Exxon Valdez Oil Spill Trustee Council

645 G Street, Suite 401, Anchorage, AK 99501-3451 907/278-8012 fax: 907/276-7178

December 4, 1997

Dr. John F. Piatt
USGS Alaska Science Center
1011 East Tudor Road
Anchorage, Alaska 99503

RE: Deferred Project 98338 / Survival of Adult Murres and Kittiwakes in Relation to Forage Fish Abundance

Dear John:

I am writing to inform you of my recommendation that the *Exxon Valdez* Oil Spill Trustee Council provide $56,200 in funding for Project 98338 / Survival of Adult Murres and Kittiwakes in Relation to Forage Fish Abundance. The technical review of your proposal was very favorable, as outlined in the enclosed memorandum from the Chief Scientist. However, you will see that Dr. Spies finds it likely that the questions posed in your proposal can be substantially answered by using conventional leg bands. In the interest of cost savings, he recommends that the funds for radio transmitters be deleted from your budget. I also am recommending the deletion of funds for the laptop computers, which are related to the radio transmitter work.

Please submit a revised detailed budget in the amount of $56,200 (including agency general administration costs) by December 15, 1997 if at all possible. My recommendation on your project will be considered by the Trustee Council at its meeting December 18. If the Council adopts my recommendation, funds will be released as soon as the administering agency provides my office with documentation of NEPA (National Environmental Policy Act) compliance.

If you have any questions about my recommendation, please give me a call.

Sincerely,

Molly McCammon
Executive Director

Enclosure

cc: Lisa Thomas, DOI-USGS Liaison

APPLIED
marine
SCIENCES

December 2, 1997

To: Molly McCammon
Executive Director
Exxon Valdez Oil Spill Trustee Council

From: Robert Spies, Chief Scientist

I have sent out to review and received comments back on the revised proposal "Survival of adult murres and kittiwakes in relation to forage fish abundance" (98388). This is a good proposal that is consistent with the peer review recommendations from the last APEX workshop. The APEX project has focused exclusively on chick production in colonies with different abundances of forage fish. The proposed work would help complete the picture in terms of population ecology of two seaPbird species at two sites of widely different forage fish abundance by extending the measurements to survival of adult birds from the same colonies. Both reviewers were in strong support of the work. I have attached their comments to this memo in the hope that they may be useful to the investigators. Given the analysis of power presented in the proposal, it appears likely that the questions posed in the proposal can be substantially answered by using conventional leg bands.Although the use of radiotransmitters would be a valuable complement to the banding data, in the interest in achieving some cost savings the radiotags are not essential to estimate adult survival. I therefore recommend that the proposal be funded with a resuction of $12.8K in FY98.

cc: S. Senner
S. Schubert

2155 Las Positas Court, Suite S Livermore, CA 94550 510 373.7144 FAX 510 373.7834

Review of "Survival of adult murres and kittiwakes in relation to forage fish abundance" - Project Number 98338 by Piatt

27 November 1997

The preparation of this project description is consistent with an enthusiastic recommendation of the peer reviewers made during the last review session on APEX. The fundamental question that this project addresses is the following: does reduced abundance of forage fish during the chick-rearing season around seabird colonies (specifically black-legged kittiwakes and common murres) affect the abundance of seabirds at the colony by reducing productivity (= numbers of chicks fledged), numbers recruited to the breeding population (survivorship of fledged chicks to breeding age), or adult overwinter survivorship. The present APEX study is measuring only the productivity and therefore cannot pin down the mechanism by which colonies (Chisik anyway) shrink with forage food reductions. This study will fill the void by assessing the adult overwinter survival component. This issue is also key to the ability to assess an important question of trade-offs: by providing enough food to rear chicks under conditions of relative forage food scarcity do adults jeopardize their own survival over the coming winter. That question was identified by the modelers (Schneider, Ainley, etc.) in the APEX project as perhaps the major limitation in their ability to do colony population modeling with the data coming from the APEX study. In addition, the paradoxical differences in response of kittiwakes and murres to food shortage may be resolved by this study.

Because this proposal is responsive to the suggestions of the peer review team, is professionally prepared by a quality scientist, has feasible methodologies, and seems cost-effective, I recommend its support by the EVOS Trustee Council. I do have some concerns and rise some issues for consideration. First, while I accept (and welcome!) the power analysis that suggests that the sample sizes are probably sufficient to detect a significant difference in adult survivorship between Gull Island and Chisik, there is a possibility of a much more powerful and compelling test. The test proposed is based upon contrasts of colonies. Individual birds within colonies presumably vary in their responses to food shortage such that these colony contrasts include substantial among bird differences in their error variance. If the same individual birds can be used for study of foraging effort in summer and subsequent overwinter survival, then the ability to detect relationships and potential trade-offs between the two is greatly increased. The proposed component of this study using radio-transmitters to help quantify foraging time budgets provides a potential for following the overwinter fate of those same birds. They would have to be tagged also so that if they lost the transmitters they could still be identified in the next summer. Furthermore, one would need to question whether the added weight of the transmitter would interfere with the test of the trade-off hypothesis. I suspect not because the need to carry extra weight would just reduce overall survivorship but not destroy the pattern of differences between birds that committed differentially to chick rearing the previous summer. On the other hand, if the weight of the transmitters was so great, it might doom all instrumented birds to death, in which case this artifact would prevent testing of the trade-off hypothesis. The PI should consider the merits of this opportunity for more powerful testing of the trade-off hypothesis.

Second, I question the need for $28,000 for grad student stipend and tuition. The cost in my institution is exactly half that.

Third, I wish that the proposal had explained why measuring the recruitment response to food shortage is not feasible. I am prepared to believe it, but I would like to have seen the logical basis.

I should add that I concur that this project should involve two field seasons, both for purposes of replication and also to insure that methodologies do not need fine-tuning for the second year to achieve the desired measurements.

REVIEW COMMENTS FOR *EXXON VALDEZ* OILSPILL TRUSTEE COUNCIL
"Survival of adult murres and kittiwakes in relation to forage fish abundance": Detailed Project Description #98338
J. F. Piatt - PI

Concern over seabird populations in the EVOS region stems from perceived failure to recover or continued declines after the 1989 spill. As underscored by this proposal, it is necessary to measure at least two of the following factors in order to evaluate population limitation: 1) breeding success/productivity, 2) fledgling survival/subsequent recruitment, and 3) adult survival. This proposal addresses a very real gap in the overall APEX program by adding complementary measures of adult survival to the ongoing investigations of breeding productivity. Moreover, the proposal is economical (p. 3) via its focus on the easier of the two previously unaddressed factors (recruitment being the more time- and resource-intensive).

Another substantial strength if this project is its comparison of failing and thriving colonies (p. 8); extremes in mensurative experiments are far more likely to enable detection of a relationship between foraging effort and adult survival. That the project does not rely upon telemetry for measuring survival is also appropriate given the logistical problems inherent in that technique (Summary of pilot FY97 work for EVOSTC DPD #98338).

The DPD has well-prepared illustrations that greatly amplify the text. I have marked directly onto the text a few minor corrections. In addition, more substantive comments below are keyed to sections of the report with corresponding numbers and pages.

1) Choice of this sample size (p. 7) is not clear from the previous (and good) discussion. If 125 birds from each colony can resolve a 5% difference in survival with strong power and at $\alpha = 0.05$, then why obtain 200?

2) Could the declining murre populations at Chisik Island be attributed to emigrating adults as well (p. 2)? If not, how will you know?

3) The Heisey and Fuller (1985) reference (Table 1) is not listed in Literature Cited.

Exxon Valdez Oil Spill Trustee Council

645 G Street, Suite 401, Anchorage, AK 99501-3451 907/278-8012 fax: 907/276-7178

FAX COMPLETE

FAX COVER SHEET

John Piatt 425-488-6180

To: Lisa Thomas Number: Auto

From: Sandra Schubert Date: December 5, 1997

Comments: Total Pages: 6

re: Deferred Project # 98338

HARD COPY TO FOLLOW _____

Document Sent By: Keri

3/27/96

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*** MULTI TRANSACTION REPORT ***
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TX/RX NO. 7794

INCOMPLETE TX/RX

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Exxon Valdez Oil Spill Trustee Council

645 G Street, Suite 401, Anchorage, AK 99501-3451 907/278-8012 fax: 907/276-7178

December 4, 1997

Bob Henrichs, President
Native Village of Eyak Tribal Council
P. O. Box 1388
Cordova, AK 99574

RE: Project 98286 / Youth-Elders Subsistence Conference

Dear Bob:

I am writing to inform you of my recommendation that the *Exxon Valdez* Oil Spill Trustee Council provide $90,200 in FY 98 funding for the Youth-Elders Subsistence Conference (Project 98286), contingent on (1) resolution of the issues raised by the Chief Scientist in the enclosed letter, including the fact that the Eyak Tribal Council, and most other village councils in the spill region, have not adopted the Trustee Council's TEK protocols, and (2) approval of a reduced budget. Please note that the recommended funding amount includes general administration costs of $5,900 for the U.S. Department of Interior, the administering agency for your project.

In particular, the Chief Scientist suggests that the effectiveness of the conference would be improved by shortening it by one day and focusing the discussion topics more clearly. In addition, both Bob Spies and I are concerned that an early April date will create conflicts for participating principal investigators, as April 15 is the deadline for submission of annual reports and project proposals. A date in late March or late April would be better.

An additional point not raised by the Chief Scientist that I would like you to consider is the due date for the project's final report. The Detailed Project Description calls for the report to be submitted April 15, 1999. Because this project will not receive Trustee Council funding in FY 99, the report should be submitted prior to the end of FY 98 (that is, no later than September 30, 1998).

Regarding the budget, I recommend the following reductions:

(1) From 12 months funding for the conference planner to 5 months funding. You received 3 months salary for the planner in FY 97. An additional 5 months would provide full-time funding October-May (through one month after the conference is held).

(2) A $5,000 reduction in the travel budget, which seems quite high. For example, the budget is built on ten speakers. It is unclear who the speakers will be, but ten speakers is a lot for one conference and $1,000 in travel per speaker appears excessive.

(3) Reduce Eyak's indirect charge to the 10 percent stated in the DPD.

Please submit a revised detailed budget and DPD addressing the above concerns by December 15, 1997 if at all possible. My recommendation on your project will be considered by the Trustee Council at its meeting December 18. If the Council adopts my recommendation, funds will be released once the above contingencies are met and the administering agency has provided my office with documentation of NEPA (National Environmental Policy Act) compliance.

If you have any questions about my recommendation, please give me a call.

Sincerely,

Molly McCammon
Executive Director

Enclosure

cc: Catherine Berg, DOI Liaison

APPLIED
marine
SCIENCES

November 24, 1997

Ms. Molly McCammon
Executive Director
Exxon Valdez Oil Spill Trustee Council
645 G Street, Suite 401
Anchorage, Alaska 99501

Dear Molly,

I sent the revised proposal "Native village of Eyak Youth/Elders subsistence conference" (98286) out to review and received the reviewer comments. I have also read the proposal myself.

The proposal is greatly improved over the original submission and appears to be a logical extension of the momentum from the first subsistence conference in 1995 and the continued excellent cooperation and communication in some of the science projects to date. A number of comments have been raised in the review process that are worth considering in formulating your recommendation to the Trustee Council.

1. In the related project "Community involvement and traditional knowledge" (--052), considerable effort has been made to formulate protocols for exchange of traditional knowledge. These protocols were developed in a consensus mode in Project 052 and have been sent to various tribal councils for endorsement. As far as I know the Eyak Tribal Council has not endorsed these protocols. Perhaps they are still considering this possibility, but on the face of it I find it hard to reconcile that apparent position with this proposal that calls for active exchange of traditional knowledge and "western" scientific knowledge.

2. Various budget issues have been raised in the attached reviews and it appears that budget savings are possible.

3. Given its objectives, the conference appears to be too long. One and a half or two days seems more appropriate.

4. Early April is not a good time of the year for participation of the P.I.s since reports and proposals are due. Any reasonable reduction of their participation or shortening of the conference that would still address the general objective of this proposal would make the conference more workable. Perhaps a date in late March or late April would be better.

5. The subjects of the general discussion sessions need to be better formulated. The more focused the discussion the better, and the more likely the experience will be positive for the youth and elders.

2155 Las Positas Court Suite S Livermore, CA 94550 510.373.7142 FAX 510.373.7834

In conclusion, there are some policy and budget issues to consider. If these are resolved, then the length and timing of the conference should probably be changed. Please call me if you have any questions with regard to this recommendation.

Sincerely,

Robert B. Spies
Chief Scientist

cc: S. Senner
S. Schubert

RE: Review of Project # 98286 "Native Village of Eyak, Youth/Elders Subsistence Conference

****

Bob- I read the Eyak proposal and have just a few comments.

First off, the proposal was a vast improvement over the previous proposal submitted for this project. It seems to me to be more focused and better written (though not without its problems). Of particular importance is that there is a broader, less provincial attitude in the proposal-- there seems to be a concerted effort at incorporating elements of both the western scientific perspective and the local perspective in dealing with the spill. In my opinion this is a big step for these guys. Also, they have clearly done some planning for the conference, as evidenced by the attached agenda. In sum-- it appears they are moving in the right direction, they are working towards a concrete goal for the conference, and they have some good ideas.

Having said that, there are still problems with the proposal as written. The budget seems to be high. I'm not sure that it takes a person an entire year to plan a conference-- and since the conference is in April, when does the year start and end? The proposal appears to me to be very heavy on the planning end of things-- not to undermine what they are doing but it shouldn't take that much planning (especially as about 1/2 of the presenters have done this sort of thing before-- many times). Also, some of their other costs seem to be strange-- only $1,500 for conference materials but $5,000 for conference proceedings (and that seems very low-- I think it is way underestimated given that this is a proposed 3 day conference).

I would shorten the conference, limit the PI presentations and have some of the panels listed for later on in the conference both at the beginning and the end of the meeting (i.e., ways to assist recovery effort, recovery of subsistence ways). Those are the focus of the conference-- they should be highlighted more.

In sum-- I think it is a good proposal, vastly improved over previous submissions. I think it is still too costly--the budget can and should be reduced. The agenda should be re-worked to more accurately reflect some of the sentiments covered in the proposal. Finally, three days (actually 2.5 days) is a long time for a conference of this type-- they might consider shortening it to 2 days.

Hope this helps-- as always if you have any questions feel free to call. Have a nice weekend.

Exxon Valdez Oil Spill Trustee Council

645 G Street, Suite 401, Anchorage, AK 99501-3451 907/278-8012 fax: 907/276-7178

FAX COVER SHEET

FAX COMPLETE

– Bob Henrichs
– Catherine Berg

To: Patty Brown Schwalenberg Number:

From: Sandra Schubert Date: 5 December 1997

Comments: Total Pages: 6

Re: project #98286

HARD COPY TO FOLLOW _____

Document Sent By: Ken Dial

3/27/96

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START TIME	12/05 13:40
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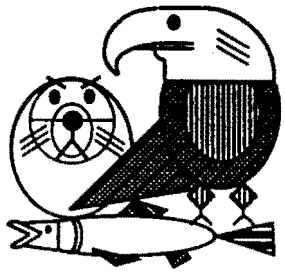
PAGES	6
RESULT	OK

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



December 4, 1997

Bjorn Lomborg, Associate Professor
University of Aarhus
Department of Political Science
DK-8000 Aarhus C
DENMARK

Dear Professor Lomborg:

Please find enclosed a copy of the *Exxon Valdez* Oil Spill (EVOS) Research and Restoration Information Project CD-ROM. It was funded by the Trustee Council and developed by the Alaska Department of Natural Resources and the United States National Oceanic and Atmospheric Administration.

On this CD-ROM you will find the EVOS Geographic Information System Database and Data Dictionary, 1989 State/Federal Trustee Council Hydrocarbon Database, the EVOS Project Bibliography, as well as an instruction booklet.

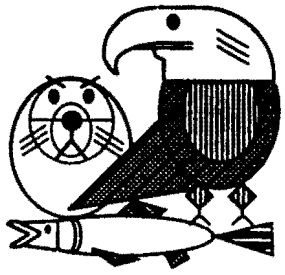
I hope you will find this information useful.

Sincerely,

Molly McCammon
Executive Director

MM/kh
Enclosures (2)

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



December 4, 1997

Ms. Paula Phillips
Alaska Conservation Alliance
750 West 2nd Avenue, Suite 109
Anchorage, Alaska 99501

Dear Ms. Phillips:

Please find enclosed a copy of the *Exxon Valdez* Oil Spill (EVOS) Research and Restoration Information Project CD-ROM. It was funded by the Trustee Council and developed by the Alaska Department of Natural Resources and the United States National Oceanic and Atmospheric Administration.

On this CD-ROM you will find the EVOS Geographic Information System Database and Data Dictionary, 1989 State/Federal Trustee Council Hydrocarbon Database, the EVOS Project Bibliography, as well as an instruction booklet.

I hope you will find this information useful.

Sincerely,

Molly McCammon
Executive Director

MM/kh
Enclosures (2)

Exxon Valdez Oil Spill Trustee Council

645 G Street, Suite 401, Anchorage, AK 99501-3451 907/278-8012 fax: 907/276-7178

MEMORANDUM

TO: Restoration Work Force

FROM: Sandra Schubert, Project Coordinator

RE: Deferred Projects

DATE: December 4, 1997

In preparation for the December 10 meeting of the Restoration Work Force, please find attached materials on the following deferred projects:

98064/Harbor Seals	[Chief Scientist's review memo forthcoming]
98131/Clam Restoration	Progress report [review memo forthcoming]
98162/Herring Disease	Preliminary FY 97 results; revised budget [review memo forthcoming]
98163R/Marbled Murrelet	Preliminary FY 97 results [review memo forthcoming]
98263/Stream Enhancement	FY 97 annual report; Chief Scientist's review memo
98286/Elders-Youth Conference	DPD and budget; Chief Scientist's review memo
98320T/Herring TEK	Interim report on FY 97 results [review memo forthcoming]
98338/Murres and Kittiwakes	Memo discussing FY 97 results; revised DPD and budget; Chief Scientist's review memo
98339/Human Use Model	Memo discussing concerns raised at previous Trustee Council meeting

The Executive Director's recommendation on funding for deferred projects will be circulated to the Work Force Monday, December 7. The Work Force meeting to discuss the recommendations will begin at 9:00 a.m. December 10 at the Restoration Office.

EVOS Clam Restoration Project No. 97131/98131
Progress Report through November 10, 1997

Good progress has been made in this project since March 1997. The hatchery has met with much greater success in producing littleneck clam seed. Nursery programs at both the hatchery and the remote tidally operated fluidized upwelling system (tidal FLUPSY) are going well and information from the growout tests at Tatitlek, Nanwalek and Port Graham are indicating that harvestable (38 mm) clam can be produced in less than three growing seasons. The following is a brief summary of activities in the hatchery, nursery and growout segments of the project.

Hatchery

Since March 1997 the hatchery has placed over 1.1 million pediveliger littleneck clam larvae into setting. Of these just over 400,000 survived the metamorphosis to seed. The success in seed production seems to be at least partially related to conditioning broodstock (inducing them to spawn). Using 9.5o C conditioning temperatures instead of the 13o C previously used has made it easier to induce spawning as well as resulted in improved gamete quality.

The littleneck clam larvae have proven very sensitive to rearing densities typically used in clam culture. The hatchery has had to rear the larvae in densities that are less than half normal densities. Although this has greatly improved survivals it has put a strain on the limited space in the small pilot hatchery currently being used. This has prevented the hatchery from achieving the 800,000 seed objective that was set for FY 97.

The hatchery continues to collect equipment for installation in the new facility and a third hatchery employee in now undergoing training.

Nursery

The hatchery pond was drained and cleaned this spring. Since then a dense diatom bloom has been easily sustained in the pond even to the present time with a 4o C to 5o C seawater temperature. Outdoor microalgae culture in large 10,000 liter also proved very successful and reliable this summer. The tanks were fed unfiltered seawater from the 70 meter deep intake. The seawater was fertilized and aerated in the tanks

using only natural illumination. Alga densities of 500,000 cells per millimeter of Skeletonema costatum or Thalassiosira gravida were commonly achieved within five days. The algae can either be fed to pre-nursery or nursery upwellers or used as a large scale inoculate to the saltwater pond.

This summer, 1 mm littleneck spat were placed in upwellers and fed from the algae pond. They achieved a size of about 3 mm after about 6 weeks. Most of these spat were then transferred to the FLUPSY in Prince William Sound to test the potential of that system and relieve crowding at the hatchery.

Littleneck spat from the hatchery were placed in the tidal FLUPSY in late August. Grow data on these clams has not been worked up, but they appear to be growing well with negligible mortality. As additional spat in the hatchery reach to 3 mm size they are being placed in the FLUPSY system. It is expected that around 40,000 spat will be placed in the FLUPSY before winter. They will be planted out over the spring and summer as they reach 10 mm.

Growout

About 24,000, eight-millimeter to ten-millimeter littleneck clam seed were planted in growout areas near Tatitlek, Nanwalek and Port Graham in early July 1996. As of October 1997 these clams were averaging 21.5 mm with a range of 18 mm to 24 mm. Survival is around 85%.

If this growth rate continues it appears that littleneck clams will reach harvest size (38 mm) in less than three growing seasons. This is more than twice as fast as wild littleneck clam growth cited in the literature. However, most of the clams in the growout study are displaying false annual growth rings. Counting these rings as annual growth make the clams appear to be twice as old as they actually are. It could be then that littleneck clams in the wild grow about as fast as the clams in this study. A study on littleneck clam aging would be a good spin-off from this project. The ability to age littleneck clam populations accurately would be a great help managing the harvest.

98162

Occurrence of viral hemorrhagic septicemia virus in impounded Pacific herring of Prince William Sound, Alaska

Preliminary Report

November 17, 1997

By Paul Hershberger, Richard M. Kocan, and Gary D. Marty

Abstract

The Pacific herring (*Clupea pallasi*) population in Prince William Sound, Alaska has been low since 1993, when severe population decline was associated with isolation of viral hemorrhagic septicemia virus (VHSV). Fisheries were closed in 1993 and not reopened until the fall of 1996. Because laboratory studies indicated that confinement or handling stress could contribute to VHSV expression, this study examined the relation of VHSV and closed spawn-on-kelp fisheries in Prince William Sound. From each of 3 closed commercial pounds, daily 40-fish samples were examined for external lesions, and internal organs were assayed for VHSV. VHSV prevalence in initial samples varied from 12.5% on day 0 (pound #1), to 0% and 25% on day 1 (pounds 2 and 3). VHSV sample prevalence peaked 2 or 4 days after capture (15-30%), and then declined to 0 to 7.5% on the last sample date, 6 to 8 days after capture. VHSV prevalence was significantly greater in females than in males (11.8% vs. 7.8%), and prevalence of external lesions such as focal skin reddening was greater in VHSV-positive fish. VHSV prevalence was not associated with pound density, and dissolved oxygen within pounds at slack tide was always greater than 12mg/dL. Water samples from within pounds at slack tide were negative for virus. VHSV prevalence in 46 dead fish (15%) was no different than the prevalence in 40 live fish (12.5%) randomly sampled from the same pound 5 days after capture. Two 40-fish samples of Pacific herring naturally spawning near the pounds were negative for VHSV. We conclude that VHSV expression was associated with closed pounding and sick fish, but VHSV was not the major cause of fish mortality within the pounds. Decreasing VHSV prevalence during the study, and lack of virus in water and fish samples outside the pounds are evidence that closed pounds do not represent a severe threat to the feral fish population. Note, however, that the prevalence of VHSV in unpounded fish in 1997 was higher than in any other year (1994-1996), and a second year of study is recommended to examine the relation of closed pounds and VHSV in years when viral prevalence in unpounded fish might be less.

Introduction

Recent discovery of viral hemorrhagic septicemia virus (VHSV) in several fish species from the west coast of North America (Eaton et al. 1991, Meyers et al. 1992, Meyers et al. 1994, Meyers and Winton 1995) has raised new concerns regarding host range, viral virulence and transmission, and management of affected populations. Strain differences within the same species of fish (Kaastrup et al. 1991) as well as genetic (Bernard et al. 1992, Winton et al. 1991, and Bernard et al. 1990) and serological (Jorgensen 1972) differences within the virus may affect virulence. Questions still remain regarding natural transmission of the pathogen and management of certain fisheries that may contribute to virus proliferation.

The life history of *C. pallasi* in Prince William Sound (PWS) is similar to herring in other regions. Small resident populations remain in coastal inlets and bays throughout

the year (Stevensen 1955), but the majority of juveniles move off shore following their first summer and first return to natal spawning areas in early spring (Alderdice and Velsen 1971) of their third year (Lassuy 1989). Spawning events generally occur in "waves" lasting 1-3 days with the larger fish within a stock tending to spawn first (Lassuy 1989 and Hay 1986). Initiation of a spawning event is most likely triggered by release of a sexual pheromone contained in the milt followed by a rapid spawning response by both sexes (Stacey and Hourston 1982).

This project was designed to determine whether activities associated with the closed pound spawn-on-kelp (SOK) fishery are responsible for initiating active VHSV infections within the captured and confined herring. In the SOK fishery, sexually mature pre-spawn herring are purse seined, transported to a floating net pen (or pound) containing suspended kelp fronds, and held in the pound for several days to spawn upon the kelp. The kelp fronds with adherent herring eggs attached are then harvested and sold to the Japanese as kazunoko.

SOK pounds may foster VHSV infections for several reasons. First, stressors such as temperature and crowding have been reported to exacerbate VHSV infections in European rainbow trout farms (Enzmann and Konrad 1984). Conditions in the SOK pounds are often kept very crowded in an attempt to acquire a high quality product containing multiple layers of eggs on the kelp surface. Second, other investigators have noted the presence of "*Vibrio*-like disease" or unusually high mortality in crowded net pens containing herring (Brett and Solmie 1982, Krieberg et al. 1982, Krieberg et al. 1984, and Hay et al. 1988). Fish had subcutaneous hemorrhage, but attempted bacterial isolation was unsuccessful. Interestingly, the clinical signs of the reported disease were very similar to those reported by Meyers et al. (1994) for VHS in wild *C. pallasi*. Also, recent experiments with herring in Puget Sound suggest that captured herring shed VHSV into the surrounding water within 2 hours post capture (Hershberger and Kocan, unpublished data). Thus, SOK pounds may create a situation highly conducive to rapid shedding of large quantities of VHSV into the water, followed by viral exposure to large numbers of confined fish.

