests post recovery. Two light-stalk positions (anterior center and from the lower side of the abdomen) were tested with our first experimental surgeries. We found no difference in swimming ability post recovery for tagged or untagged fish in these experiments. When the first beta-test salmon archive tags are available from LOTEK in mid-May we will test surgical implant protocols, fish recovery, and behavior in tagged coho salmon for one to two weeks prior to live releases in Ship Creek. All surviving tagged coho will be released with the Ship Creek hatchery coho the first week in June. We will survey for early jack recoveries at the Ship Creek weir and among sport fishers from mid-July through November 2001.

Finding where and when coho salmon go at sea and their temporal and spatial use of specific marine locations critical to oil spill management and recovery are important steps to identifying factors potentially contributing to survival and fitness under different environmental conditions. Data developed from archive tags on hatchery coho will provide inference on hatchery vs. wild fish interactions, "hot-spots" of coho production within Cook Inlet, migration paths and critical ocean habitat, and spawning fidelity of hatchery fish within the basin. All of these data will set baseline structure and sampling protocols for future implementation of archive tags on wild salmonid stocks throughout Alaska, including potential studies of endemic cutthroat trout (*O. clarki clarki*), Kenai feeder chinook salmon (*O. tshawytscha*), coastal steelhead (*O. mykiss*), Dolly Varden (*Salvelinus malma*), and Cooper River chinook and coho salmon. Our studies of hatchery stocks will provide valuable information to ADFG on the management and stability of hatchery production in this area and its contribution to the local fishery.

The definition of "critical habitat" in the marine environment for anadromous and pelagic fishes is essential to the development of reserves or protected areas (Anonymous, NOAA, 1999). In Alaska, the relationship of aquatic protected areas to subsistence, commercial, or sport fisheries is a critical factor in considerations of design and implementation of reserves. Resource protection and strategic use are not incompatible concepts when a sound foundation of scientific knowledge on the distribution and abundance of key species is incorporated into reserve planning and resource use, and if local community-based natural resource management is included in the analyses of such data (Getz et al. 1999). This proposal continues to test the application and deployment of a new technology, electronic archive tags, in investigations into the temporal and spatial distribution of key anadromous and marine fish species. Many aquatic species that fall under the jurisdiction of the Trustee Council in their efforts to restore the resources and services injured by the spill may benefit from the development and local adaptation of this technology. Monitoring of critical habitat use by near-shore and marine fish species will allow these organisms to speak directly to the managers of the resource during the development, implementation and applications of recovery or enhancement activities.

For many commercially important anadromous and marine fish species ocean-use and critical habitat remain uninvestigated with little or no scientific evidence to support distribution on temporal or spatial scales. The use of radio telemetry and satellite-linked tracking for studying fishes has experienced a recent exponential growth in the development of technologies and applications (Lucas et al. 1993; Eiler 1995; Sibert 2000). In addition to critical habitat designation, physiological telemetry can now be used to monitor energy expenditure, life history migrations, stage of life cycle, and environmental conditions critical to improving and validating habitat-use models for pelagic fishes (B. Block et al. 1998). Archival technologies offer the fisheries research community a new tool that is required to resolve movement patterns, spatial and temporal habitat use, and stock structure of many migratory marine species found throughout Alaska. The critical advantage to this new technology is that it allows documentation of habitat use that is independent of harvest or fishing effort. Conventional identification tags have been used on fish since the early 1900s to estimate catch effects. Hydroacoustic tags can provide multi-day records of location, depth, temperature and swimming speed in marine fishes, but their temporal and spatial scale is limited by the range of signal recovery and transmission duration in salt water. In the late 1980's the first generation of archive tags was developed and deployed on marine fish.

Recovery rates for archive tags in the open ocean are typically low (~30%). It is unclear, however, if these poor recoveries are due to differences in survivorship of the fish, differences in tagging technique, tags location, or tag failure. In studies with an active fishery and where fish carrying an external identification tag can be collected at terminal spawning locations, archive

tag recoveries can be quite successful (60-80%, D. Welch, pers. comm.) Testing tag recovery rates and efficiencies in a hatchery stock released into Cook Inlet provides the best possible conditions for initial archive tag studies using this technology in Alaska.

Data archived by these tags include records of ambient and internal body temperature, pressure, and light. It is possible to estimate latitude (geoposition) for tag location at any given time from light intensity, temperature, and accurate temporal measurements of dawn and dusk (Hill 1994). The longitude determination is equally accurate throughout the year and at all locations except those where no dawn and dusk events are recorded. Latitude determinations are most accurate at the solstices and useless at the equinoxes. This is clearly a problem in Alaska waters where long crepuscular periods (winter) are followed by intense solar periods (summer). The accuracy of light-level measurements, duration of crepuscular events, atmospheric or oceanic aberrations, and individual fish behavior can all impact the accuracy of geoposition estimates. A current error rate of 50-60 miles is not uncommon in the analyses of these data from temperate waters. We expect a much lower error rate in Alaskan waters based on current studies of light sensors and data analyses adapted to local light conditions (EVOS #00478).

Data from archive tags can be made available at the time of recovery to any user group after developed algorithms translate sequence data stored on tags into temperature, pressure, and light information. Successful integration of archive tag data into the EVOS Trustee Council's Gulf Ecosystem Monitoring (GEM) program will allow the development of a unique and continuous information base on natural use of critical marine habitat by coho salmon caught in the Ship Creek sport fishery and during spawning migrations. These data will allow estimates of the duration of ocean use, migrations, development rates, and movement of hatchery fish into natural salt and freshwater habitats in Cook Inlet. This proposal suggests that data collected from archive tags deployed in Cook Inlet be made available to local communities and interest groups through internet web links with a USGS/BRD web site dedicated to this study. This proposal is intended to test the accuracy and efficiency of archive tags for estimates of geoposition and ocean use by coho salmon in Cook Inlet. If successful these data can provide an effective database for sampling protocols and analyses of critical habitat use by post-smolt and maturing wild salmon populations throughout Alaska waters.

Additional research on cost-effective tagging regimes for this area need to follow our development of efficient light-based geoposition estimates using archive tags. To this end the PI (JLN) was invited to participate in a development consortium devoted to scientific advances in the application of electronic tagging tools in marine ecosystems. This informal consortium is made up of several research scientists, resource managers, and manufacturers devoted to tagging technology in ocean environments. The rationale of the consortium is to provide open communications on the existing technology (supply and demand, recent developments, application problems and successes) and to push for the appropriate level of investment and product specifications (e.g. size, transmission potential, data storage, validated data) for ongoing needs and the manufacturability (including quality, reliability, satellite platforms, price, and development times) for future research. This consortium provides an active dialogue among key researchers and institutions that are willing and able to invest resources to aid and abet the development and application of this technology in a transparent process that will share the risks and the rewards. Our satellite pop-up tag study (EVOS project 00478) designed to test geolocation technology under local application is considered one of the few "well structured technical assessments of this technology" currently in progress. J. L. Nielsen (PI), David Welch (Pacific Biological Station DFO, Nanaimo, B.C.), and George Boehlert (NMFS, Pacific Grove, CA) recently received a Census of Marine Life grant from the Sloan Foundation's Pacific Ocean Salmon Tracking Project (CoML POST - 2002-2004) for a field test of steelhead kelt migrations

on the Kenai Peninsula (Ninilchik River, Anchor, and Deep creeks), Smith River, California, and on the Keogh River, B.C., using archival and acoustic tags. Life history investigations of oceanic behavior by salmonids will be greatly enhanced by using archive tags to trace migratory patterns of individual fish during their development at sea. Both offshore and coastal elements will provide critically needed insight on how salmon use the ocean during their extensive migrations as pre-adult and adult fish.

