**Project Title: Community Involvement/Traditional Ecological Knowledge**

| | |
|---|---|
| Project Number: | 97052 |
| Restoration Category: | General Restoration |
| Proposer: | Chugach Regional Resources Commission |
| Lead Trustee Agency: | Alaska Department of Fish & Game |
| Cooperating Agencies: | None |
| Duration: | 6 Years |
| Cost FY97: | 375,386.00 |
| Cost FY98: | 255,000.00 |
| Cost FY99: | 255,000.00 |
| Cost FY00: | 255,000.00 |
| Cost FY01: | 255,000.00 |
| Cost FY02: | 255,000.00 |
| Geographic Area: | Oil Spill Area |
| Injured Resource/Service: | All Injured Resources/Services |



## ABSTRACT:

Project 97502 would continue and expand upon the original concept of increasing community involvement in the restoration process begun under 95052. This project would have two major components: community involvement and traditional ecological knowledge. Martha Vlasoff's subcontract as the Spill Area-Wide Coordinator would be renewed through a contract with the Chugach Regional Resources Commission (CRRC) to serve as a liaison between the communities, and the existing network of scientists, agency personnel, restoration office personnel and the Trustee Council. Through direct communications with a network of local facilitators, the Spill Area-Wide Coordinator would continue to actively involve local residents in the restoration program particularly on-going scientific studies. The ADF&G will compile the TEK raw data they currently hold and put it into a database using the Whiskers! database as a template.

## INTRODUCTION

Nine local facilitators were hired in FY96 through cooperative agreements with the village councils of Tatitlek, Chenega Bay, Port Graham, Nanwalek, Eyak (Cordova), Qutekcak (Seward), Valdez, and the native associations in Bristol Bay and Kodiak. Under 97052, the number of community facilitators would be expanded by one to include the community of Seldovia. Martha Vlasoff, the full time Spill Area Wide Coordinator, will renew her subcontract with CRRC and continue to work out of the Restoration Office, to accomplish the following tasks:

1. Increase involvement of community members and local tribal traditional natural resource programs throughout the spill region in restoration projects (local hire, use of local equipment, traditional knowledge expertise, research assistants, traditional harvest or other data collection, comprehensive natural resource community planning, traditional educational curriculum development, local resource employment, and career development). This community process will require a local representative (Community Facilitator), who will become familiar with the new and ongoing projects funded by the Trustee Council, will identify those that would benefit by a community component, and will work with Principal Investigators (PIs) to develop and implement community based projects.

2. Subcontract with and serve as contact point for Community Facilitator in each of ten participating communities (Tatitlek, Chenega Bay, Port Graham, Nanwalek, Cordova, Seward, Seldovia, Valdez, Kodiak region, and the Alaska Peninsula region.) The tasks for the Spill Area Wide Coordinator in relation to the Community Facilitators would be to:

    a. Coordinate the provision of technical assistance to the villages by the Trustee Council staff and agency personnel to develop project proposals.

    b. Coordinate the participation of Community Facilitators in the annual Restoration Workshop and other workshops/meetings.

    c. Distribute a brief report/update monthly to each Community Facilitator. Updates could include information regarding new and/or continuing research proposals/projects, study results, restoration work planned in the area, Restoration Office activities, Trustee Council actions, etc.

3. Organize the annual round of Trustee Council/Restoration Office meetings held in conjunction with the Invitation/Draft Work Plan. This would include presentations in specific communities by select PIs.

4. Organize a meeting with the Community Facilitators and Trustee Council staff and PIs to review the research protocols and how they are working.

5. Provide input at the Restoration Work Force meetings.

6. Provide input to the Restoration Update newsletter editorial board.

7. Prepare quarterly project status reports and ensure all annual/final reports are submitted on a timely basis by the affected communities.

The cooperative agreement signed in FY96 between the Alaska Department of Fish & Game, Subsistence Division, and the Chugach Regional Resources Commission would be extended to include FY97/ Under this agreement, all parties to the agreement would jointly and cooperatively:

1. Identify suites of injured resources that could be incorporated into the Traditional Ecological Knowledge (TEK) approach. This would also be done in consultation with the Chief Scientist.

2. Through the development of a training manual in FY96, the Community Facilitators would be trained to assist the PIs in their research projects by adding the traditional knowledge to the research information through interviews with local community members.

3. Over the past 15 years, the Subsistence Division has collected TEK for various projects. This information as well as any new information, will be compiled by ADF&G into an organized format and incorporated into a database template, modeled after the Whiskers! program currently managed by ADF&G. This database will then be available to all Village Councils in the spill area, regional Native organizations, Trustee Council agencies and scientists, and other user groups. Rules of access and use of this database will be developed by the communities with the assistance of CRRC and the Subsistence Division, ensuring appropriate levels of confidentiality. Training will also be provided to the communities and other use groups on the use of the database by the Subsistence Division. This is a continuation of work begun under the TEK portion of 96052.

4. ADF&G will provide training for and assistance to EVOS researchers/scientists on the interpretation and potential application of TEK to their restoration projects. This might include a separate workshop and/or ongoing involvement with select researchers.

The specific tasks the local Community Facilitators are expected to undertake include the following:

1. Inform the Spill Area Wide Coordinator of community issues, concerns or questions regarding the oil spill. These issues could be identified through community meetings conducted by the Community Facilitators or through other means and could include ideas for new projects.

2. Assist the Spill Area-Wide Coordinator in increasing community involvement in restoration projects. This will include the development of a community labor database, listing the names, telephone numbers, area of expertise, and compensation requirements of specific community members who are interested

and able to work on the EVOS Trustee Council funded projects. Areas of expertise range anywhere from skiff and other equipment availability, general laborers, and interviewers, to research assistants, guides, and traditional wisdom holders.

3. Work with the Spill Area-Wide Coordinator in coordinating the annual round of Trustee Council community meetings as well as community visits from project PIs. The Community Facilitator will also serve as the initial contact in the village for any project conducted in the traditional use areas of the communities.

4. The Community Facilitators are responsible for ensuring that the protocols and guidelines developed in FY96 are strictly adhered to by all parties involved in the Trustee Council funded project.

5. Work closely with the village council's tribal traditional natural resource program to coordinate all activities that have a direct impact the local community resources and any research projects that will complement the tribe's traditional knowledge of the traditional use areas.

6. Disseminate to community members the monthly update from the Spill Area-Wide Coordinator.

7. All Community Facilitators shall attend the annual Restoration Workshop and associated meetings, including certain scientific review sessions (on SEA, persisting oil, marine mammal projects, etc.)

8. Assist in identifying injured species on which TEK should be collected.

9. Receive training on the use of the TEK database and assist in keeping the information updated in regards to their specific community.

10. Conduct interviews with local traditional wisdom holders under the supervision of the Spill Area-Wide Coordinator and the Subsistence Division.

Additional duties to be undertaken by the ADF&G Subsistence Division include:

1. Serve as contact point for community assistants trained under 95279 (food safety testing) to handle sample of abnormal resources, facilitate processing of samples, and communicate findings back to the communities.

2. Provide technical expertise and general assistance to the Restoration Office, Trustee Council, Spill Area-Wide Coordinator, and PIs on subsistence restoration, including assistance in the development and writing of project proposals.

3. Prepare monthly narrative reports for the Trustee Council Executive Director summarizing interactions by Subsistence Division staff with the public on oil spill restoration topics.

4. Administer the cooperative agreement with CRRC, which will include reviewing the processing invoices, reviewing quarterly reports, and monitoring contractor performance.

## NEED FOR THE PROJECT

### A. Statement of Problem

The *Exxon Valdez* oil spill caused severe disruption of the lives of many people living in the spill impacted area. The spill also caused residents of the area to be concerned about the safety of their wild food sources, and the integrity of the surrounding natural environment. While scientific studies aimed at restoring the resources and services damaged by the oil spill have occurred throughout the spill area, most of the researchers work for agencies or institutions based in Anchorage, Fairbanks, or outside Alaska. Residents have voiced concern over a lack of involvement by spill area communities in the restoration efforts, and incomplete communication to spill area inhabitants of study proposals and results. While the past two years have facilitated an increasing amount of communication between the scientists and the communities, there still exists a void for meaningful involvement in the restoration process by the community members at the grass roots level. At the same time, researchers have recognized that local residents have traditional knowledge that could help them answer questions they have not been able to answer through conventional scientific means.

### B. Rationale

People living in the spill area have detailed knowledge about the condition of resources, which can significantly add to data collected as part of scientific studies, and possibly even enhance the success of restoration efforts. Local people have expressed a desire to be involved in all aspects of restoration projects, and a willingness to work with researchers.

This project furthers the Trustee Council's goal of facilitating the involvement of spill area residents and resource users in the restoration process.

Village Councils are currently developing their own natural resource use plans with the assistance of CRRC, and any outside activities need to be incorporated into those plans.

## C. Summary of Major Hypotheses and Objectives

The objectives of the project will be to:

1. Increase the meaningful involvement of spill area communities in the restoration efforts of the Trustee Council;

2. Improve the communication of findings and results of restoration efforts to spill area village councils and inhabitants and the appropriate regional organizations. It is expected that by doing so, this project will increase the effectiveness of overall restoration efforts; and

3. Develop a means by which western science and traditional wisdom can be compiled and utilized in a cooperative manner with the intent of furthering the restoration process in a way that is sensitive to the needs of the affected communities.

## D. Completion Date

Since the objective of this project is to integrate the local communities into the restoration program, we see a need to continue this program until the spill restoration project is complete. The project should be evaluated on a yearly basis to determine how it can best serve the needs of the Trustee Council and the local communities.

## COMMUNITY INVOLVEMENT

The core of this project is community involvement.