Based on this knowledge, a pilot study was conducted on the 1996 spawn-on-kelp fishery in Craig, Alaska (SE Alaska) to determine whether SOK pounds may foster VHSV infections. Of 38 fish sampled nonrandomly from the fishery, 21% were positive for VHSV. When the PWS pound fishery was reopened in 1997, the Trustee Council funded a more comprehensive study to examine the epizootiology of VHSV in SOK pounds in PWS.

Methods

The 1997 closed pound SOK fishery in PWS consisted of 8 fishers who consolidated into 3 pound structures. Experimental design for the pound study consisted of dip netting 40 herring from each of these 3 pounds on consecutive days after capture and introduction of the herring into the pounds. Data from each fish included age (from scales), weight, length, gender, external lesion scores, and VHSV tissue titer in spleen and kidney pools. External lesions were scored the same as for field study of Pacific herring disease (Marty et al. In press). VHSV tissue titrations were performed by Dr. Ted Meyers using a plaque assay, as described in Meyers et al. (1994). Water samples were also taken from each pound every other day at slack tide ($\pm$ 1h), frozen, and later assayed by Paul Hershberger for VHSV titer. Dissolved oxygen and water temperature were measured inside and outside the pounds at slack tide ($\pm$ 1h). In addition to the daily 40- fish samples, 2 40-fish samples of naturally

beach-spawning herring from outside the pounds were assayed. A 40 fish sample of recently deceased herring floating inside one of the pounds was also taken for virus isolation and similar viral analyses were conducted on these fish.

Results

The 3 SOK pounds were located in Fidalgo Bay, in the Northeast region of PWS, and designated pound #1, #2, and #3 (Table 1). The owners of pound # 1 were the first to catch fish and load their pound (4/11/97). All fish in this pound were caught at the head of Irish Cove in 1 set and transported only a few hundred meters to the pound. The fish in pound # 2 were added in 2 different loading events and all herring in this pound were caught in Two Moon Bay and transported 2.2 km to the closed pound. Herring were first introduced to pound #2 at 04:00 hrs on 4/13/97, but too few fish were in the pound to sample with a dip net. Hence, no day 0 sample was taken from this pound. The next group of herring (approximately 16 metric tons) was added to this pound just before midnight on 4/13/97, and a day 1 sample was taken on 4/14/97 at 06:00 hrs. All the fish in Pound #3 (approximately 0.1 metric ton) were taken in 1 set at the head of Landlocked Bay on 4/11/97 and transported only a few hundred meters to the pound. Too few fish were in this pound to sample with a dip net on day 0 without disturbing the kelp. The pound owners were subsequently unable to catch any more herring so the pound was abandoned and the kelp removed. This enabled sampling of the fish in the pound since the sides of the pound could be lifted during sampling events and the herring captured using either a dip net or cast net.

Table 1. Sampling Dates from the Pounds

	Date (1997)								
	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19
Pound 1	day 0	day 1	day 2	day 3	day 4	day 5	day 6	day 7	day 8
Pound 2			NS	day 1	day 2	day 3	day 4	day 5	day 6
Pound 3	NS	day 1	day 2	day 3	day 4	day 5	day 6	day 7	day 8

*NS= no sample

All 3 pounds were different dimensions and loaded at various crowding densities (Table 2). Pound #2 was by far the most crowded; it contained the most fish (18 metric tons) and lacked corner weights to hold the sides of the pound down, enabling the sides to float up and crowd herring to the surface. Predators including kittiwakes, eagles, and sea lions captured herring from this pound throughout the study. Pound #3 was the deepest pound, containing the fewest (0.9 metric tons) and youngest herring (mean age 4 years).

Table 2. Physical and Biological Characteristics of the Pounds

	# permit holders*	mean herring age	estimated herring biomass (metric tons)	Pound dimensions (LxWxD) (m)	Herring density (kg/m^3)
Pound #1	1	7	4-5	5.5x11.6x4.6	17.0
Pound #2	3	7	18+	17.7x8.5x6.1	19.6
Pound #3	4	4	0.9	6.1x7.3x9.1	2.2

* each permit holder is allowed 5.67 metric tons of herring

Water temperature and dissolved oxygen (DO) remained near optimal in each of the pounds (Tables 3-5). Measured DO never dropped below 12mg/L inside the pounds and was not significantly different from DO outside the pounds.

Table 3. Pound #1 Water Quality

Date	Sampling Time (hours)	Dissolved oxygen (mg/L) inside the pound	Dissolved oxygen (mg/L) outside the pound	Temp. (C)
4/10 (pre-fish)	08:00	14.0-14.7	-	4.6-4.9
4/12 (Day 1)	11:40	14.0	15.1	-
4/14 (Day 3	14:15	15.0	15.3	5.7
4/16 (Day 5)	10:10	15.0	14.8	5.7
4/18 (Day 7)	11:45	12.2	13.7	5.2

Table 4. Pound #2 Water Quality

Date	Sampling Time (hours)	Dissolved oxygen (mg/L) inside the pound	Dissolved oxygen (mg/L) outside the pound	Temp. (C)
4/10 (pre-fish)	08:00	14.1-14.6	-	4.9-5.1
4/13 (Day 0)	13:45	15.2	15.0	6.1
4/15 (Day 2)	13:50	14.7	14.9	6.0
4/17 (Day 4)	10:50	13.9	14.6	5.1
4/19 (Day 6)	06:35	12.9	13.2	5.8

Table 5. Pound #3 Water Quality

Date	Sampling Time (hours)	Dissolved oxygen (mg/L) inside the pound	Dissolved oxygen (mg/L) outside the pound	Temp. (C)
4/10 (pre-fish)	07:30	13.4-13.7	-	4.7
4/12 (Day 1)	18:00	15.7	15.5	-
4/14 (Day 3)	10:15	15.1	15.3	6.1
4/16 (Day 5)	06:30	14.5	14.9	5.8
4/18 (Day 7)	16:25	13.8	13.8	6.5

VHSV prevalence in herring from pound #1 showed a bimodal peak in prevalence with the percent positive fish peaking on days 1 and 4 (Figure 1). Initially (day 0) 12.5% of the sampled herring tested positive for VHSV, and by day 8 virus was undetectable in any fish from the pound. VHSV prevalence in herring from pound #2 increased from 0% on day 1 to a high of 15% by day 4 and decreased thereafter (Figure 2). Again, a bimodal viral prevalence occurred in the herring of pound #3, where VHSV prevalence peaked on days 2 (27.5%) and 5 (12.5%) then returned to low levels (Figure 3). No VHSV was detected in tissues samples of naturally, wild beach-spawning herring. Additionally, 15% of the dead fish sampled from the surface of pound #2 tested positive for VHSV.

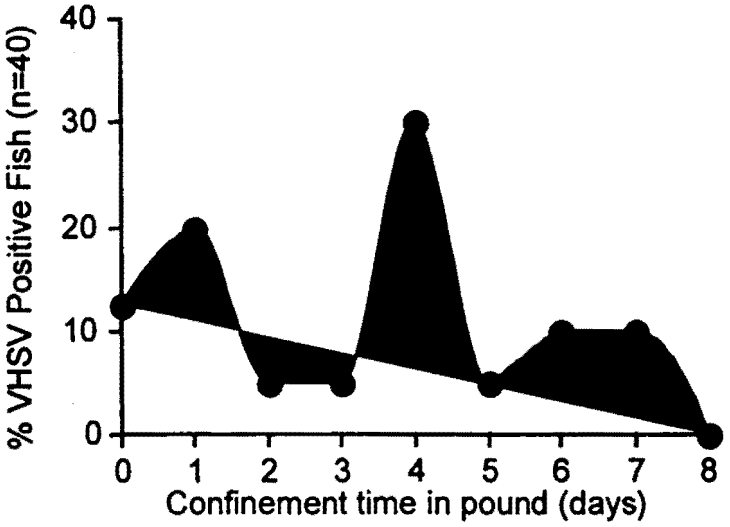


Figure 1. VHSV prevalence of herring in pound #1.

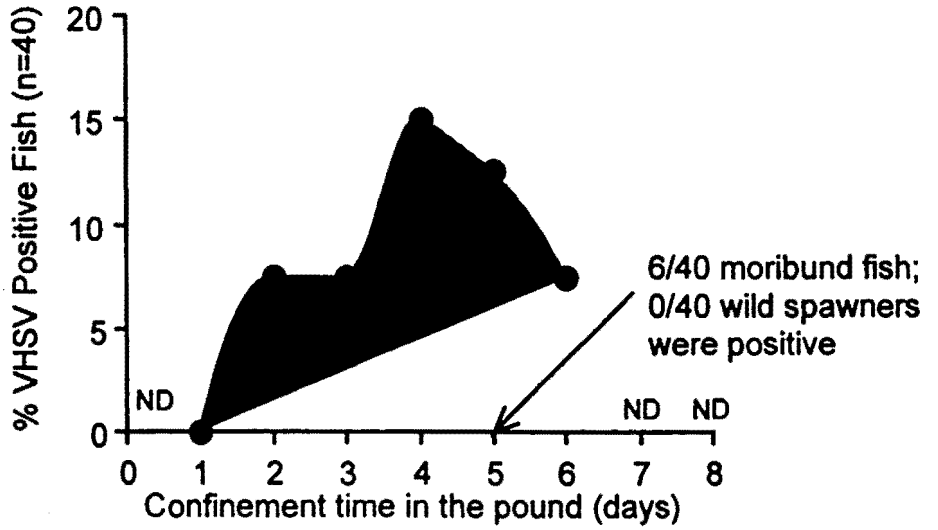


Figure 2. VHSV prevalence of herring in pound #2.

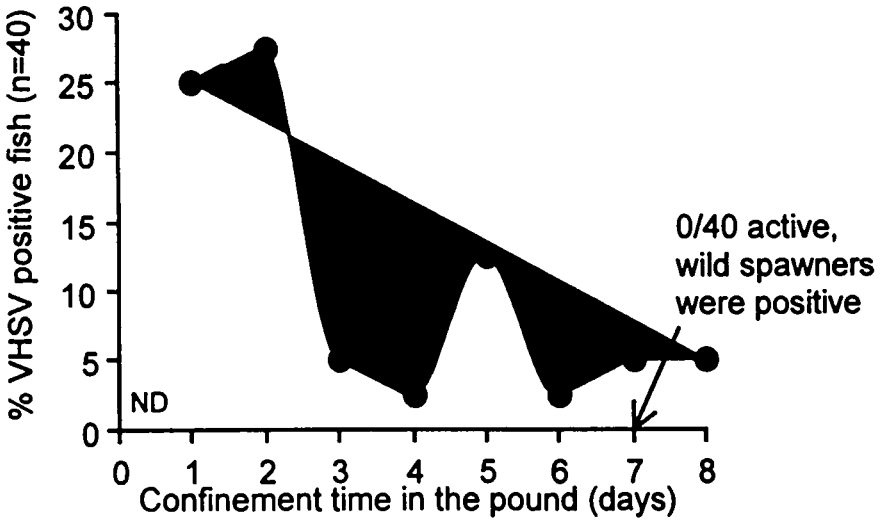


Figure 3. VHSV prevalence of herring in pound #3.

The year classes with the largest percentage of virus-positive fish were the 4-6 year olds and possibly the 11-year-olds (Figure 4).

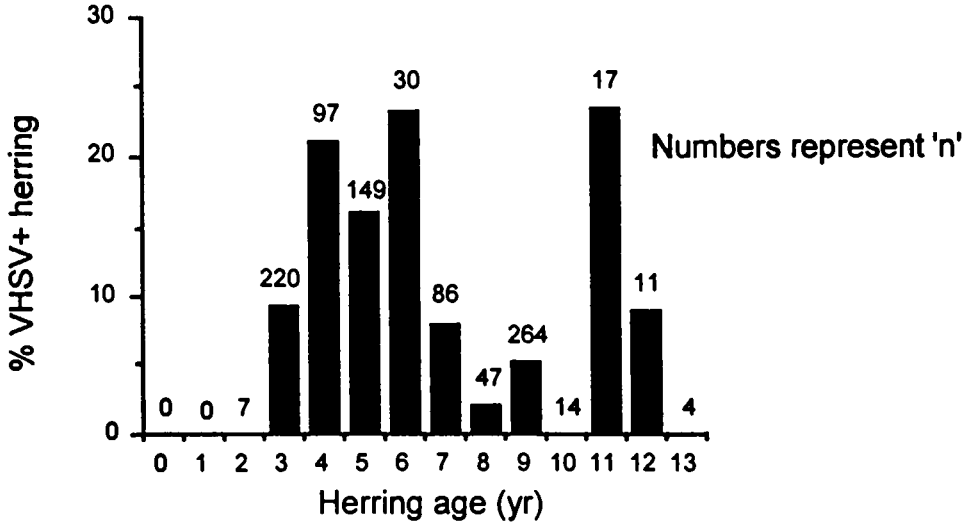


Figure 4. VHSV occurrence with herring age.

VHSV prevalence was significantly greater in females (11.8%, 51 of 431) than in males (7.8%, 48 of 614; chi-square test, 2x2 contingency table). Prevalence of external lesions was greater in VHSV+ fish (Table 6), but statistical analysis of differences has not yet been done.

Table 6. Prevalence of external lesions in Adult Pacific herring Sampled from pounds in Prince William Sound, April 1997.

	CFF*	CFR	FBR	FSR	DSR
VHSV+ (n = 99)					
%>0	51.5	61.6	70.7	10.1	36.4
%>1	13.1	9.1	22.2	2.0	9.1
VHSV- (n = 941)					
%>0	40.6	56.5	62.3	4.0	27.5
%>1	6.3	13.3	18.3	0.64	6.7

*CFF = caudal fin fraying; CFR = caudal fin reddening, FBR = fin base reddening, FSR = Focal skin reddening, DSR = diffuse skin reddening

Conclusions

VHSV prevalence data from this study indicate that herring within the SOK pounds undergo confined epizootics. VHSV prevalence within tissues of confined *C. pallasi* increased after introduction of fish to the pounds, peaked, and then decreased to near background levels by day 6-8. Alternatively, VHSV prevalence from herring tissues in pounds #1 and #3 could be interpreted to be high initially, decreasing to low levels by the end of the study. This alternative interpretation suggests that conditions within the pounds may have contributed to reduced viral prevalence in the captured herring.

Stating that the pounds contributed to recovery of the captured herring is improbable for several reasons. First, the observation that 25% of the herring from pound #3 tested positive for VHSV after 1d in the pound is not surprising considering the young age of the herring in this pound. Data from pound studies in Puget Sound as well as Figure 4 confirm that younger fish are more susceptible to VHSV infections than older fish. The mean age of the herring in Pound #3 was only 4 years and the median age was 3 years, while the mean age of the fish in the other pounds was 7 years. A 1996 pound study in Puget Sound revealed 0% VHSV-positive fish on Day 0, followed by 12.2% VHSV-positive herring on Day 1. Thus, the rapid onset of virus expression in pound #3 is not unprecedented. Second, a 40-fish sample of naturally wild-spawning herring from near where the fish in pound #3 were captured was negative for VHSV. Because these fish were caught in the same vicinity, of the same age structure, and in the same reproductive condition as those in the pound, it is likely that the wild-spawning fish were from the same school as those in the pound. Also, it is uncertain whether 12.5% of the herring in pound #1 were actually positive at the time of capture (Figure 1). Since this study, experiments in Puget Sound have revealed rapid shedding of VHSV after capture of wild herring. VHSV has been found in transport water containing wild herring after only 2 hours, while no virus could be detected in 100 fish sampled at the time of capture. This may be significant in understanding the high virus prevalence in the initial sample from pound #1 because this sample took almost 8 hours to process. A sample of 40 herring was taken for virus analysis at 16:30 hours and not finished processing until 22:00 hours. These herring were kept alive in totes until processed, thus potentially swimming in virus-infected water for several hours. Similar rapid VHSV infection was reported by Baroni et al. (1982) who found VHSV antigen in cells infected with VHSV only 8h postinfection. Thus, a more feasible explanation of the data would be to conclude that VHSV prevalence of confined herring initially increased in the pounds and then decreased to near-background levels by day 6 to 8.

Evidence of a bimodal peak in VHSV prevalence was observed in pounds 1 and 3, with a second peak occurring on day 4 or 5. Such a pattern could result from initial shedding of VHSV by some of the herring introduced to the pound, exposing other fish to the virus. The second peak could then result from previously uninfected herring expressing the virus after being exposed to water-born virions in the pound. Semblance of bimodal viral prevalence in confined herring has also been seen in laboratory studies of Puget Sound herring held in tanks (Hershberger and Kocan unpublished data).

Data from these experiments demonstrate that VHSV is not responsible for all herring mortality in the pounds. Thus, either: 1) most of the herring died from something other than VHS, or 2) virulence of VHSV is rapidly reduced in the host post mortem. Puget Sound studies performed by Hershberger and Kocan (unpublished data) suggest the former explanation since VHSV virulence was retained for at least 4 hours in raw seawater, suggesting a resilient nature of the virion. Also, data from this study do not indicate that overcrowding in the pounds affects VHSV prevalence. Pound #2 had almost an order of magnitude more fish biomass per volume of water than pound # 3, yet the herring in pound #3 had a greater prevalence of virus. Comparison of these 2 pounds is limited due to the different age structure of fish, but studies in Puget Sound also showed that crowding had little effect in activating infection. By comparison, Krieberg et al. (1982) found that crowding was associated with increased disease prevalence in pounded Pacific herring.

There was no indication of poor water conditions within the pounds. DO concentrations within the pounds remained above 12mg/L around slack tides, a time when water exchange should have been at a minimum. Such levels of DO are more than adequate for adult herring survival.

Although no VHSV was detected in water samples from within the pounds, this can not be interpreted to mean that no virus was present. Recent studies (unpublished data) have shown approximate 10-fold decreases in VHSV titers following a freeze-thaw episode of water samples. Due to the remote nature of the study site, the water samples went through 3 partial freeze-thaw episodes prior to being analyzed for virus titer. Such temperature fluctuations might have resulted in a 1,000-fold decrease in the number of virulent virus particles in the samples and may explain why no VHSV was found in the water.

Female herring may be more susceptible to active infections with VHSV. Greater prevalence of VHSV in females from pounds was consistent with a similar trend in gender prevalence from wild herring in the Montague area (Marty, unpublished observations from April 1997). Also, younger herring (4-6 year olds) were more susceptible to VHSV than older herring (Figure 4), a finding also consistent with VHSV in wild herring from the Montague area. Superficially, there appears to be a high susceptibility of the 11 year olds to VHSV, but the sample size of this age class was too small (17 fish) to make a conclusive statement of viral susceptibility. Interestingly, the 11-year-old fish would have returned to spawn for the first time in 1989, the year of the *Exxon Valdez* oil spill.

Data from this study indicate that closed pound SOK fisheries may: 1) activate latent infections in previously infected herring, and 2) Spread VHSV to non-immune fish in the pounds. The potential is high for spreading VHSV to fish outside the pounds because wild herring are attracted to the spawn emitted by herring within the pounds

(Stacey and Hourston 1982). This study was not designed to determine what particular component of the SOK fishery is responsible for initiating the VHSV epizootic within captured herring. The SOK fishery involves several potentially stressful events for the captured herring such as purse seining, transport to the pound, crowding, and confinement. It remains uncertain which processes are responsible for triggering VHSV epizootics within the captured herring. If, for example, initial purse seining of the fish is sufficient to cause VHSV shedding within captured herring, other fisheries such as herring sac roe may also contribute to VHSV proliferation. We suggest that such research questions be addressed in future studies.

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Revised 12-2-97

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FFY 1997*	Proposed FFY 1998
Personnel		$4.2
Travel		$0.0
Contractual		$20.9
Commodities		$24.8
Equipment		$0.0
Subtotal		$49.9
General Administration		$2.1
Project Total		$52.0
Full-time Equivalents (FTE)		0.2
Other Resources		$164.0

LONG RANGE FUNDING REQUIREMENTS					
Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002		
0.0**					

Dollar amounts are shown in thousands of dollars.

Comments:

This project proposal includes :

- University of Washington: Field and Laboratory Studies

- Alaska Department of Fish and Game: Logistical and Analytical Support

**Funds for writing final report in FY99 are included in the FY98 request.

1998

Prepared: 2 Dec97
wjh

Project Number: 98162
Project Title: Investigation of disease factors affecting declines of Pacific Herring populations in Prince William Sound, AK - Herring Pound Fishery Investigtions
Agency: ADFG

FORM 3A
AGENCY
PROJECT
DETAIL

12/2/97

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Personnel Costs:							
PM	Name	Position Description	GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1997
	G. Carpenter	Fishery Biologist II	16C	0.0	5,093		0.0
	Vacant	Fish & Wildlife Technician II	9A	0.0	3,229	2,614	0.0
	Vacant	Fish & Wildlife Technician II	9A	0.0	3,229	2,614	0.0
	Vacant	Fish & Wildlife Technician II	9A	0.5	3,229	2,614	4.2
		(Note: "Overtime" = Sea Duty)					
		Subtotal		0.5	14,780	7,842	
						Personnel Total	$4.2

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1996
PM						
	Description					
					Travel Total	$0.0

1998

Prepared: 2 Dec97
wjh

Project Number: 98162
Project Title: Investigation of disease factors affecting declines of Pacific Herring populations in Prince William Sound, AK- Herring Pound Fishery Investigtions
Agency: ADFG

FORM 3B
Personnel
& Travel
DETAIL

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Contractual Costs:		Proposed
Description		FFY 1997
PWS Fall Sampling		0.0
		0.0
		0.0
PWS Spring Sampling		0.0
		0.0
		0.0
		0.0
PWS Spring Sampling	Vessel Charter (Support vessel, 8d @ 1100/d)	8.8
(Herring Pound sampling)	Air Charter (3RT to Port Fidalgo@ 250/hr, 3 hr total)	0.8
	Shipping	0.5
CONTRACTOR No.1:	University of Washington	10.8
CONTRACTOR No.2:	University of California - Davis	0.0
CONTRACTOR No.3:	Simon Fraser University	0.0
When a non-trustee organization is used, the form 4A is required.	**Contractual Total**	$20.9

Commodities Costs:	Proposed
Description	FFY 1997
	0.0
Tissue sample analysis (herring pound disease samples) (1040 samples @ $20/sample)	20.8
Pathology Laboratory - Virology/Bacteriology Supplies	4.0
Commodities Total	$24.8

1998

Prepared: 2 Dec97
wjh

Project Number: 98162
Project Title: Investigation of disease factors affecting declines of Pacific Herring populations in Prince William Sound, AK- Herring Pound Fishery Investigtions
Agency: ADFG

FORM 3B
Contractual & Commodities DETAIL
12/2/97

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1997
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

1998

Prepared: 2 Dec97
wjh

Project Number: 98162
Project Title: Investigation of disease factors affecting declines of Pacific Herring populations in Prince William Sound, AK- Herring Pound Fishery Investigtions
Agency: ADFG

FORM 3B
Equipment
DETAIL

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1997	Proposed FY 1998
Personnel		$5.9
Travel		$1.7
Contractual		$0.4
Commodities		$0.5
Equipment		$0.0
Subtotal		$8.5
Indirect		$2.3
Project Total		$10.8
Full-time Equivalents (FTE)		0.2
Other Resources		$93.0

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002
$0.0			

Comments:

Indirect costs include the standard overhead rates and applications for the University of Washington (27.3%).

National Biological Service, Marrowstone Island Field Station (quarantine facility) provides filtered and UV-sterilized flowing sea water for disease studies and decontaminated effluent. On-site laboratory facilities and equipment are being supplied to the project by NBS (equivalent value of $23K for tank charges). Salary for Dr. James Winton, fish virologist ($16K); and technical assistance (~$6K).

UW Fisheries provides environmental rooms, fish and cell culture facilities, computing and communications equipment, histopathology tissue processing, and libraries (~$48K).

1998

Prepared: 2 Dec97
wjh

Project Number: 98162
Project Title: Investigation of disease factors affecting declines of Pacific Herring populations in Prince William Sound, AK- Herring Pound Fishery Investigtions
Name: Contractor No. 1: University of Washington

FORM 4A
Non-Trustee
SUMMARY

12/2/97

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Personnel Costs: University of Washington School of Fisheries			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FFY 1998
	Kocan, RM	PI, Sub-contract manager, field collections	0.5	6,850	0	3.4
		toxicologist, larval herring				0.0
		culture				0.0
	Kocan, RM	write final report	0.0	6,850	0	0.0
						0.0
	Hershberger	Graduate Student	1.5	1,674	0	2.5
	Bradley, M	Technician/fish culturist, Marrowstone Island	0.0	3,311	0	0.0
	Mehl,T	Technician, culture disease organisms/SOF	0.0	3,482	0	0.0
					0	0.0
						0.0
						0.0
						0.0
		Subtotal	2.0	22,167	0	
					Personnel Total	$5.9

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FFY 1998
	Two RT from Seattle to Alaska	650	2	8	50	1.7
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$1.7

1998

Prepared: 2 Dec97
wjh

Project Number: 98162
Project Title: Investigation of disease factors affecting declines of Pacific Herring populations in Prince William Sound, AK- Herring Pound Fishery Investigtions
Name: Contractor No. 1: University of Washington

FORM 4B
Personnel
& Travel
DETAIL

12/2/97

1997 EXXON VALDEZ TRUST COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Contractual Costs:	Proposed FFY 1998
Description	
* Long distance, FAX, photocopies, postage	
Histopathology, processing	0.4
Contractual Total	**$0.4**

Commodities Costs:	Proposed FFY 1998
Description	
brine shrimp, oyster larvae, rotifers, algae paste, super Selco, sea salt, aquarium supplies	
chemical analyses, liquid nitrogen, dewar flask rental, reagents, tissue culture supplies	0.5
Commodities Total	**$0.5**

1998

Prepared: 2 Dec97
wjh

Project Number: 98162
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Name: Contractor No. 1: University of Washington

FORM 4B
Contractual & Commodities DETAIL

12/2/97

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1998
			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
tissue culture hood	2
cold room	1
refrigerated centrifuge	2
spectrophotomoter	1
scintillation counter	1
computers, PC and Macs	3
flow-through sea water system	2
sea water filtration system	2
sea water sterilization (UV) system	1
microscopes, compound and dissecting	6
low temperature incubators	4
environmental chamber	1
fish tranport tanks	2

1998

Prepared: 2 Dec/97
wjh

Project Number: 98162
Project Title: Investigation of disease factors affecting declines of Pacific Herring populations in Prince William Sound, AK- Herring Pound Fishery Investigtions
Name: Contractor No. 1: University of Washington

FORM 4B
Equipment
DETAIL
~~12/2/97~~

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E. Tudor Rd.
Anchorage, Alaska 99503-6199

IN REPLY REFER TO:

Memorandum

To: David Duffy, Project Leader, Project 98173

From: Kathy Kuletz, Principal Investigator, Project 98173R
David Irons, Migratory Bird Management

Subject: Preliminary results from the Marbled Murrelet Project

The Trustees deferred funding of the Marbled Murrelet Restoration Project (Project 98173R) for FY98, with the recommendation that funding be contingent on demonstrating a relationship between murrelet productivity and fish abundance (Project 98173A). Presented here are preliminary analyses that demonstrate a positive relationship between fish abundance and murrelet productivity. I also describe comparisons that will be made when other data sets are available. These results show that marbled murrelet abundance and productivity link directly to the APEX hypotheses.