Our current proposal (EVOS #01404) is investigating species-specific tagging protocols, size and location of tags as they affect survival rates (for both fish and tags), effects of coastal geology on tag recovery and data collection, and the effects of fish mortality and tag mortality on the interpretation of results in coho salmon in Ship Creek. These objectives will require integration of archive tag data with other significant geological, oceanographic, and climatic databases for this area. Alaska Department of Fish and Game will benefit from this study by an analysis of hatchery fish adaptation to and use of critical marine habitats in Cook Inlet. These data will allow interpretation of hatchery fish interactions with local fish stocks (both predators and prey) and other aquatic resources such as marine mammals at different locations or habitats. Significant data already exist for beluga whale distribution within Cook Inlet that can be compared to coho salmon migrations. These data will provide information important to the development of hatchery supplementation programs and conservation strategies for the marine food web in this area.

This proposal requests continued funding to undertake archive telemetry studies on Cook Inlet coho salmon incorporating five program elements. We address our progress made on all of these aspects of the study below:

1) Rear coho salmon from the Ship Creek stock maintained by ADFG for live releases into Cook Inlet at ADFG's hatchery facilities (Fort Richardson and Elmendorf) until they reach critical size for surgical implants of archive tags (~200 mm).

   a. This part of the project is underway and protocols for accelerated growth in coho salmon are in place at the hatchery. We initiated the study with 292 coho on 12/12/01 and currently are holding 277 live fish (5% mortality, primarily due to protocol implementation studies and initial tagging experiments).
   b. We initiated accelerated growth protocols for coho at Fort Richardson Hatchery. Water temperature was slowly increased to 14° C over two days. Diet rations were increased to 0.5g/fish/day. In three months the average coho fork length has increased from 109.63 mm to 157.02 mm and average weight from 15.85 to 51.46 grams. Average fish condition factor (K) has increased from 1.17 to 1.30 and instantaneous growth factor (IGR) ranged from 0.01 to 0.04 over the same period.

2) Implant beta-test archival tags in salmon pre-smolts. Monitor tag retention, behavior, and growth in captivity prior to any live releases.

   a. We have placed "visible implant tags" (VI tags) in 46 coho to date. These colorful individually numbered tags are placed in the ocular orbit above the eye and mark fish as individuals. VI tags should remain clearly visible in the coho through their adult stage and will allow identification of archive-tagged

coho in the study area if other external indicators fail. Beta production salmon archival tags (N = 125) and dummy tags (N = 60) of the same specifications have been ordered from LOTEK for $61,843.20.

b. We went to the University of Waterloo (UW), Toronto, Canada to experiment on implementation protocols for the first production of dummy archive tags. Dr. Scott McKinley, faculty at UW, is the only person in the world who has had experimental experience in the implementation of these tags in Atlantic salmon under contract with LOTEK. Dr. McKinley assisted Derek Wilson (USGS) in the development and experimental tests of protocols for coho salmon in our study. Fifteen hatchery rainbow trout were used as surrogates for coho pre-smolts and implanted with dummy archival tags in the laboratory at Waterloo. Fish size ranged from 180 - 335 mm in length. Tag size was 35 mm long by 1mm circumference with a 155 mm light stalk (average weight = 6.9 g). Two protocols for the extension of the external light stalk were tested, extension from the anterior side and extension from the central lower abdomen. All rainbow trout survived the surgical implants.

c. Swimming performance and stamina tests were made on tagged and untagged rainbow trout at UW. Control fish were of the same size as the tagged fish in this experiment. Fish were placed in velocity chambers and tested at water velocities ranging from 0.4 - 1.4 m/sec (0.1 m/sec intervals, RPM 240 – 840). Each fish was tested at each velocity interval for 10 minutes. U-crit speed was calculated by increasing the RPM/water velocity every ten minutes by 1/10 of a meter per second. There was no statistical difference between U-crit values for tagged trout (average = 1.047 m/sec) and control (untagged) fish (average = 1.054 m/sec).

d. The dummy tags received from LOTEK were slightly larger than the original specifications projected by LOTEK. After the UW experiments we feel that a critical size threshold will be 200 mm for these tags in coho or about 2.5% weight of the whole fish. We are currently modeling our experimental coho population at the hatchery to predict how many of the prototype tags we will be able to implement with these new criteria prior to the release of hatchery fish into Ship Creek. We are in communications with LOTEK on the standardization of these tags and how we might implement even smaller tags. Future design modification on the tags will be implemented in the 2002 release. An earlier start on accelerated growth at the hatchery in 2002 will also allow us to product more fish at the required size.

3) 2001 and 2002 live releases of archived tagged fish with VI and/or archival tags will be made in association with the standard hatchery releases made by ADGF into Ship Creek. Expected release dates are May 25-June 5 each year.

a. This release includes an imprinting period for coho in Ship Creek water at the Elmendorf Fish Hatchery outside of Anchorage. After an initial recovery period, tagged coho will be integrated into the general hatchery population for transport and eventual release into Ship Creek.

b. Observations will be made during integration and upon release for factors contributing to injury or incidental mortality of tagged fish under these protocols.
c. We will modify the 2002 releases based on data assembled from the first year's experiments.

4) Monitor tag recoveries in the fishery, at the hatchery release site, and in adjacent streams.

a. We have contracted with the Ship Creek silver salmon derby organizers to include information about our tagging program in their literature for 2001. We will be offering a tag recovery fee and a lottery for a reward drawn from all recovered tags in 2001.
b. We expect tag recovery to begin with the movement of coho jacks (immature males) into Ship Creek starting in mid-July 2001. We will work with ADFG in checking the Ship Creek weir everyday to monitor jack movements and look for tagged fish. USGS employees will walk the creek during peak angling hours, before, during, and after the derby. We will informally interview anglers to discuss the tagging study, our recovery efforts, and the lottery opportunity. We anticipate the first year's recover will consist primarily of jack recoveries in Ship Creek at the weir.
c. In 2002 and subsequent return years we will monitor the adult population for tagged fish migrating up Ship Creek both from the sport fishery and at the weir.
d. Information dissemination and outreach will be made to the Cook Inlet commercial coho fishery fleet in an effort to recover any tagged fish from their harvest. To this end all tagged fish will also have their adipose fin removed prior to release.