## FY97 BUDGET

| Budget Line Items | CRRC | ADF&G | In-Kind | Total Budget |
|---|---|---|---|---|
| Personnel (incl. Fringe) | $ 0.00 | $59,126.00 | 28,000.00 | $59,126.00 |
| *Division Project Coordinator (Miraglia)* | *0.00* | *50,270.00* | *0.00* | *50,270.00* |
| *TEK Data Compilation/Input (Simeone)* | *0.00* | *8,856.00* | *0.00* | *8,856.00* |
| *CRRC Executive Director* | *0.00* | *0.00* | *9,500.00* | *9,500.00* |
| *Natural Resource Specialists`* | *0.00* | *0.00* | *18,500.00* | *18,500.00* |
| Travel | 35,000.00 | 5,000.00 | 2,500.00 | 40,000.00 |
| Contractual | 200,000.00 | 0.00 | 17,000.00 | 217,000.00 |
| *Community Facilitators* | *150,000.00* | *0.00* | *0.00* | *150,000.00* |
| *Spill Area Wide Coordinator* | *48,000.00* | *0.00* | *0.00* | *48,000.00* |
| *Technical Assistance* | *2,000.00* | *0.00* | *0.00* | *2,000.00* |
| *Alaska Inter-Tribal Council* | *0.00* | *0.00* | *12,000.00* | *12,000.00* |
| *Native American Fish & Wildlife Society* | *0.00* | *0.00* | *5,000.00* | *5,000.00* |
| Commodities | 250.00 | 500.00 | 2,500.00 | 3,250.00 |
| Equipment | 0.00 | 25,000.00 | 0.00 | 25,000.00 |
| Capital Outlay | 0.00 | 0.00 | 0.00 | 0.00 |
| Subtotal | $235,250.00 | $89,626.00 | 50,000.00 | $374,876.00 |
| General Administration | 23,525.00 | 26,985.00 | 5,000.00 | 55,510.00 |
| Project Total | $258,775.00 | $116,611.00 | $55,000.00 | $430,386.00 |

## PROJECT DESIGN

### A. Objectives

1. To increase the involvement of spill area communities in the restoration efforts of the Trustee Council.

2. To improve the communication of findings and results of restoration efforts to spill area village councils and their members and the appropriate regional Native organizations in a format that is more meaningful and easier to understand.

3. To improve the communication of traditional ecological knowledge and wisdom from local residents to scientists, which can significantly enhance the value of Trustee Council restoration efforts.

### B. Methods

The project will be implemented by a Spill Area-Wide Coordinator hired through a contract with the Chugach Regional Resources Commission, and the local Community Facilitators, with the assistance of the Alaska Department of Fish & Game's Division of Subsistence.

The objectives will be achieved using the following methods:

A contract will be renewed by ADF&G Subsistence Division to CRRC for overall coordination of the Community Facilitators and Spill Area-Wide Coordinator. The contractor will be expected to arrange for the hiring (where applicable) and coordination of local facilitators in the communities of Chenega Bay, Tatitlek, Port Graham, Nanwalek, Cordova, Seward, Valdez, Seldovia, and regional coordinators for the Kodiak Island and Alaska Peninsula regions.

Working with the Community Facilitators, the Spill Area-Wide Coordinator will identify those projects funded by the Trustee Council for which a community outreach component would be appropriate, and will work with the principal investigators of those projects to design and implement community outreach components. The goal of community outreach will be to continue the partnership begun under 95052 between the people of the oil spill region and scientific researchers. Outreach will include communication of traditional knowledge and local interests, as well as communication of research proposals and study results.

The effectiveness of the project will be evaluated on an annual basis, by the Trustee Council staff working in cooperation with the Spill Area-Wide Coordinator, the communities in the oil spill region, and the Subsistence Division of the ADF&G.

## C. Contracts and Other Agency Assistance

A contract will be let to CRRC for overall coordination of a facilitator network through a Spill Area-Wide Coordinator. The contractor will be expected to arrange for the hiring and coordination of local facilitators in the communities of Chenega Bay, Tatitlek, Port Graham, Nanwalek, Cordova, Seward, Valdez, Seldovia, and regional coordinators for the Kodiak Island and Alaska Peninsula regions. However, all other communities in the oil spill impacted area will also be included in outreach efforts, even though a local facilitator will not be hired in each community.

These tasks are being contracted out for the following reasons:

1. The use of a regional organization as opposed to a state agency would better serve the needs of the local community members.

2. The Trustee Council has encouraged contracting tasks out to the private sector as much as possible, and as appropriate.

3. The state procurement systems makes it difficult to contract directly with the communities in the oil spill region. It has proven to be simpler to contract out the coordination of the facilitator network on a sole source basis with CRRC, who has an established working relationship with the communities.

## D. Location

The project will be undertaken throughout the oil spill region Local Community Facilitators will be hired in the communities as mentioned above, however, all other communities in the oil spill impact area will also be include din outreach efforts, even though a local facilitator will not be hired in each community.

The project's benefits will be realized both in the communities involved and in the restoration of the injured resources. Better communication among the Trustee Council staff, researchers, and residents of the communities impacted by the spill should improve the effectiveness of restoration efforts.

## SCHEDULE

### A. Measurable Project Tasks for FY97

| | |
|---|---|
| October 1, 1996 | Contract with CRRC and ADF&G Renewed |
| October 1, 1996 | Subcontract with Martha Vlasoff Renewed |
| October 1, 1996 | Subcontracts with Communities for Community Facilitators developed or renewed |
| October 1-31, 1996 | MOU renewed between ADF&G & CRRC |
| Ongoing | Identification of Species for TEK |
| November, 1996 | Training Workshop for Community Facilitators |
| Nov. 1 - Dec. 31, 1996 | Preparation for Annual Restoration Workshop |
| Nov., 1996 | Coordinate development of new projects w/ communities |
| January, 1997 | Participate in Annual Restoration Workshop |
| January, 1997 | Conduct Annual Review of Protocols for TEK |
| Oct. 1996 - Mar. 1997 | Database complete and ready for training and dissemination to communities |
| March-April, 1997 | Work with communities to develop and/or write proposals for FY98 work plan |
| March-April, 1997 | Work with communities to compile final reports |
| April, 1997 | Conduct Training for Comm. Facil. on Database |
| Ongoing | Provide ongoing technical assistance to Facilitators |

### B. Project Milestone and Endpoints

The project should be continued as long as there are significant restoration efforts underway. The project should be evaluated on a yearly basis to determine the most efficient way to continue to keep the communities involved in the Trustee Council Restoration Program.

## C. Project Reports

Annual reports will be compiled in coordination with the ADF&G and provided each year by CRRC on April 15th, describing and summarizing the progress made during the previous federal fiscal year. In addition, bi-monthly reports will be provided to the participating communities by the Spill Area-Wide Coordinator.

## COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This community outreach effort is in fact a novel effort to coordinate the Restoration Program with the local residents and builds on the established relationship between CRRC and the communities in Prince William Sound. Under this project, CRRC will work to establish new relationships with Seldovia, Kodiak Island and Alaska Peninsula area residents.

CRRC is contributing a considerable amount of in-kind services to the project. A new program is being developed by CRRC, with the assistance of the Alaska Inter-Tribal Council and the Native American Fish & Wildlife Society. This program is for the establishment of tribal traditional natural resource programs in four of the villages in the Chugach Region. CRRC, through a BIA contract, is providing a total of $36,800 in salaries and fringe for four natural resource specialists to be hired at the local level. The Alaska Inter-Tribal Council is contributing an additional $12,000 for the program development, as well as technical assistance. The Native American Fish & Wildlife Society is contributing the technical expertise of their contracted biologists to provide training and technical assistance at the local level. Part of the initial duties of the Natural Resource Specialists will be to collect traditional harvest and other baseline data (such as population assessments) on the resources in their traditional use areas. This information can then be incorporated into the TEK portion of the project. It has been suggested to the communities that the Community Facilitators also serve as the Natural Resource Specialists to aid in maximizing the available funds. CRRC is currently in the process of seeking funds to start tribal traditional natural resource programs in each of the seven villages in the Chugach Region.

## ENVIRONMENTAL COMPLIANCE

This project is categorically excluded under NEPA guidelines.

## PERSONNEL

Patty Brown-Schwalenberg: Ms Brown is the Executive Director of the Chugach Regional Resources Commission (CRRC). She has worked for the past 13 years in such positions as Tribal Administrator for her tribe, the Lac du Flambeau Band of Lake Superior Chippewa Indians, Society Administrator for the Native American Fish & Wildlife Society, Office Manager of the Bering Sea Fisheries Development Fund, and as a private consultant, assisting Alaska Native communities in obtaining funding for natural resource management programs, and setting up their natural resource program administrative systems. CRRC and the previous organizations that Ms Brown has operated have consistently met all standards of proper management, including annual program and financial audits.

Martha Vlasoff: CRRC will renew the subcontract with Ms. Vlasoff to be the Spill Area-Wide Coordinator for this project. She has been active in spill area issues for six years and has worked for the Chugach Heritage Foundation in their Language Rejuvenation Project. Ms. Vlasoff was a resident of Tatitlek for 15 years and has been very active in native issues within the State of Alaska. Ms. Vlasoff is also on the Board of Directors for the Keepers of the Treasures and the Alaska Conservation Foundation organizations. Ms. Vlasoff will also be utilizing outside technical assistance in various aspects of the project throughout the fiscal year.