Fish biomass and murrelet productivity

The key question within the APEX hypotheses is whether seabird productivity is controlled by the abundance of forage fish, and if so, what level of abundance is required for recovery. I examined fish biomass within specific murrelet study sites by extracting only those nearshore hydroacoustic transects intersecting with my study sites during the peak chick-rearing period (July). For 1995 and 1996 I used hydroacoustic values presented in APEX reports (Haldorson et al. 1996, Haldorson et al. 1996 Annual Report). These values measure fish biomass of the entire transect (including waters without fish). The 1997 data, analyzed by Bill Ostrand (unpubl. data) for Project 97163B, used the hydroacoustic data to measure the biomass of fish schools, and thus, reflects the density of fish within schools and the number of schools at a study site. The measure of total transect biomass and biomass of fish schools can not be compared among years, but the latter allowed me to examine 1997 murrelet data relative to an index of fish abundance.

In 1995, nearshore fish biomass was positively and significantly correlated to the density of juvenile murrelets among areas (Fig. 1). There was no murrelet study in 1996, although we conducted four juvenile surveys at Naked Island (see below). In 1997, the biomass of fish schools was positively related to juvenile murrelet density among sites (Fig. 2). Additionally,

the number of fish schools observed during aerial surveys in 1997 (E. Brown, pers. comm.) also corresponds to murrelet productivity; in July, 22 fish schools were counted around Naked Island which had the highest murrelet productivity, 8 were counted in the Galena area and 2 at Jackpot, with the lowest murrelet productivity.

At Naked Island we have three consecutive years of juvenile surveys that will be compared to fish abundance. The nearshore fish biomass in 1995 and 1996 align with the decrease in murrelet density in 1996 (Fig. 3). The 1997 fish biomass data will be included when analysis for Project 97163A is completed.

Murrelet diet and productivity

The relationships shown above lead directly to three of the APEX hypotheses: (Number 7) seabird diet composition reflects changes in the relative abundance and distribution of forage fish, (number 8) seabird productivity reflects forage fish abundance, and (number 9) seabird productivity is determined by differences in forage fish nutritional quality. Hypothesis 8 is supported by the preliminary results shown above, and can be tested with additional years of data. However, we have intriguing results suggesting that the type of prey fed to chicks may also affect murrelet productivity (hypothesis 9). Further, availability of prey may vary temporally among sites (hypothesis 7), which might have influenced chronology and reproductive success.

In 1997, murrelet chick diets varied considerably among study sites, particularly between Naked and Jackpot. Although the main chick food was herring (51%) and sand lance (46%), birds at Naked primarily used sand lance, birds at Galena used both species, and birds at Jackpot used herring (Fig. 4). At Naked, where sand lance use predominated, juvenile murrelet density averaged 1.51 juveniles/km^2. Productivity was lower at Galena and Jackpot (0.68 juveniles/km^2), where herring predominated. In addition to prey species, prey size (and thus nutrient value) appears to be an important factor when raising chicks. We found that adults and juveniles ate different sized prey. Adults often foraged on age class 0 sand lance and herring but fed their chicks, almost exclusively, older sand lance and herring.

We found evidence suggesting that diet is linked to murrelet nesting chronology. Fledging began and peaked earliest at Naked, where sand lance was used throughout the breeding season. The appearance of juveniles began a week later at Jackpot, and most of the juveniles did not appear there until late August. Additional years of data on murrelet diet and productivity would be needed to separate spatial effects.

Murrelet restoration and the APEX project

Separating the effects of total fish biomass, the nutrient value of different prey, and their temporal availability, will require the integration of several years of data from the murrelet project and related projects in APEX. The murrelet productivity index, which uses the density of juveniles and their ratio to adults, was developed for this purpose (Kuletz and Kendall, in press).

The value of this method was supported by results in 1997, however, journal reviewers suggested that at least three years of data would be required to fully substantiate the method.

The marbled murrelet was one of the key species injured by the oil spill. The full benefit of restoration efforts for the murrelet requires integration with the APEX project, and synthesis of results from previous murrelet studies. Such a synthesis is the final objective of the murrelet project, which will model the distribution of adult and juvenile murrelets in Prince William Sound (PWS) relative to terrestrial and marine features.

The marbled murrelet is the most abundant seabird in PWS, which makes it both an important part of the PWS ecosystem and accessible throughout APEX study areas. Further, the murrelet's nesting ecology makes it less susceptible to the local predation or weather-related mortality that can eliminate or obscure productivity studies at typical seabird colonies.

The results presented here clearly demonstrate the importance of monitoring murrelet abundance and productivity to examine APEX hypotheses. Therefore, we ask that the Trustees continue funding the murrelet project through FY98. The project objectives will then be subject to revision following the January review, in accord with other APEX projects.

Literature Cited

Haldorson, L., T. Shirley, and K. Coyle. 1996. Biomass and distribution of forage species in Prince William Sound. APEX Project 95163A annual report. University of Alaska, Fairbanks. Juneau Center School of Fisheries and Ocean Sciences

Haldorson, L., T. Shirley, K. Coyle and R. Thorne. Project 163A - 1996 Annual Report. Forage Species Studies in Prince William Sound. APEX Project 96163A annual report. University of Alaska, Fairbanks, Juneau Center School of Fisheries and Ocean Sciences.

Kuletz, K.J. and S.J. Kendall. [In press]. A productivity index for marbled murrelets in Alaska based on surveys at sea. Journal of Wildlife Management.

FIGURES

Figure 1. Juvenile murrelet density (birds/km^2) and July nearshore fish biomass (of transects) at four study sites in July, 1995. *(Data from Haldorson et al. 1996).*

Figure 2. Relationship between juvenile murrelet density (birds/km^2) and nearshore biomass of fish schools in those areas surveyed in July, 1997. *(Data from Bill Ostrand, Principal Investigator, Project 97163B; unpubl. data).*

Figure 3. Annual variation in juvenile murrelet density (birds/km^2) at Naked Island in 1994-1997, and nearshore fish biomass at Naked Island in July of 1995 and 1996. Comparable fish biomass data will be available for 1997.

Figure 4. Marbled murrelet chick diets at study sites in Prince William Sound in 1997. Prey were visually identified as adult murrelets held fish prior to deliver to chicks.

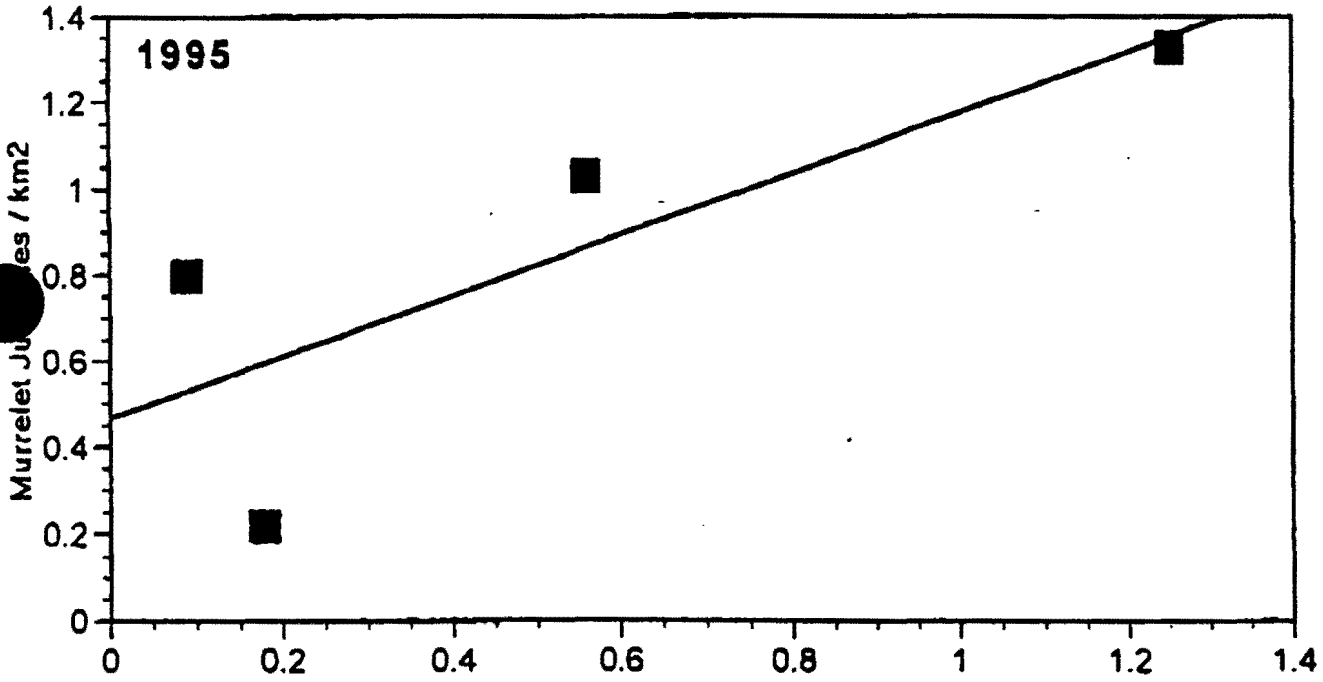


Fig. 1. - July Nearshore Fish Biomass (g / m3) of Transect

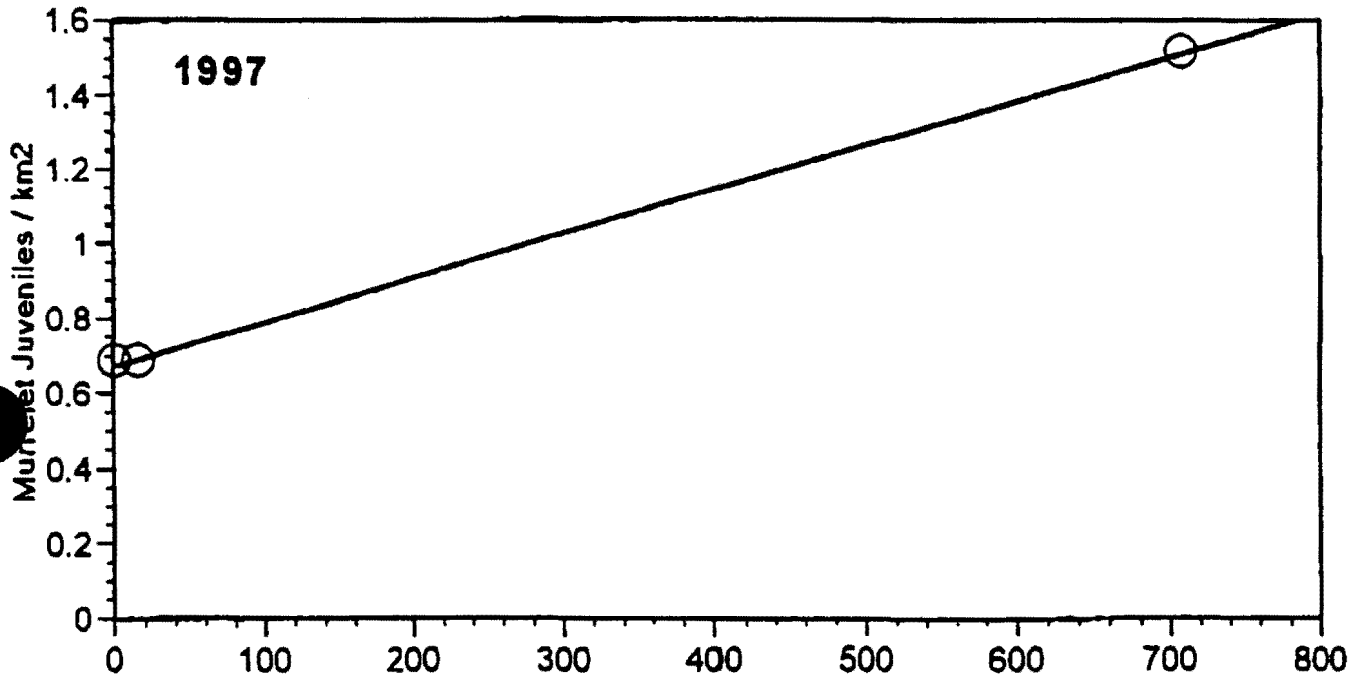


Fig. 2. - July Nearshore Biomass (g/m3) of Fish Schools

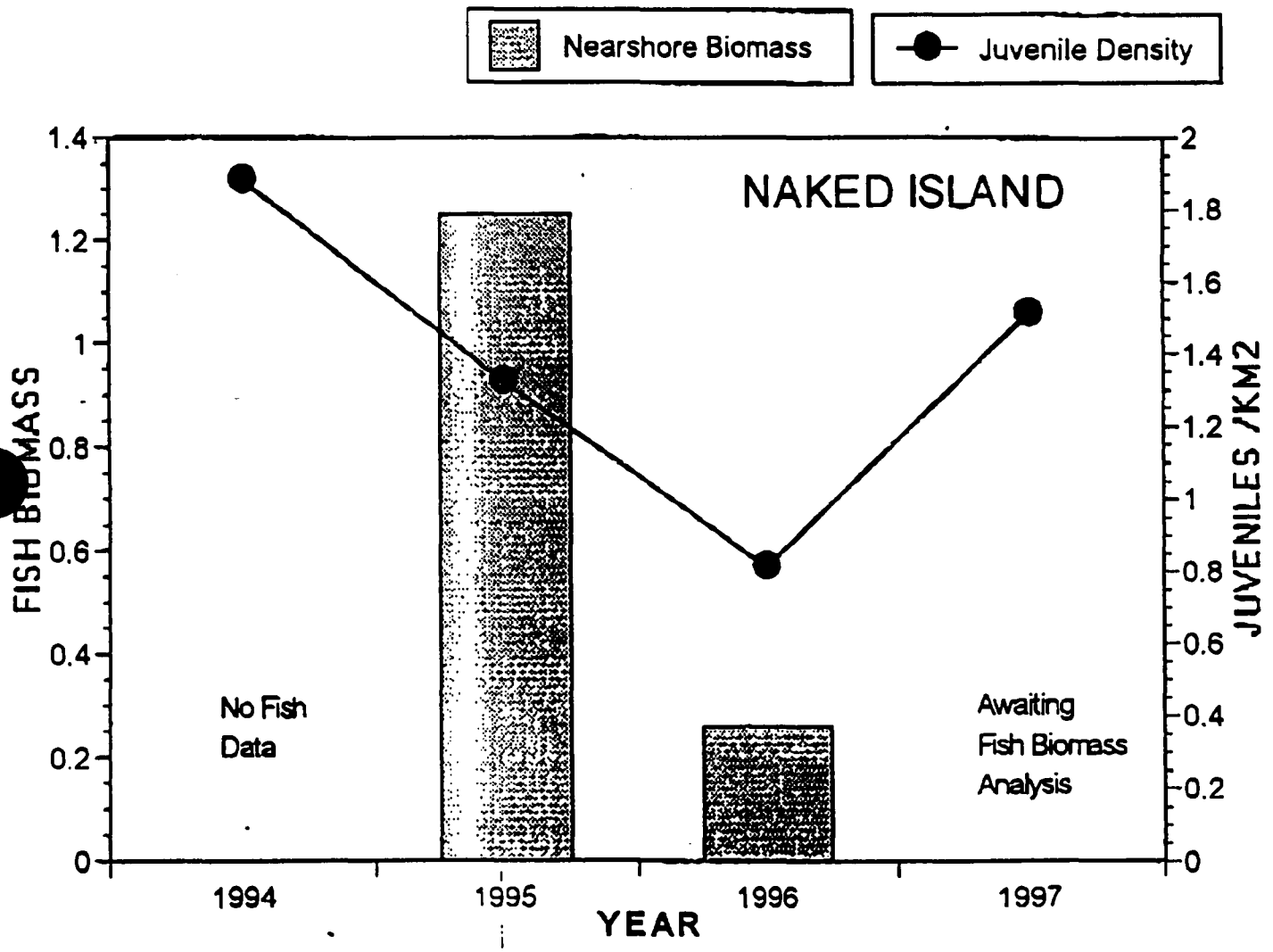
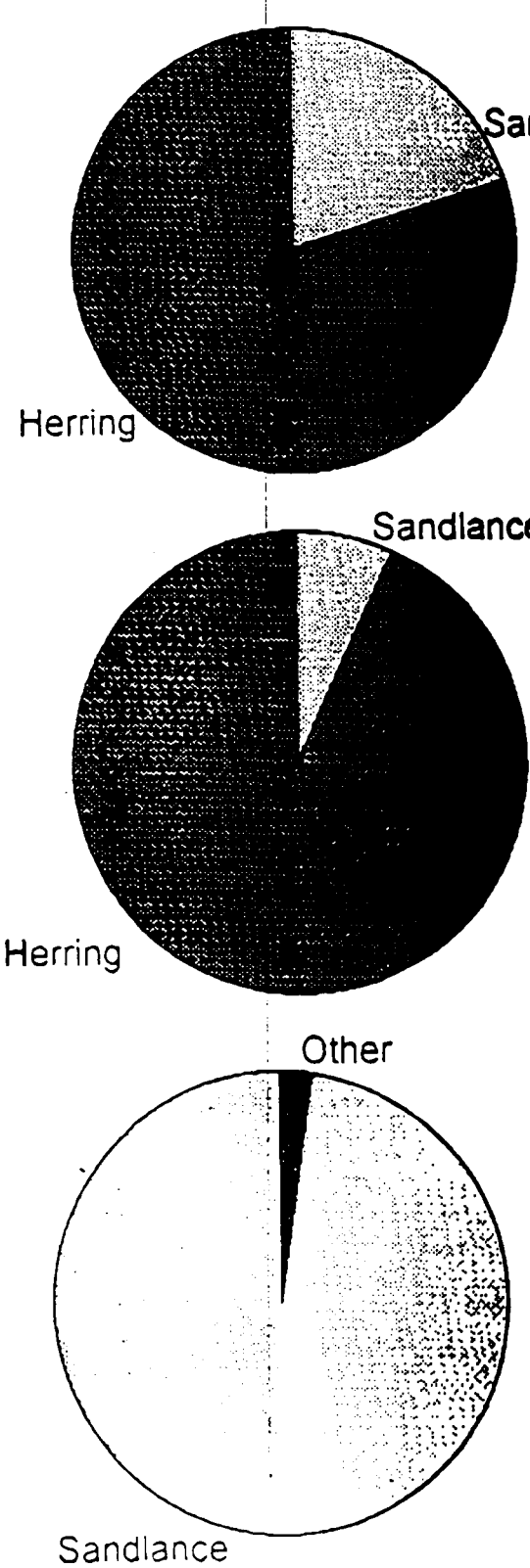


Fig. 3. - Annual Murrelet Productivity and Fish Biomass

Fig. 4. - Murrelet Chick Diet in 1997



GALENA
n = 10 identified
(33 Total Fish)

JACKPOT
n = 43 identified
(76 Total Fish)

NAKED
n = 42 identified
(55 Total Fish)

98263

Draft

***Exxon Valdez* Oil Spill**
Restoration Annual Report

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

Restoration Project 97263

This annual report was prepared for peer review as part of the *Exxon Valdez* Oil Spill Trustee Council restoration program for assessing project progress. Peer review comments have not been addressed in this annual report.

Walter Meganack, Jr.
Dr. Douglas Martin
John L. Hall
Arvid J. Hall

Port Graham Corporation

Alaska Department of Fish and Game
333 Raspberry Road
Anchorage Alaska 99518

November 1997

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

Restoration Project 97263

Study History: The project effort was initiated under Restoration Project 97263 and will continue under 98263. This is the annual report for FY97 by W. Meganack, Jr. under the title Assessment, Protection and Enhancement of Wildstock Salmon Streams in the Lower Cook Inlet. FY98 will be the implementation stage and FY 99 will consist of monitoring enhancement projects and the final report.

Abstract: This project began in FY97 and was designed to replace lost subsistence services resulting from the *Exxon Valdez* oil spill. The first phase of this project was to conduct an inventory and assessment for enhancement projects on the four major salmon streams in the Lower Cook Inlet (LCI) oil spill area. During FY98 and FY99 restoration and enhancement projects will be implemented with instream fisheries habitat improvement techniques, primarily creation of spawning channels, removing natural barriers to spawning and constructing wall-based rearing structures. A literature and data survey search was conducted on the four streams. We then conducted fisheries habitat assessments with aerial photos to the USDA Forest Service Region 10 protocols. During the field season we surveyed the stream reaches to verify the Region 10 channel types and inventory stream reaches with no existing data. With this existing and the newly obtained data we have designed six enhancement projects on three streams in the survey area primarily for coho salmon *(Oncorhynchus kitusch).*

Key Words: *Exxon Valdez*, subsistence, coho salmon, enhancement, restoration, *Oncorhynchus kitusch*, instream fisheries habitat, lower Cook Inlet.

Citation: Meganack, Jr. W. and D. Martin, et al. 1997. Assessment, Protection and Enhancement of Wildstock Salmon Streams in the Lower Cook Inlet, *Exxon Valdez* Oil Spill Restoration Project Annual Report (Restoration Project 97263), Port Graham Corp, Port Graham, Alaska and Alaska Department of Fish and Game, Anchorage Alaska.

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Executive Summary

Subsistence users in the LCI area and specifically the residents of Port Graham are heavily dependent on salmon from the Port Graham River, Windy Creek, Scurvy Creek and Rocky River. These four major salmon streams and their tributaries were inventoried and assessed with existing data from previous EVOS projects including aerial photo interpretation, ground truthing, and field inventories. The goal is to replace lost or damaged resources by replacing or enhancing the habitat of wildstocks of salmon important to the people who live in Lower Cook Inlet. Subsistence users were interviewed to assess the historical level of runs and the current, depressed level due to EVOS and preferences for replacing damaged susbsistence resources. Existing data includes the baseline studies commissioned by the EVOS Trustee Council: Stream Habitat Assessment Project: Prince William Sound and Lower Kenai Peninsula Project No. R-51, (Sundet & Kuwada, 1994), Fish Habitat and Channel Conditions for Streams on Forested Lands of Coastal Alaska: An Assessment of Cumulative Effects, (Martin,1996), Survey and Evaluation of Instream Habitat and Stock Restoration Techniques for Wild Pink and Chum Salmon (Carpenter, Dickson Dudiak, Honnold & Willette, 1995). Habitat Protection Information for Anadromous Fish Channel Type Classification Study (Olson & Zemke, 1993)

Field surveys were then conducted to augment existing data and to ground truth aerial photo inventories. As a result eight specific enhancement and restoration projects were then developed from this field inventory. With the information from the interviews with local subsistence users and an evaluation of the existing species and available quantities, the decision was made to target coho salmon for enhancement and restoration for subsistence purposes. We will coordinate the design and implementation of the specific projects with Dr. Doug Martin and Dr. William Hauser Assistant Fisheries Program Manager of the Alaska Dept. of Fish and Game Habitat and Restoration Division.

For several decades fisheries biologists have successfully modified existing stream structures as a technique to improve habitat conditions for salmon spawning and rearing in Alaska and the Pacific Northwest. Fish passes and wall based rearing ponds can be very effective in adding spawning and rearing habitat for the existing wildstock salmon. These structures will be installed with data and insight derived from a thorough inventory and analysis of the current habitat conditions in the entire watershed and the specific needs of a particular salmon species. These enhancement and restoration projects will primarily target coho salmon with beneficial effects for pink, chum and sockeye salmon.

Introduction

These surveys are the first phase of a three year project commissioned by the *Exxon Valdez* Trustee Council, and are designed to promote the restoration and enhancement of salmon for subsistence. The freshwater streams and the associated riparian areas are critical habitat for several species of injured fish and wildlife resources. Coho, Pink and sockeye salmon and Dolly Varden use freshwater environments for important life functions such as spawning, rearing and overwintering. However, it is the restoration or the effective replacement of the subsistence resources relied on by the indigenous peoples which is the focus of this project.

Precipitation on the lower Kenai Peninsula, mostly rain, averages 25 to 100 inches per year, and much higher levels on the mountains. The Gulf of Alaska is a noted originator of fierce storms, some approaching hurricane force. The lower Kenai Peninsula is characterized by steep slopes. The streams in our study area contained extensive and complex primary, secondary and tertiary spawning and rearing areas. Although intertidal spawning is quite common for pinks and chums, the primary spawning habitat of the coho salmon, the targeted species for this project extends to the headwaters of these watersheds.

The Alaska Earthquake of March 27, 1964, measuring 8.6 on the Richter scale created subsidence in the study area ranging from -3.0 to -5.0 feet. This subsidence had an undetermined effect on available spawning areas for pink and chum salmon. Chum runs in the study area have remained depressed but pink runs seem to have rebounded in the last three years in Rocky, Windy and Port Graham River (ADF&G Harvest and Escapement reports 1959-1997). The absence of a commercial harvest and the capability of pink salmon to exploit any suitable spawning area with the inherent benefit of a two year life cycle has generated an accelerated recovery.

Objectives

This project addressed these objectives:

1. Consolidate existing information on wildstock salmon habitat and augment with new information from surveys. Enter relevant data into a GIS for future management. Study historical levels of salmon returns to present returns and extrapolate potential for building runs to historical highs.

2. Inventory, assess and develop protection and enhancement projects on the four major salmon streams and lakes on PGC land closest to the Native Village of Port Graham and have, or will have road access.

3. Improve the in-stream spawning and rearing habitat for Coho, Pink and Chum salmon through enhancement projects, for example, fish ladders, spawning channels, wall-based rearing ponds, etc.

4. Enhance existing wildstocks of salmon to serve as substitution and compensation for the lost and damaged subsistence resources important to the subsistence users of Lower Cook Inlet.

5. Educate and involve the subsistence users in the fundamentals of fisheries management and wise land stewardship. Improve quality and quantity of wildstock salmon as a subsistence resource in the LCI. Gauge success by comparing returns in next ten years with historical averages.

Objective One of this project concentrated on a compilation of the existing data and literature from ADF&G and other sources as cited who have inventoried these streams and existing runs since the 1960's.