5) Plot estimates of geoposition, movement, critical habitat use, and maturation cycles from archive tags collected from coho salmon in Cook Inlet. Draw inference from these data for coho use of ocean conditions, migration paths, stray rates, and critical marine habitat needs. These data will be incorporated into the GEM database and provide information on:

a. Identification of the distribution and habitat utilization by key life stages of coho salmon in Cook Inlet.
b. Identify critical marine features:
    i. Do coho respond to sharp thermal boundaries?
    ii. Do coho depend on specific marine structural features?
    iii. Do coho use specific migration pathways?
c. Gain inference on the ecosystem dynamics of Cook Inlet;
    i. How do other species respond to coho movement with in Cook Inlet?
    ii. What is the interaction between hatchery and wild coho in Cook Inlet?
d. Predict how long-term trends in coho distribution, fish condition, growth, and survival may be impacted by changes in marine habitats due to natural or anthropomorphic shifts in ocean conditions.

NEED FOR THE PROJECT

A. Statement of Problem

Knowledge of the marine distribution of fish over time and space within Alaska's near-shore and oceanic ecosystems is needed to make sound management decisions for recovery, management of the resource, and for the development of reserves and/or protected areas in marine ecosystems. Without sound scientific support, recovery and conservation activities in marine systems will remain controversial among diverse user groups, especially in species governed by such diverse interests as coho salmon. Including local community based information in the deployment and recovery of these scientific data will be an effective tool in resource management. Documentation of individual fish behavior in economically and ecologically important species within Alaska will aid in the development of a common-ground database on fish distributions over time and space during the development and implementation of management units within the marine systems where frequent conflict-of-interest problems are expected to arise.

The marine environment imposes severe constraints on the type of tags that can be used to monitor the behavior of fish in their natural environment. Seawater is highly conductive and radio waves do not propagate well in this medium. Recently marine biologists have developed new technologies in an effort to address this problem. Archive tags are internally positioned in the fish's abdomen with light and temperature sensors extending outside the fish on a thin antenna. Sensors are programmed to collect data at set intervals for up to three years. To date this technology has been applied to many important marine species including cod and anadromous salmonids (primarily in Atlantic waters) and in Canadian steelhead populations (D. Welch, pers. comm.) The developmental approach used in the acquisition and analyses of light data generated by archive tags is the same as that used for pop-up tags (EVOS #00478) with the same need for adaptation to local climatic and solar conditions.

Additional research needs to be undertaken on cost-effective and efficient tagging regimes for this new technology, especially in salmon species. The implications of the successful application of archive tags in salmon for documentation of ocean use are enormous. Documentation of changes in salmonid ocean migrations, marine habitat use, and their reaction to critical production variables in the marine environment are necessary for our understanding of salmonid response to decadal shifts in ocean conditions and larger climatic cycles of ocean productivity. This study would facilitate investigations of species-specific tagging protocols, size and location of tags as they affect survival rates (for both fish and tags), effects of coastal geology and local climate on light data, recovery probability for different terminal captures and tag types (i.e. sport fishery and weirs with archive tags vs. satellite pop-up tags), and the effects of fish mortality and tag mortality on the interpretation of results. We will also develop a platform for data exchange, crossover studies, and data archive capacity for ecosystem scale marine habitat analyses in Cook Inlet. This latter objective will require integration of archive tag data with other significant geological, oceanographic, and climatic databases for this area.

Potential future applications directed at discovery and monitoring of ocean habitat use by coho salmon are broad. A clear understanding of marine life history and ocean forage migrations in salmonids will only become available with the development and appropriate application of this technology. Understanding temporal and spatial use of marine habitats by critical marine species will contribute significant information to fisheries resource management decisions in Alaska.

B. Rationale/Link to Restoration

Information collected during this study will contribute to our ability to use new technology to assess recovery and impediments to recovery (critical habitat) for an economically and ecologically important fish species found in marine waters throughout Alaska, coho salmon. The proposed work represents an initial scientific approach to increase our technological capacity to investigate the factors that affect population dynamics on multiple temporal and spatial scales. If successful, this technology will help in the definition of critical habitat for proposed marine reserves throughout Alaska. Without an understanding of the general underlying patterns of habitat use that dictate population change and species interaction within marine units or areas, we can not prescribe or limit specific activities within the reserve based on species distribution. Analysis of critical habitat use, hatchery/wild interactions, and interspecific competition for different life history stages of key species will allow integration of sustainable use or limited harvest in the conservation and management of these species within critical marine areas sensitive to anthropomorphic changes over time. The development of archive tag technology offers a promising window on this type of information.

Archival tag technologies offer the fisheries research community a new tool that is required to resolve movement patterns, spatial and temporal habitat use, and stock structure of many migratory marine species found throughout Alaska. The critical advantage to this new technology is that it allows documentation of habitat use based on actual fish movement and behavior in areas and at times where human observations are impossible. Conventional identification tags have been used since the early 1900s, but individuals must be recaptured before information is obtained. Hydroacoustic tags can provide multi-day records of location, depth, temperature and swimming speed in marine fishes, but their temporal and spatial scale is limited by the range of signal recovery and transmission duration. In 1996 the first generation of archive satellite "pop-up" tags were developed and deployed on pelagic fish, but these tags are currently limited to very large fish (~70 lbs). Implant archive tags allow recovery of data from much smaller individuals including salmon pre-smolts. The data archived by these tags can include records of ambient and internal body temperature, pressure, and light. It is possible to estimate latitude and longitude for tag location at any given time from changes in light intensity (see project #00478). Approaches developed from studies of satellite pop-up tags in the previous proposal are transferable to analyses of data collected from implant archive tags in salmon pre-smolts and young adults throughout Alaska.

C. Location

Data to be compiled will come from tags deployed in Cook Inlet. Initial physiological data concerning tagging effects and efficiencies of light intensity data will be assessed using a limited number of fish in captivity at ADFG hatchery facilities at Fort Richardson and Elmendorf Air Base. Tagging and recovery of coho with archive tags will take place in collaboration with ADFG and the local sport and commercial fishing communities. Tag array disposition on a stationary buoy in Resurrection Bay (project #00478) will provide general background information for the interpretation of light data in geoposition estimates for Alaska waters. Tag recoveries will employ local sport fishers through links with the Ship Creek silver salmon derby, survey for early returning males (jacks) in Ship Creek, collection of tagged adults at the release site (Ship Creek weir), and incidental recoveries in other sport, commercial and research fisheries in and around Cook Inlet.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

All efforts will be made throughout the project to incorporate participation in and provide local involvement in the implementation and development of this project in relation to target populations and tagging localities. Project staff will be available to present information to the local community. An active web site at <www. absc.usgs.gov> will include internet access to real-time data from tags as it becomes available to the PI. All articles, video, or photographs of the tagging study will be made available to the Trustee Council. The nature of the tagging study and the charismatic character of the fish subject make this a potentially high profile public relations project for the recovery and Trustee Council.

PROJECT DESIGN

A. Objectives

1) Rear coho salmon from the Ship Creek stock for live releases into Cook Inlet at ADFG's hatchery facilities (Fort Richardson and Elmendorf) until they reach critical size for surgical implants of archive tags (~200 mm).

2) Implant beta-test archival tags in salmon pre-smolts. Monitor tag retention, behavior, and growth in captivity prior to any live releases.