Rita Miraglia: Ms Miraglia has served as the oil spill coordinator for the Division of Subsistence since 1990. As such, she has organized and participated in the subsistence resource collection and testing programs of 1990 and 1991, and participated in the community based subsistence restoration planning process, begun in 1994. She has served as the Division's primary liaison with the Oil Spill Health Task Force. She has been the lead communicator of restoration study findings to communities in the oil spill impact area through community meetings and newsletters. Ms Miraglia has a Masters degree in Anthropology from the State University of New York. Before coming to the Division, she worked for Chugach Alaska Corporation. As a member of CAC's Oil Spill Response Team, Ms Miraglia sat on the Interagency Shoreline Clean-up Committee in Valdez in 1989, and the Cultural Technical Advisory Group in 1990, working to ensure that the concerns of the predominantly Alaska Native communities and native regional organizations were considered in the oil spill response. Under the present proposal, Ms Miraglia will serve as project coordinator for the Division (10 months).

Dr. Bill Simeone: Dr. Simeone was added to the Subsistence Division staff in 1995 as a Subsistence Resource Specialist. He is a Sociocultural Anthropologist, with a Doctor of philosophy degree from McMaster University. Before coming to the Division, Dr. Simeone worked as a consultant with Stephen Braund and Associates. His duties with Braund included working with the communities in the oil spill area, documenting the impacts of the spill. Under the present proposal, Dr. Simeone will be assigned for two

months to serve as the lead on preparation of the integrated database, including negotiation of agreements regarding confidentiality and disposition of data.

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Proposed Project Leader: Patty Brown-Schwalenberg
Chugach Regional Resources Commission
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Proposed Project Manager: Dr. Joseph R. Sullivan
Habitat & Restoration Division
Alaska Department of Fish & Game
333 Raspberry Road
Anchorage, Alaska 99518
phone number: 267-2213
fax number: 522-3148

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Date Prepared

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1996 | Proposed FFY 1997 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Personnel | | $59.8 | | | | | | |
| Travel | | $5.0 | | | | | | |
| Contractual | | $286.3 | | | | | | |
| Commodities | | $0.5 | | | | | | |
| Equipment | | $0.0 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
| Subtotal | $0.0 | $351.6 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| General Administration | | $27.2 | | | | | | |
| Project Total | $0.0 | $378.8 | | | | | | |
| Full-time Equivalents (FTE) | | 1.0 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

Comments:
In addition to the funds requested in this project proposal, the Chugach Regional Resources Commission is also contributing an additional $55,000 in-kind to the project in the way of technical assistance, staff time, and financial assistance.

**1997**

Prepared:



Project Number: 97052
Project Title: Community Involvement & Use of Traditional Ecological Knowledge
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

4/16/96

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1996 - September 30, 1997

| **Personnel Costs:** | | GS/Range/ | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|
| Name | Position Description | Step | Budgeted | Costs | Overtime | FFY 1997 |
| Rita A. Miraglia | Subsistence Resource Specialist III | 18B | 10.0 | 5.1 | 0.0 | 51.0 |
| William Simeone | Subsistence Resource Specialist II | 16B | 2.0 | 4.4 | 0.0 | 8.8 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | Subtotal | | 12.0 | 9.5 | 0.0 | |
| | | | | | **Personnel Total** | $59.8 |

| **Travel Costs:** | Ticket | Round | Total | Daily | Proposed |
|---|---|---|---|---|---|
| Description | Price | Trips | Days | Per Diem | FFY 1997 |
| Anchorage-Port Graham/Nanwalek | 0.2 | 1 | 2 | 0.1 | 0.4 |
| Anchorage-Chenega Bay/Tatitlek | 1.3 | 1 | 2 | 0.1 | 1.5 |
| Anchorage-Alaska Peninsula | 1.0 | 1 | 2 | 0.1 | 1.2 |
| Anchorage-Kodiak City | 0.2 | 1 | 1 | 0.1 | 0.3 |
| Kodiak City-Akhiok | 0.2 | 1 | 1 | 0.1 | 0.3 |
| Kodiak City-Karluk | 0.1 | 1 | 1 | 0.1 | 0.2 |
| Kodiak City-Larsen Bay | 0.1 | 1 | 1 | 0.1 | 0.2 |
| Kodiak City-Old harbor | 0.1 | 1 | 1 | 0.1 | 0.2 |
| Kodiak City-Ouzinkie | 0.1 | 1 | 1 | 0.1 | 0.2 |
| Kodiak City-Port Lions | 0.1 | 1 | 1 | 0.1 | 0.2 |
| Anchorage-Cordova | 0.2 | 1 | 1 | 0.1 | 0.3 |
| | | | | | 0.0 |
| | | | | **Travel Total** | $5.0 |

**1997**

Prepared:

Project Number: 97052
Project Title: Community Involvement & Use of Traditional Ecological Knowledge
Agency: Alaska Department of Fish and Game

FORM 3B
Personnel
& Travel
DETAIL



4/16/96

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| **Contractual Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| Contract with Chugach Regional Resources Commission<br>4A Linkage | 286.3 |
| When a non-trustee organization is used, the form 4A is required. **Contractual Total** | $286.3 |

| **Commodities Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| Printing, telephone, zerox costs | 0.5 |
| **Commodities Total** | $0.5 |

**1997**

Prepared:

Project Number: 97052
Project Title: Community Involvement & Use of Traditional Ecological Knowledge
Agency: Alaska Department of Fish and Game

FORM 3B
Contractual & Commodities
DETAIL



4/16/96

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1996 - September 30, 1997

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

**1997**

Project Number: 97052
Project Title: Community Involvement & Use of Traditional Ecological Knowledge
Agency: Alaska Department of Fish and Game

FORM 3B
Equipment
DETAIL

Prepared: 4/16/96

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1996 | Proposed FFY 1997 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Personnel | | $0.0 | | | | | | |
| Travel | | $35.0 | | | | | | |
| Contractual | | $200.0 | | | | | | |
| Commodities | | $0.3 | | | | | | |
| Equipment | | $25.0 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
| Subtotal | $0.0 | $260.3 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| Indirect | | $26.0 | | | | | | |
| Project Total | $0.0 | $286.3 | | | | | | |
| Full-time Equivalents (FTE) | | 0.0 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

Comments:

**1997**

Prepared: 5 of 8

Project Number: 97052
Project Title: Community Involvment & Use of Traditional Ecological Knowledge
Name: Chugach Regional Resources Commission

FORM 4A
Non-Trustee
SUMMARY

4/16/96

## 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Personnel Costs: | | | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|
| | Name | Position Description | Budgeted | Costs | Overtime | FFY 1997 |
| | | | | | | 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 | FFY 1997 |
| | Port Graham to Anchorage | 0.4 | 3 | 8 | 0.2 | 2.8 |
| | Tatitlek to Anchorage | 0.9 | 3 | 8 | 0.2 | 4.3 |
| | Chenega Bay to Anchorage | 0.9 | 3 | 8 | 0.2 | 4.3 |
| | Seldovia to Anchorage | 0.4 | 3 | 8 | 0.2 | 2.8 |
| | Nanwalek to Anchorage | 0.4 | 3 | 8 | 0.2 | 2.8 |
| | Cordova to Anchorage | 0.3 | 3 | 8 | 0.2 | 2.5 |
| | Valdez to Anchorage | 0.3 | 3 | 8 | 0.2 | 2.5 |
| | Kodiak to Anchorage | 0.9 | 3 | 8 | 0.2 | 4.3 |
| | Bristol Bay to Anchorage | 0.9 | 3 | 8 | 0.2 | 4.3 |
| | Seward to Anchorage | 0.3 | 3 | 8 | 0.2 | 2.5 |
| | Anchorage to Miscellaneous Villages in Spill Area by Coordinator | 0.3 | 4 | 7 | 0.1 | 1.9 |
| | | | | | | 0.0 |
| | | | | | **Travel Total** | $35.0 |

**1997**

Prepared:

Project Number: 97052
Project Title: Community Involvement & Use of Traditional Ecological Knowledge
Name: Chugach Regional Resources Commission

FORM 4B
Personnel & Travel
DETAIL



4/16/96

## 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| **Contractual Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| Community Facilitators | 150.0 |
| Spill Area Wide Coordinator | 48.0 |
| Honoraria | 2.0 |
| **Contractual Total** | $200.0 |

| **Commodities Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| | 0.3 |
| **Commodities Total** | $0.3 |

**1997**

Prepared:

Project Number: 97052
Project Title: Community Involvement & Use of Traditional Ecological Knowledge
Name: Chugach Regional Resources Commission

FORM 4B
Contractual & Commodities DETAIL

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1996 - September 30, 1997

| **New Equipment Purchases:** | Number | Unit | Proposed |
|---|---|---|---|
| Description | of Units | Price | FFY 1997 |
| Computers for local facilitators | 10 | 2.5 | 25.0 |
| | | | 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** | $25.0 |

| **Existing Equipment Usage:** | Number | |
|---|---|---|
| Description | of Units | |
| | | |

**1997**

Project Number: 97052
Project Title: Community Involvement & Use of Traditional Ecological Knowledge
Name: Alaska Department of Fish and Game

FORM 4B
Equipment
DETAIL

Prepared: 4/16/96

**PROJECT TITLE: A MASS-BALANCE MODEL OF TROPHIC FLUXES IN PRINCE WILLIAM SOUND.**

Project Number: 97054

Restoration Category:

Proposer: Fisheries Centre, University of British Columbia, Vancouver, British Columbia, V6T 1Z4, Canada.