Objective Two consisted of targeted habitat surveys, based on the information gathered in Objective One, using USDA Forest Service Region 10 Survey protocols on Port Graham River, Windy Creek, Scurvy Creek and Rocky River.

The classification of streams, and their associated habitat would provide not only the available spawning and rearing habitat but would be useful for determining the impacts of land use practices, assessing basin wide cumulative impacts of the management practices on the stream habitats, and providing generalized information on stream habitats from site specific data. The USDA Forest Service, Alaska Region channel type system (Paustian et al., 1990) was developed in the Alaska Region, and as a result, it is tailored to many of the stream systems found throughout Alaska. The channel type system uses geomorphic features, that are identifiable on aerial photos, to classify stream channels into subunits or reaches that can be used to assess fish habitat quality and to identify areas suitable for restoration or enhancement. As such it provides a useful tool for quantifying available spawning and rearing habitat for the targeted species of this survey. The system provides an ecosystem approach to restoration on the watershed scale.

[1]The channel typing system is based three major concepts:

1). Geomorphic processes that are independent of in-channel processes affect stream channel characteristics. Time, initial relief, climate, geology and vegetation are the dominant independent variables that influence the progress of the erosional evolution of a landscape and its hydrology. Runoff water acts as a principal landscape sculptor, producing a characteristic drainage network morphology (drainage density, channel shape, gradient, and pattern) and hill slope morphology (slope, length, and profile form),(Schumm, 1979). The relief and area of the drainage basin remaining above base level is determined by geology, climate, and vegetation. Relief, in turn, significantly influences runoff and sediment yield per unit area from the drainage basin. Drainage basin area determines the volume of runoff generated at the mouth of a given drainage basin. Runoff volume and basin relief together determine the potential energy available to the drainage basin for channel erosion and sediment transport..

2). In-channel fluvial processes affect channel characteristics. Stream gradient, cross-sectional area, and substrate in a given stream reach are directly related to stream flow

[1] Olson & Zemke

regimen, upstream erosion rates, and sediment routing through the drainage network. Most natural channels tend to approach an equilibrium condition where erosional and depositional processes balance one another. However, a shift in headwater erosion, sediment delivery, or basin runoff characteristics may result in rapid and dramatic changes to stream channel morphology until a new equilibrium configuration is reached.

3). Abiotic processes within the riparian zone affect in-channel characteristics. Riparian vegetation strongly influences bank morphology and flood plain characteristics. Roots of stream side vegetation determine stream bank form and erosion rating, particularly in alluvial channels. Riparian vegetation dissipates the energy of erosive flood flows and acts as a filter for sediment laden water. Fallen trees and rootwads (large woody debris) that enter the channel play a major role in trapping sediment and creating structural diversity such as pools and undercut banks that are very important aquatic habitat features.

Intensive surveys for the Port Graham drainage have been accomplished by Dr. Doug Martin from 1993-97. For consistency purposes these survey protocols were then used to inventory the upper Port Graham River.

Objective Three consisted of identifying the most promising and feasible restoration and enhancement projects based on the data review, aerial photo interpretation and ground surveys.

Objective Four: Select the most appropriate and cost effective restoration and enhancement projects. The appropriate prescriptions for structural improvement will then be based on the species and the objectives desired for that stream.

Methods

Objective One: □Objective One focused on the compilation and review of all available fisheries information relevant to the four major salmon streams. We consulted with personnel in ADF&G (Fish & Habitat) and the USDA Forest Service. We then proceeded to acquire all available maps, aerial photos, ADF&G records and reports concerning these streams. Meetings were scheduled with ADF&G, COMFISH, and Cook Inlet Aquaculture in May and June of 1997. We also consulted with the Seward Harbormaster on a fish enhancement project at Jap Creek in Seward.

Once all the available data was collected it was inventoried and catalogued for each stream. On Port Graham River, the existing data included inventories completed by Sundet & Kuwada, 1993 USFS Inventory by Olson & Zemke, 1993 and Martin Environmental in 1993 to 1996. This data consisted of comprehensive inventories of habitat and species up to the barrier falls in Section 20

Data on Windy Creek consisted of historical compilations of pink and chum harvest and escapement from 1959 to present (Table 1) In addition, channel typing had been accomplished through Olson & Zemke, 1993.

Scurvy Creek had been the targeted for an enhancement project by CIAA in 1984. The project was construction of a spawning side channel just below the bridge of the road to Rocky River. In addition, a private entity has proposed constructing a hatchery on Scurvy Creek with source water from Scurvy Lake for hatchery production. Water quality data on Scurvy Lake has been documented. Low historical runs for pink salmon were noted by ADF&G foot surveys.

Rocky River has been extensively inventoried and studied. Logging activities in the 1970's under a State of Alaska timber sale could have had some effect on the productivity of this system. Historical salmon run data suggest that runs were also affected by the Alaska Earthquake of 1964 which caused subsidence and a receding of 500 meters at the mouth. Pink runs are currently near historic averages. Chum runs remain depressed. Coho runs have never been officially documented because there was no targeted commercial harvest of this species in this district.

Unrectified photo mosaics at a scale of 1" =660' from 1993 air photos (original scale 1'=1000') were generated for each stream showing the existing Region 10 data and channel types. These were plasticized for field use and evaluation.

Objective Two: Once existing data was evaluated and potential projects for each stream were considered, then targeted habitat surveys were designed for each stream. These were based on the information gathered in Objective One, using USDA Forest Service Region 10 Survey protocols on Port Graham River, Windy Creek, Scurvy Creek and Rocky River.

Field: During June 25-28, 1997 field crew training was accomplished on the lower Port Graham River. Field surveys were then scheduled for August 24-31, 1997. Habitat surveys were accomplished to verify stream channel types and calls and evaluate previous inventories on each stream. Due to the limited amount of funding available for field work not all reaches of each stream were inventoried. Assessing the existing data, aerial photos and local knowledge, reaches with the highest potential for restoration were targeted. Each discrete stream channel reach was classified according to the Region 10 Stream Classification protocols. Habitat types were also noted, including: rapid, riffle, glide, cascade, falls, backwater pool, dam pool, lateral scour pool, straight scour pool, trench pool, side channel pool, plunge pool and beaver pond. The field surveys were conducted using one person to estimate habitat unit areas, one to record data and measure habitat unit areas and depth. Available spawning and rearing areas were then calculated. Field inventoried stream reaches were measured with a hip chain in meters. Stream width was measured with a three meter pole after the habitat was measured visually. Areas suitable for spawning were evaluated by the size of the substrate and level of fine material. The number and sizes of large woody debris were also inventoried. Also, disturbances, channel

type, harvest history, bank condition, riparian vegetation, substrate, and juvenile and adult fish present were noted (Sample Survey Forms—Appendix Three).

Objective Three: On the basis of the existing data survey, local knowledge and the aerial photos several restoration and enhancement projects were identified for each stream. These potential projects were: a fish pass ladder on Port Graham River, wall based rearing Ponds on Windy Creek Left, fish ladders or step pools on Scurvy Creek and side channel restoration and enhancement on Rocky River.

This field survey data was then analyzed to determine the limiting factors for each targeted salmon species (Coho) in the four individual streams. Based on the limiting factors analysis and the targeted species, habitat enhancement prescriptions were then developed for each enhancement area on the four major streams.

Objective Four was to select the most appropriate and cost effective restoration and enhancement projects for each watershed.

The prescriptions for structural improvement on each stream became evident on analyzing the existing data and field surveys. Coho salmon became the targeted species for enhancement based on interviews with local subsistence users. Pink salmon, on their present odd-year cycle and levels of returns documented this year revealed strong, wild runs. The lack of a heavy commercial harvest due to the low market value of pinks is also a contributing factor to the good runs in 1997. Chum and pink salmon utilize essentially the same habitat and chum runs should continue to recover for the same reasons the pinks have. However, due to their four year cycle recovery will take longer. Sockeye runs in these watersheds are currently low and kings show up as anomalies. Therefore, based on local subsistence users' preference and the opportunity to enhance habitat for coho, it was decided to target specifically those projects that would enhance or restore habitat for coho primarily with secondary effects for pink, chum and sockeye.

Results and Discussion

Objective One: A substantial amount of existing data concerning fisheries habitat in the project area was obtained during the literature search and survey. This data enabled us to make a preliminary assessment of the fisheries habitat and relative strength of salmon runs for each watershed. On the basis of this research and a compilation of the harvest and escapement for Windy Creek (Left & Right) and Rocky River (Table 1), it was determined through statistical analysis that the most recent returns of pink salmon were at or near their historical average. During the last 30 years there were three years with exceptional returns (Chart 1). In our statistical analysis, these three years were deleted from the data set because these numbers were

significantly higher than any of the other years and severely skewed the average. The average for the other 27 years was determined. This average was then inserted into the three years which were deleted to arrive at a more accurate number for the 30 year average return. This new average was one half to one third lower than the current escapement and harvest goals for these areas. (Chart 2) Pink returns are currently exceeding these new escapement goals but chum returns remain at depressed levels. On the basis of this data the decision was made to eliminate the enhancement or restoration of projects targeted for pink or chum salmon. Current available habitat for pink salmon is more than adequate to sustain this fishery. The best strategy for chum salmon restoration is to eliminate all harvest: commercial, sport or subsistence until escapement goals are met.

On Port Graham River there have been extensive surveys of anadromous fish habitat conducted by Martin, Sundet and Kuwada and Olson & Zemke. However, no on the ground surveys had ever been conducted upstream from the 3 meter falls located in Section 20, Township 10 South 14 West. Sundet & Kuwada identified these falls as a barrier to fish passage. It was decided after make a preliminary field survey of the falls that a fish passage device was quite feasible for this falls. A detailed inventory of the anadromous fish habitat upstream from the falls was needed to evaluate the net benefit to subsistence which would result by constructing a fish pass.

Windy Creek Left & Right had extensive harvest and escapement data (ADF&G), and an aerial photo inventory (Olson & Zemke). No field surveys had been conducted other than those done by ADF&G to determine escapement and extent of anadromous use (ADF&G Fish Habitat Catalog). The existing data from Olson & Zemke was transferred to a 1" = 660' unrectified photo mosaic.

Scurvy Creek was the focus of an effort by CIAA in 1984 to build the pink salmon run through construction of a side channel for spawning. Spawners were transferred up to above the falls by helicopter on the lower creek that were thought to hinder upstream migration. A private individual has proposed building a salmon hatchery on Scurvy Creek with water for hatchery production to be derived from Scurvy Lake. Relevant data fro this report consisted of mainly water quality and temperature taken from the lake.

Rocky River has been extensively inventoried and studied for habitat and restoration (Sundet & Kuwada, Olson & Zemke, Willette, et al). The 1964 earthquake has a measurable effect by subsiding the land base which resulted in a loss of 500 meters of pink and chum spawning habitat. In addition, it is alleged that logging activities in this watershed in the 1970's have reduced the overall productivity. Based on a report by Pentec for Koncor Forest Products titled Examination of Variation in Returns of Pink Salmon to Lower Cook Inlet Fishery Areas Before and After Commercial Timber Harvest in 1968-69 and 1978-1980. October 3, 1991

revealed that there was no statistical relation between the size of runs and areas that had been logged or not logged. However, there are several areas where logging activities altered the channels of several important tributaries. In addition, we identified a possible lack of large woody debris for the long term in this watershed. These areas were targeted for intensive habitat surveys and evaluation for restoration and/or enhancement.

Objective Two:

OB2: Port Graham River: On August 25, we inventoried the barrier falls on Port Graham River. A three meter pole and clinometer were used to draft a channel profile of the falls. The fall consists of two channels which spilt around a large 6 by 10 meter bedrock outcropping in the center of the channel (Chart 3). We inventoried both the left and right channels of the falls. The field survey conducted on August 26, 1997, evaluated the stream reaches above the barrier falls. These three reaches contain 1,297 meters of channel type FP4, 495 meters of FP3 and 290 meters of MC2. There are also 1,200 meters of HC3 which was not inventoried. We inventoried this stream reach to the upper end of the habitat until reaching a short section of MC1. Based on aerial photo analysis additional habitat suitable for coho spawning and rearing exists upstream and was inventoried using aerial photo techniques. These upper reaches contain a total of 10,127 lineal meters of habitat suitable for coho spawning and rearing, including 82,596 square meters of habitat with 20,004 square meters of spawning habitat and 24,318 square meters of rearing habitat (Table 8). The dominate substrates for reaches which were field inventoried were gravel (67%), cobble (19%) and boulder (0.5%) the remainder is in bedrock and sand. The reaches in lower Port Graham contain 19,533 lineal meters, with 366,683 square meters of potential habitat with 64,662 square meters of available spawning habitat and 178,516 square meters of available rearing habitat. The upper Port Graham reaches contain 23 percent of the total available spawning and 12 percent of the total available rearing habitat for the entire Port Graham River watershed. Construction of a fish pass could result in additional 23,476 coho spawners annually (Table 8). Sufficient rearing habitat exists throughout the entire watershed to support the additional production from these spawners (Table 9) Based upon a cost-benefit analysis with each coho valued at $22.50 for subsistence purposes this creates a net benefit over 20 years (the expected life of the fish pass of $???. (Table 12)

OB2 Windy Creek L&R: Stream channel types were then verified with Region 10 Stream Protocols. A total of six reaches were inventoried and verified. Stream channel identifications from Olson and Zemke were very accurate in this watershed, however based on our surveys the boundary between channel types was adjusted on the photo mosaic in the field. Windy Creek Right,4,562 lineal meters, contains 30,658 square meters of anadromous fish habitat 225 square meters of available spawning habitat and 2,479 square meters of available rearing habitat (Table 3). During stream surveys, thousands of pinks were spawning. We estimate that there were upwards of 60,000 spawners this year pending ADF&G foot and aerial

surveys. No previously unknown barriers to fish passage were identified during our photo or field surveys. While in the Windy Creek watershed we inventoried Dog Creek and Dog Creek Jr.. These streams, 5,681 lineal meters, contain 22,875 square meters of anadromous fish habitat with 1,491 square meters of available spawning area and 3,159 square meters of available rearing area. Windy Creek Left, 8,340 lineal meters contains 66,548 square meters of anadromous fish habitat with 4,029 square meters of available spawning habitat and 8,377 square meters of available rearing habitat (Table 4). Approximately 4,135 meters upstream from the mouth are two low wet meadows adjacent of the stream channel which show evidence of being ancient abandoned stream channels. During our field survey these were investigated for the suitability for enhancement into wall based rearing habitat structures. Ground water was found in several small channels with 3 dead pinks and two live pinks. Fry were observed in the shallow pools. There is excellent access to the main channel at the base of a large pool. The other meadow contained similar conditions. On the basis of the total amount of rearing habitat available on Windy Left, these enhancement projects would add critical off-channel winter rearing habitat for Coho. These enhancement projects would add an additional 40,000 square meters of available rearing habitat for coho salmon. There is sufficient spawning area to fully seed these ponds (Table 4).

OB2 Scurvy Creek: Scurvy Creek has been the subject of several enhancement projects and a proposed private fish hatchery. The main channel is 8,340 meters long and originates in Scurvy Lake. However, the there is an overall steep gradient and the channel is of the medium confined types (MC 2, MM1&MM2). Three falls are evident from the aerial photos and ground surveys. The lower fall is passable by salmon during high flows. Presently Scurvy Creek supports a small run of pink salmon (avg. escapement 400 fish per year, ADF&G foot Surveys). Preliminary field investigations revealed that the upstream falls were remote, confined by bedrock and would be cost prohibitive to build either step pools or fish ladders at this time. The stream channel types found on Scurvy Creek are charactereized by poor quality spawning and rearing habitat in addition to the number and size of major falls. Scurvy Creek, 6,710 lineal meters, contains 49,811 square meters of anadromous fish habitat, 461 square meters of available spawning habitat and 4,290 square meters of available rearing habitat (Table 6). On August 29, 1997 we investigated the side channel which CIAA had constructed below the bridge. There were no spawners using the channel. We did find coho fry and large smolts in the side channel. We determined that further inventory of Scurvy Creek habitat was unwarranted. No enhancement or restoration projects are contemplated as a part of this project on Scurvy Creek due to the high gradient, confined channel types (predominantly boulder and cobble), scarcity of suitable spawning gravel and three major barriers to fish passage. Scurvy Lake might have potential for stocking of rainbows or cutthroats in a future project.

OB2: Rocky River: On August 29, 1997 we conducted field reviews of channel types on Rocky River. Rocky River, 30,664 lineal meters, contains of 823,831 square meters of

anadromous fish habitat 189,906 square meters of available spawning habitat and 206,470 square meters of available rearing habitat (Table 7). Due to the wealth of existing data located during OB1 we determined that verifying channel types from the aerial photos and conducting field surveys on known problem areas within the system. In section 26 an inadequately placed culvert from a 1970's era logging road was blocking access to the main river. 636 square meters of coho rearing habitat is currently being blocked from use at this location. Restoration of access to this side channel could result in additional return of 81 adult coho of which 33 would be harvestable. (Table 11)

In section 23 a small lake that has verified runs of coho and sockeye a major tributary to the lake has become diverted and is currently in a new channel which follows a logging road before emptying into the main channel of Rocky River. We surveyed the abandoned FP3-MM1, dry channel 350 meters upstream to where we located a logjam that has allowed the stream to spread gravel into an alluvial fan. We further surveyed this channel upstream to where the channel type changed into MC1. The channel was full with gravel from the upstream canyon. A large log jam appears to have contributed to the diversion of this channel. Restoration would involve removing the gravel from the upper abandoned stream channel and redirecting the flow in to the old channel. A new large culvert or bridge would be needed to ensure that the stream will stay in its old channel instead of creating an alluvial fan. This would restore 723 square meters of spawning habitat for this lake tributary which contains coho and sockeye adults and juveniles. This project could result in an annual return of 848 coho of which 344 would be harvestable. Estimated annual return of harvestable coho would equal $7,732.000. This un-named lake (ADF&G 242-30-10120-0010) currently provides 1,080,000 square meters of rearing habitat more than sufficient to support the additional fry (Tables 12&13).

While reviewing the past and current condition of Rocky River, the long term supply of woody debris became a concern. Logging in the 1960's and 1970's did not have buffer strips to protect the riparian zone. Large spruce trees were removed in the area the river is likely to migrate in the next one hundred years. It was decided that a possible restoration project was to analyze the stream channel morphology and inventory the future supply of large woody debris in this system by comparing the number and size of large spruce or cottonwood located within the 100 year flood plain of this system. Future recruitment of large woody debris was deemed to be important for the future runs of coho. Other channel types in the Rocky River system were verified using site checks as needed.

Objective Three: The field survey data was analyzed to determine barrier or lack of spawning or rearing habitat was a limiting factor for the targeted salmon species (Coho and Pink Salmon) in the four individual streams. Based upon the limiting factors analysis and the targeted species, habitat enhancement projects were then selected for each individual stream., except Scurvy Creek which was deemde to expensive to pursue at this time. The proposed enhancement and restoration projects are:

1. Port Graham River: Construction of a fish pass ladder on falls located in Section 20.

2. Windy Creek Left: Construction of two wall based rearing ponds adjacent to Mile Post of the Port Graham Road.

3. Rocky River: Culvert and bridge replacement to restore impacted fish habitat from State managed timber sales in the 1970's

4. Rocky River: Stream diversion into restored channel into Red Lake with installation of adequate culvert.

5. Rocky River: Photo interpretation of riparian zone and analysis of future recruitment of large woody debris. Plant spruce wildings as necessary to restore riparian zone for future LWD recruitment.

Objective Four: To select the most appropriate and cost effective restoration and enhancement projects for each watershed. The above projects were selected and project plans with estimates for each project. The summary of these costs are shown below.

Estimated Project Summary	**FY98**	**FY99**	**FY00**
Port Graham River Fish Pass	57.0	15.5.	15.5
Windy Creek L Ponds	50.0	6.5	6.5
Rocky River			
Rearing Channel	24.0	2.0	2.0
Red Lake Spawning Ch	20.0	2.5	2.5
Large Woody Debris Study	5.0	10.0	10.0
Summary	156.0	36.5	34.5

Conclusions

The habitat, accessibility and the known size of the historical runs on these streams make them excellent candidates for enhancement projects.

As needed, environmental assessments will be prepared and submitted to USDA-Forest Service. The necessary permits from ADF&G Habitat for enhancement projects will be applied for and secured by the Port Graham Corporation.

Instream restoration and enhancement will occur during the early summer of 1998 (May 15th to July 15th). Most salmon in these streams have runs that occur in the late summer to fall and this timing would avoid conflicts with the salmon runs and subsistence harvest. Enhancement projects will be scheduled to not conflict with the out migration of fry and smolts in these streams. Construction will be coordinated with the ongoing timber sale and road building operators and their equipment in the Port Graham drainage. It is anticipated that with the excellent road access and the availability of heavy equipment, that PGC will be able to implement these projects on a cost effective basis. Work crews will be necessary for most projects and will consist of four to five persons. Proposed projects include: spawning channel restoration, construction of fish ladders or removing impediments to spawning, creation of wall-based rearing habitat long term management, study and restoration of riparian zones for future large woody debris recruitment.

All structures or projects will subsequently be mapped. Future monitoring will be critical to assess the rate of success and to determine which objectives have been met or exceeded. Monitoring will continue for ten years conducted by PGC. A final report and GIS data will be compiled in FY 1999. Construction and enhancement would occur during FY 98 and FY 99. All of these streams are accessible by the Port Graham Corporation Forest Road System. Heavy equipment is available from the logging and road building contractors on an extremely cost effective basis. In addition, hand tools and manual labor will be utilized extensively by the local subsistence users when appropriate. Engineering and design is proposed for fall and winter 1997-98.

Preliminary Project Plans: See Appendix

(Appendix is available from Restoration office.)

APPLIED
marine
SCIENCES

November 24, 1997

Ms. Molly McCammon
Executive Director
Exxon Valdez Oil Spill Trustee Council
645 G Street, Suite 401
Anchorage, Alaska 99501

Dear Molly,

I have received and sent out for review the report"Assessment, protection and enhancement of wildstock salmon streams in Lower Cook Inlet" (97263) submitted by the Port Graham Corporation. The reviewers found the report to have considerable merit, particularly with regard to the feasibility of supplementation for Coho salmon, but the schedule for implementation was far too compressed to be realistic and there were a number of comments and questions raised in the review:

1. What would be the source of the supplementation stock? If the source of the stock is not local, then the genetic implications of interbasin transplants need to be addressed as per Trustee Council policy.

2. There are often difficulties maintaining salmon spawning channels as proposed here. Given the local geomorphology, what is the prognosis for maintenance of such channels ?

3. Are there potential harvest management problems with the supplemented stock ? If so, how can these be satisfactorily addressed ?

4. Some of the five proposed projects appear to be worthwhile, while others, such as the Rocky River and Red Lake spawning channels, will produce only small numbers of additional salmon at a relatively high cost.

5. The scope and schedule of the proposed effort is rather ambitious. I doubt, for instance, that engineering plans and implementation of those plans can be carried out on the proposed schedule. Also the costs for the proposed work cannot be accurately estimated until the engineering is complete. In the EVOS process engineering plans and estimated costs are typically done in an initial phase and then approval would be obtained subsequently for implementation of the work.

Once basic questions with regard to supplementation in a biologically and economically appropriate manner are answered, I suggest a prudent approach. Such an approach would include pursuing one or two objectives for salmon supplementation, first with engineering plans and cost estimates in FY1998, and then a separate proposal for the actual work.

2155 Las Positas Court, Suite S Livermore, CA 94550 510.373.7142 FAX 510.373.7834

I suggest that these issues be addressed by the Port Graham Corporation either in a revised proposal, report or in a supplementary letter before this project is considered by the EVOS Trustee Council on December 18th.

Sincerely,

Robert B. Spies
Chief Scientist

cc: S. Senner
S. Schubert
C. Rozen
J. Sullivan

SE226
Rec'd 11/14/97

Project Title: **Native Village of Eyak Youth/Elders Subsistence Conference**

Project Number: 98286

Restoration Category: General Restoration

Proposer: Native Village of Eyak Tribal Council

Lead Trustee Agency: Department of Interior

Cooperating Agencies: None

Duration: 1 year

Cost FY98: $111,100.00

Geographic Area: Oil Spill Area

Injured Resource/Service: All Injured Resources/Services

ABSTRACT

This project would bring together Elders and other traditional knowledge bearers, students who are participating in the Youth Area Watch Project (/210), and principal investigators from EVOS-sponsored research projects to create a forum for the exchange of information between Western scientific ways of knowing and traditional ways of knowing. The forum will give rise to possible collaborative efforts between local community members and research scientists in designing FY99 EVOS projects. In addition, it will facilitate a re-examination of the positive outcomes from the Community Conference on Subsistence and the Oil Spill, which was held in September of 1995.

INTRODUCTION

The goal of this project is to promote the recovery of subsistence uses of natural resources through the exchange of relevant information of the Exxon Valdez oil spill from two cultural perspectives. One perspective is that of the local person who has lived through the experience and who now uses tradition knowledge, knowledge which has been observed and handed down throughout the cultural heritage of the people, to base their assessment of the recovery of the ecosystem. The other perspective, the western scientific approach, is grounded in a quantitative orientation that uses a process of hypotheses, controlled experiments and formal confirmation Throughout the conference, there will be presentations from a panel of principal investigators and local resource experts.

These panelists will be clustered in groups similar to the ones used in the annual work plan by the Restoration Office. Individuals from both traditions will speak about their research and/or knowledge about a specific species or ecosystem. Such a conference will facilitate the discussion between the generations and between natives and the scientific community regarding subsistence practices, means of assisting in the recovery of injured resources, and to share information on current research in an easy-to-understand forum.

In FY97, the Exxon Valdez Oil Spill Trustee Council provided $15,000 to plan for this conference. Although the funding did not become available until late FY97, planning activities continued as originally proposed to make this conference a reality. Community meetings have been held over the past year to plan for this conference. The conference is scheduled for the first week in April, 1998, and will be held alternatively between the local high school and the tribe's conference hall (Masonic temple). Suggested speakers include Evelyn Biggs-Brown (herring); Dave Scheels (octopus); Craig Matkin (killer whales); Kathy Frost and/or Kate Wynn (harbor seals); Ted Cooney (SEA Project); and someone to speak on behalf of the APEX and NVP projects. In addition, speakers from the oil spill impacted communities will also be invited, including Don Kompkoff, Bob Henrichs, Lydia Robart, Mike Eleshansky, Elenore McMullen, Walter Meganack, Jr., Larry Evanoff, Fr. Michael Oleksa, as well as speakers from Kodiak and the Alaska Peninsula.