3) 2001 and 2002 live releases of all tagged fish with VI and/or archival tags will be made in association with the standard hatchery releases made by ADGF into Ship Creek. Expected release dates are May 25-June 5 each year.

4) Monitor tag recoveries in the fishery, at the hatchery release site, and adjacent streams.

5) Plot estimates of geoposition, movement, and marine habitat use from archive tags collected from coho salmon in Cook Inlet. Draw inference from these data for coho use of ocean conditions, migration paths, stray rates, and critical marine habitat needs. These data will be incorporated into the GEM database and provide information on:

(a) Identification of the distribution and habitat utilization by key life stages of coho salmon in Cook Inlet.
(b) Identify critical marine features:
  (i) Do coho respond to sharp thermal boundaries?
  (ii) Do coho depend on specific marine structural features?
  (iii)Do coho use specific migration pathways?
(c) Gain inference on the ecosystem dynamics of Cook Inlet;
  (i) How do other species respond to coho movement with in Cook Inlet?
  (ii) What is the interaction between hatchery and wild coho in Cook Inlet?

B. Methods

Active archive tags and dummy tags will be deployed in each of two years and under various conditions to gather and analyze data tag recovery and marine habitat use by coho salmon in Cook Inlet. Prior to the initial release, we will monitor surgical tag implantation effects on a test population (University of Waterloo). Tests will include anesthetic effects, physiological stress during and after tagging, swimming ability post tagging, stability of implantation over time, fish mortality, fish growth and fish behavior post tagging. Live releases of 60 – 185 tagged coho will be made in years 2001 and 2002 from ADFG's coho hatchery facility at Fort Richardson into Ship Creek. Recovery of tags from the fishery and from natural returns to the Ship Creek weir and in geographically proximate spawning locations will be monitored for 18 months post release. Estimates of actual fish location will be obtained from data collected from tagged fish captured in the fishery or recovered at the weir. These data will then be compared and analyzed for rigor of geoposition estimates based of our findings from previous captivity light studies and the stationary tag array in the Gulf of Alaska.

Conversion of archive data to position and movement cycles for individual fish will be made using adaptations of existing conversion algorithms available from the vendor and our initial field trials of light sensor tags in the Gulf of Alaska. New approaches to estimating geoposition from light data using time series analyses will be used in this study (R. Hill, Wildlife Computers, pers. comm.) Data for location and position for individual tags collected in the wild will be plotted on digitized maps of the Cook Inlet (two dimensional) incorporating any bathymetric data (three dimensional) available for this area using standard telemetry and GIS mapping methods (Baltz 1990; Cressie 1991; Thompson et al. 1992).

This study will continue the development and implementation of the internet link of Alaska tagging studies in marine fishes and results will run parallel to the ongoing field studies and tagging data development. The web site will be posted on the USGS/BRD Alaska Biological Science Center's home page at <www.absc.usgs.gov>.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

This proposal relies on a number of significant research collaborators including ADFG's Bill Hauser, Larry Peltz, Jeff Milton, and Bob Clark. Many unnamed collaborations will develop during the implementation of this project (i.e. commercial or sport fishers, fishing volunteers, and community participants). Known collaborators include: Dan Mulcahy, DVM, USGS/BRD fish and wildlife veterinarian; Scott McKinley, University of Waterloo; Roger Hill, Wildlife Computers; Dr. Paul Howey, Microwave Telemetry, Inc., Jim Lotimer and Keith Stoodley, LOTEC Marine Technologies, Inc.; David Welch, DFO Nanaimo, Canada; George Boehlert, NMFS, Pacific Grove, CA. All technical and clerical staff will be employees of USDGS/BRD Alaska Biological Science Center or qualified individuals contracted directly for this project.

SCHEDULE

A. Measurable Project Tasks for 2001 - 2004

Funding 2001 (EVOS/USGS BRD)

January:	Initiate accelerated growth protocols for coho at Fort Richardson hatchery (292 fish). Implement population monitoring for growth and survival in coho salmon.
February:	Develop web page for project.
March:	Purchase of archival and dummy tags for coho study. Initiate VI tagging in fish at critical size.
April:	Control tests for surgical implants of tags for estimates of survival, handling stress, swimming ability and delayed mortality in tagged fish (University of Waterloo).
May – June:	Surgical implants of archive tags in size-structured study groups and implement monitoring protocols for tag retention, growth, behavior and survival. Release tagged coho with general hatchery release into Ship Creek.
July:	Update web page for study results and plots of initial data.
July – Nov.:	Monitor and evaluate tagged fish recovery, survival, behavior and tag retention from fish recovered in the sport fishery on Ship Creek, the Ship Creek weir, and the commercial fishery in Cook Inlet.

Funding 2002- 2003 (EVOS/USGS BRD)

Dec. 01-January 02:	Initiate accelerated growth protocols for 300 coho at Fort Richardson Hatchery. Implement population monitoring for growth and survival in coho salmon.
March 02:	Purchase of additional archive tags (second generation) for coho study. Initiate VI tagging in fish at critical size.
April 02:	Second year surgical implants of tags in captivity for estimates of survival, stress, swimming ability and delayed mortality in tagged fish at Fort Richardson Hatchery.
April 15, 02:	Annual report due EVOS on preliminary results.
May – June 02:	Surgical implants of archive tags in size-structured coho study groups. Release tagged coho with general hatchery release into Ship Creek.

July –Nov. 02:	Monitor and evaluate tagged fish recovery, survival, behavior and tag retention from fish recovered in the sport fishery on Ship Creek, the Ship Creek weir, and the commercial fishery in Cook Inlet.
Aug. 02:	Presentation will be given on preliminary results of study at AFS meeting, Baltimore, MD.
Nov. – Dec. 02:	Data integration for tag recoveries, plot coho distribution and movement patterns in Cook Inlet.
Jan. 2003:	Prepare data presentation and attend restoration meeting.
April 15, 03:	Annual report due EVOS.
July –Nov. 03:	Monitor and evaluate tagged fish recovery, survival, behavior and tag retention from fish recovered in the sport fishery on Ship Creek, the Ship Creek weir, and the commercial fishery in Cook Inlet.
Nov. – Dec. 03:	Data integration for tag recoveries, plot coho distribution and movement patterns in Cook Inlet.

Funding 2004 (USGS BRD)

April 15 2004:	Submit final report to EVOS on study results.
June – Sept. 04:	Preparation of manuscript for publication of results of coho tagging study.

B. Project Milestones and Endpoints

All EVOS costs for this project will be incurred in 2001 or 2002, with primary tagging costs in 2001 and secondary costs in 2002. Survey and monitoring costs increase in FY2002 due to increased probability of adult tag recoveries at the Ship Creek weir and a second tagging and release of coho from the hatchery. Similar costs of recovery in 2003 will be covered by USGS/BRD.

Due to timing of coho salmonid life cycle in Cook Inlet (one year at sea) data analyses will continue into FY2004.

Project will be completed upon submission of the final report prior to Sept. 15, 2004.

C. Completion Date

All project objectives billed to EVOS will be met before the end of Sept. 2003.