Lead Trustee Agency:

Cooperating Agencies:

Alaska Sea Life Center:



Duration: 2 years

Cost FY 97: $138,267.4

Cost FY 98: $74,120

Geographic Area: Prince William Sound

Injured Resource/Service: All injured biological resources and all damaged services

## ABSTRACT

Support is requested for a two-year project devoted to the construction, validation, and dissemination of a model of trophic interactions among the organisms of Prince William Sound (PWS), as required to synthesize the vast amount of information gathered before and after the 1989 *Exxon Valdez* spill, and to evaluate its impact at the ecosystem level. Project components are: 1) an initial workshop devoted to model specification by PWS researchers, 2) an extended study by project staff, and 3) a dissemination phase consisting of a training workshop for potential users of the software implementing the model, and the production of a CD-ROM for the public domain, incorporating an interactive graphic version of the software, and an extensive database on the biology and local/traditional knowledge on the fishes of PWS.

## INTRODUCTION

The project proposed here is a response to the fact, noted by the Trustee Council, that "the restoration program has reached a stage where it is appropriate to integrate and synthesize what is being learned from different research and monitoring projects" and thus to enable the Trustee Council "to view the effects of the oil spill and the long-term restoration and management of injured resources and services from an ecosystem-level perspective." (EVOS Trustee Council, 1996, p.53) The approach proposed to achieve this is based on the reasoning that biological production (expressed as energy or carbon) in a given ecosystem must be either exported or consumed locally, and that the biological production of a given group that is not exported must be equal to that which is consumed by the other groups in the system. Such simple mass-balance constraint, when explicitly formulated for each of the major species or functional groups of an ecosystem, can be used to validate (or correct) independent standing stock and flux estimates, and to rapidly construct thermodynamically "possible" trophic models of ecosystems. Models of this sort can then be used to draw numerous inferences on the structure of ecosystems, and the interactions among their components (Christensen and Pauly 1992a, b, 1995, Pauly and Christensen 1993, Pauly and Christensen 1995).

The project proposed here is to construct a trophic model, based on the well-documented ECOPATH II software, used from both the above-cited contributions and the models of diverse ecosystems presented by various authors in Christensen and Pauly (1996). The structure of the model will by based on inputs by colleagues studying the various groups in PWS with EVOS funding, and other experts to be contacted as appropriate. This broad participation, and the consensus-seeking process used for model specification should ensure that the product will be perceived as state-of-the-art within the EVOS community.

Further, the system of linear equations underlying mass-balance models can be straightforwardly reexpressed as a system of coupled differential equations using a new module (ECOSIM) of the ECOPATH II software (Walters et al , MS). This allows, once mass-balance has been established, the rapid construction of a simulation model for any ecosystem. Thus, the proposed project will also generate a simulation model of trophic interactions in PWS, allowing e.g. "preliminary examination of the potential impacts of large-scale perturbations such as the major decline in the population of Pacific herring." (EVOS Trustee Council, 1996, p.53.)

To ensure the acceptability and wide dissemination of the model , among the public as well as among managers, the product will be released in the context of a training/evaluation workshop, and also made available for distribution by the Trustee Council to interested organizations and institutions, including schools, in form of a CD-ROM that will also contain a database with local /traditional knowledge and scientific information on all fishes of PWS, and of Alaska, i.e., a locally-enriched, customized version of FishBase, the global, computerized encyclopedia of fishes. (see MacCall and May 1995)

## NEED FOR THE PROJECT

### A. Statement of Problem

"Research sponsored by the Trustee Council has produced many data sets on the distribution, abundance and productivity of many species and ecological communities of the northern Gulf of Alaska and Price William Sound. These data need to be integrated in a simple model to benefit long-term resource Management." Also , "the restoration program will increasingly focus on an integrated, ecological approach. To that end, The Trustee Council has identified a possible need for a simple cost-effective ecosystem model" (EVOS Trustee Council, 1996, p.53.)

In a large, multi-faceted research program it is often easy to lose track of the relevance and position of each individual project in the overall picture that is being created. Several EVOS-funded projects are devoted to the biology and ecology of distinct groups of organisms, sometimes also including their prey, and /or their predators. A straightforward approach to link these organisms, and hence the projects that study them, is through the fact that all organisms, in natural ecosystems, are connected through feeding links. Indeed, trophic interactions are among the most significant links between organisms, especially when considering how to restore a damaged environment and to monitor the potential flows of toxic residues through that environment.

### B. Rationale/Link to Restoration

A rapidly-achieved overview of the trophic structure of Prince William Sound and the relationships between the different species and groups that inhabit the area will assist both individual EVOS projects and in planning future policy. For example, an ECOPATH II model of PWS will be able to indicate whether there has been, since the oil spill, a shift in the trophic structure that is hindering the recovery of seabirds and marine mammals. As well, a quantitative analysis of the relationships between seabird foraging and hatchery-released fish will help to identify problems in the restocking program. The versatility of the ECOPATH II system allows it to produce a fast and cost-effective overview of any part of the system. The basic idea of this project is that the use of a mass balance model such as ECOPATH II will allow easy identification of areas of trophic flux that will be of great interest to all workers involved in the restoration project. The initial workshop will allow the input of data and ideas from a range of people from different projects, while the subsequent analysis of the output from the model will provide feedback and ideas to the researchers in the individual projects.

Further, the outputs from the ECOSIM module of ECOPATH II will allow rapid exploration of the predicted consequences of various intervention or events (e.g. restocking, selective harvesting, or changes in some physical forcing functions). The final evaluation meeting will provide a forum for validating and teaching the use of this relatively simple model for evaluating management options for PWS.

Production of an interactive software displaying temporal changes resulting from the direct or indirect effects of management interventions will allow for novel approaches for explaining basic ecological

principles, and species interactions in PWS to the general public, schoolchildren and various special groups. The public impact of the proposed project will be strengthened by embedding its main output, the ECOPATH II/ECOSIM model of PWS, into a database on the fish of PWS region, i.e., a version of

the computerized encyclopedia of fishes known as FishBase, whose coverage of Alaskan fishes will be completed by incorporation of as much biological and local/traditional knowledge as can be straightforwardly extracted from published sources.

### C. Location

The model to be constructed will refer to PWS in the narrow sense. The proposed workshops (one for model specification , and one for product release, see above) will be held at locations which will minimize participants' travel and other costs, presumably in Anchorage. The biological and local/traditional knowledge to be incorporated into FishBase will pertain to the wider PWS region, i.e., include information from outside PWS proper.

## COMMUNITY INVOLVEMENT

Trophic linkages derived from the experience of fishers and hunters will be considered when specifying the PWS model if citeable sources can be found documenting this experience. Similarly, all local/traditional knowledge on the fishes of the PWS region to be included in FishBase will rely on published sources, as the project does not include a field component. However, care will be taken to enable access to all scientific information on the fishes of the PWS region through local common names, in as many aboriginal languages as possible, using the routines newly incorporated into FishBase for such coverage of common names. We anticipate, based on our experience with First Nations in British Columbia, that this specific aspect of the database will to be particularly attractive to aboriginal leaders and communities [A project extension phase to deepen this specific aspect of the database, and which would include a field work component, may be proposed, given an expression of interest by the Trustee Council]

## PROJECT DESIGN

### A Objectives

The project objectives for FY 97 will be:

1. Prepare and hold a one-week PWS model specification workshop;
2. Use inputs from 1. and published literature to construct/balance a first model;
3. Interact with experts and modify ECOPATH mass-balance model until consensus on trophic interactions in PWS is reached;
4. Enter biological information, local names in local languages, and local knowledge (sofar published) on PWS region fishes into FishBase

For FY 98, the project objectives will be:

5. Modify ECOPATH II such that seasonal changes are explicitly considered when establishing mass balance;
6. Link the ECOSIM module of the PWS model with an existing model of PWS capable of predicting primary production, and thus drive the trophic interactions in ECOSIM;
7. Prepare aCD-ROM with ECOPATH/ECOSIM model(s) of PWS, and a database on the fishes of the PWS region;
8. Prepare and hold a one-week workshop to present and disseminate the final product (in 7), and teach its use.

Additionally, throughout the duration of the project, and beyond, every opportunity will be taken to present the project and its products, especially at conferences and in the primary literature.

## B Methods

Based on work of Dr. J.J. Polovina (1984), of the US National Marine Fisheries Service, Drs. D. Pauly and Villy Christensen, then both at the International Center for Living Aquatic Resources Management (ICLARM) in Manila, Philippines, have developed an approach, implemented as a well-documented software for personal computers, which allows for rapid construction and verification of mass-balance models of ecosystems (Christensen and Pauly 1992 a, b). The steps involved consist essentially of:

(i) Identification of the area and period(s) for which a model is to be constructed (here PWS proper, before and after the spill);
(ii) Definition of the functional groups (i.e., "boxes") to be included;
(iii) Entry of a diet matrix, expressing the fraction that each "box" in the model represents in the diet of its consumers (with uncertainty being accommodated by wide intervals about the entries);
(iv) Entry of food consumption rate, of production/biomass ratio or of biomass, and of fisheries catches, if any, for each box (with uncertainty again being accommodated by wide intervals about the entries);
(v) Balance the model using either a Monte Carlo approach (i.e., randomly selecting entries from input distributions and selecting model realization based on parameters closest to central values) or modify entries (iii&iv) until input = output for each box;
(vi) Compare model outputs ( network characteristics, estimated trophic levels and other features of each box) with estimates for the same area during another period, and or with outputs of the same model type from other, similar areas, etc., and use result of comparison to ensure that inputs are credible;
(vii) Use model balanced in (vi) to generate simulation model via the ECOSIM module of ECOPATH, run same and test its sensitivity to various perturbations;
(viii) Use results in (vii) to refine mass balance model if required, then output different runs

These steps can be implemented easily when basic parameter estimates exist (as in the case of PWS), and numerous, well-documented examples already exist of ECOPATH II applications to aquatic ecosystems, ranging from aquaculture ponds and flooded rice paddies to shelf systems (see Pauly and Christensen

1993, and contributions in Christensen and Pauly 1993), notably the North Sea, and preliminary versions of three systems relatively close and similar to PWS (Georgia, Strait, Vancouver Island and Alaska Gyre), constructed during a one-week workshop similar to the one proposed here, and held in November 1995. Each participant will cover a functional group and its associated fluxes: phytoplankton and primary production, marine bacteria and their consumption of detritus, zooplankton and secondary production, major fish species and their fisheries, marine mammals and birds and their food consumption. Rate and biomass estimates will be standardized for the PWS area and for two different periods ( pre spill and post spill). Ongoing analysis of data and model updating will provide a means of incorporating new information from the various EVOS projects and also a route for identification of possible gaps in current research. Thus, the work of project staff can be tailored to requirements identified during the specification workshop.