Participants will include all people from the oil spill affected area; however, we are proposing to pay for travel for at least one elder and two youth from each of the 21 communities. An estimated 300 participants are expected at this event. A tentative agenda has been developed as well as a conference planning guide to assist the planning committee in their efforts. Both of these documents are attached to this Detailed Project Description.

NEED FOR THE PROJECT

A. Statement of Problem

The need for this project is established by three factors:

1. The request by local communities to continue the momentum established under the first elders/youth conference.
2. The need to discuss the results of the Traditional Ecological Knowledge projects(s) with a broad range of elders from the region, while simultaneously making the youth aware of this information.
3. The difficult process of providing the communities, and the public in general, the often technical results of the many EVOS-sponsored biological/ecological research efforts.

B. Rationale/Link to Restoration

Subsistence uses of natural resources are essential to the economies and ways of life of communities affected by the oil spill. After the spill, these uses were severely disrupted due to natural resource injuries and concerns about the safety of using subsistence foods that may have been contaminated by oil. Because of these reduced subsistence uses, opportunities to teach subsistence skills and traditional knowledge have also been diminished.

The restoration strategy for subsistence has four parts, including an objective "to accelerate recovery of subsistence resources and services." One means to achieve this goal is "through increasing availability, reliability or quality of subsistence resources, or increasing the confidence of subsistence users." Increasing the confidence and understanding of subsistence users will be achieved from two directions:

1. By gathering of knowledgeable individuals (including elders) and young people to address how natural resource injuries and other problems raised by the spill have been overcome by the employment of traditional knowledge and values.

2. By having western scientists provide their perspective on the recovery and health of resources in the region.

The conference will discuss and disseminate traditional knowledge about resource conservation and subsistence uses, and about the common experiences shared by subsistence users and researchers since the spill. This would complement the work done under the Subsistence Foods Testing Project (93017/94279/95279), which has principally involved bringing scientific information to subsistence users. Additionally, this project will assist with the restoration of subsistence resources through monitoring of the recovery of subsistence uses.

C. Location

This conference will take place in Cordova at both the Cordova High school and the Native Village of Eyak's conference hall (Masonic temple). In addition, Cordova also has an Elks Hall, Moose Hall, City Library, two motels, many bed and breakfast businesses, and the tribe may be able to gain limited access to the North Pacific Processors bunkhouse.

COMMUNITY INVOLVEMENT

Representations made by local communities have been the impetus for this proposal. The conference will be run locally and with the exception of some airline charters, all logistical issues will be addressed with local resources. The Native Village of Eyak will organize a planning committee which will include members of the local community and other community facilitators.

PROJECT DESIGN

A. Objectives

The major objective of this conference is to provide a context for the exchange of information and understanding on the health and recovery of resources within the oil spill area. This information will be exchanged from two perspectives, that of traditional ecological knowledge and that of Western science. Written conference proceedings and a video which summarize the conference and its findings and recommendations will also be produced and distributed. It is hoped these materials will provide the foundation for a public outreach effort intended to communicate the health and well being of the region ten years after the spill.

It is also hoped that conference participants will identify, discuss and bring examples of positive and sustaining processes that have dealt with the injured suffered by the natural resources and the activities associated with subsistence uses.

B. Methods

A Conference Planning Coordinator has been hired and will be responsible for putting together a conference planning committee comprised of local community members, community facilitators, principal investigators, and Restoration Office staff to perfect the draft agenda, and to plan, organize and develop conference logistics as outlined in the attached conference planning guide. It is anticipated that the following contacts will be made during the conference planning and development process:

1. Elders, hunters, and fishers in oil spill impacted communities to discuss their agenda issues, select potential speakers, and to secure their logistical support for conference provisioning.

2. Community Facilitators, the Spill Area Wide Community Involvement Coordinator, and the TEK Specialist to integrate their issues into the conference agenda and obtain their support in developing this Elders/Youth Conference.

3. EVOS staff and EVOS principal investigators to coordinate their participation and to explicitly develop their contributions to the conference.

The conference will be video-taped and audio-taped. A proceedings volume will be prepared. A summary video, approximately 30 minutes in length, will also be produced to present the conference highlights and recommendations. A full video of the conference could be made available for viewing upon request. It is intended that the proceedings and video be used as educational tools to promote an exchange of information and to strengthen subsistence traditions

throughout the region. In addition, conference materials can serve as a basis for subsequent graphic or multimedia presentations that may be jointly developed by the TEK and various other science projects to commemorate the status of the spill area ten years after the oil spill.

The conference will last three days. Each community of the spill area will nominate one elder, two students (high school or college aged) and one additional representative. In addition, a variety of principal investigators will be solicited to participate in the conference. A balance will be sought between specific species/resource projects and overall ecosystem and analytical investigations. The conference itself will likely consist of formal presentations, panel discussions, and question/answer periods.

Milestones of this project will be accomplished, as follows:

1. A noted regional facilitator will be appointed to serve as the conference moderator.

2. The conference will occur in early April, 1998

3. A separate contract will be awarded to videotape the conference and to produce an edited video presentation

4. Conference proceedings and products will be produced in draft form and sent to participants for their review and analysis

5. Final products of the conference will be distributed by the end of the project period.

C. Cooperating Agencies, Contracts, and other Agency Assistance

The Bureau of Indian Affairs, Department of Interior, will implement this project through a cooperative agreement with the Chugach Regional Resources Commission and the Native Village of Eyak under P.L. 93-638.

BUDGET

Budget Line Items	Budget Amount
Salaries	$20,000.00
Fringe (20%)	4,000.00
Travel	53,500.00
Staff Travel	*2,500.00*
Participant Travel	*41,000.00*
Speakers Travel	*10,000.00*
Conference Materials	1,500.00
Reproduction	500.00
Conference Proceedings	5,000.00
Telephone	1,200.00
Meeting Expenses	10,000.00
Administration of Grant	15,400.00
Total	$111,100.00

Salaries: Salaries are for the Conference Planning Coordinator, who will be paid at the rate of $20,000 per annum for a full time position. Specific duties for this position are included in the Conference Planning Guide.

Fringe: Fringe is calculated at the rate of 20% which includes all payroll tax related costs, including workers compensation.

Travel: Travel is broken down into three categories for administrative purposes. The Conference Planning Coordinator is allocated $2,500 to travel to the villages in the spill area to meet with the communities and obtain their input into the agenda and other aspects of the conference. $41,000 is included in this line to pay for travel for at least two individuals from each spill affected community to attend the conference. This figure was derived by utilizing known costs for traveling to Cordova from those particular communities participating in this project. Lodging and meal costs will be supplemented by other sources, so the full federal rate for lodging and per diem is not included in this figure. Finally, the project is proposing to pay for speakers travel, which is calculated at $10,000 for approximately 10 speakers not including community members, whose travel will be paid out of the $41,000 mentioned above.

Conference Materials: This includes conference folders, pens, tablets, and educational materials which will be provided for the conference participants.

Reproduction: This will cover the cost of printing the agenda and other information the presenters may wish to include in the conference packets.

Conference Proceedings: A contract will be developed with a professional videographer to record the conference and edit the conference material into a 30 minute video which will be available for distribution after the conference.

Telephone: Local and long distance telephone costs for the Conference Planning Coordinator are covered by this line item, as well as any conference calls that may need to be made for the Conference Planning Committee. This is calculated at a rate of $100/month.

Meeting Expenses: Although donations will be solicited for the coffee breaks and traditional feast, it is anticipated that approximately $10,000 is needed to pay for coffee, donuts, and soda for the coffee breaks, as well as cooks, eating utensils, paper plates, salt/pepper, butter, bread, and other basic items needed for the traditional feast. Funds in this line item will also pay for meeting room rental, and rental of presentation equipment requested by the presentors.

Grant Administration: It is anticipated that the Native Village of Eyak will require 10% of the total grant for administration purposes.

SCHEDULE

A. Measurable Project Tasks for FY98

October 1, 1997	Hire Conference Planning Coordinator
November 15, 1997	Select Conference Planning Committee and conduct first planning meeting
November 30, 1997	Send out letters of invitation to speakers identified in Year I to participate
December 15, 1997	Confirm selected speakers for conference from draft agenda developed in Year I; conduct second Conference Planning Committee meeting; identify subcommittees for traditional feast, dance groups, fundraising, agenda development, conference proceedings, etc. Identify host hotel and meeting site; prepare conference announcement
January 5, 1998	Send out first conference announcement with agenda; Place announcements in appropriate newsletters and newspapers
January 15, 1998	Conduct 3rd Conference Planning Committee meeting; work on second draft of agenda
February 15, 1998	Conduct 4th Conference Planning Committee meeting; reports made on progress to ensure planning is on track; finalize agenda and speakers
March 1, 1998	Send out second conference announcement, including mailings to newspapers, regional organizations, EVOS newsletter, Chugachmiut newsletter, etc.
March 15, 1998	Conduct 5th Conference Planning Committee meeting; reports made to finalize last minute details
April 1-3, 1998	Hold Conference
April 15, 1998	Send out thank you letters to speakers, dancers, granting agencies, volunteers, and other participants who contributed to the conference
September 30, 1998	Distribute Conference Proceedings

B. Completion Date

The project will be completed by September 30, 1998.

PUBLICATIONS AND REPORTS

The Conference Proceedings will be submitted under the EVOS final report procedures on April 15, 1999.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Information about the status of injured natural resources and potential means towards recovery based upon scientific studies should be integrated into the conference. Conference findings, including observations by subsistence harvesters of natural resource populations, will be available for use by other researchers through written conference proceedings and video tapes. Other proposed subsistence restoration projects (e.g., 98052/Community Involvement; 98352/TEK: Consolidated Approach; 95244/Seal and Sea Otter Cooperative Harvest Assistance) also have public information components that will benefit from information which is shared through the conference and its resultant products. This project would complement the work done under the Subsistence Foods Testing project (93017/94279/95279).

PROPOSED PRINCIPAL INVESTIGATOR

Bob Henrichs, President
Native Village of Eyak Tribal Council
P.O. Box 1388 • Cordova, Alaska 99574

PERSONNEL

Robert Henrichs: Bob is the President of the Native Village of Eyak Tribal Council and has served in that capacity for the past 3 1/2 years. He is also a commercial fisherman and past member of the federal Regional Subsistence Advisory Council.

Altana Olson: Altana is the Conference Planning Coordinator for the Native Village of Eyak. She has worked with Chugachmiut, the Chugach Region non-profit, for the past five years. In that position, she has assisted in the coordination of a variety of conferences, including the Elders Youth Subsistence Conference held in Cordova in 1992.

Patty Brown-Schwalenberg: Patty is the Executive Director of the Chugach Regional Resources Commission. She has worked for the past 13 years with tribes on natural resource issues. As the Administrator for the Native American Fish & Wildlife Society, she coordinated seven regional conferences and one national conference annually with attendance ranging from 35 to 700 people. Patty will assist the Conference Planning Coordinator and Committee in the development of the conference. She will also be responsible for getting the funds from the BIA to Eyak, utilizing CRRC as a pass-through agency.

YOUTH/ELDERS SUBSISTENCE CONFERENCE
April 1-3, 1998 - Cordova, Alaska

DRAFT AGENDA

Thursday, April 1, 1998:

9:00 a.m.	Welcome - Bob Henrichs, President, Eyak Tribal Council
9:15 a.m.	Dance Group - Eyak Tribal Dancers
9:45 a.m.	Panel Presentation - SEA Project (Ted Cooney, Moderator)
10:30 a.m.	Break
10:45 a.m.	Panel Presentation (continued)
Noon	Break for Lunch
1:00 p.m.	Panel Presentation - Community Involvement/TEK Project (Hugh Short/Henry Huntington, Moderators)
2:00 p.m.	Response from Communities
3:00 p.m.	Elders Panel - Sharing of Knowledge
5:00 p.m.	Nanwalek Dance Group and Adjourn for the Day

Friday, April 2, 1998:

9:00 a.m.	Panel Presentation - APEX Project
10:30 a.m.	Break
10:45 a.m.	Panel Presentation - NVP Project (Lisa Thomas, Moderator)
12:00 p.m.	Break for Lunch
1:00 p.m.	Herring Project - Evelyn Biggs-Brown Octopus Research - David Scheels Killer Whales - Craig Matkin Harbor Seals - Kathy Frost/Kate Wynn Clam Restoration Project - Jon Agosti/Jeff Hetrick

Friday, April 2, 1998 (continued):

2:30 p.m. Response from Communities

3:00 p.m. Break

3:15 p.m. Roundtable Discussion on Ways to Assist Recovery Effort

5:00 p.m. Kodiak Dance Group and Adjourn for the Day

6:30 p.m. Traditional Feast/Video/Storytelling by Elders

Saturday, April 3, 1998:

9:00 a.m. Atka Dancers

9:15 am. Youth Panel - Visions for the Future

10:15 a.m. Break

10:30 a.m. Open Discussion on Recovery of Subsistence Ways

12:00 p.m. Adjourn

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1997	Proposed FY 1998
Personnel		$0.0
Travel		$0.0
Contractual		$111.1
Commodities		$0.0
Equipment		$0.0
Subtotal	$0.0	$111.1
General Administration		$7.8
Project Total	$0.0	$118.9
Full-time Equivalents (FTE)		0.0
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002
$0.0	$0.0	$0.0	$0.0

Dollar amounts are shown in thousands of dollars.

Comments:

1998

Project Number: 98286
Project Title: Elders/Youth Conference
Name: U.S. Department of Interior

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepare[illegible]1/18/97

[illegible]/20/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1998
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.0	0.0	0.0	
					Personnel Total	$0.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1998
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.0

1998

Project Number: 98286
Project Title: Elders/Youth Conference
Name: U.S. Department of Interior

FORM 3B
Personnel
& Travel
DETAIL

Prepare[illegible]1/18/97

[illegible]/20/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Contractual Costs:	Proposed
Description	FY 1998
638 contract with Native Village of Eyak	111.1
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$111.1

Commodities Costs:	Proposed
Description	FY 1998
Commodities Total	$0.0

1998

Project Number: 98286
Project Title: Elders/Youth Conference
Name: U.S. Department of Interior

FORM 3B
Contractual & Commodities DETAIL

Prepared: 11/18/97

/20/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1998
			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

1998

Project Number: 98286
Project Title: Elders/Youth Conference
Name: U.S. Department of Interior

FORM 3B
Equipment
DETAIL

Prepared: 1/18/97

/20/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1997	Proposed FY 1998						
Personnel		$24.0						
Travel		$53.5						
Contractual		$9.5						
Commodities		$8.7						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$95.7		Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
Indirect		$15.4						
Project Total	$0.0	$111.1		$0.0	$0.0	$0.0	$0.0	
Full-time Equivalents (FTE)		12.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1998

Project Number: 98286
Project Title: Elders/Youth Conference
Name: Native Village of Eyak

FORM 4A
Non-Trustee
SUMMARY

Prepare[illegible]/18/97

[illegible]/20/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 1998
Altana Olson	Conference Planner (includes 20% fringe)		12.0	2.0	0.0	24.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		12.0	2.0	0.0	
					Personnel Total	$24.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1998
RT to Cordova from:					0.0
Participant travel					0.0
Nanwalek, Port Graham, Seldovia	0.5	9	27	0.1	7.20
Kodiak, Akhiok, Old Harbor, Karluk, Port Lions, Larsen Bay, Ouzinkie	0.8	21	63	0.1	23.1
Chignik Bay, Chignik Lagoon, Chignik Lake, Perryville	0.8	12	36	0.1	13.2
Seward	0.3	3	9	0.1	1.8
Tatitlek - charter	0.3	1	9	0.1	1.2
Chenega Bay, Valdez - charter	0.4	2	18	0.1	2.6
Negative amount to offset per diem rounding ($50 instead of the rounded $100)					-8.1
Speaker Travel - 10 speakers at $1000 per speaker	1.0	10			10.0
Staff travel - three round trips to Anchorage, two trips to locations for Conference Coordinator					0.0
not yet specified (average amount used for ticket price).	0.5	5			2.5
				Travel Total	$53.5

1998

Project Number: 98286
Project Title: Elders/Youth Conference
Name: Native Village of Eyak

FORM 4B
Personnel
& Travel
DETAIL

Prepare[illegible]/18/97

[illegible]/20/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Contractual Costs:	Proposed
Description	FY 1998
Reproduction	0.5
Conference proceeding	5.0
Telephone expense	1.2
Meeting facility	3.0
Cooks	0.5
Rentals	0.5
Contractual Total	$10.7

Commodities Costs:	Proposed
Description	FY 1998
Conference materials (folders, pens, tablets, educational materials, etc.)	1.5
Meeting expenses (coffee, refreshments, soda, utensils, plates, condiments, etc.)	6.0
Commodities Total	$7.5

1998

Project Number: 98286
Project Title: Elders/Youth Conference
Name: Native Village of Eyak

FORM 4B
Contractual & Commodities DETAIL

Prepared: 11/18/97

20/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1998
			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	

1998

Project Number: 98286
Project Title: Elders/Youth Conference
Name: Native Village of Eyak

FORM 4B
Equipment
DETAIL

APPLIED
marine
SCIENCES

November 24, 1997

Ms. Molly McCammon
Executive Director
Exxon Valdez Oil Spill Trustee Council
645 G Street, Suite 401
Anchorage, Alaska 99501

Dear Molly,

I sent the revised proposal "Native village of Eyak Youth/Elders subsistence conference" (98286) out to review and received the reviewer comments. I have also read the proposal myself.

The proposal is greatly improved over the original submission and appears to be a logical extension of the momentum from the first subsistence conference in 1995 and the continued excellent cooperation and communication in some of the science projects to date. A number of comments have been raised in the review process that are worth considering in formulating your recommendation to the Trustee Council.

1. In the related project "Community involvement and traditional knowledge" (--052), considerable effort has been made to formulate protocols for exchange of traditional knowledge. These protocols were developed in a consensus mode in Project 052 and have been sent to various tribal councils for endorsement. As far as I know the Eyak Tribal Council has not endorsed these protocols. Perhaps they are still considering this possibility, but on the face of it I find it hard to reconcile that apparent position with this proposal that calls for active exchange of traditional knowledge and "western" scientific knowledge.

2. Various budget issues have been raised in the attached reviews and it appears that budget savings are possible.

3. Given its objectives, the conference appears to be too long. One and a half or two days seems more appropriate.

4. Early April is not a good time of the year for participation of the P.I.s since reports and proposals are due. Any reasonable reduction of their participation or shortening of the conference that would still address the general objective of this proposal would make the conference more workable. Perhaps a date in late March or late April would be better.

5. The subjects of the general discussion sessions need to be better formulated. The more focused the discussion the better, and the more likely the experience will be positive for the youth and elders.

In conclusion, there are some policy and budget issues to consider. If these are resolved, then the length and timing of the conference should probably be changed. Please call me if you have any questions with regard to this recommendation.

Sincerely,

Robert B. Spies
Chief Scientist

cc: S. Senner
S. Schubert

98320T

Exxon Valdez Oil Spill
Restoration Project Interim Report

Local and Traditional Knowledge of Herring and Other Forage Fish

Restoration Project 98320T supplement
Interim Report

This interim report has been prepared for review as part of the Exxon Valdez Oil Spill Trustee Council restoration program for the purpose of assessing project progress. Peer review comments have not been addressed in this interim report.

Jody Seitz

School of Fisheries and Ocean Sciences
University of Alaska Fairbanks
200 O'Neill Building
Fairbanks, Alaska 99775-7220

November 1997

Local and Traditional Knowledge of Herring and Other Forage Fish

Restoration Project 97320T Supplement
Interim Report

Study History: The project was initiated in 1997. The project was designed to document the historical distribution of forage fish such as juvenile herring, sandlance, capelin, and eulachon through qualitative interviews with key respondents in several communities. The information will be mapped and indexed by subject and provided to the Alaska Predator Ecosystem Experiment (APEX) and Sound Ecosystem Assessment (SEA) researchers. It is designed to provide researchers with population and habitat use information over a longer period and broader area than can be known through existing records and current data collection efforts.

Abstract: The researchers used a combination of key respondent interviews and mapping to document the locations of juvenile herring, herring of unknown age (unknown herring), mixed adult and juvenile herring (mixed herring), herring spawn, unidentified small fish (small fish), capelin, sand lance, eulachon and pollock. Researchers concentrated on recording information about juvenile herring and small fishes other than juvenile herring, such as sand lance and capelin. A total of thirty-nine respondents were interviewed in thirty-seven interviews (two couples were interviewed jointly). Ten interviews were carried out in Homer; twenty-six interviews were conducted in Cordova; and three interviews were carried out in Tatitlek. Most interviews were tape recorded. Respondents and researchers marked locations of fish schools on charts overlaid with mylar. Fish schools were color-coded by species for later reference. Maps of juvenile herring distribution in Prince William Sound were produced using the computer mapping programs GMT and ARC Info for this report.

Key Words: *Exxon Valdez*, nursery areas, juvenile herring, forage fish, small fish, sand lance, capelin, traditional ecological knowledge, local knowledge, distribution.

Introduction

The Prince William Sound ecosystem, on the northern rim of the Gulf of Alaska, supports many ecologically important species, several of which are listed as threatened or endangered. Salmon and herring are two of the most important resources in the region, supporting both commercial fishing communities and wildlife populations. The 1989 Exxon Valdez oil spill occurred in the Sound at the most productive season of the year, early spring. Herring were returning to spawn, in record numbers.

Brown et al. (1996) reported that about half of the egg biomass was deposited within the oil trajectory, and an estimated 40 to 50 percent sustained oil exposure during early development. The 1989 year class was a minority of the 1993 spawning population, one of the smallest cohorts observed in the Sound. In 1993, only one third of the herring population expected to spawn were observed (Meyers, etc. all 1994). Viral hemorrhagic septicemia virus was identified in the population and later determined to be the primary disease related reason for the population crash.

In 1994, as part of a larger effort to understand the productivity of pink salmon and herring within the Prince William Sound ecosystem, fisheries oceanographers began a project to understand the factors contributing to the survival of juvenile herring. A focus of that project was an effort to learn more about the habitats of herring early life history stages from hatch up until the time they recruit to the adult population.

Locations of herring nursery areas have never been the subject of research in Prince William Sound prior to this effort. Herring research concerning distribution has primarily consisted of documentation of spawning areas, adult spawning aggregations, and concentrations of overwintering adult herring. This research has been focused in support of commercial fishing activities in early spring, fall and winter. Juvenile herring were sometimes caught with adult herring, but there did not seem to be complete overlap and catch-age sampling targeted adults. On the other hand, there seemed to be a large amount of anecdotal information available about distribution of small schooling fishes during times and places in Prince William Sound outside of commercial herring fishing seasons and areas.

The human presence in Prince William Sound dates back thousands of years. There are people still alive in communities around the sound who have lived in areas or who worked in areas which are no longer occupied. There are still people alive who remember and participated in the reduction fisheries, and who sampled the herring in the catch for scientific analyses. Then and more recently residents have had the opportunity to observe herring in the course of a variety of activities, including: subsistence hunting and fishing, aerial surveys of resource populations, herring or salmon spotting, fishing for bait herring or crab, or even delivering the mail by boat. Compiling and summarizing the large body of human knowledge about small herring and other schooling fishes provide researchers invaluable and often the only clues to past trends.

The goal of this project is to document historic knowledge about herring, especially during life stages and seasons when little other information is available. Since information about other schooling forage fishes can be readily obtained as well for no extra cost, the goal was expanded to include documentation of historic knowledge about all small schooling fishes. Specific objectives included the development of an appropriate interview guide, development of a historic knowledge data base, mapping and analyzing historic trends and providing this information in a format that is readily accessible to researchers. Finally, recommendations are provided in this report concerning the direction and continuation of this project.

Objectives

1. Develop an appropriate method for collection of historical and contemporary ecological knowledge about herring and other forage fish held by residents of the region.
2. Collect, organize, map, and disseminate these data.
3. Recommend how the effort should proceed.

Methods

TEK Protocol: The project followed the Traditional Ecological Knowledge protocols as outlined by the *Exxon Valdez* Oil Spill Trustee Council TEK advisory group. In Cordova, letters were written to the Traditional Village of Eyak and Cordova District Fishermen United was contacted regarding the project.

The first contacts were initiated from a list of potential respondents created by 97320T Project Leader, Evelyn Brown. CDFU contributed a list of potential participants. Following the first interview, other respondents were contacted through chain referral. Letters and project descriptions were sent to potential respondents. Written requests for permission to carry out the project were submitted to the IRA councils of Chenega Bay and Tatitlek. The Valdez Native Association was contacted by letter and by phone. In Homer individual respondents were recommended by chain referral and were contacted by phone, letter, and in person. An example of the interview guide is attached (Appendix A).

Community Approval:

The project leader sought approval by the IRA Councils of Chenega Bay and Tatitlek. Tatitlek approved the project May 10, 1997. The Tatitlek IRA Council recommended several elders. Two older men and a couple were interviewed. There is a chance that with the community review, more people will contribute information.

Due to May weather, followed by summer activities, Chenega Bay's annual meeting was postponed until August. Despite repeated communication via letter, fax, and phone, this project was not considered until a September 11, council meeting. I was given approval to conduct the study in Chenega Bay on September 30, 1997.

Interview method:

All participants were given project descriptions and asked to read and sign a statement regarding the anonymity of their information, which the interviewer also signed. The statement assures the respondent that their information will be presented as part of compiled responses in a manner that protects their identity.

The interviews were carried out following Ives (1980) and Weiss (1994). All respondents were asked for permission to record the interview. Most of the interviews were tape recorded. The interview guide was developed with the assistance of the herring researchers and was adapted over several interviews. I also referred to the interview design used by Ames and Watson in their study of cod and haddock spawning areas in the Gulf of Maine Ames (1966, unpublished manuscript). In the initial seven interviews I asked for detailed information on the respondent's use of the Sound. The interview guide was revised after the seventh interview.

The revised interview asked less detail about respondents' use of the sound and got right to the questions about juvenile herring and forage fish. I maintained questions on commercial fishing history, and for pilots, their flight path. When these are combined with a review of ADF&G's commercial fishing seasons and history, should provide much of the relevant information about patterns of use of the sound.

Responses for all interviews were recorded on a data sheet and on a chart overlaid with mylar. Following the interviews, the tapes were later reviewed, and used to check the datasheets and charts. The notes from the interviews have yet to be entered into the notes database.

Data was entered into Excel spreadsheets and digitized using a customized mapping program designed as a cruise planner for SEA by Charles Falkenberg, Prince William Sound Science Center, Cordova. The Homer data will be digitized using NavMaster software, since the Planner does not cover the outer Kenai Peninsula. Both GMT software and ARC View and ARC Info mapping software were used to create the maps for this report.