PUBLICATIONS AND REPORTS

Preliminary report submitted to EVOS April 15, 2002 in first year's recovery of tags. A final report of activities will be submitted to the Restoration Office on or before 15 Sept. 2004.

Manuscript containing final results and recommendations will be submitted to a peer-reviewed scientific journal for publication in FY04.

Website development and maintenance of our tagging database will be available FY01-04. At the end of the project we will transfer the internet site to a webmaster designated by the Trustee Council.

PROFESSIONAL CONFERENCES

International workshop was held on tracking salmon at sea FY01 (British Columbia, CA). Preliminary report of findings will be given at AFS meeting in Baltimore MD, August 2002. Final results will be presented at professional scientific meeting yet to be identified.

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

This research provides fundamental information needed for the implementation and development a new technology dedicated to the identification of critical marine habitat for coho in Cook Inlet. The definition of critical marine habitat for economically and ecologically important fish species will serve as a cornerstone for future Trustee sponsored conservation and use management proposals under the GEM program. The major objectives of this work require interaction with several other investigators and integration of all available data that are relevant to the question of critical marine habitat in Alaska.

PROPOSED PRINCIPAL INVESTIGATOR

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PERSONNEL QUALIFICATIONS

Jennifer Nielsen is Fisheries Supervisor and Research Biologist (GS14) with the Alaska Biological Science Center, USGS Biological Resources Division. She has conducted salmonid and fisheries research throughout the western Pacific for the past 22 years. Dr. Nielsen is an Associate Professor at the University of Alaska, Fairbanks in the School of Fisheries and Ocean Sciences. From 1995 - 1999 she was a visiting scientist at Hopkins Marine Station, Stanford University, where the first experiments on satellite pop-up tags were conducted on blue fin tuna. From 1995 - 1999, she was an Adjunct Professor in Ichthyology and Fisheries at the University of California, Berkeley and Moss Landing Marine Laboratory, and served on the Scientific Review Board for the Monterey Bay Aquarium. Dr. Nielsen has published over 30 peer-reviewed journal publications and book chapters, numerous technical reports, and gives frequent national and international presentations at scientific meetings addressing research issues in fish conservation, behavior, evolution, and genetics. Her work on salmonid fishes is recognized internationally for its contribution and focus in fisheries conservation and management.

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approved 8-6-01

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Actual FY 2001	Proposed FY 2002	LONG RANGE FUNDING REQUIREMENTS					
						Estimated FY 2003		
Personnel	$15.40	$44.1						
Travel	$0.60	$0.8						
Contractual	$1.30	$2.0						
Commodities	$0.90	$0.9						
Equipment	$54.40	$50.0						
Subtotal	$72.60	$97.8						
General Administration	$2.40	$6.8						
Project Total	$75	$104.6						
Full-time Equivalents (FTE)	0.4	1.4						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

USGS/BRD will provide salary for PI, staff veterinarian, and systems scientist throughout the study and support all activities including logistical travel and training costs.
Data analysis and reporting writing will be done with USGS/BRD funds.

Revision December 2000: The budget originally proposed for this project ($100K) is being revised downward to $75K as requested by the Trustee Council. The $25K reduction being taken from salary will now be funded by the USGS instead.

FY02

Prepared 4/9/01

Project Number: 02404
Project Title: Testing Archival Tag Technology in Alaska Salmon
Agency: DOI-USGS--BRD

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Personnel Costs*:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2002
Name	Position Description					
J. Nielsen*	Fisheries Supervisor	GS14/01	3.5	7.2		0.0
D. Wilson**	Fisheries Biologist	GS7/01	9.0	4.2		37.8
D. Mulcahy*	Fish/Wild. Veterinarian	GS13/05	0.5	6.8		0.0
D.Douglas*	Fish/Wild Scientists	GS12/05	0.5	6.0		0.0
Biological technician TBA	Fisheries Technician	GS05/01	3.0	2.1		6.3
						0.0
						0.0
						0.0
*all personnel costs will be covered by USGS/BRD						0.0
**3 months salary will be funded by USGS/BRD						0.0
						0.0
	Subtotal		16.5	26.3	0.0	
					Personnel Total	$44.1

Travel Costs:	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2002
Description					
PI travel to professional conference					0.80
Web site preparation at USGS/BRD costs					0.00
PI & veterinarian travel to tagging site at USGS/BRD costs					0.00
Technical staff travel to hatchery site and weir at USGD/BRD costs					0.00
Data analyses, ARC-View mapping at USGS/BRD costs					0.00
				Travel Total	0.80

FY02

Prepared 4/9/01

Project Number: 02404
Project Title: Testing Archival Tag Technology in Alaska Salmon
Agency: DOI-USGS-BRD

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed
Description	FY 2002
Tag recovery reward reimbursements - Ship Creek Fish Derby	2.0
Additional tag recovery costs for 2003 & 2004 covered by USGS/BRD	0.0
ARC-View technical mapping training covered by USGS/BRD	0.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$2.0

Commodities Costs:	Proposed
Description	FY 2002
Materials and supplies - misc.	0.9
Hatchery costs for accelerated growth in coho covered by ADFG	0.0
2002 - 2004 Publication costs will be covered by USGS/BRD	0.0
Commodities Total	$0.9

FY02

Prepared 4/9/01

Project Number: 02404
Project Title: Testing Archival Tag Technology in Alaska Salmon
Agency: DOI-USGS--BRD

FORM 3B
Contractual &
Commodities
DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2002
Archive tags (light/temp/pressure) (100 @ 480 ea.)	100	0.5	50.0
			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	$50.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency
Any tags remaining from FY01 will be implanted in coho in 2002.		

FY02

Prepared 4/9/01

Project Number: 02404
Project Title: Testing archival tag technology in Alaska salmon
Agency: USGS

FORM 4B
Equipment
DETAIL

Revision 9-19-01
Approved TC 8-6-01

EXXON VALDEZ OIL SPILL DETAILED PROJECT DESCRIPTION

Project Title: Harlequin duck population dynamics

Project Number:	02407
Restoration Category:	Monitoring
Proposer:	Alaska Department of Fish and Game
Lead Trustee Agency:	Alaska Department of Fish and Game
Cooperating Agencies:	USFWS, USGS-BRD
Alaska SeaLife Center:	No
Duration:	3rd year of 3 year project with close-out
Cost FY02:	$68,700
Geographic Area:	Prince William Sound
Injured Resource:	Harlequin ducks

ABSTRACT

Harlequin duck (*Histrionicus histrionicus*) populations in Prince William Sound (PWS) have not recovered from the effects of the *Exxon Valdez* Oil Spill. Populations are declining in oiled areas while increasing in unoiled areas. Proposed late-winter boat surveys have been designed to assess the recovery of ducks inhabiting oiled areas. Population structure, abundance, and recruitment will be compared between oiled and unoiled areas in PWS to assess trends, population dynamics, and the progress of recovery. This survey will also help identify changes to the Gulf of Alaska ecosystem and improve our ability to differentiate between natural and man-caused population changes. This will be the final year of field-work for Project \407.