## C Cooperating Agencies, Contracts and Other Agency Assistance

The PIs and other investigators of all EVOS-funded projects devoted to studying PWS organisms will be contacted (preferably through the Trustee Council), and invited to participate, along with other experts, in the model specification workshop, and the subsequent validation process. Personal contacts were established during the January 1996 Restoration Workshop which will facilitate this; however commitments were not sought at this stage, as they were assumed to be easy to obtain one the project has been approved..

The Fisheries Centre, UBC, will subcontract item 4 under "Objectives" (see above) to the FishBase Project of the (non-profit) International Center for Living Aquatic Resources Management (ICLARM), Manila Philippines, both because data encoding in the Philippines is extremely cost-effective, and more importantly, because data entry for FishBase is done only centrally, by FishBase project staff. (Note that creating local alternative to FishBase would not be cost effective, due to the major international investment that has already gone into FishBase). Additionally, the Fisheries Centre will subcontract item 7 to an off-campus consultant who is an affiliate of the Fisheries Centre and has experience with fisheries related projects. All other items will be handled by Fisheries Center faculty, or affiliates, or project staff to be hired by the Fisheries Centre.

## SCHEDULE

### A Measurable Project task for FY 97 (October 1, 1996 - September 30, 1997)

| | |
|---|---|
| 1) October 1 - February 28: | prepare and hold model specification workshop (early 1997) and prepare documention of same for publication in Fisheries Centre Research Report series. |
| 2) December 1: | Initiate entry of data on Alaskan fishes into FishBase; |
| 3) March - September 30: | Refine model initially specified during workshop, with emphasis on data from EVOS projects, and their uncertainty, and present model at scientific conferences(incl. at the 1997 Restoration Workshop), and in the primary literature. |

## B Project Milestones and Endpoints

*FY 97 Milestones (besides required annual reports):*
January 1997: Presentation of concept at Annual Restoration Workshop;
February 1997: Holding of PWS Model Specification Workshop;
April 1997: Publication of workshop report;
June 1997: Submission of two scientific papers documenting key features and behavior of trophic mass-balance model(s) of PWS;
August 1997: Submission to Trustee Council of first FishBase CD-ROM enriched with information on PWS fishes.
*FY 98 Milestones (besides required annual reports):*
November 1997: incorporation into ECOPATH of a routine explicitly accounting for seasonal oscillations, and submission of scientific paper documenting this feature, illustrated through a PWS mass-balance model accounting for seasonal oscillations of all input parameters; .
January 1998: Presentation at Annual Restoration Workshop of an ECOSIM-based trophic simulation model, with primary production driven by a physical model of PWS.
March /April 1997: holding of final workshop;
August 1998: release of CD-ROM with PWS ECOPATH/ECOSIM models and database on scientific and local knowledge of PWS fishes, for distribution by Trustee Council.

## C Completion Dates

As for "Milestones;" project will be completed on August 1998 (FY 98)

## PUBLICATIONS AND REPORTS

The above project milestones identify anticipated publications and reports; more details cannot be provided at present. The publication record of the Principal Investigator (see attached resume) is invoked here: we will document and publish our work in the primary literature.

## PROFESSIONAL CONFERENCES

The principal Investigator is often invited to present keynotes at various conferences (see resume) and will use the opportunities this provides to present the results of the proposed work, and its EVOS science context.

## COORDINATION AND INTEGRATION OF RESTORATION EFFORTS

The aim of the proposed work is to synthesize data from projects funded by the Trustee council (see above under "NEED FOR THE PROJECT")

**PROPOSED PRINCIPAL INVESTIGATOR**

Dr Daniel Pauly
Professor, Fisheries Centre,
University of British Columbia
2204 Main Mall, Vancouver, B.C.
Canada, V6T IZ4
Fax: (604) 822 8934
**E-mail: pauly@fisheries.com**

## PERSONNEL

The key qualifications of the Principal Investigator for this project is to have initiated, while still at ICLARM, Manila, Philippines, the activities which led to the emergence of the ECOPATH II approach and software, and of FishBase, and to have authored a large number of primary literature publications documenting these (see references and resume). Further, he has organized several workshops (including one in the Pacific Northwest) and training courses at which the ECOPATH II approach was taught and used. He will be responsible for items 1-8 under "Objectives".
Other project staff will include:
Dr Villy Christensen, Adjunct Professor, Fisheries Centre, who co-initiated the ECOPATH II approach and programmed most of its routines, and will be responsible for item 5 (see above);
Dr Carl Walter, Professor, Fisheries Centre, UBC, who developed the ECOSIM module of ECOPATH, and who will be responsible for item 6;
Dr Tony Pitcher, Director, Fisheries Centre UBC, who will serve as Project Manager, and
A staff member to be hired by the project, and to be responsible, together with the P.I for items 1, 2, 3, and 8.

## LITERATURE CITED

Christensen, V. and D. Pauly (editors) 1994. Trophic Models of Aquatic Ecosystems. ICLARM Conference Proceedings. 26, 390 p.

Christensen, V. and D. Pauly 1992a. ECOPATH II - A system for balancing steady-state ecosystem models and calculating network characteristics. Ecol. Modelling 61:169-185.

Christensen, V. and D. Pauly 1992b. A guide to the ECOPATH II software system (version. 2.1). ICLARM Software 6. 72 p.

MacCall, R.A. and R.M. May 1995. More than a seafood platter. Nature 376: 735.

Pauly, D. and V. Christensen 1993. Stratified models of large marine ecosystems: a general approach and an application to the South China Sea, p. 148-174. *In* K. Sherman, L.M. Alexander and B.D. Gold (editors). Stress, mitigation and sustainability of large marine ecosystems. AAAS Press, Washington,

Polovina, J.J. 1984. Models of a coral reef ecosystem I: the ECOPATH model and its application to French Frigate Schoals. Coral Reefs 3(1):1-11.

*Exxon Valdez* Oil Spill Trustee Council 1996. Invitation to submit restoration proposals for federal fiscal year 1997. *Exxon Valdez* Oil Spill Trustee Council, Anchorage.

**1997 EXXON VALDEZ TRUST_ _ COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1996 | Proposed FFY 1997 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| Personnel | | $67,000.0 | | | | | | |
| Travel | | $29,870.0 | | | | | | |
| Contractual | | $8,000.0 | | | | | | |
| Commodities | | $5,000.0 | | | | | | |
| Equipment | | $12,500.0 | | | | | | |
| Subtotal | $0.0 | $122,370.0 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| Indirect | | $15,897.4 | | | | | | |
| Project Total | $0.0 | $138,267.4 | $74,120.0 | | | | | |
| | | | | | | | | |
| Full-time Equivalents (FTE) | | 17.0 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

Comments: Indirect project costs are equivalent to UBC contract overheads and cover general services, administration, space and buildings, computer facilities, basic office supplies and communications including computer networks. They are calculated at the standard UBC contract rates for 'non-commercial govemment and NGOs' rate of 30% of the costs of on-campus personnel, 0% of off-campus personnel, and 2% of travel costs.

**1997**

Prepared:

Project Number: 97054
Project Title:
Name:

FORM 4A
Non-Trustee
SUMMARY

## 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Personnel Costs: | | | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|
| Name | Position Description | | Budgeted | Costs | Overtime | FFY 1997 |
| Dr Daniel Pauly | PI - UBCFC | | 1.5 | 8000.0 | | 12,000.0 |
| Dr Carl Walters | numerical modeller - UBCFC | | 0.5 | 8000.0 | | 4,000.0 |
| Dr Tony Pitcher | ecologist & project manager - UBCFC | | 0.5 | 8000.0 | | 4,000.0 |
| Dr Villy Christensen | ecopath model consultant | | 0.5 | 8000.0 | | 4,000.0 |
| (to be appointed) | postdoc research assistant -UBCFC | | 12.0 | 3000.0 | | 36,000.0 |
| Mr Peter Meier | CD ROM design & programming | | 0.5 | 8000.0 | | 4,000.0 |
| (to be appointed) | Secretarial support | | 1.5 | 2000.0 | | 3,000.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | Subtotal | | 17.0 | 45000.0 | 0.0 | |
| | | | | | Personnel Total | $67,000.0 |

| Travel Costs: | Ticket | Round | Total | Daily | Proposed |
|---|---|---|---|---|---|
| Description | Price | Trips | Days | Per Diem | FFY 1997 |
| PI and modeller or ecologist to workshops 1, 2 and annual EVOS me | 840.0 | 4 | 16 | 130.0 | 5,440.0 |
| Christensen from Denmark | 1700.0 | 1 | 8 | 130.0 | 2,740.0 |
| 5 US participants in workshop 1 - non-Alaskans | 1000.0 | 5 | 20 | 130.0 | 7,600.0 |
| 7 US participants in workshop 1 - Alaskans | 650.0 | 7 | 28 | 130.0 | 8,190.0 |
| postdoc to Anchorage, Fairbanks, Cordova and workshop 1 | 1650.0 | 2 | 20 | 130.0 | 5,900.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | Travel Total | $29,870.0 |