Participants were asked to record where they had seen juvenile herring -- herring less than four inches long. They were asked the year, or time frame during which they had seen the fish schools, and asked to use colored pens to mark these schools on a chart covered with mylar. If they could not recall the exact year, they were asked to recall the range of years when they were in the area and how they saw the fish, whether they were caught, or seen or a sonar, or seen on the surface of the water. If respondents could not recall seeing juvenile herring they were asked to recall seeing herring in general, or small fish, at different times of the year. Information was also sought on sand lance, capelin, and eulachon, under the general category of small fish other than herring.

Respondents were also asked to judge how often they saw juvenile herring in the places they had seen them, especially if they saw them over the course of a season, or a range of years. They were asked to judge if they had seen them consistently, occasionally, or rarely.

C - CONSISTENTLY - "I'd see them almost every time I went there this time of year.
O - OCCASIONALLY - "I'd see them once in a while this time of year."
R - RARELY - "I remember them showing up there once or twice."

We also sought information about the presence of animals associated with the fish schools, but found it difficult to record much about their presence or absence over multiple years.

The Data

The Prince William Sound database consists of data from interviews with twenty-five Cordova residents, four Tatitlek residents, and eight Homer residents who fished along the outer Kenai Peninsula and Prince William Sound. The notes database comprises these interviews and additional phone conversations and interviews where no observations were actually mapped. The observations are from 1938 to 1997.

Ten Homer residents contributed observations to the database on the outer Kenai Peninsula. The observations of fishes in the bays and coastal areas of the Kenai Peninsula are from 1952 to 1997.

The Maps

The maps of juvenile herring observations in Prince William Sound were created using GMT software at the University of Alaska Fairbanks, Institute of Marine Science. Maps of juvenile herring observations in Prince William Sound for 1970, 1980, and 1990 are enclosed.

Maps were also created in ARC Info of a portion of the database for the Outer Kenai Peninsula. These were created for observations of juvenile herring, capelin, sandlance, and other small fishes which respondents saw over a period of years, every time they went to these places in the summer (consistently).

These maps group observations from a range of years into the decades which they overlap. For example, if someone saw juvenile herring in Eaglek Bay from 1970 through 1985, their observations would be represented in both the 1970s and in the 1980s. The same process was followed for observations on the outer Kenai. If a respondent had one observation in one decade, it was lumped into that decade for the purposes of this series of maps.

Notes
An additional source of information about the observations is the notes database. This is in preparation. Notes are being indexed using ASKSAM, which is compatible with ADF&G's marine mammal database. The notes concern a variety of topics: how respondents saw the fish; how they identified the fish; where the fish were in relation to the shore, or to depth; adult herring migrations; abnormal events – such as a large number of dead juveniles; and respondent's theories about herring.

Here is an example of the response to a question about how the respondent recognized juvenile herring. The notes database has not been compiled yet. This is only an example.

> To tell schools of fish in the summer, he notes that herring have, generally speaking, round schools. The schools of juveniles have soft edges. They are hard to tell from bait fish or needle fish in cloudy conditions with flat light. With enough light you can see the fish "flash". The herring flash is bright silver, but the bait fish looks brown and gold. The herring flash is much larger than the bait fish.
>
> "Juveniles and bait fish are out there eating and growing. They are schooled up in round schools, for protection. They stay off the beach, and can be found on top of a cone of adults. They will be usually one to three fathoms from the surface and rarely against a beach. They like calm water with low currents, such as the backwaters of bays. If he were looking for juveniles while out flying he'd fly transects across the bays. However, he mainly looks for salmon. Their fry go into shallow water.
>
> Sac roe fish are adults that have a mission. They are traveling and will be seen as a ball with a tail coming out ahead of it."
>
> One year he saw a lot of juvenile herring around Naked Island and Perry Island.
>
> *Describe for me, if you could, what it looked like to see a lot of fish:*
> 'In terms of thousands of tons, we're not talking about tens of thousands of tons, but you've got to remember -we're not looking for herring. We're looking for salmon, and you're flying along the beaches.
>
> The schools typically were 10 to 30 ton schools and if they were less than 10 tons, you'd have to be careful about calling them bait or herring. You'd have to have some light, because a lot of the bait fish were in little 2 to 5 ton schools. In terms of numbers, putting a number on it as far as of biomass, I don't know if I could do that. Eaglek's always been a good producer of juveniles. And if you flew around in there you'd see 15 schools, 20 schools at a peak, and at a lull you might see one."

Results

Respondents
Respondents included 28 salmon fishermen, of whom 21 were also herring fishermen and eight of whom were also pilots and had spotted salmon. Five individuals had had other occupations as professional biologists and mail carriers. The average age of respondents was 54 years, the youngest was 34 and the oldest person interviewed was 86. They ranged in years of commercial fishing experience from one year to sixty-eight years, with an average of 30 years of experience. Herring spotter pilots ranged in experience from eight to thirty-six years, with an average of thirteen years experience. Several of the respondents were pilots by occupation. Several had worked both in the fishing industry and as charter pilots. Professional and non-professional pilots had a range of experience from four to 36 years, and averaged eighteen years of experience. The averaged experience of persons in other occupations was twenty years.

The enclosed tables present some of the data upon which the maps are based. They list the places where observations occurred, and the range of years and number of respondents who

saw fish in a group of neighboring areas or in one place. These tables show the overlap in time, and number of people making the observations.

The dots plotted on these maps are merely coordinates along the lines, points and polygons marked by respondents. We were restricted by our software and hardware to these size maps, and unless the coordinates are adjusted, lines cannot be plotted on top of each other and still be distinguished. Therefore, all the areas marked are represented by dots on these larger scale maps. To see if we could produce better representations of the lines, points, and polygons marked by respondents we produced regional maps of the sound as well (Figures A-C for all maps). The sound was divided into eastern, northern and southwestern regions, and areas with observations were represented as lines or polygons. The technician was unable to shade the polygons.

The locations where juvenile herring were seen in the spring (March, April, or May) during the 1970s, 80s, and 90s were listed (Table 1) and mapped (Figure 1). The number of respondents was listed below each decade. In the seventies observations from four respondents were concentrated along the northern shore, Valdez Arm - Galena Bay, Port Fidalgo, and the head of Port Gravina.

In several areas respondents saw herring over a range of several years (Table 1). In order to maintain the anonymity of respondents' information, I have not included respondent ID's in these tables, but listed the year ranges and the number of different observers for each area. For example, four respondents saw juvenile herring in Eaglek Bay during the 1980s and 1990s. As you may see from looking up Eleanor Island, the large spot at Eleanor Island is actually only one person's observation in one year. There is some error in the plotting of this point.

Eight respondents' observations from spring of the 1980s were concentrated along the northern shore, the eastern side of the sound, and the northern end of Montague Island.

In the 1990s, four respondents observed juvenile herring in all of the above areas and along the western shore and the southeastern end of Montague Island. For somewhat finer scale views of these observations, please see the regional illustrations.

The number of observers and locations juvenile herring were seen in summer was mapped (Figure 2) and the range of years in which they were seen was listed by each place (Table 2). Over the seventies and eighties four respondents saw juveniles at Culross Island. More respondents saw juveniles in the summer than at any other time of year.

Seven respondents saw juvenile herring in Eaglek Bay between 1970 and the 1997. There were two observers in the seventies, five in the eighties, and three in the nineties. Two respondents saw juvenile herring in Landlocked Bay in the summer in the seventies. During the eighties and nineties four observers saw summer juvenile herring in St. Mathew's Bay; Port Gravina, and Sheep Bay and Landlocked Bay. Fairmount Island is another place were juveniles were often seen in summer -one observer in the seventies is followed by three observers in the eighties, and two in the nineties. Polygons encircling Perry and Naked Islands are correctly represented. The respondent saw huge schools of juveniles around both islands in the late 80s.

In both spring and summer juvenile herring were observed near Fairmount Island, in Port Fidalgo, Port Gravina, Montague, Sheep and Simpson Bays (Tables 1 and 2; Figures 1 and 2).

Figures 3 and 4 illustrate the information gathered for fall and winter. The fall and winter information reflects the exploration in the early 70s of the sound for the bait fishery. Fishermen had taken some fish for bait all through the 1960s. It is said that the harvests were small, and not reported to the ADF&G.

In the early 70s local Cordova fishermen experimented with fishing for bait, and searched the sound for herring. Reported harvests were small until fishermen figured out how to catch the herring more efficiently, using a pair trawl and deep seines. In 1977, the Northern District and Montague Districts were established for the sac roe fishery. The Eastern District, consisting of Port Gravina and Orca Bay was established in 1980. After the sac roe districts were established, bait fishing was not allowed within them.

From 1978 until 1981 pair trawling and seiners were used to harvest bait outside the sac roe districts. The pair trawl users reported that they "got so they wouldn't go up into the bays, because they didn't want to run into juvenile herring." Table 3 reports juvenile herring caught with shrimp trawls and smelt nets in Simpson Bay. Table 4 reports in the notes for Simpson Bay, they "plugged the trawl.' The respondents reported they spent hours scraping juvenile herring out of the trawl with flat-bladed snow shovels. They made the mistake a couple of times and didn't investigate the heads of bays again.

Although some information gathered about small fish, capelin and sand lance has been mapped (Figure 5) the tables for these figures have not been prepared yet.

The differences in the distribution of juvenile herring observations between the years can not be solely explained by respondents' participation in commercial fishing. The majority of the respondents who fish (18 out of 28) began fishing prior to 1970, only five of the fishermen interviewed were no longer fishing in the 1990s. Nine herring spotter pilots' experience bridges all three decades.

Experience spotting salmon is harder to determine. Fishermen charter planes together to fly the sound looking for schools of fish. The pilots fly the plane, the fishermen look for fish. This practice was made illegal in 1994, and prior to that it's difficult to say how many fisherman participated in this. However, at that time of year, the juvenile herring would have been most visible to people engaged in this type of activity.

Summary

This preliminary report was prepared just as the data has been entered into the computer and is the first representation of the information. The final report will be greatly refined.

The interview schedule for Chenega and Valdez has been delayed due to scheduling problems mentioned earlier, and due to the timing of this grant. Winter is a much better time of year for interviewing people, and I hope to carry out the work before the end of January.

Due to administrative obstacles, hiring of a data entry technician was delayed by four months. This seriously compromised our ability to get other work done on the project. We are now caught up with data entry, but behind in other areas – such as interviews in Valdez, and notes transcription.

An opportunity has opened up to work with a GIS professional at the USFS. For as little as a purchase order I can now have maps made easily and professionally of any of the data. The data is analyzed in Microsoft ACCESS and EXCEL and plotted using a relational database. An example of this is provided in the enclosed ARC Info map of the outer Kenai Peninsula. The maps show the number of records for each area. The records are each year an observation was made. There is no information about the numbers of respondents presented in these maps.

Recommendations

1. Complete interviews in Seward, Chenega Bay and Valdez and wrap up the final report by May 30, 1998. The interviews in these areas should provide more information about the outer Kenai Peninsula and the western sound.

2. If SEA or APEX researchers are interested in more information about fish stocks in these areas or would like another treatment of the data than has been presented, I request further funding to fulfill their request.

Recommendations – Evelyn Brown

1. The low sample sizes for each location, season, and year range strata may affect the ability to conduct statistical analysis of the data. I recommend that the project be continued if for no other reason but to increase the sample size providing a product with which statistical analysis could be conducted. The repetition of certain locations over space and time provides hope that such an analysis would be fruitful. A more rigorous treatment of the data may ensure that we can not only publish the results, but be able to cite the results as a building block of the ecosystem studies. A total respondent sample size of 100 may be close to the minimum number needed for analysis (given the number of strata present).

2. Along with increasing the sample size, I recommend that we conduct a randomization procedure in selecting future respondents. Although the respondents so far were not selected in a random manner, if the sample size is large enough, post-randomization selection can be done. It is possible that a stratefied random design be adopted where communities or social groups are chosen as stratifications within which a random set of respondents is drawn. In any case, any consideration of future expansion for this project should include discussion of these two items.

3. Judging from the large amount of information amassed during these interviews and the general agreement with SEA and APEX results to date, this project was well-worth completing.

NOTE: Maps & data summary are available from the Restoration Office.

REFERENCES

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98338

Survival of Adult Murres and Kittiwakes in Relation to Forage Fish Abundance

Summary of pilot FY97 work for EVOSTC proposal no. 98338

We proposed to determine the overwinter survival of adult common murres and black-legged kittiwakes at two of the colonies currently being investigated by APEX (Project 98163M). As detailed in our proposal, assessment of these species' overwinter survival is a critical component of the APEX goal: To understand the mechanisms that regulate both natural seabird population flux and recovery from perturbations such as the Exxon Valdez oil spill.

Our proposal described a two-pronged approach: Use of conventional banding/resighting methods to measure murre and kittiwake survival while concurrently measuring murre survival using implanted long-lived VHF radio transmitters. Using radio implants to measure survival has no precedent in the Alcidae, but has been proven to be a practical approach in studies of other taxa. To assess the relative merits of radio telemetry versus banding as tools for measuring seabird survival, we carried out a highly successful pilot project in 1997.

RESULTS

Banding

The conventional banding work went better than we anticipated. Although our effort was limited, we were still able to band substantial numbers of birds (see Table). A much greater effort will be required in 1998 to resight these banded birds.

Numbers banded in 1997, by species and location		
	Kittiwake	Murre
Gull Island	56	54
Chisik Island	69	132

Due to Gull Island's topography, murres and kittiwakes at Gull Island are difficult to capture for banding. We were also restricted in capturing birds to areas outside our established long-term study plots. However, we are confident that a more focused and earlier effort in FY98 would result in at least a doubling of the banded population on each island, thereby approaching the minimum sample size required for calculations of survival based on capture/recapture models.

Radio transmitter implants

On 8-10 August, 1997, we surgically implanted VHF radio transmitters into 20 murres. We used a range of transmitter designs in order to identify the one best suited for murre implantation. Ten of the transmitters were built in a cylindrical hermetically-sealed package based on a preexisting design for abdominal implantation, while the other ten were built in a novel disc shape for dorsal subcutaneous implantation (specifications available from Holohil Systems, Ontario, Canada). Half of each design used a wire whip external antenna, and half used an internal helix (coiled) antenna. Thus we implanted four unique groups of transmitters with five radios in each group: abdominal implant with external antenna; abdominal implant with internal antenna;

subcutaneous implant with external antenna; and subcutaneous implant with internal antenna. Our main goals were to evaluate differences between radio designs, and to determine whether murres implanted with radios would I) survive the surgery; and ii) survive the breeding season. All twenty birds appeared to tolerate the surgical implantation procedure, and (with one exception) all birds were released within 5 h of surgery. One bird was slower in recovery, but appeared to be fully recovered and was released 12 h after surgery.

To determine the birds' survival following surgery, we relied on presence/absence telemetry data recorded by a Data Collection Computer (DCC; ATS Inc., Asanti, MI), since visual resighting of implanted birds was mostly opportunistic. Problems in maintaining the DCC resulted in data gaps over the course of the breeding season, notably in the week immediately following the surgeries. The helix-antenna radios had a shorter than expected range, and were only sporadically picked up by the DCC, meaning that birds with helix-antenna radios could have been in attendance at the colony while absent from the DCC data.

The fate of each implanted bird is therefore incompletely known, but indications are that all four types of transmitter were tolerated reasonably well. Based on a combination of visual resighting, DCC data, aerial surveys, and other opportunistic telemetry records, we determined that eight of ten external-antenna transmittered birds survived the breeding season, with fairly regular colony attendance (Fig. 1). Six of ten helix-antenna transmittered birds survived the breeding season and at least sporadically attended the colony (Fig. 1).

External radio transmitters

We experimented with external radio transmitter attachment methods for both species. We attached six transmitters to kittiwakes, following established protocol. All six birds tolerated the attachment with no apparent change in behavior. We used waterproof tape to attach three external transmitters to murres (a method in current use by British workers). This method appeared to work well, but was impossible to evaluate completely as the murre's chicks fledged earlier than anticipated, causing the transmittered adults to depart the colony prior to the planned recapture.

CONCLUSIONS

We conclude that implanted VHF radio transmitters are not the optimum method of measuring adult survival in murres (despite the successful implantations) for the following reasons:

1) quality of information obtained using implants does not justify logistics and expense
2) substantial disturbance to the colony occurs during captures and subsequent bird absences
3) banding work was less difficult than expected, and remaining problems can be overcome

For FY98, we plan to focus our efforts on traditional banding and resighting to measure survival in murres and kittiwakes. This will require an intensive effort in resighting during the pre-egg laying period for kittiwakes (May) and murres (June). We will expand slightly our external-mount radio transmitter work, in order to measure the relative "foraging stress" between colonies and quantify this potential contributor to adult mortality. The modified proposal for EVOSTC project no. 98338 is attached.

		Calendar date	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7	9/8
		Julian date	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251
Band	Frequency	tx type																															
WOE	166.555	SUBQ EX			M/V							D	D/T/A	D	D	D	D	D	D/V/T	D	D	D	D	D	D/M		A						
BGE	166.796	SUBQ EX			M/V							D/V	D/T	D	D/T	D	D	D	D/T	D	D	D	D	D	D		A						
EOE	166.865	SUBQ EX											A*		T	T											A						
RRE	166.878	SUBQ EX			M						V/T	D	D/T	D	D	D	D	D	D/T	D	D	D	D	D	D		A						
GGE	167.130	SUBQ EX			M/V										D	D	D	D	D/V/T	D	D	D	D	D	D/M		A					D	
WRE	167.162	ABD EX						T			T	D	D/T/A	D	D/T	D	D	D/T	D	D													
YOE	167.189	ABD EX	V		M						T	D	D/T/A	D	D	D	D/T	D/T	D/T	D	D	D/V	D										
OGE	167.198	ABD EX						T			T	D	D/T	D	D	D/T	D	D	D/T	D	D	D	D	D	D/V					D			
YRE	167.290	ABD EX			M			T					D/T/A	D	D	D/T	D	D	D/T	D	D	D	D	D	D		A						
BRE	167.301	ABD EX											A*			T*											A						
OOE	167.048	ABD HELIX			V									D				D	V				D										
ORE	167.071	ABD HELIX			M																												
BOE	167.078	ABD HELIX										D							Y														
EGE	167.090	ABD HELIX			M								D	D	D				D	D	D												
GRE	167.147	ABD HELIX										V				D			Y			D	D		D/V/Y				V			
ERE	167.218	SUBQ HELIX																	Y	D													
RGE	167.240	SUBQ HELIX																															
WGE	167.251	SUBQ HELIX												D	D	D																	
GOE	167.258	SUBQ HELIX																															
ROE	167.283	SUBQ HELIX			M																												

D = DCC (telemetry data collection computer)
M = MANUAL DCC
V = VISUAL
A = AERIAL TELEMETRY SURVEY
T = TELEMETRY TRIANGULATION
Y = TELEMETRY USING YAGI ANTENNA AT COLONY
* = LOCATED ALIVE BUT AWAY FROM COLONY

Fig. 1: Attendance of murres at Gull Island colony following surgical radio transmitter implantation. Key denotes method used to measure attendance.

Revised 11/6/97

Survival of Adult Murres and Kittiwakes in Relation to Forage Fish Abundance

Project Number:	98338
Restoration Category:	Research (new)
Proposed By:	U.S. Geological Survey (PI- John F. Piatt)
Lead Trustee Agency:	DOI-BRD
Cooperating Agencies:	DOI-FWS
Duration:	3 years
Cost FY 98:	$69,000
Cost FY 99:	$66,000
Cost FY 00:	$45,000 (data analysis, reporting)
Cost FY 01	$0
Cost FY 02	$0
Geographic Area:	Cook Inlet, Gulf of Alaska
Injured Resource:	Multiple resources

ABSTRACT

Some seabird populations damaged by the *Exxon Valdez* oil spill continue to decline or are not recovering. In order to understand the ultimate cause of seabird population fluctuations, we must measure productivity, recruitment, and adult survival. Current APEX studies are focused on measuring productivity only. Recruitment measurement demands an unrealistic study duration. We propose to augment current studies in lower Cook Inlet that relate breeding success and foraging effort to fluctuations in forage fish density by using banding and resighting to quantify the survival of adult common murres and black-legged kittiwakes.

INTRODUCTION

Some seabird populations in the Gulf of Alaska have undergone marked fluctuations during the past few decades (Hatch and Piatt 1995; Piatt and Anderson 1996), including periods of decline or non-recovery. Ultimately, the ability of injured or declining seabird populations to recover depends on: 1) breeding success, or productivity; 2) fledgling survival and subsequent recruitment; and 3) overwinter survival of adults (Harris and Wanless 1988). Without concurrent measurement of at least two of these three parameters, it is difficult to determine which factor is limiting a population's recovery.

Mechanisms that regulate seabird populations by influencing productivity, recruitment, and adult survival are poorly understood, but food supply is clearly important (Cairns 1992). Studies sponsored by the *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) in 1995 and 1996 (APEX, project no. 98163) have shown linkages between food supply and population fluctuations. Exactly which parameters of reproductive strategy are driven by food supply, and so drive population fluctuations, remain unclear. To date, APEX has focused on forage fish availability and its relationship to productivity.

We propose to determine the overwinter survival of adult common murres (*Uria aalge*) and black-legged kittiwakes (*Rissa tridactyla*) using established banding and resighting techniques at two of the colonies (Fig. 1) currently being investigated by APEX (Project 98163M). Results of 1996 work show clear differences in prey availability between the two colonies, with forage fish being scarce around Chisik Island and abundant around Gull Island. Both seabird species must work significantly harder at Chisik to provide food to their chicks (Fig. 2). This difference appears to be manifested in sharply reduced kittiwake production at Chisik Island (Fig. 2). Observing that kittiwake populations have been steadily declining at Chisik while increasing at Gull (Fig. 3), one might be tempted to conclude that weak productivity and recruitment are driving the Chisik kittiwake population declines. However, while murres (at least in recent years) have been similarly productive at Chisik and Gull (Fig. 2; J.F. Piatt unpubl. 1997 data), the Chisik Island murre population has historically declined at an even greater rate than the kittiwake population.

From these data we conclude that the murre population decline at Chisik Island and concurrent increase at Gull Island may be attributable to differences in adult survival rates. Measurement of survival rates, in coordination with APEX's focus on food supply and colony productivity, should help to more completely resolve the mechanisms underlying seabird population fluctuations, particularly for those species such as murres that are able to buffer against periods of food shortage by increasing foraging effort (Burger and Piatt 1990; Irons 1992).

Our proposed research will measure adult survival of both murres and kittiwakes at Chisik and Gull Islands. We will use conventional banding/resighting methods to establish both species' adult survival rates. We will also use radio telemetry to measure activity budgets of breeding murres at each colony, in order to quantify "foraging stress" integrated throughout the breeding

season. Foraging stress from breeding effort is probably a major contributor to adult overwinter mortality (Golet et al. 1998). Working in collaboration with the CISeaFFS component of the APEX project, we will compare survival between colonies in relation to foraging stress, breeding success, and forage fish abundance. The proposed work will enhance our understanding of the relationships among survival, reproduction, and foraging in kittiwakes and murres in lower Cook Inlet. In a broader context, our research will clarify the mechanisms and limiting parameters underlying natural population declines or the failure of injured populations to recover.

NEED FOR THE PROJECT

A. Statement of the Problem

Research has provided few clear examples of how seabird population biology is affected by changes in prey availability (Hunt et al. 1991). Consequently, it has been difficult to understand the non-recovery of some EVOS-damaged seabird populations because natural changes in forage fish stocks may have also contributed to their decline. The picture is further complicated by our inability to pinpoint which aspect of population biology ultimately drives population fluctuations. To determine the cause of population declines or non-recovery, the population's productivity, recruitment, and adult survival should be measured concurrent with evaluation of available food supply (Cairns 1992).

Current EVOSTC-funded work (APEX, project no. 96163M) is measuring productivity and foraging differences of seabirds in response to fluctuating prey availability. Preliminary results from research conducted in lower Cook Inlet show some correspondence between productivity and forage fish availability to breeders. There is no correspondence, however, in species such as the murre which are able to increase foraging effort in response to decreasing forage fish abundance (Burger and Piatt 1990). Differences in recruitment and/or adult survival are thus implicated as important determinants of population fluctuations. Yet their relative importance has not yet been established by EVOSTC researchers, despite past work which has shown that variation in either recruitment or adult survival could obscure or even offset population fluctuations apparently driven by productivity differences (Hudson 1985).

Since murres and kittiwakes do not commence breeding until they are several years old (Hudson 1985; Aebischer and Coulson 1990), it is not feasible to measure recruitment in Cook Inlet seabird populations within the time frame required by EVOSTC funding. Measurement of adult overwinter survival has not yet been studied within a complete ecological framework, and has been identified by APEX reviewers as an important topic for expanded research in pursuit of understanding population fluctuations and recovery.

B. Rationale

Population changes are continually being driven by natural ecosystem changes, and are occasionally driven by anthropogenic perturbations such as the *Exxon Valdez* oil spill. In order to separate natural population fluctuations from anthropogenic population changes, we must have a complete understanding not only of the factors which drive population changes (e.g. change in prey availability) but also of the population biology parameter which is most altered by those driving forces. Chick productivity in relation to varying prey availability is currently being studied, but cannot explain all observed population trends. It is not feasible to measure chick survival and recruitment. Therefore, to assess the potential for recovery of seabirds affected by the *Exxon Valdez* oil spill by pinpointing the cause of population trends, a study of adult survival and its relationship to prey availability is required.

In collaboration with the ecosystem-based study of seabird foraging conditions and breeding biology currently being conducted by APEX in lower Cook Inlet (project no. 98163M), we have a unique opportunity to assess not only the role of adult survival in seabird population fluctuations, but also the suspected linkage between foraging effort during the breeding season and adult overwinter survival. By choosing species with different long-term breeding strategies (kittiwakes maintain investment in reproduction at relatively constant [high] levels despite variation in food supply; murres adjust reproductive effort in relation to prey availability by altering buffer or "loafing" time) we will address questions raised by ongoing APEX work that shows linkage between prey availability and population fluctuation in some species (kittiwake) but only implies a linkage in others (murre). Refined understanding of foraging effort in relation to food supply will further our understanding of the costs of breeding in murres and kittiwakes. Stress induced by increased foraging effort in response to poor foraging conditions may explain variation in adult survival.