INTRODUCTION

Harlequin duck (*Histrionicus histrionicus*) populations in Prince William Sound (PWS) have not recovered from the effects of the *Exxon Valdez* Oil Spill (*Exxon Valdez* Oil Spill Trustee Council 1999). Populations are declining in oiled areas while increasing in unoiled areas (Rosenberg and Petrula 1998). Ducks in oiled areas exhibited elevated levels of cytochrome P450 induction, indicating continued oil exposure, and adult female winter survival was lower in oiled than unoiled areas (Trust et al. 2000, Esler et al. 2000). Collectively, these studies suggest that oil exposure, female survival, and population dynamics are linked and provide strong evidence that harlequin ducks have not recovered from the effects of the *Exxon Valdez* oil spill.

Harlequin ducks occur year-round in intertidal zones of PWS (Isleib and Kessel 1973). At least 1,298 harlequin ducks were estimated to have died as a direct result of oil exposure following the Exxon Valdez oil spill (J. Piatt pers. comm.). Oil spill studies of harlequin ducks in western Prince William Sound (PWS) from 1990-93 found consistently low numbers of birds during the breeding season, little breeding, low productivity, and an apparent decline in post-breeding molting birds (Patten et al. 1998a, Patten et al. 1998b). In 1995, six years after the Exxon Valdez oil spill there was no sign of recovery (Exxon Valdez Oil Spill Trustee Council 1996).

As a result of the 1990-1993 findings and the lack of recovery, ADF&G initiated population monitoring in 1994 (Rosenberg and Petrula 1998). These studies, conducted from 1994 through 1997, found no difference in population structure between oiled and unoiled areas; no brood production in the spill area; and a decline in molting populations. Similar population structures, a positive finding, indicated that the population was in a position to recover. However, the declining trend in numbers during autumn surveys for the oiled areas of western PWS remained a concern, especially since populations in unoiled eastern PWS increased. This indicated that recovery has not occurred.

Other studies support our findings. Winter survival of adult female harlequin ducks was lower on oiled areas than unoiled areas in PWS (Esler et al. 2000). Modeling efforts based on this data predicted a declining population in the oiled area and a stable population in the unoiled area. Lower survival rates may be related to continued oil exposure (Esler et al. 2000, Peterson 2001). Results of USFWS marine bird surveys are ambiguous. These surveys show no evidence of population recovery based on summer surveys. However their March surveys show an increase in densities in both oiled and unoiled areas, suggesting that the recovery process may be underway (Lance et al. 2001).

Sea duck populations, in general, are composed of relatively long-lived birds with delayed sexual maturity. Productivity may be limited to a few favorable years and population levels may change slowly. Long-term population stability depends on high adult survival coupled with a few years of successful reproduction. Initial high losses of adults, especially females, may result in a long and slow recovery period, especially if initial causes of mortality are still influential.

Harlequin ducks occur year-round in the nearshore environment, feed on benthic invertebrates, exhibit site-fidelity, are relatively long-lived, and are widely dispersed in the Gulf of Alaska.

These characteristics make them unique among nearshore avian predators and ideal candidates for monitoring ecosystem change.

We propose one more year of winter surveys in order to compare population trends and structure with survey data collected in 2000 and 2001. We will survey oiled and unoiled areas identified in project \427 (Rosenberg and Petrula 1998) plus the additional oiled and unoiled areas added by this project (\407). With 3 years of expanded geographic coverage we can compare regional differences in population trends within oiled and unoiled areas, increase statistical power to detect recovery, and improve our ability to asses changes in the marine ecosystem. We will also be able to incorporate a 1997 winter survey of narrower geographic scope.

Surveys will be conducted in March. March is a period of relative stability in both numbers and movements of harlequin ducks. With modifications, this is a continuation of Project /427 Harlequin Duck Recovery Monitoring conducted from 1995-1997. No fieldwork was conducted on project /427 in FY98 or FY99.

NEED FOR THE PROJECT

A. Statement of Problem

Harlequin ducks have not recovered from the effects of the *Exxon Valdez* oil spill. Populations in oiled areas are continuing to decline (Rosenberg and Petrula 1998). Declining molting populations, coupled with low female survival, and exposure to hydrocarbons in oiled areas are all indicative of a lack of recovery and continued oil spill effects. Residual oil is still present in the nearshore environment (Carls et al. 2001) and has the potential to interfere with physiological processes (Holland -Bartels et al. 1999). Two main hypotheses have been presented to explain population declines: (1) ingested oil is continuing to cause either mortality and/or sublethal impairment of reproduction; and/or (2) initial mortality caused significant losses to the western PWS population which may result in a protracted recovery period.

The greatest biological problem in identifying the effects of the EVOS was our lack of basic knowledge on harlequin duck life history, ecology, distribution, and abundance. Poor knowledge of harlequin duck life history at the time of the spill made it difficult to design effective damage assessment and monitoring programs. Scant baseline data on population size made assigning injury and recovery based on pre-and post-spill comparisons tenuous because of a low sample size, high variability, and data that was collected many years before the spill. Poor understanding of regional differences within PWS confounded interpretations of differences between oiled and unoiled areas. This clearly pointed out the need to have good baseline information and time-series data on numbers, distribution, population structure, and a variety of life history events.

Identifying and establishing the cause of population declines depends on knowledge of the status of the resource immediately prior to environmental perturbations and an understanding of the inter-annual variability or the normal variation between years in periods of little perturbations in the larger physical system. Thus, our ability to detect departures from natural variation is necessary if we are to accurately evaluate the effects of major environmental perturbations whether natural or

man-caused. This requires numerous samples, distributed through time, preferably focusing on long-lived species that tend to show less natural variability. Without time-series data on harlequin duck abundance and abiotic and biotic ecosystem changes we lack the ability to interpret the affects of natural or man-induced processes.

B. Rationale/Link to Restoration

This proposed work represents a relatively simple, workable approach to the long-term monitoring of harlequin duck populations that will allow us to assess recovery from the spill, detect long-term ecosystem changes, gather basic life history information, and improve management.

We propose a survey that will have the power to detect trends in populations in oiled and unoiled areas, provide information on population demographics, and give insight into geographic differences within PWS. This study is directly linked to the recovery objectives for harlequin ducks in the EVOS Restoration Plan (Exxon Valdez Oil Spill Trustee Council 1999). This project will provide winter population trends; compare population structure, and provide an index of recruitment between oiled and unoiled areas.

Harlequin ducks are highly philopatric to breeding, molting, and wintering sites (Robertson and Goudie 1999, Robertson et al. 2000). This is an adaptive strategy in natural situations and predictable environments. It is not favorable in the face of dramatic environmental perturbations or rapidly changing land-use practices. It does not favor rapid recovery and colonization of new undisturbed sites. This strong philopatry may result in continued exposure to residual oil or delays in pioneering new nest sites once populations stabilize. Monitoring provides a direct approach to assess recovery.