1997

Prepared:

Project Number:
Project Title:
Name:

FORM 4B
Personnel
& Travel
DETAIL

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| **Contractual Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| report draft, editing, binding and delivery | 8,000.0 |
| **Contractual Total** | $8,000.0 |

| **Commodities Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| JAZ and computer discs | 2,500.0 |
| cd rom blanks | 1,000.0 |
| LAN charges | 1,000.0 |
| secretarial | 500.0 |
| **Commodities Total** | $5,000.0 |

**1997**

Prepared:

Project Number:
Project Title:
Name:

FORM 4B
Contractual & Commodities DETAIL

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| New Equipment Purchases: | Number | Unit | Proposed |
|---|---|---|---|
| Description | of Units | Price | FFY 1997 |
| CDROM cutting machine | 1 | 3000.0 | 3,000.0 |
| Proprietory software | 1 | 1500.0 | 1,500.0 |
| notebook computer for postdoc | 1 | 5000.0 | 5,000.0 |
| JAZ'massstorage drive | 2 | 1500.0 | 3,000.0 |
| | | | 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** | $12,500.0 |

| Existing Equipment Usage: | Number |
|---|---|
| Description | of Units |
| | |

**1997**

Prepared:

Project Number:
Project Title:
Name:

FORM 4B
Equipment
DETAIL

# STATE OF ALASKA

**DEPARTMENT OF FISH AND GAME**

*DIVISION OF WILDLIFE CONSERVATION*

*TONY KNOWLES, GOVERNOR*

*1300 College Road*
*Fairbanks, AK 99701-1599*
*PHONE: (907) 459-7213*
*FAX: (907) 452-6410*

MEMORANDUM

TO: Molly McCammon
Exxon Valdez Restoration Office
Anchorage

FROM: Kathy Frost
Fairbanks

DATE: 9 May 1996

SUBJECT: Modification to DPD for 97064, Harbor Seals



---

Since we prepared and submitted the 1997 DPD for EVRO project 97064 (Monitoring, Habitat Use, and Trophic Interactions of Harbor Seals in Prince William Sound, Alaska.) we have completed the annual report for project 95064 and our spring 1995 field trip. After reviewing the data obtained and analyzed to date from our satellite tagging studies, and after discussing the data with Dr. Mike Castellini who conducts harbor seal physiology studies in conjunction with our project, we would like to recommend some changes to the field program described in the 1997 DPD.

Sensitivity analyses and simulations developed as part of the harbor seal population model showed that survival of age classes 0-4 has a large impact on the dynamics of the harbor seal population. The population is far more sensitive to changes in survival of these age classes than to changes in adult survival. Also, it seems likely that younger seals would be more sensitive to changes in food availability. Therefore, we think it is important to increase our understanding of these age classes during the remaining two years of this study.

When we began this project, it was not possible to instrument small, subadult seals with satellite-linked depth recorders (SDRs) because the tags were too large. In fall 1994, we first obtained SDRs that could be used on small seals. Including this most recent field trip in April, we have instrumented 25 adults and 18 subadults. An additional 4-6 subadults will be tagged in September, giving us an almost equal number of adults and subadults. To date only two of the young seals we tagged were thought to be pups. That is because even the small 0.5 -watt SDRs may be too large to be carried by pups for an extended period. However, recent developments in the design of satellite tags will mean that by summer 1997 a reliable 0.25-watt tag, small enough to be easily carried by a pup, should be available. We tested an early version of the 0.25 watt SDR in September 1995, and more testing will occur throughout the 1996 field season by projects around the world.

We propose the following modifications to the 1997 DPD for project 97064:

1) Reschedule the sampling and tagging of seals which would have occurred during April-May or September 1997 to late June or July 1997.

2) Tag pups of the year (instead of adults and subadults older than pups) with 0.25-watt SDRs.

3) Conduct standard sampling of all seals caught during our efforts to catch and tag pups in summer. This will expand the seasonal coverage for studies of fatty acids, stable isotopes, health and condition indices, etc. Project 97001, which coordinates field work with 97064, will also emphasize studies of pups.

These proposed modifications should provide us with a more well-rounded picture of what harbor seals in Prince William Sound are doing. It is clear from the tagging studies conducted to date that movement patterns of subadults and adults are different, and that subadults are more likely to range over a wider area. Since pups are thought to be an especially vulnerable age class, and also less flexible in the range of prey they can consume, it will be extremely valuable to obtain information on their movements and diving behavior.

I have reviewed the proposed budget for 97064 and looked for ways to save money. The proposed modifications to the field work, in addition to economizing in some other ways, will result in a budget reduction of $33,700, or almost 10%. This is due to the elimination of one field trip during 1997 and the associated costs for vessel charter, transportation of field crews, etc.

Please let us know whether these changes are acceptable. I am enclosing a revised version of the Excel budget showing the new dollar amounts. I have also sent a copy of this to Joe Sullivan at ADF&G.

cc: Joe Sullivan
Mike Castellini

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1996 | Proposed FFY 1997 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| Personnel | $129.4 | $139.4 | | | | | | |
| Travel | $10.6 | $8.2 | | | | | | |
| Contractual | $118.7 | $83.9 | | | | | | |
| Commodities | $60.9 | $59.5 | | | | | | |
| Equipment | $21.0 | $0.0 | | | | | | |
| Subtotal | $340.6 | $291.0 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| General Administration | $27.7 | $26.8 | | | | | | |
| Project Total | $368.3 | $317.8 | $150.0 | $50.0 | | | | |
| | | | | | | | | |
| Full-time Equivalents (FTE) | 1.8 | 2.3 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

Comments:

**1997**

Prepared: ~~18-Mar-96~~

Project Number: 97064
Project Title: Monitoring Habitat Use and Trophic Interactions of Harbor Seals in Prince William Sound
Agency: AK Dept. of Fish & Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY



Revised 5/15/96

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1996 - September 30, 1997

| **Personnel Costs:** | | GS/Range/ | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|
| Name | Position Description | Step | Budgeted | Costs | Overtime | FFY 1997 |
| 11-2115 | WBIII, Program Coordinator and Mngt | 18K | 10.0 | 6.3 | | 63.0 |
| 11-2113 | WBIII,Permits, Data Analysis&Interpretatic | 18L | 4.0 | 6.4 | | 25.6 |
| 11-2137 | Analyst Programmer III - GIS programmin | 17E | 2.0 | 5.2 | | 10.4 |
| 11-2206 | Biometrician II - survey statistical analysis | 19E | 1.0 | 5.9 | | 5.9 |
| Vacant | WT IV | 13D | 1.0 | 4.5 | | 4.5 |
| 11- | Biometrician II - sat tag statistical analysis | 19A | 3.0 | 5.2 | | 15.6 |
| Vacant | Graduate intern | 12A | 6.0 | 2.4 | | 14.4 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | Subtotal | | 27.0 | 35.9 | 0.0 | |
| | | | | | **Personnel Total** | $139.4 |

| **Travel Costs:** | Ticket | Round | Total | Daily | Proposed |
|---|---|---|---|---|---|
| Description | Price | Trips | Days | Per Diem | FFY 1997 |
| Fbks-Cordova for Sep surveys, 1 person | 0.5 | 1 | 10 | 0.1 | 1.5 |
| Fbks-Anchorage, tagging, 2 persons x 1 field trip | 0.2 | 2 | 2 | 0.1 | 0.6 |
| PWS-Anchorage 1-way charter, crew rotation | 0.2 | 1 | 0 | 0.0 | 0.2 |
| Portage-Whittier by train (2 vehicles per trip) | 0.4 | 2 | 0 | 0.0 | 0.8 |
| Fbks-Portage, personal vehicles | 0.3 | 2 | 0 | 0.0 | 0.6 |
| Fbks-PWS, community meetings, 1 person | 0.8 | 1 | 2 | 0.1 | 1.0 |
| Fbks-Anchorage, Harbor Seal Commission, 1 person | 0.2 | 2 | 2 | 0.1 | 0.6 |
| Fbks-Anchorage, annual workshop, 1 person | 0.2 | 1 | 5 | 0.1 | 0.7 |
| Fbks-Anchorage, workshop no advance, 1 person | 0.3 | 3 | 6 | 0.1 | 1.5 |
| Fbks-Anchorage, coordination committee, 1 person | 0.2 | 2 | 3 | 0.1 | 0.7 |
| | | | | | 0.0 |
| | | | | **Travel Total** | $8.2 |

**1997**

Prepared: 18-Mar-96

Project Number: 97064
Project Title: Monitoring Habitat Use and Trophic Interactions of Harbor Seals in Prince William Sound
Agency: AK Dept. of Fish & Game

FORM 3B
Personnel
& Travel
DETAIL

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| **Contractual Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| NOAA contract for ARGOS satellite data, FY96 obligation for Sep 96 tags | 12.0 |
| NOAA contract for ARGOS satellite data, new FY 97 tags | 12.0 |
| Print/graphics (slides for workshops, report production, summary for villages) | 0.5 |
| Long distance phone calls | 1.5 |
| Postage (DHL, courier, etc.) | 0.2 |
| Trailer parking & launch fees, Whittier ($100/trip x 2 trips) | 0.2 |
| Aircraft charter 37 hrs @ $.23/hr x 1 survey during fall molt | 8.5 |
| Vessel charter for tagging/sampling @ 1.8/day x 10 days x 1 trip | 18.0 |
| Lipid analysis contract with Dalhousie University | 30.0 |
| Freight and shipping of samples | 1.0 |
| When a non-trustee organization is used, the form 4A is required. **Contractual Total** | $83.9 |

| **Commodities Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| Genetics supplies for analysis of 50 -100 samples/year | 5.0 |
| Fuel for boats and skiffs | 2.0 |
| Biopsy punches, flipper tags, epoxy. tag supplies, film | 1.5 |
| Small boat supplies (propellers, oars, oil, etc.) | 1.0 |
| Laboratory supplies (cryovials, vacutainers, syringes, gloves, needles, etc.) | 0.8 |
| Repair supplies for skiffs, net, etc. | 2.5 |
| 12 satellite tags @ $3.7/unit (from Wildlife Computers) | 44.4 |
| Misc. field and meeting supplies (waterproof notebooks, bindings, marine charts, batteries, etc.) | 0.3 |
| Computer supplies and software for graphics, GIS, and other analyses | 2.0 |
| **Commodities Total** | $59.5 |