C. Location

The proposed research will be undertaken in lower Cook Inlet, Alaska. The project's benefits will be realized throughout the EVOS area, in the form of enhanced understanding of seabird population trends and recovery mechanisms. Homer, Alaska is the only community that may be directly affected by the proposed research (as detailed below).

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Gull Island in Kachemak Bay is owned by the Seldovia Native Association (SNA). Limited subsistence use occurs during summer, with occasional egging and harvesting of juvenile birds (Fred Elvsaas, pers. comm.). It is also a major tourist attraction for visitors to Homer. Permission to work on and around the island has been obtained under the provision that annual reports of findings be made available to the SNA. We also plan to inform the local tour boat operators about our activities so that our presence at the island can be explained to visiting

tourists. Chisik Island is managed by the Alaska Maritime National Wildlife Refuge, and we will employ charter vessels from Homer to support field work there. Chisik Island supports a small, seasonal fishing community and we will inform the summer residents about the nature and purpose of our activities. Every attempt will be made to include local residents in the pool of applicants considered for volunteer positions related to the project. Whenever possible, equipment and other resources will be acquired locally in the Homer area. Traditional and local ecological knowledge will be sought from fishermen and other residents, particularly on the topic of seabird population trends and foraging patterns.

PROJECT DESIGN

A. Objectives

Survival Component

1. To determine adult common murre and black-legged kittiwake overwinter survival rates, using conventional banding and resighting methods.

2. To relate differences in common murre and black-legged kittiwake overwinter survival to differences in prey availability and foraging effort during the breeding season.

Foraging Component

3. To characterize the daily and seasonal activity patterns of breeding common murres and black-legged kittiwakes using radio telemetry, and examine their relationship to prey availability.

B. Background

To test our primary hypothesis- that adult common murre and black-legged kittiwake overwinter survival is related to prey availability and foraging stress during summer- we need to obtain measures of overwinter survival concurrent with measures of prey abundance and distribution. Data on prey (forage fish) abundance and distribution will be obtained via coordinated efforts with EVOSTC-funded projects 96163M (APEX) and 97306 (Sand Lance Ecology).

We will conduct the proposed research at Chisik and Gull Islands, lower Cook Inlet (Fig. 1). Chisik Island has relatively low prey availability within typical murre/kittiwake foraging ranges, while Gull Island has high prey availability (Piatt unpubl. data). The Chisik Island populations of both murres and kittiwakes have shown steady declines over the past two decades, in contrast to the Gull Island populations which are expanding (Fig. 3). Ongoing APEX work has shown a significant relationship between breeding success and foraging effort for kittiwakes, but not for murres (Fig. 2). Both species show increased foraging effort with decreased prey availability, but

it appears that murres have a greater range of foraging effort within which they can still successfully produce chicks, as indicated by past studies (Burger and Piatt 1990). This raises the question: Is there a delayed or hidden cost to successful breeders that have had to "work harder" to raise their chicks? One way such a cost may be expressed is in decreased annual adult survival.

Measurement of survival:

Adult overwinter survival in seabirds has typically been measured by intensive banding and resighting programs (Harris and Wanless 1988; Aebischer and Coulson 1990; Hatchwell and Birkhead 1991; Hatch et al. 1993; Sydeman 1993). A suite of potential confounding factors (loss of bands, emigration, intracolony movement, observer failure to see marked birds) complicate survival estimates based on banding and resighting (Harris and Wanless 1988; Hatch et al. 1993). Models have been developed which account for some of these problems (Pollock et al. 1990); overcoming the remaining uncertainties depends directly on the amount of personnel effort that can be dedicated to banding and resighting work. Intensive effort will be required to resight banded birds, especially during the pre- egg-laying stage for kittiwakes (May) and murres (June). Adult common murres are particularly difficult to resight, due to the murre's compact body posture while at the nest site. Furthermore, precise survival estimates based on banding are ideally generated by multi-year studies, due to evidence that long-lived seabirds may sometimes skip one or more years of attempts at breeding (Hudson 1985; Golet et al. 1998).

Measurement of foraging effort:

Increased foraging effort may be the most important contributor to reduction in adult seabird survival (Golet et al. 1998), illustrating the trade-off between yearly reproductive output and longevity. The CISeaFFS study is currently measuring murre and kittiwake foraging effort (in terms of bird-hours spent away from the colony) using a series of four all-day nest (n= 8-12) watches, spread throughout the chick-rearing stage. All-day watches give information on nest-site attendance, foraging trip duration, and chick provisioning rate. However, this method requires intense personnel effort, making an increase in coverage not feasible. To elucidate the potential correspondence between foraging effort and adult survival demands larger sample sizes. We plan to use a Data Collection Computer (DCC) at both colonies to measure murre and kittiwake attendance throughout the breeding season. The DCC will give continuous 24-hour measurement of colony attendance throughout the breeding season, allowing for more powerful comparison of breeding effort and overwinter survival. An additional advantage of using the telemetry/DCC method to quantify foraging stress is the minimal effort required by field personnel once birds are radio-tagged. With equal personnel effot, the DCC generates far more comprehensive attendance data compared to visual observations. Pilot work done for this project in FY97 demonstrated the feasibility of this method. Foraging data obtained concurrently with APEX forage fish abundance and distribution data will give insight into the mechanisms that reduce or influence adult survival as well as productivity, elucidating the forces that drive population fluctuations.

B. Methods

Survival Component: Resighting efforts to search for birds banded during the FY97 pilot work will commence in late May and early June 1998. Initial effort will focus on nest-sites at which birds were banded the previous year. Search coverage will then be expanded to include all visible nests, in order to document any intracolony movement. Coverage will also include roosting rocks and other gathering areas, to look for birds that may skip breeding in the year following banding, but continue to attend the colony.

To increase the population of individually marked birds, we plan to expand the banding work commenced in the FY97 pilot study. Breeding birds will be noosed, and their position in the colony will be noted on archival plot photos or sketches. Captured birds be individually banded as per USFWS protocol. All birds will be weighed using a spring balance, and culmen, head-bill, tarsus, and wing length (flattened, straightened, to longest primary) will be measured

Sample Size and Survival Statistics: Assuming a binomial distribution (sample unit being an individual murre, with survival being a yes or no), a power analysis of sample size in a two by two table (Steel and Torrie, 1980) predicts that a sample size of 47 marked birds per island would resolve a 6% difference in survival between colonies with acceptable statistical power and confidence (Table 1). To double the resolution (3%) would require a sample size nearly five times greater. A sample size of 125 is predicted to resolve a 5% difference with strong power and significance at the 0.05 level. Previous studies have reported murre survival rates ranging from 87% to 98%, measured at stable colonies (Hudson 1985, Sydeman 1993). Given that our study colonies represent relative extremes of population expansion and decline, it is not unreasonable to expect their survival rates to also be at the extreme ends of the normal range. Therefore, detection of a 5% difference with statistical significance should adequately address our primary hypothesis. To allow calculation of resighting probabilities, potentially obviating the use of Jolly-Seber or related models, our goal will be to have a minimum of 200 individually marked birds of each species at each colony.

Foraging Component: We will use radio transmitters to collect data on murre foraging effort (Uttley et al. 1984; Monaghan et al. 1994). As early in the breeding season as feasible, radios will be attached to murres and kittiwakes (n=15 per species per colony) following proven protocols using zip-ties, glue, and waterproof tape (D. Irons, USFWS, pers. comm.; M. Harris, Institute of Terrestrial Ecology, United Kingdom, pers. comm. Data Collection Computers (DCCs) will be used to remotely gather continuous 24-hour data on murre colony attendance throughout the breeding season. Instrumented and control murres will be visually monitored on selected days throughout the breeding season, to assess the impact of transmitter attachment on breeding and foraging performance (Wilson et al. 1986; Wanless et al. 1988; Wanless et al. 1989; Croll et al. 1992). Visual monitoring will be carried out by cooperators in the CISeaFFS component of APEX. Technical telemetry guidance and advice on study design will be provided

by research collaborator Dr. David Irons in coordination with the kittiwake component of the APEX project.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

The proposed research will be conducted by a research student, under the PI's supervision. A Research Work Order will be used to provide funding for one MSc. student at a university yet to be determined. Personal Services contracts may be used for statistical consultation and programming assistance.

SCHEDULE

A. Measurable Project Tasks for FY 98

Oct. 1-Jan. 31:	Evaluate results of pilot FY 97 work; refine study design
Jan. 15-24:	Attend Restoration Workshop
Feb. 1-April 15:	Arrange logistics (resighting, capture and banding, nest monitoring, etc.)
April 16-Sept. 10:	Conduct field work
Sept. 11-Sept. 30:	Begin data analysis

B. Project Milestones and Endpoints

April 15:	Resighting, banding, and nest monitoring protocols will be finalized
Sept. 10:	Field work designed to address all project objectives (listed under PROJECT DESIGN, Part A above) will be completed
Dec. 31, FY 99:	Preliminary data analysis will be completed
April 14, FY 99:	Project design modifications (based on FY 98 results) will be completed
April 15, FY 99:	Submit annual report (FY 98 findings)
Sept. 10, FY 99:	Field work, as necessary based on FY 98 results, will be completed
April 15, FY 00:	Submit annual report (FY 99 findings)
Sept. 30, FY 00:	Preparation of research results for publication in peer-reviewed journals will be completed

C. Completion Date

Our proposed research takes advantage of a natural comparative system (failing vs. thriving colonies) to reduce the time required to test the hypothesis that increased foraging effort will decrease adult survival. We propose two field seasons (FY98 and FY99) to ensure an adequate sample size and to allow for modification of project design based on initial results. The project will be completed by the end of FY 00, which is planned as a close-out year during which no new

research will be undertaken. Efforts in FY 00 will focus on the graduate student's thesis completion and defense, and on publication of research results in peer-reviewed journals.

PUBLICATIONS AND REPORTS

The first planned product of the proposed research will be the annual report detailing FY 98 findings, due on April 15, 1999. Publication of project results in peer-reviewed journals will be pursued as soon as scientifically appropriate and logistically possible.

PROFESSIONAL CONFERENCES

Results of this project will be presented at the Annual Meeting of the Pacific Seabird Group, and at local professional meetings where appropriate.

NORMAL AGENCY MANAGEMENT

This research would not be conducted as a normal part of USGS research on seabirds.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The proposed research issues are related to management and conservation of seabirds in Alaska as addressed by the U.S. Fish and Wildlife Service (USFWS) 'Seabird Management Plan' (USFWS Region 7, Migratory Bird Management). The proposed work will complement and be coordinated with: i) long-term studies conducted by the Alaska Maritime National Wildlife Refuge (AMNWR, USFWS Region 7), which includes annual monitoring of seabird productivity at 9 major seabird colonies throughout Alaska; ii) related studies (APEX) of seabird-forage fish interactions being supported by EVOSTC in Prince William Sound; iii) EVOSTC-funded research on the Pacific sand lance; iv) ongoing studies of seabird populations in areas of oil and gas development conducted by the Minerals Management Service (MMS) in Alaska and the Biological Resources Division of the USGS and, v) ongoing studies of marine fish and oceanography conducted by the University of Alaska, Fairbanks out of the Kasitsna Bay Marine Lab in Kachemak Bay.

Logistic support from the USFWS and AMNWR will include vessel use, storage facilities, laboratory space, computer usage, and communications. Field sites and research platforms will be shared with the EVOSTC-funded APEX and sand lance projects. Telemetry equipment will be borrowed where possible, saving a minimum of $15K in the first year of funding for the proposed research.

PRINCIPAL INVESTIGATOR

Dr. John F. Piatt
Alaska Science Center
Biological Resources Division
USGS
1011 E. Tudor Road
Anchorage, AK 99503
tel. (907) 786-3549
fax (907) 786-3636
E-mail: john_piatt@nbs.gov

PRINCIPAL INVESTIGATOR

Dr. John F. Piatt, Research Biologist (GS-13) with the Alaska Science Center, Biological Resources Division, USGS in Anchorage. Obtained a Ph.D. in Marine Biology from Memorial University of Newfoundland in 1987 (dissertation on seabird-forage fish interactions). Since 1987, studied seabirds at colonies and at sea in Gulf of Alaska, Aleutians, Bering and Chukchi seas. Author on 45 peer-reviewed scientific publications about seabirds, fish, marine mammals, and effects of oil pollution on marine birds. Responsible for coordination and oversight of the proposed research.

PROJECT LEADER

Thomas Van Pelt, proposed MSc. student. Over five years of experience working in Gulf of Alaska and Aleutian marine ecosystems. Responsible for project design, logistics, data analysis, and preparation of manuscripts and reports.

COLLABORATORS

Dr. David B. Irons, Migratory Bird Management, USFWS. Extensive experience with radio telemetry and seabird survival studies in Prince William Sound. Will collaborate on project design, and provide technical guidance.

Dr. Alexander S. Kitaysky, University of Washington, Dept. of Zoology. Will collaborate on study design and field work.

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Table 1. Power analysis of sample size (in a two by two table). One minus beta is power; a power of <0.50 is typical in survival estimations. One minus alpha is the confidence interval. Ps and Pe are estimated survival fractions at two hypothetical colonies. Thus, with a sample size of 47 (transmitters per colony), we would expect to resolve a 6% difference (Ps minus Pe) with a power of 0.51 and 90% confidence intervals. With a sample size of 125, we would expect to resolve a 5% difference with a power of 0.75 and 95% confidence intervals. In general, as sample size doubles, variance is halved (Heisey and Fuller, 1985). Resolution of differences <5% demands unacceptably large sample sizes.

alpha	Zalpha	beta	Zbeta	Ps	Pe	n =
0.10	1.18	0.25	0.68	0.92	0.89	352.32
0.10	1.18	0.49	0.01	0.92	0.89	226.01
0.05	1.65	0.25	0.68	0.95	0.90	125.25
0.10	1.18	0.25	0.68	0.95	0.90	100.14
0.10	1.18	0.49	0.01	0.94	0.89	72.49
0.10	1.18	0.49	0.01	0.95	0.89	46.97

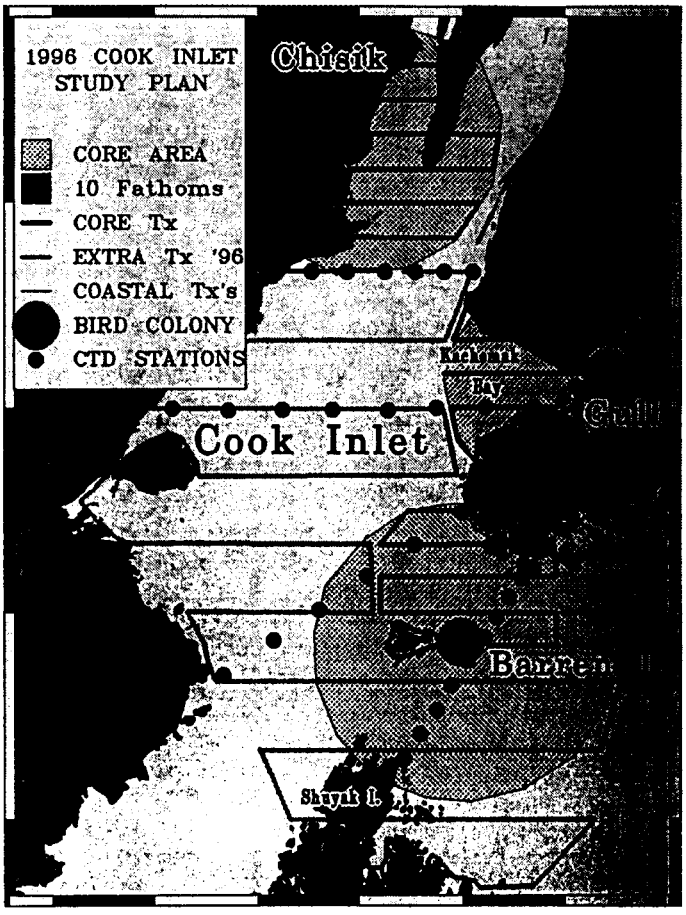
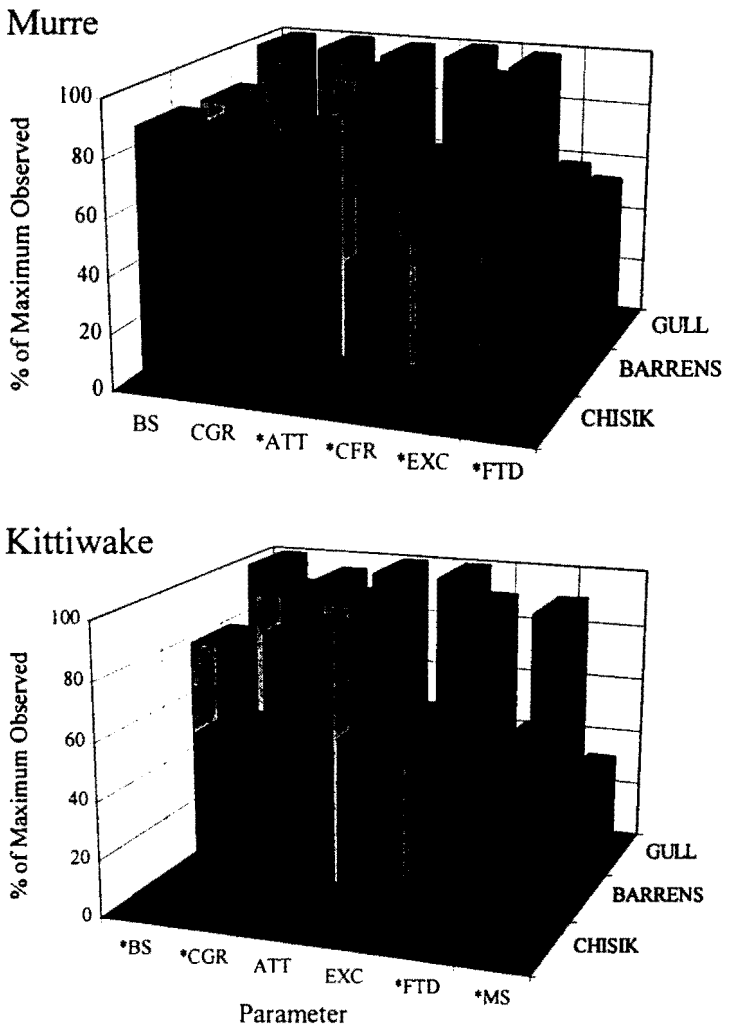


Figure 1. Study area in lower Cook Inlet. Colonies proposed for study of adult survival are located on Chisik and Gull Islands.



Parameters: BS- Breeding Success, CGR- Chick Growth Rate, ATT- Attendance by Adults, CFR- Chick Feeding rate, EXC- Exchange Rate of Brooding Adults, FTD- Foraging Time Duration, MS- Mean Meal Size. Asterisk (*) indicates significant difference in parameter values between colonies.

Figure 2. Variation in reproductive and behavioral parameters of seabirds at Chisik, Gull, and Barren Island colonies in 1996. Note high and similar breeding success of murres at Gull and Chisik, hypothetically made possible by increased foraging effort of Chisik murres. Chisik kittiwakes were apparently unable to compensate, and therefore failed to produce chicks.

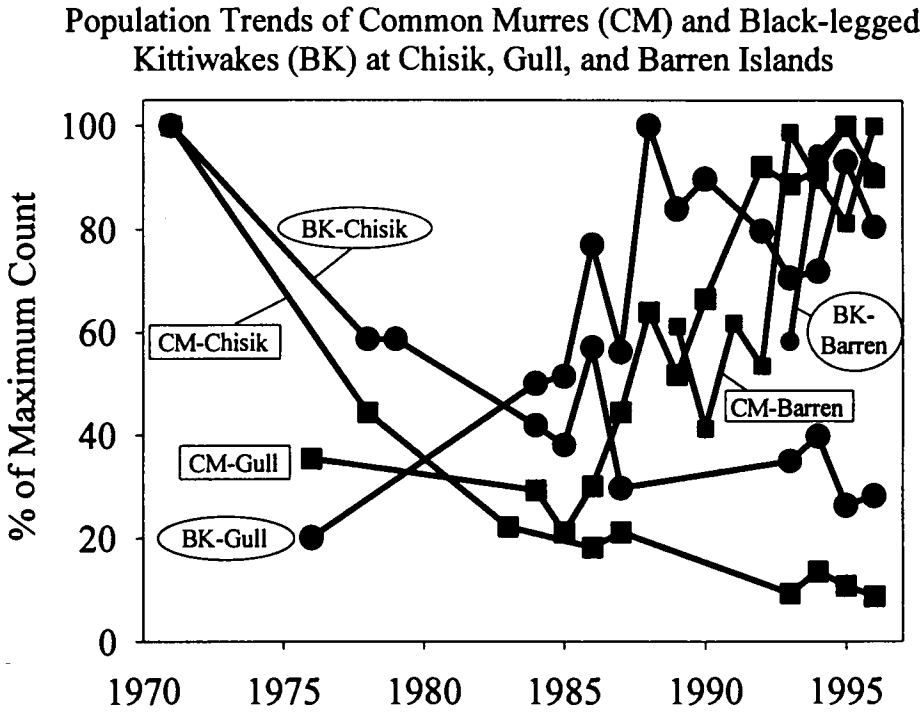


Figure 3. Population trends of murres and kittiwakes showing declines at Chisik Island and increases at Gull Island.

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1997	Proposed FY 1998						
Personnel		$10.6						
Travel		$1.2						
Contractual		$36.2						
Commodities		$13.5						
Equipment		$3.4	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$64.9		Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
General Administration		$4.1						
Project Total	$0.0	$69.0		$66.0	$45.0	$0.0		
Full-time Equivalents (FTE)		0.4						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1998

Prepared: 1 of 4

Project Number: 98338
Project Title: Survival of Adult Murres and Kittiwakes in Relation to Forage Fish Abundance
Agency: U.S. Geological Survey

FORM 3A
TRUSTEE
AGENCY
SUMMARY

11/6/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1998
Vacant	Biotech	GS-5	2.5	2.1		5.3
Vacant	Biotech	GS-5	2.5	2.1		5.3
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		5.0	4.2	0.0	
					Personnel Total	$10.6

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1998
Anc/Hom/Anc	0.2	6	0	0.0	1.2
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$1.2

1998

Prepared: 2 of 4

Project Number: 98338
Project Title: Survival of Adult Murres and Kittiwakes in Relation to Forage Fish Abundance
Agency: U.S. Geological Survey

FORM 3B
Personnel
& Travel
DETAIL

11/6/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Contractual Costs:	Proposed
Description	FY 1998
Air Charter Homer-Chisik (RT) (6 x $500/trip)	3.0
Boat Charter (Camp support; 2 RT Homer/Chisik @ 1500/trip)	3.0
Safety training	0.2
Research Work Order with University (to be determined)	
RWO Includes:	
Grad Student Stipend and Tuition	28.0
Benefits	2.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$36.2

Commodities Costs:	Proposed
Description	FY 1998
Fuel (resighting from water, 15d @ 20gal/day @ 3.00/gal)	1.0
Misc. Equip.	1.0
Radio Transmitters (15 per species, per colony +5 reference = 65 @ $150.00)	9.8
Color bands (300 per species, per island)	1.2
Metal bands (300 per species, per island)	0.5
Commodities Total	$13.5

1998

Prepared:

Project Number: 98338
Project Title: Survival of Adult Murres and Kittiwakes in Relation to Forage Fish Abundance
Agency: U.S. Geological Survey

FORM 3B
Contractual & Commodities DETAIL

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FY 1998
Laptops for DCC download and analysis in field	2	1.5	3.0
Pelican cases and cables	2	0.2	0.4
			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**	$3.4

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency
Data Collection Computer (ie, telemetry receiver and control unit; 2 @ 5k each)	2	FWS
Receiver and Antennae (2 @ 2K each)	2	USGS
Boston Whaler (camp and personnel support; @ 75K)	1	FWS
Laptop Computer (@1.5K)	1	USGS
Zodiac inflatables (required for resighting BLKI from water; 2 @ 7K each)	2	USGS

1998

Project Number: 98338
Project Title: Survival of Adult Murres and Kittiwakes in Relation to Forage Fish Abundance
Agency: U.S. Geological Survey

FORM 3B
Equipment
DETAIL

Prepared: 4 of 4

11/6/97

APPLIED
marine
SCIENCES

December 2, 1997

To: Molly McCammon
Executive Director
Exxon Valdez Oil Spill Trustee Council

From: Robert Spies, Chief Scientist

I have sent out to review and received comments back on the revised proposal "Survival of adult murres and kittiwakes in relation to forage fish abundance" (98388). This is a good proposal that is consistent with the peer review recommendations from the last APEX workshop. The APEX project has focused exclusively on chick production in colonies with different abundances of forage fish. The proposed work would help complete the picture in terms of population ecology of two seabird species at two sites of widely different forage fish abundance by extending the measurements to survival of adult birds from the same colonies. Both reviewers were in strong support of the work. I have attached their comments to this memo in the hope that they may be useful to the investigators. Given the analysis of power presented in the proposal, it appears likely that the questions posed in the proposal can be substantially answered by using conventional leg bands.Although the use of radiotransmitters would be a valuable complement to the banding data, in the interest in achieving some cost savings the radiotags are not essential to estimate adult survival. I therefore recommend that the proposal be funded with a reduction of $12.8K in FY98.

cc: S. Senner
S. Schubert

2155 Las Positas Court, Suite S Livermore, CA 94550 510 373.7142 FAX 510 373.7834

98339

United States Department of Agriculture | Forest Service | Chugach National Forest | 3301 C Street Suite 300 Anchorage, AK 99503

File Code: 2620 Date: 15 October 1997

Subject: EVOS Project 98339

To: Oil Spill Restoration Manager

During the August Trustee Council meeting, the Department of Interior (DoI) raised some concerns about the Human Use and Wildlife Disturbance Model (EVOS project 98339) proposed by Lowell Suring and myself. On October 9th, I met with Bud Rice of the National Park Service to talk about the proposed pilot project and those concerns. Three major areas of concern were identified and discussed.

1. The applicability of the model to other oil spill areas.

I explained that the project is designed as a pilot with the intent of developing a model that can be adapted to other locations.

2. The choice of injured species that will be used to demonstrate the model.

The proposal calls for a literature review of human disturbance on all injured species and site specific application of the model to harbor seals, pigeon guillemots, and cutthroat trout. Other species such as black oystercatchers will be very sensitive to human disturbance. However, the distribution data for this species in western Prince William Sound is less thorough than for the species we selected. We feel that our choice of 'emphasis species' will provide the greatest effectiveness in applying and evaluating the model.