Information from this project will aid in the development of a population model. A population model is central to monitoring harlequin duck recovery. The model must include demographic parameters and identification of critical periods of the annual cycle that may limit recovery from the *Exxon Valdez* oil spill. This will allow researchers to predict population trends and rate of recovery. While some of this information has been collected for PWS populations (Rosenberg and Petrula 1998, Holland-Bartels et al.1999) and harlequin ducks in North America (Goudie et al. 1994, Robertson and Goudie 1999), many specifics are still lacking, including data on productivity, recruitment, dispersal, and subadult survival.

Detecting trends in abundance and productivity from natural year-to-year variation will be met sooner with increased sampling. Results of this work will have a direct bearing on assessing the status and outlook for this resource and help guide agency programs and policies related to public uses, especially subsistence and recreational hunting, land-use practices, and wildlife viewing.

C. Location

The proposed project will be conducted in the oil spill area of western Prince William Sound and unoiled eastern PWS between Valdez and Cordova and northern Montague Island. March surveys will repeat areas surveyed in /427 Harlequin Duck Recovery Monitoring (Rosenberg and Petrula 1998). Additional survey sites in PWS will be located on Montague Island, following the sampling scheme of project \025 Nearshore Vertebrate Predator Project (Holland-Bartels et al. 1999), and southwestern PWS.

Surveys in the spill area will focus on Knight Island, Applegate Island, Foul Bay, Main Bay, Eshamy Bay, Crafton Island, Chenega Island, Green Island, Naked Island, and Bainbridge, Evans, and LaTouche islands in southwestern PWS. Surveys in non-oiled areas will include portions of Hinchinbrook Island, Simpson Bay, Sheep Bay, Port Gravina, Landlocked Bay, Bligh and Busby islands, Galena Bay and Valdez Arm, and Montague Island.

Communities affected by the project include Chenega Bay, Tatitlek, Whittier, Valdez, and Cordova.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

The project will continue to inform and coordinate our community involvement activities. This effort began with project /427 (Harlequin duck recovery monitoring) and a TEK report is included in Rosenberg and Petrula (1998). This effort was continued with project /273 (Scoter life history and ecology: linking satellite telemetry with traditional ecological knowledge).

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. Information gathered from this project will be shared with local communities. Study plans and results of project /427 and project /273 have been presented in the oil spill communities of Tatitlek, Chenega Bay, Cordova, Port Graham, Nanwalek, and Seldovia and at meetings of community facilitators. We will continue to present information to local communities and prepare articles or photographs for Trustee Council publications.

Boat and air charter contracts, and other services will continue to be contracted from local sources when possible.

PROJECT DESIGN

1. Surveys

A. Objectives

1. Compare population structure (number of breeding pairs, subadult males, adult males, and females) between oiled and unoiled areas during March.

2. Estimate density for oiled and unoiled survey sites in March.

3. Compare annual changes in density and population structure for oiled and unoiled survey sites.

4. Compare annual changes in density and population structure *within* oiled and unoiled survey sites during March.

5. Compare results with EVOS project /427 Harlequin Duck Recovery Monitoring (spring, summer and fall surveys).

6. Add to our knowledge of harlequin duck life history

7. Integrate data with other long-term monitoring surveys to detect long-term changes in marine ecosystems

B. Methods

This study will test the following hypotheses:

1. Objective 1.
   H_o: The ratio of males to females; total ducks to subadult males; and breeding pairs to total ducks is the same for oiled and unoiled populations during March.

   H_1: The ratio of males to females; total ducks to subadult males; and breeding pairs to total ducks is different for oiled and unoiled populations during March.

A generalized logit model (Agresti, 1990) will be used to test differences in population structure for oiled versus unoiled survey sites. Male:female ratios for individual survey periods will be compared by estimating proportions using cluster sampling (flocks) (Cochran, 1977).

2. Objective 2. No hypothesis is being tested.

3. Objective 3.
   Ho: The rate and direction of population change between years is the same for oiled and unoiled survey sites.

H_1: The rate and direction of population change between years is different for oiled and unoiled survey sites.

Density changes will be tested by regression and population structure will be tested with logistic regression (Agresti, 1990).

4. Objective 4.
H_0: The rate and direction of population change between years is the same within oiled and unoiled survey sites.

H_1: The rate and direction of population change between years is different within oiled and unoiled survey sites.

Density changes will be tested by regression and population structure will be tested with logistic regression (Agresti, 1990).

5. Objective 5. No hypothesis is being tested.

6. Objective 6. No hypothesis is being tested.

7. Objective 7. No hypothesis is being tested.

March surveys. Surveys will be conducted in representative portions of oiled areas in western PWS and unoiled areas in eastern PWS. FY 95-97 transects will be repeated (Rosenberg and Petrula 1998) and new transects have been added in areas of northern Montague Island and southwestern PWS. Surveys will be conducted from approximately March 20 through 30. Repeat surveys will not be conducted and surveys in oiled and unoiled areas will not be conducted simultaneously because population flux is expected to be minimal at this time of year.

All harlequin ducks will be recorded along each survey route. Observations will be recorded as pairs or by sex, and males will be divided into two age groups using predetermined criteria (Rosenberg and Petrula 1998). Surveys will be conducted from open skiffs up to 20 feet long. Each skiff will have two observers. Surveys will be conducted from within 30 meters of shore along predetermined routes. A pace and course will be chosen that will assure complete coverage of the survey area and maximize the opportunity to see ducks. All transects will be mapped and all observations will be recorded by date and location and mapped by flock.

Population composition and annual changes in density will be compared to test whether harlequin duck populations are exhibiting similar growth trends or the oiled (injured) population is exhibiting a different direction or rate of change. We will continue to test whether low reproductive success in oiled areas has resulted in changes in population age and sex structure. The proportion of first-year males to total males will be used as a measure of past reproductive success. Proportions of paired birds and male:female ratios will be compared for oiled and unoiled sites to indicate breeding propensity. Surveys will be used to detect changes in abundance and compare the direction and rate of change between years for the two survey areas. Surveys within oiled and unoiled areas will be

compared to determine if geographic differences are detectable. Data from FY95-FY97 surveys will be incorporated into the analysis when applicable.

Power Analysis. We compared our March 1997 survey with the corresponding subset of our March 2000 survey. Data from 2001 was recently collected and can not be added at this time. In EPWS (unoiled), 24 transects from 5 geographically similar regions were surveyed covering 244 km of shoreline. In WPWS (oiled), 18 transects from 7 geographically similar regions were surveyed covering 310 km of shoreline. For each transect we fit a simple linear regression model (y = density, x = year) to obtain an estimate of the rate of change in duck densities (birds/km). A hierarchical ANOVA was used to test for differences in the rate of change between locations. The model used was:

Rate of Change = overall mean + location + region (location) + transect (region location)

The power of the test was then calculated for several differences in slope between EPWS and WPWS and is presented below.

Difference in slope	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2	1.3
power (α= 0.10)	0.52	0.67	0.81	0.90	0.95	0.98	0.99	1.00	1.00
power (α= 0.05)	0.30	0.46	0.62	0.76	0.87	0.94	0.97	0.99	1.00

We observed a significant difference in the rate of change in density between EPWS and WPWS (difference in mean slopes = 0.76, p-value = 0.016). We would correctly reject the null hypothesis that there is no difference in the rate of change between EPWS and WPWS 81% of the time when the slopes differed by at least 0.7 (α=0.10). Because the slope is based upon density (birds/km), we can convert this change in slope to the change in the number of ducks we observe on our surveys.