**1997**

Prepared: ~~18 Mar 96~~

Project Number: 97064
Project Title: Monitoring Habitat Use and Trophic Interactions of Harbor Seals in Prince William Sound
Agency: AK Dept. of Fish & Game

FORM 3B
Contractual & Commodities DETAIL

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| New Equipment Purchases: Description | Number of Units | Unit Price | Proposed FFY 1997 |
|---|---|---|---|
| | | | 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 |
|---|---|---|
| Equipment used by project, purchased with oil spill funds | | |
| Leitz binoculars | 1 | ADF&G |
| HP LIID Printer | 1 | ADF&G |
| Compaq 286 Computer | 1 | ADF&G |
| Zodiac Raft | 1 | ADF&G |
| | | |
| Equipment used by project, but purchased with non-oil spill funds | | |
| 20 ft Boston whaler | 1 | ADF&G |
| 17 ft Boston whaler | 1 | ADF&G |
| Seal nets | 1 | ADF&G |
| 2 486 computers + Plotter | 1 | ADF&G |
| Printer | 2 | ADF&G |
| Color printer | 1 | ADF&G |

**1997**

Prepared: ~~18-Mar-96~~

Project Number: 97064
Project Title: Monitoring Habitat Use and Trophic Interactions of Harbor Seals in Prince William Sound
Agency: AK Dept. of Fish & Game

FORM 3B
Equipment
DETAIL

# Monitoring, Habitat Use, and Trophic Interactions of Harbor Seals in PWS

| | |
|---|---|
| Project Number: | 97064 |
| Restoration Category: | Research, Monitoring |
| Proposer: | Kathryn J. Frost, ADF&G |
| Lead Trustee Agency: | ADF&G |
| Cooperating Agencies: | none |
| Alaska SeaLife Center: | |
| Duration: | 2nd year, 3-year project |
| Cost FY 97: | $351,600 |
| Cost FY 98: | $150,000 |
| Cost FY 99: | $50,000 |
| Geographic Area: | Prince William Sound |
| Injured Resource: | Harbor Seals |



## ABSTRACT

This project will monitor the status of harbor seals in Prince William Sound and investigate the possible causes for the ongoing decline. Aerial surveys will be conducted to determine whether the population continues to decline, stabilizes, or increases. Seals will be satellite-tagged to describe their movements, use of haulouts, and hauling out and diving behavior. Samples of blood, blubber, whiskers, and skin will be collected to study diet, health and condition, and genetic relationships to other harbor seal populations.

## INTRODUCTION

More than 300 harbor seals (36% of the seals in oiled areas) were estimated to have died in Prince William Sound (PWS) because of the *Exxon Valdez* oil spill (EVOS). ADF&G harbor seal studies began in PWS immediately after the EVOS as part of the Damage Assessment Program. They included aerial surveys to quantify mortality and necropsies to document levels of hydrocarbons and tissue damage in oiled seals. Beginning in 1991, because harbor seals were damaged by the EVOS, the Trustee Council funded a harbor seal restoration study in which ADF&G continued to monitor the trend of harbor seals in PWS and began to investigate the causes of the ongoing decline.

Annual counts were made of pups and non-pups during June, and all seals during August-September. Surveys showed a normal rate of pupping, but a continued decline in overall numbers. Methods were developed for catching harbor seals and, by September 1995, satellite tags had been successfully attached to 41 seals. Results indicate that most tagged seals used only a few haulouts near the tagging site and did not swim far to feed. Some seals traveled to the Gulf of Alaska, then returned to PWS, and a few moved between haulouts in central PWS and glaciers in northern PWS. The deepest dives were over 1,300 ft, but most were 300-450 ft. Blood samples were collected from all seals and tested for disease. DNA was analyzed to examine whether PWS harbor seals belong to a separate population. Analyses of stable isotopes in whiskers and fatty acids in blubber provided information about seal diets. Results of these initial investigations suggested that disease was not the cause of the decline. Preliminary data indicate differences in the diets of young and adult seals, and seals from different areas.

During the 1996 field season, satellite tagging, sampling, and monitoring will continue. Research will focus on two possible causes for the decline: 1) Is it food limitation? 2) Is it mortality caused by predators (such as killer whales) or humans (subsistence hunting and/or fishing-related mortality)? Aerial surveys will be flown to monitor trends during the molting period in 1996 and 1997. Extensive analyses of survey data completed during 1995 indicated that pupping period surveys are not very useful for trend analysis because the variance is so large, and pupping surveys will therefore be discontinued. Satellite tags will be attached to 12 seals. Blood, whiskers, blubber, skin, and measurements will be taken from all seals that are caught during tagging. Similar samples are being collected by ADF&G in southeast Alaska, where harbor seals are not declining. Data will be compared to better understand why seals are doing well in some areas and declining in others.

The research being proposed for 1996-1997 (FY 97) is a continuation of harbor seal restoration studies funded by the Trustee Council in 1995-1996. Next year's study will build upon previous research findings and incorporate new components to address high-priority issues regarding harbor seal recovery. Aerial surveys to monitor the trend of harbor seals in PWS will be continued in 1996-1997 and the data analyzed to determine whether the decline has stopped. Satellite transmitters will be attached to 12 seals in 1997. Fatty acid studies will be continued to include more prey species, and seals from different seasons/locations. Information on diet will be integrated with data from forage fish studies to understand how harbor seals utilize prey and how they may depend on seasonal or area-specific concentrations of prey.

## NEED FOR THE PROJECT

### A. Statement of Problem

From 1984-1988, harbor seal counts at 25 trend sites in PWS declined by 43% due to unknown causes. The decline continued in 1989, aggravated in oiled areas by the EVOS. Counts of harbor seals at oiled trend count sites declined by 45%, compared to 11% at unoiled sites. More than 300 harbor seals (36% of those in oiled areas) were estimated to have died in PWS because of the spill. Since 1989, numbers have continued to decline. There were 28% fewer seals in 1994 than in 1989, and 57% fewer than in 1984. The reasons for the continuing decline are unknown.

### B. Rationale

Harbor seals are important to residents of PWS for subsistence. In 1985-1989, harbor seals made up 13%-27% of the subsistence foods harvested in Tatitlek and Chenega Bay. During 1992-1993, these two villages harvested less than half the number harvested annually before the spill. Native residents have noted the scarcity of seals and the impact this has had on subsistence hunting. Harbor seals are also watched and photographed by tourists and recreational users of PWS, and they interact with and are incidentally killed by commercial fisheries.

Like all marine mammals, harbor seals have special federal protection under the Marine Mammal Protection Act (MMPA). Because of the ongoing decline, it is essential that current population data be available so that inappropriate restrictions on human activities are not implemented. It is important to understand what factors are limiting the population. We cannot assume, given the ongoing decline, that the number of seals in oiled areas will return naturally to pre-spill levels. It is necessary to continue monitoring trends, identify and appropriately manage areas of particular biological significance, and communicate information on population status to subsistence hunters and fishermen in order to minimize mortality and augment recovery in any way possible. Commercial fisheries in PWS may face greater restrictions designed to reduce incidental take of harbor seals unless something can be done to understand and reverse the population decline.

The ongoing declines of harbor seals began over two decades ago in the Kodiak area, and were detected at least a decade ago in PWS. Although periodic surveys have documented these downward trends and are useful for determining whether the recovery objective of "stable or increasing population trends" has been met, they are not adequate for determining what is causing the seal population to decline, or for designing conservation and management measures to facilitate recovery and ensure the future health of the population. Unless research is specifically designed and conducted to investigate the factors limiting harbor seals, it is likely that little progress will be made in understanding and mitigating the decline. Similar declines have occurred in Steller sea lions, also for unknown reasons. For both of these species, it has been suggested that changing prey availability may be an important factor. This is a difficult but important topic to investigate. It will require a multidisciplinary approach that incorporates an understanding of harbor seal behavior, habitat use, and energetics, with data about the distribution, abundance, and

biology of prey species and predators. Information is also needed about health and disease, stock identity, and sources of mortality.

### C. Location

This project will be conducted in PWS. Aerial surveys will be flown over the 25 established trend count sites shown in Figure 1 and listed in Table 1. Seal tagging and sampling will take place at a variety of locations throughout PWS. Tagging locations will be chosen to represent different habitats and different proximity to areas oiled by the EVOS, and will be coordinated with sampling locations for oceanographic and forage fish studies. Communities that harvest harbor seals or engage in commercial fishing activities, and therefore may be affected by or utilize the results of this study, include Cordova, Chenega Bay, Tatitlek, and Valdez.

## COMMUNITY INVOLVEMENT

Information from this study will be presented at oil spill symposia, planning workshops, conferences, and in the published literature. Information will be provided to the University of Alaska Sea Grant program and ADF&G Division of Subsistence for use in meetings and discussions with PWS subsistence hunters. ADF&G marine mammals staff regularly attend meetings with various public groups (tourism industry, fisheries, conservation groups, subsistence communities) to inform them about status, important conservation issues, and key research needs for harbor seals.