3. The relationship of the project to the Whittier Access road.

Because of the anticipated effect of the Whittier Access road on amount of human use in western Prince William Sound, there is interest in having the Forest Service and/or Alaska Department of Transportation provide some support for developing this model. I discussed the contributions that the Forest Service is already making to this project. It should also be recognized that human use has increased dramatically in western Prince William Sound, and throughout the oil spill area, over the last 10 years. Regardless of the anticipated impacts of the Whittier Access road, there is a need to understand the effects of human use on the recovery of the injured resources. This project provides a tool for evaluating current disturbance levels and for predicting future disturbance potential.

Bud and I were in agreement on the value of project for managing resources. We were also in agreement that western Prince William Sound was a reasonable pilot area to develop this assessment technique. I believe we have addressed the major concerns expressed by the DoI. Lowell and I look forward to initiating development of this assessment technique once funding is received for the project.

s/ Karen A. Murphy

Karen A. Murphy
Wildlife Biologist

Exxon Valdez Oil Spill Trustee Council

645 G Street, Suite 401, Anchorage, AK 99501-3451 907/278-8012 fax: 907/276-7178

December 3, 1997

Bob Henrichs, President
Traditional Council
Native Village of Eyak
P.O. Box 1388
Cordova, Alaska 99574

Dear Bob:

Thank you very much for your invitation to the Sobriety Day potlach. I would love to be there. However, I have guests from out of town coming into Anchorage that weekend, and there is just no way I can leave town myself.

Also, have you considered holding the potlatch either in November or January, not so close to Christmas, but also not interfering with Russian Christmas?

Yes, you're right - it's about time I showed up. I'm sorry once again that it can't be this year. I wish you all the best for a successful event.

Sincerely,

Molly

Molly McCammon
Executive Director

NATIVE VILLAGE OF EYAK

P.O. BOX 1388, CORDOVA, ALASKA 99574
TEL-907-424-7738/FAX-907-424-7738

November 24, 1997

Molly McCammon
Executive Director
EVOS Trustees Council
Anchorage, Alaska

Dear Molly

The Native Village of Eyak invites you to the 4th Annual Memorial & Sobriety Day Celebration Potlach, to be held in Cordova, Alaska on Saturday December 13, 1997.

There will be dance groups from Chenega Bay, Tatitlek, and of course our own dance group. Jim LaBelle is the keynote speaker. Bill Stevens, Virgil Titus, Mike & Daisy Demientoff will be providing the music. We have a permit to take a potlach moose. There will be workshops, speakers, music, dance groups and of course good food!!!!!!!!!!!!!!!!!

There will be a welcoming dinner on the evening of the 12th.
Hope you can make it.

Sincerely yours

Bob Henrichs

President
Traditional Council
Native Village of Eyak

P.S. About time you showed up Molly.

YOU ARE INVITED
TO
THE NATIVE VILLAGE OF EYAK'S

4TH ANNUAL SOBRIETY & MEMORIAL DAY CELEBRATION

DECEMBER 13, 1997
HIGH SCHOOL GYM
CORDOVA, ALASKA

THERE WILL BE
KEYNOTE SPEAKER: JIM LABELLE
DANCE GROUPS
WORKSHOPS
EARL POLK WILL BE THERE
BILL STEVENS, VIRGIL TITUS, MIKE & DAISY
DEMIENTEFF WILL BE PROVIDING MUSIC
WE WILL HAVE A POTLATCH MOOSE FOR THE
ALWAYS GREAT DINNER
AND MANY MORE

for Information call 907-424-7738

Exxon Valdez Oil Spill Trustee Council

645 G Street, Suite 401, Anchorage, AK 99501-3451 907/278-8012 fax: 907/276-7178

Molly
Signed
original
before
they left
office

December 2, 1997

Ms. Tabitha Luddem
30 Starring Way
Littleborough
Lancashire
England
OL15 8NX

Dear Ms. Luddem:

Please find enclosed a copy of the *Exxon Valdez* Oil Spill (EVOS) Research and Restoration Information Project CD-ROM. It was funded by the Trustee Council and developed by the Alaska Department of Natural Resources and the United States National Oceanic and Atmospheric Administration.

On this CD-ROM you will find the EVOS Geographic Information System Database and Data Dictionary, 1989 State/Federal Trustee Council Hydrocarbon Database, the EVOS Project Bibliography, as well as an instruction booklet.

I hope you will find this information useful.

Sincerely,

Molly McCammon
Executive Director

MM/kh
Enclosures (2)

Exxon Valdez Oil Spill Trustee Council

645 G Street, Suite 401, Anchorage, AK 99501-3451 907/278-8012 fax: 907/276-7178

December 2, 1997

Ms. Debbie Satler
Palos South Middle School
13100 82nd Avenue
Palos Park, IL 60477

Dear Ms. Satler:

Please find enclosed a copy of the *Exxon Valdez* Oil Spill (EVOS) Research and Restoration Information Project CD-ROM. It was funded by the Trustee Council and developed by the Alaska Department of Natural Resources and the United States National Oceanic and Atmospheric Administration.

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I hope you will find this information useful.

Sincerely,

Molly McCammon
Executive Director

MM/kh
Enclosures (2)

Exxon Valdez Oil Spill Trustee Council

645 G Street, Suite 401, Anchorage, AK 99501-3451 907/278-8012 fax: 907/276-7178

December 2, 1997

Dr. Shintaro Goto
Kanazawa Institute of Technology
Environmental Information Research Lab
7-1 Ohgigaoka Nonoichi Kanazawa
Ishikawa 921, Japan

Dear Dr. Shintaro Goto:

Please find enclosed a copy of the *Exxon Valdez* Oil Spill (EVOS) Research and Restoration Information Project CD-ROM. It was funded by the Trustee Council and developed by the Alaska Department of Natural Resources and the United States National Oceanic and Atmospheric Administration.

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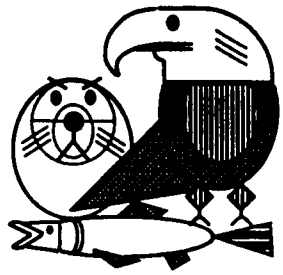
I hope you will find this information useful.

Sincerely,

Molly McCammon
Executive Director

MM/kh
Enclosures (2)

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



December 2, 1997

Mr. Brad Fisher
Royal Melbourne Institute of Technology
Department of Land Information
City Campus
GPO Box 2476V
Melbourne Victoria 3000
Austrailia

Dear Mr. Fisher:

Please find enclosed a copy of the *Exxon Valdez* Oil Spill (EVOS) Research and Restoration Information Project CD-ROM. It was funded by the Trustee Council and developed by the Alaska Department of Natural Resources and the United States National Oceanic and Atmospheric Administration.

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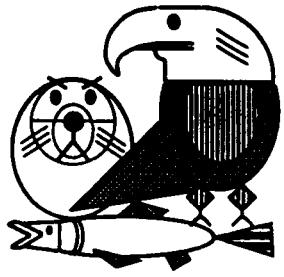
I hope you will find this information useful.

Sincerely,

Molly McCammon
Executive Director

MM/kh
Enclosures (2)

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



December 2, 1997

Mr. Mark Mitchell
Upper Canada College
Upper Scholl
200 Lonsdale Road
Toronto, Ontario
Canada M4V 1W6

Dear Mr. Mitchell:

Please find enclosed a copy of the *Exxon Valdez* Oil Spill (EVOS) Research and Restoration Information Project CD-ROM. It was funded by the Trustee Council and developed by the Alaska Department of Natural Resources and the United States National Oceanic and Atmospheric Administration.

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I hope you will find this information useful.

Sincerely,

Molly McCammon
Executive Director

MM/kh
Enclosures (2)

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178

December 2, 1997

Ms. Inez Hopkins
3653 Richenacker
Boise, ID 83705

Dear Ms. Hopkins:

Please find enclosed a copy of the *Exxon Valdez* Oil Spill (EVOS) Research and Restoration Information Project CD-ROM. It was funded by the Trustee Council and developed by the Alaska Department of Natural Resources and the United States National Oceanic and Atmospheric Administration.

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Executive Director

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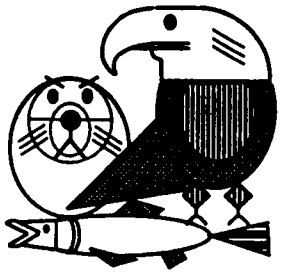
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



December 2, 1997

Mr. Meifeng Luo
University of Rhode Island
Department of Environmental and
Natural Resource Economics
APT 421, Graduate Village
Kingston, RI 02881

Dear Mr. Luo:

Please find enclosed a copy of the *Exxon Valdez* Oil Spill (EVOS) Research and Restoration Information Project CD-ROM. It was funded by the Trustee Council and developed by the Alaska Department of Natural Resources and the United States National Oceanic and Atmospheric Administration.

On this CD-ROM you will find the EVOS Geographic Information System Database and Data Dictionary, 1989 State/Federal Trustee Council Hydrocarbon Database, the EVOS Project Bibliography, as well as an instruction booklet.

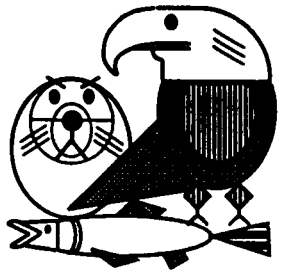
I hope you will find this information useful.

Sincerely,

Molly McCammon
Executive Director

MM/kh
Enclosures (2)

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



December 2, 1997

E.F. Brussee
Dune Waterworks
Hoge Morsweg 16
2332 HL Leiden
Netherlands

Dear E.F. Brussee:

Please find enclosed a copy of the *Exxon Valdez* Oil Spill (EVOS) Research and Restoration Information Project CD-ROM. It was funded by the Trustee Council and developed by the Alaska Department of Natural Resources and the United States National Oceanic and Atmospheric Administration.

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I hope you will find this information useful.

Sincerely,

Molly McCammon
Executive Director

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Enclosures (2)

Exxon Valdez Oil Spill Trustee Council

645 G Street, Suite 401, Anchorage, AK 99501-3451 907/278-8012 fax: 907/276-7178

December 2, 1997

Mr. Michael Galginaitis
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P.O. Box 101352
Anchorage, AK 99510-1352

Dear Mr. Galginaitis:

Please find enclosed a copy of the *Exxon Valdez* Oil Spill (EVOS) Research and Restoration Information Project CD-ROM. It was funded by the Trustee Council and developed by the Alaska Department of Natural Resources and the United States National Oceanic and Atmospheric Administration.

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I hope you will find this information useful.

Sincerely,

Molly McCammon
Executive Director

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Enclosures (2)

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645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178

December 2, 1997

Richard A. McQuaide
1619 Plumwood Drive
Houston, TX 77014

Dear Mr. McQuaide:

Please find enclosed a copy of the *Exxon Valdez* Oil Spill (EVOS) Research and Restoration Information Project CD-ROM. It was funded by the Trustee Council and developed by the Alaska Department of Natural Resources and the United States National Oceanic and Atmospheric Administration.

On this CD-ROM you will find the EVOS Geographic Information System Database and Data Dictionary, 1989 State/Federal Trustee Council Hydrocarbon Database, the EVOS Project Bibliography, as well as an instruction booklet.

I hope you will find this information useful.

Sincerely,

Molly McCammon
Executive Director

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Enclosures (2)

Exxon Valdez Oil Spill Trustee Council

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December 2, 1997

Heather Gogola
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Bucknell University
Lewisburg, PA 17837-2081

Dear Ms. Gogola:

Please find enclosed a copy of the *Exxon Valdez* Oil Spill (EVOS) Research and Restoration Information Project CD-ROM. It was funded by the Trustee Council and developed by the Alaska Department of Natural Resources and the United States National Oceanic and Atmospheric Administration.

On this CD-ROM you will find the EVOS Geographic Information System Database and Data Dictionary, 1989 State/Federal Trustee Council Hydrocarbon Database, the EVOS Project Bibliography, as well as an instruction booklet.

I hope you will find this information useful.

Sincerely,

Molly McCammon
Executive Director

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Enclosures (2)

Exxon Valdez Oil Spill Trustee Council

645 G Street, Suite 401, Anchorage, AK 99501-3451 907/278-8012 fax: 907/276-7178

MEMORANDUM

To: EVOS Project Leaders and Principal Investigators

From: Molly McCammon, Executive Director

Date: December 1, 1997

Subject: 1998 Restoration Workshop and Call for Abstracts

Final plans are taking shape for the 1998 Restoration Workshop, which will be held January 29-30, 1998, at the Hotel Captain Cook. Although the agenda is not final, I have enclosed the most recent draft for your information. A few reminders are in order:

For project leaders and principal investigators who had projects in FY 1997, please submit your one-page abstract to Stan Senner at the Restoration Office by Monday, December 15 (see attached guidelines). These abstracts will be duplicated, collated, and distributed in advance of the workshop and will provide everyone ready access to the full range of work supported by the Trustee Council. Please try hard to write your abstract in plain English, since not everyone who reads these will be steeped in your subject matter.

If you plan to present a poster, please notify both Stan and Bill Hauser, poster session chair, of your plans by December 15 (see attached guidelines). There will be a formal poster session combined with a reception on Thursday evening, January 29.

Be sure to make your room reservations at the Hotel Captain Cook now. Call 1-800-843-1950. Room rates are $78 single; $98 double occupancy. Ask for the "*Exxon Valdez* Restoration Workshop" (Group #229) rate.

Lastly, there will be one-day review sessions for the three ecosystem-scale projects (SEA, NVP, and APEX) on January 26-28. These will be at the Hotel Captain Cook and are open to investigators from other projects and to the public.

We look forward to having your abstract by December 15 and seeing you in January. Thank you.

MM/kh
enclosures (3)
cc: Restoration Liaisons and Work Force

[October 24, 1997 version]

DRAFT

1998 Restoration Workshop
January 29-30, 1998

Theme: Long-term Monitoring and Research

Day 1- Thursday, January 29

8:00 am	**Registration** (30 min)
8:30	**Introduction and Annual Report on EVOS Program, Announcements** *Molly McCammon, Executive Director* (30 min)
9:00	**Trustee Perspective** *State or Federal Trustee* (15 min)
9:15	**Injury & Recovery Update** *Dr. Robert Spies, Chief Scientist, and Stan Senner, Science Coordinator* (15 min)
9:30	**Nearshore Vertebrate Predator Project** (NVP, 97025) *Dr. Leslie Holland-Bartels, USGS-Biological Resources Division* (30 min)
10:00	**Break**
10:30	**Sound Ecosystem Assessment** (SEA, 97325) *Dr. Ted Cooney, University of Alaska Fairbanks* (30 min)
11:00	**Alaska Predator Ecosystem Experiment** (APEX, 97163) *Dr. David Duffy, University of Alaska Anchorage* (30 min)
11:30	**Chenega Shoreline Cleanup**, 97291, *Dianne Munson (?) and Chris Brodersen* (30 min)
12 Noon	**Buffet Lunch** (in hotel) (75 min)
1:15 pm	**Oil-related pink salmon egg mortality,** 97191A, *Brian Bue* (20 min) **Effects of oil on pink salmon straying and survival,** 97076/191B, *Alex Wertheimer and Ron Heintz* (30 min) **Coded wire tag recoveries and otolith thermal mass marking,** 97186/188, *Tim Joyce* (30 min) **Genetic discrimination of PWS herring populations,** 97165, *Dr. Jim Seeb and Dr. Lisa Seeb* (20 min)

3:00 **Break**

3:30 **Harbor seal condition and health status,** 97001, *Dr. Mike Castellini* (20 min)
Community-based harbor seal management and biosampling, 97244, *Monica Riedel and Dr. Vicki Vanek* (20 min)
Harlequin duck recovery monitoring, 97427, *Dan Rosenberg* (20 min)
Common murre population monitoring, 97144, *David Roseneau* (20 min)
Marine bird boat surveys in PWS, 97159, *Dr. David Irons* (20 min)

5:15 **Adjourn Plenary Session**

5:45-7:30 **Reception and Poster Session**

Day 2 - Friday, January 30

8:15 am **Anadromous and resident forms of cutthroat trout and Dolly Varden in PWS,** 97145, *Dr. Gordon Reeves* (20 min)
Traditional ecological knowledge, 97052B, *Patty Brown Schwalenberg and Dr. Henry Huntington* (25 min)

9:00 **The Global Oceans Ecosystem Dynamics Program and the Northeast Pacific Project,** *Dr. Tom Powell and Dr. Hal Batchelder, University of California, Berkeley and U.S. GLOBEC Scientific Steering Committee Coordinating Office* (30 min)

9:30 Break

10:00 **Ecological monitoring - purpose and payoff**
Dr. Donald Boesch, University of Maryland Center for Environmental and Estuarine Studies (60 min)

11:00 **Conceptual plan for long-term research and monitoring in the northern Gulf of Alaska,** *Dr. Robert Spies, Chief Scientist, and Andy Gunther, Asst. Chief Scientist* (40 min)

11:40 **Pristane monitoring in mussels,** 97195, *Jeff Short* (20 min)

12 Noon Buffet Lunch (in hotel) (75 min)

1:15 pm **Feedback on long-term monitoring and research**
Breakout sessions (5-? groups) to discuss conceptual plan (75 min)

2:30 Break

3:00	**Reports from Breakout Groups** (30 min)
3:30	**Reactions from Peer Reviewers and Special Guests** (60 min)
4:30	**Open Microphone** (30 min)
5:00	**Closing Remarks** *Molly McCammon, Executive Director* (15 min)
5:15	**Adjourn**

GUIDELINES FOR 1998 WORKSHOP ABSTRACTS
Abstracts Due December 15

Abstracts are needed from the project leader or principal investigator for each project that received EVOS Trustee Council funding in FY 1997. Please submit no later than Monday, **December 15, 1997,** to Stan Senner, Science Coordinator, at the Restoration Office, 645 G Street, Suite 401, Anchorage, AK 99501-3451. Please submit your abstract on a diskette (w/hard copy) or by e-mail (<stans@oilspill.state.ak.us>), preferably in a WordPerfect for Windows 6.0/6.1, Microsoft Word for Windows 7.0, or ASCII format.

Abstracts should be a maximum of one type-written, single-spaced page. Please (!) follow this format:

(1) **Project Number and Title**;

(2) **Principal Investigators**, including names, mailing addresses (for each PI, if different), and telephone number and/or e-mail address for the lead investigator;

(3) **Abstract**, including:

a) purpose and objectives of the restoration study or project, including reference to injured resources (include scientific names for plants and animals);
b) study area;
c) brief mention of primary methods, materials, equipment (especially if not standard);
d) description of major results in 1997, with reference to earlier results as needed; and
e) summary comments that interpret or evaluate the results, especially in view of the status of the injured resource, restoration objectives, management applications, or future program directions.

These last two items (3d & e) are the most important and should account for most of the substance of the abstract. Your abstract should not include detailed descriptions of experiments, organisms, and standard methods, nor references to the literature. In most cases tables and graphs will not be appropriate, but can be included if the abstract does not exceed one page.

Please write in plain English--i.e., use a minimum of jargon. These abstracts need to be understandable to readers of various backgrounds and levels of education.

A sample abstract is on the back of these guidelines. If you have questions, please call Stan Senner at 907-278-8012 or contact him by e-mail.

Project Number and Title: 97161 - Differentiation and Interchange of Harlequin Duck Populations Within the North Pacific

Principal Investigators: Buddy Goatcher, Katmai National Park and Preserve, Coastal Unit Office, 202 Center Avenue, #201, Kodiak, Alaska 99615-6312, (907) 486-6730

Denny Zwiefelhofer, Kodiak National Wildlife Refuge, 1390 Buskin River Road, Kodiak, Alaska 99615

Dan Esler and Kim Scribner, USGS - Biological Resources Division, 1011 E. Tudor Rd., Anchorage, Alaska 99503

Abstract: We are using genetic analyses and color-banding programs to assess the degree of population differentiation and movements among geographically separate groups of harlequin ducks (*Histrionicus histrionicus).* The primary area of study encompasses *Exxon Valdez* oil spill impacted areas of the northeast coast of the Alaska Peninsula (Katmai National Park) and Kodiak Island Archipelago (Kodiak National Wildlife Refuge) along the Shelikof Straits and Prince William Sound. Other investigators in the North Pacific region contributed additional samples for molecular genetics evaluation.

Harlequin ducks were captured in molting drives, genetic samples were collected, and leg-bands were applied with site specific colors and individual alpha-numeric codes before release on *Exxon Valdez* Oil Spill affected shorelines of Katmai (N=39), Kodiak (N=313) and Prince William Sound. A more practical live-trap design that should increase capture efficiencies was developed and constructed in 1996 and will be field tested in 1997. Resightings of colored bands from 14 flying birds were obtained in the Kodiak study area during 15-21 November. Other Prince William Sound studies have accumulated over 400 coded bandings and over 700 banded ducks to date.

We are using both nuclear bi-parentally inherited markers (microsatellites) and maternally inherited mitochondrial DNA (mtDNA) for genetic analyses. To date, 209 individuals from 6 regions [Katmai (N=35), Kodiak (N=21), Prince William Sound (N=74 from 4 locations), British Columbia (N=21), Aleutian Islands (N=23), and Washington state (N=35), have been assayed at one microsatellite locus. Preliminary results suggest that population allele frequency does not vary significantly among populations across the North Pacific. In an effort to obtain additional loci, cloning efforts are underway to develop additional polymorphic loci. We feel the microsatellite analysis will prove far superior to multilocus minisatellite (DNA fingerprinting) analysis for the purposes of this study.

If population interchange is limited among regions, recovery of populations injured by the oil spill can occur only through the recruitment of young into the population. However, if movements exist among areas, as evidenced by genetic mixing or direct band returns from this study, recovery can be enhanced by immigration from non-injured populations. We will continue to address these issues with genetic analyses and recoveries of banded individuals.

GUIDELINES FOR 1998 WORKSHOP POSTER PRESENTATIONS

Posters will be displayed throughout the 1998 Restoration Workshop at the Hotel Captain Cook in Anchorage, 29-31 January, 1998. **In addition to submitting your regular project abstract to Stan Senner at the Restoration Office, please notify both Stan and Bill Hauser, chair of the Poster Session, if you plan to present a poster.** The deadline for submitting your abstract and indicating that you plan to present a poster is Monday, December 15, 1997. When you contact Stan and Bill, please include your e-mail address. Here are the details:

Session Setting

-Similar to that of other years: i.e., a large room adjacent to main meeting room.

-Shared space with coffee service and reception.

-Posters will be displayed along outer walls: The surface of one wall is a semi-soft, flexible (folding) wall; the other is a hard, permanent, outer wall.

Allowable Space

-Without special arrangements, the maximum space available is 3.5 feet wide.

Tips

-Keep it simple. Bill Hauser can supply design, layout and construction ideas.

-Include title, author and contact information at the top.

-Present only enough data to support conclusions; use attractive figures and photos.

-All text and images must be legible from at least 4 feet away (**use ≥ 14 point font**).

Display\attachment

-Posters will be suspended from the walls; try to keep them light-weight.

-Masking tape and/or hangers will be provided. No Velcro.

Other

-Presenter is responsible for his or her own poster. Contact Bill Hauser if you will need special help or other information.

-Set up and take down times will be announced at the workshop.

-The special Reception and Poster Session will be from 5:45-7:30 pm on Thursday, January 29. Presenters are expected to accompany their posters during this time.

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Exxon Valdez Oil Spill Trustee Council

645 G Street, Suite 401, Anchorage, AK 99501-3451 907/278-8012 fax: 907/276-7178

Restoration Office Tentative Meeting Schedule

November 1997

4-5 PAG Workshop on Restoration Reserve and Archaeology Repositories
12-13 Harbor Seal review

December 1997

10 RWF Meeting
18 Trustee Council Meeting, Anchorage - Deferred Projects and Restoration Reserve Options
9 TEK Advisory Group

January 1998

26-28 SEA, NVP & APEX Reviews, Hotel Captain Cook
29-30 Annual Restoration Workshop, Hotel Captain Cook

February 1998

3-14 Genetics Review (2 days within this period) tentative dates

March 1998

For more information on any of the above meetings, please contact the Anchorage Restoration Office.

Update: 10/31/97 rwf

Exxon Valdez Oil Spill Trustee Council

645 G Street, Suite 401, Anchorage, AK 99501-3451 907/278-8012 fax: 907/276-7178

FAX COVER SHEET FAX COMPLETE

To: **Restoration Work Force**

From: Keri Hile Date: 3 November 97

Comments: Total Pages: 2

Updated Tentative RWF Meeting Schedule

RESTORATION WORK FORCE MEMBERS INCLUDE:

Belt, Gina
Berg, Catherine
Fries, Carol
Gibbons, Dave
C. Slater/B. Hauser
Bartels, Leslie/Lisa Thomas
Miraglia, Rita
Morris, Byron
Fay, Ginny
Rice, Bud
Spies, Bob
Holbrook, Ken
Wright, Bruce
Cathy Kane

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1/10/97

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	[16] 2672450	RITA MIRAGLIA
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	[18] 2672464	SULLIVAN-SLATER
	[19] 7863636	L.BARTELS
	[20] 7863350	C.BERG
	[21] 2572517	B.RICE
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Exxon Valdez Oil Spill Trustee Council

645 G Street, Suite 401, Anchorage, AK 99501-3451 907/278-8012 fax: 907/276-7178

Restoration Office Tentative Meeting Schedule

December 1997

9 TEK Advisory Group
10 RWF Meeting
18 Trustee Council Meeting, Anchorage - Deferred Projects and Restoration Reserve Options

January 1998

13 ARLIS Founders Board
26 SEA Review, Hotel Captain Cook
27 NVP Review, Hotel Captain Cook
28 APEX Review, Hotel Captain Cook
28 Community Facilitators, Restoration Office
29-30 Annual Restoration Workshop, Hotel Captain Cook

February 1998

2-3 Genetics Review (tentative dates)

March 1998

For more information on any of the above meetings, please contact the Anchorage Restoration Office.

Update: 12/9/97 rwf

Exxon Valdez Oil Spill Trustee Council

645 G Street, Suite 401, Anchorage, AK 99501-3451 907/278-8012 fax: 907/276-7178

FAX COVER SHEET FAX COMPLETE

To: **Restoration Work Force**

From: Keri Hile Date: December 9, 1997

Comments: Total Pages: 2

Restoration Office tentative
Meeting schedule.

RESTORATION WORK FORCE MEMBERS INCLUDE:

Belt, Gina
Berg, Catherine
Fries, Carol
Gibbons, Dave
C. Slater/B. Hauser
Bartels, Leslie/Lisa Thomas
Miraglia, Rita
Morris, Byron
Fay, Ginny
Rice, Bud
Spies, Bob
Holbrook, Ken
Wright, Bruce
Cathy Kane

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