By adding transects in oiled portions of southwest PWS (SWPWS) and unoiled Montague Island (Montague) we should be able to increase the power of our test, thus improving our ability to assess recovery. However, at present we cannot calculate a variance or slope for SWPWS or Montague because we only have one year of survey data. Thus, we cannot determine the power to detect a change in slopes between SWPWS and WPWS (i.e. within oiled areas) or between Montague and EPWS (within unoiled areas) until we have at least one more year of surveys. Regardless, the difference in slopes and how they compare to WPWS and EPWS will give us an estimate of geographic differences and of the contribution of these additional areas to any changes we observe.

Winter transects will give us greater power to detect change than our fall surveys (Rosenberg and Petrula 1998). With 3 years of survey data for the entire geographic coverage we will be able to calculate the true slope and variance. Beyond that, frequency of sampling will depend upon biological and economic factors, and recovery objectives. Comparing the annual variation and rate and direction of slopes relative to each other will help determine sampling frequency.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

ADF&G personnel will conduct all data collection and analysis. Winter surveys and contracts for vessel support for winter surveys will be coordinated with related EVOS projects. Private sector contracts for winter vessel support will be solicited.

SCHEDULE

A. Measurable Project Tasks for FY 2002

October – December 2001	Project start-up. Interagency coordination. Plan logistics and personnel for winter surveys. Contract for vessel support.
Jan. –Feb. 2002	Hire seasonal technicians for March survey. Prepare field equipment. Finalize field logistics.
March 2002	Conduct winter surveys in PWS.
April – June 2002	Create databases, GIS. Analyze field data and begin report preparation. Maintain equipment.
June - July 2002	Analyze data
July-Aug-Sept 2002	Analyze data and report preparation
September 30, 2002	Final report/manuscripts submitted

B. Project Milestones and Endpoints

FY02

October-February:	Coordinate and plan surveys, prepare equipment, contract for vessel support, hire personnel.
March:	Conduct population surveys.
April-September:	Data analysis and report preparation, maintain equipment.
September 30:	Submit final report or manuscripts.

This is a minimum three-year monitoring program designed to assess the recovery of an injured species. Each project objective will be assessed annually for oiled and unoiled areas then compared with each other and with data collected in subsequent years. Year to year trends will first be compared in 2000 and then each year after. At the end of three years results will be compared with the restoration goals to assess whether recovery has occurred.

C. Completion Date

Under present guidelines, harlequin ducks will have recovered when breeding- and nonbreeding-season densities return to prespill levels. An increasing population and decreasing exposure to

hydrocarbons in oiled parts of PWS will indicate that recovery is underway (Exxon Valdez Oil Spill Trustee Council, 1999).

This project will compare harlequin duck population structure and abundance between oiled and unoiled areas and within geographic areas. Until further information is gathered it will not be possible to predict when densities will return to prespill levels and oiled populations exhibit a positive trend, indicative of a population increase comparable to unoiled areas. This project may also discover new information that will suggest changes to the Recovery Objectives and it meets the objectives of the Gulf Ecosystem Monitoring program. If continued for the long-term, this survey will help identify changes to the Gulf of Alaska ecosystem and improve our ability to differentiate between natural population changes and those induced by human intervention.

PUBLICATIONS AND REPORTS

A final report will be presented to the Chief Scientist by September 30, 2002. Publications will be prepared for peer-review journals in lieu of final report when possible.

PROFESSIONAL CONFERENCES

Harlequin Duck Working Group – date and time to be determined.

NORMAL AGENCY MANAGEMENT

There are no other agency or non-agency contributions to this project. ADF&G is not required to conduct these surveys by statute or regulation. Limited staffing and funding precludes ADF&G from undertaking these surveys as part of normal operations and in the past ADF&G has not conducted marine bird surveys in PWS as part of its normal waterfowl management functions.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This research relies on incorporation of methods and information from other EVOS Trustee sponsored research, including projects /427, and /025. Equipment purchased by /427 and /273 will be used to conduct this research. Location of research sites, and data collection and analysis will follow previously established protocols. All efforts will be made to coordinate surveys and share vessel support and equipment with other EVOS projects. Personnel with ADF&G and USGS-BRD will assist each other when possible.

This project will be integrated with ongoing studies or findings of past studies including project \052B Traditional Ecological Knowledge; project \025 Nearshore Vertebrate Predator Project; project \427 Harlequin Duck Recovery Monitoring; and project \159 Prince William Sound Marine Bird and Mammal Surveys.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

No major changes from FY2001. This is the third-year of this proposed 3-year project (including close-out).

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. Mr. Rosenberg is currently the principal investigator on EVOS Trustee sponsored project \273 Surf Scoter Life History and Ecology: Linking Satellite Telemetry with TEK to Conserve the Resource. 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, surveys, data analysis, and report preparation. Mr. Petrula has an MS degree in wildlife Biology from the Univ. of Alaska, Fairbanks. He has been working on EVOS projects \427 Harlequin Duck Recovery Monitoring and \273 Surf Scoter Life History and Ecology: Linking Satellite Telemetry with TEK to Conserve the Resource.

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2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2001
D. Rosenberg	WBIII, Principal Investigator	18J	3.0	6.5		19.5
Mike Petrula	WBII, survey and data analysis	16C	2.5	4.6		11.5
2 F&G Tech.	F&G Tech. III, Field Technician	11F	1.8	3.7	1.0	7.7
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		7.3	14.8	1.0	
					Personnel Total	$38.7

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2001
Whittier parking, 2 vehicles- 12 days					0.2
Whittier Toll - 2 vehicles and trailers					0.1
Harlequin Duck Working Group	0.6	1	5	0.1	1.1
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$1.4

FY02

Prepared: 4/10/01

Project Number: 02407
Project Title: Harlequin Duck Population Dynamics
Agency: Alaska Department of Fish and Game

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed
Description	FY 2001
Boat and outboard motor repair and maintenance	2.0
Photo processing, presentation productions	0.4
Air charter for field support 4 hrs @ $270/hr	1.0
Trailer and boat moorage Whittier	0.1
Vessel support for March surveys 12 days @1300/day	15.6
Truck Leasing Costs	0.5
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$19.6

Commodities Costs:	Proposed
Description	FY 2001
Boat fuel 350 gallons @ $2.00/gal	0.7
Boat supplies- replacement 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
Commodities Total	$1.8

FY02

Prepared:4/10/01

Project Number: 02407
Project Title: Harlequin Duck Population Dynamics
Agency: Alaska Department of Fish and Game

FORM 3B
Contractual & Commodities DETAIL

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 2001
NONE			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		New Equipment Total	$0.0

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

FY02

Project Number: 02407
Project Title: Harlequin Duck Population Dynamics
Agency: Alaska Department of Fish and Game

FORM 3B
Equipment
DETAIL

Prepared: 1/10/01