Project investigators will cooperate with personnel from the ADF&G Division of Subsistence in their efforts to inform residents of Chenega Bay, Tatitlek, Valdez, and Cordova about the findings of this study and to incorporate the suggestions of PWS residents in study design. Such an exchange of information will allow biologists to benefit from residents' observations about abundance and behavior of harbor seals in PWS, and will help residents to make informed decisions about their annual harvest of harbor seals.

Investigators are working with the Alaska Native Harbor Seal Commission (ANHSC), and attend 1-2 ANHSC meetings per year to discuss study results and proposed research. During 1996, this project assisted in bringing two PWS Youth Area Watch students to Anchorage to attend an ANHSC meeting and facilitate communication between hunters and youth. Investigators will assist in developing community-based harvest monitoring and sampling programs. Biosampling is a cooperative effort of the ANHSC, NMFS, the University of Alaska Sea Grant program, and the ADF&G Division of Subsistence. Personnel from this harbor seal project will facilitate sample analysis and communication of results to community residents. During 1995-1996, the principal investigator prepared newsletter-type reports of project findings for distribution to community residents and to the Public Advisory Group. This practice will be continued in the future.

## PROJECT DESIGN

## A. Objectives

1. Monitor the abundance and trends of harbor seals at trend count sites in oiled and unoiled areas of PWS to determine whether the PWS harbor seal population has stabilized and/or increased since the EVOS. (High priority FY 97)

2. Determine whether a disease agent is contributing to the decline. (Low priority FY 97)

3. Determine the genetic relationships among harbor seals in Alaska, and whether PWS harbor seals belong to a separate management stock. (Low priority FY 97)

4. Determine whether poor pup production may be contributing to the decline. (Low priority FY 97)

5. Model the effects of different sources of mortality (such as predation by killer whales, fisheries-related take, or subsistence hunting) on harbor seal trend. (Low priority FY 97)

6. Provide information to subsistence hunters so they can make informed decisions about the level of harvest for harbor seals. (High priority FY 97)

7. Investigate trophic interactions in order to better understand whether food is limiting the harbor seal population. (High priority FY 97)

8. Gather data on the behavior and habitat use of harbor seals in PWS that can be used to design effective conservation measures. (High priority FY 97)

## B. Methods

The following hypotheses were developed for a three-year harbor seal study to meet the above objectives. FY 97 is year two of this study. During FY 97, objectives 1, 6, 7 and 8 and hypotheses 1, 6, and 7 will be the focus of our activities.

**Hypothesis 1**: The PWS harbor seal population has stabilized and/or increased since the EVOS.

1. Conduct aerial surveys at PWS trend sites during molting in 1996 and 1997;
2. Correct counts for effects of date, weather, time of day, and tide using historical PWS survey data base and information from satellite-tagged seals;
3. Compare counts to data from 1989-1995 to determine trend;
4. Model the effects of mortality caused by the EVOS on harbor seal population dynamics.
5. In 1998, reevaluate all survey data collected since 1989 to evaluate whether seal numbers are continuing to decline, have stabilized, or are recovering to pre-spill levels.
6. Based on observed trend and statistical characteristics of survey data, recommend a monitoring schedule for 1998 and beyond.

**Hypothesis 2**: A disease agent is causing harbor seals to decline.

1. Collect blood samples and analyze them to determine whether harbor seals in PWS are infected by a viral disease that may be causing or aggravating the harbor seal decline;
2. Examine all seals that are handled during tagging for external signs of disease; and
3. Archive serum samples for future testing of currently unidentified disease agents.

**Hypothesis 3**: Harbor seals in PWS belong to a separate management stock.

1. Collect and analyze genetics samples from PWS seals and compare to seals from other regions to evaluate whether PWS seals constitute a genetically distinct management stock;
2. Examine regional genetic variation within PWS; and
3. Tag subadult and adult harbor seals in PWS to study their movements and site fidelity.

**Hypothesis 4**: Low pup production may be causing harbor seals to decline. (No pupping surveys are being proposed for FFY97)

1. Conduct surveys during pupping in June to determine the number and proportion of pups;
2. Compare pup production in PWS with production in areas where harbor seal populations are stable or increasing; and
3. Incorporate pupping data into a population model to evaluate whether pup production is limiting population growth in PWS.

**Hypothesis 5.** Predation by killer whales is causing the decline or preventing recovery.

1. Estimate the number of harbor seals eaten by killer whales in PWS (in cooperation with and using data from project 012 -Comprehensive Killer Whale Investigation); and
2. Model the impact of killer whale predation on PWS harbor seals.

**Hypothesis 6**: Mortality caused by subsistence hunting and/or fisheries-related take is preventing harbor seals from recovering.

1. Obtain harvest data for harbor seals in PWS from community-based harvest monitoring program;
2. Obtain information on incidental take of harbor seals from NMFS observer data;
3. Model the impact of human-caused mortality on PWS harbor seals; and
4. Meet with hunter representatives and discuss the implications of population modeling.

**Hypothesis 7**: A change in food availability (quantity and/or quality) has caused harbor seals to decline.

1. Measure seals in PWS and develop condition indices for interannual comparisons and comparison to historical data base from the late 1970s (with project 001);
2. Provide historical and recent blubber samples to project 117 for analysis of energy content and whiskers to project 320-I for analysis of stable isotopes;
3. Compare dietary information from harbor seals sampled in the 1970s with recent data;
4. Determine individual, age-related, seasonal, and interannual differences in diets of seals as measured by fatty acid composition of lipid stores, stable isotopes of whiskers (stable isotope analyses by project 320-I), and stomach contents as available from hunters;
5. Evaluate the relative contribution of each prey type to the overall diet using measured energy content of the prey, and compare energy value of prey eaten by adults and subadults;

6. Assess variation in the fatty acid composition of prey species;
7. Determine feeding areas (location/depth) of seals based on satellite-tagging data and describe the use of and movements between haulouts and feeding areas;
8. Describe hauling out and diving behavior, and by inference, feeding behavior of satellite-tagged seals in PWS; and
9. Compare information about diet and feeding areas with information about forage fish distribution and abundance (incorporating data from SEA, APEX, and herring studies).

We are proposing one additional year of field study after 1996 (1997) with final data analysis and reporting to take place in 1998. Findings from this study will be evaluated after the 1996 field season. Modifications to the study approach for 1997 will be recommended based on recent findings from this and other PWS studies. In addition to the components outlined in this project description, questions about harbor seal health and condition, stable isotope analyses, predation by killer whales, and prey availability will also be addressed by other Restoration studies.

Aerial Surveys and Analysis (Objectives 1.1, 1.2, 1.3, 1.5, 1.6)

Harbor seal abundance will be monitored by flying aerial surveys during molting (late August-early September). A fixed-wing aircraft will be used to survey 25 trend count sites at an altitude of 700-1000 ft. These haulout sites have been used by ADF&G for PWS harbor seal trend counts since 1983, including NRDA and Restoration studies in 1989-1994 (Calkins and Pitcher 1984; Pitcher 1986, 1989; Frost and Lowry 1994a; Frost et al. 1994a; Frost et. al 1995). The trend count route includes 7 sites that were impacted by the EVOS (Agnes, Storey, Little Smith, Big Smith, Seal, and Green islands, and Applegate Rocks) and 18 unoiled sites (Table 1, Figure 1). The survey methodology and observers will be the same as those used in PWS harbor seal studies conducted in 1989-1995 (see Frost and Lowry 1994a; Frost et al. 1994a; Frost et. al. 1995), and as summarized below.

Maximum numbers of harbor seals are known to haul out during pupping and molting (Pitcher and Calkins 1979; Calambokidis et al. 1987). Within these periods, more animals are usually hauled out at lower stages of the tide, since availability of many haulout sites is limited by tidal stage. Consequently, our surveys will be conducted during late August/September (molting), and will begin within two hours before daylight low tides and finish within two hours after low tide. Replicate counts will be made at each site to allow statistical analysis of trend.

Power analysis of data from 1989-1994 indicates that in order to detect a 5% increase per year over a five year period ($p=0.05$) with a greater than 80% probability of being right (using initial population = 767, the number of seals at trend count sites in 1994), it is necessary to fly annual surveys during the molting period, with at least 7 replicates per year, and to adjust them for the effects of time of day, date, and tide (Figure 2). This analysis was based on data collected by ADF&G during 1984-1994, and took advantage of one of the most extensive data sets of its kind. The recommendation of 7 or more replicates is similar to the number of replicates recommended by Pitcher based on analysis of other harbor seal surveys in Alaska (Pitcher 1986, 1989). The number of replicates also may be influenced by weather, which can limit the number of days suitable for flying within a survey period.

Visual counts will be made of seals at each site, usually with the aid of 7 power binoculars. Photographs will be taken of large groups for later verification using a hand held 35-mm camera with 70-210 mm zoom lens and high speed film (ASA 400). Color slides will be commercially developed and the seals will be counted from images projected onto a white surface.

Aerial surveys do not estimate the total number of seals present since they do not account for seals that are in the water or seals hauled out at locations not on the trend count route. Surveys provide indices of abundance based on the number of hauled out seals. Interpretation of trend count surveys relies on the assumption that counts of harbor seals on select haulout sites are valid linear indices of local abundance. We assume that within a given biological window, such as the molting period, hauling out behavior remains the same from one year to the next, and counts can thus be compared (e.g., Harvey 1987, Pitcher 1989). Standardization of procedures minimizes the affects of variables such as tide and weather that could influence the number of seals hauled out on a given day. In addition, for all future PWS surveys the results of a multivariate analysis will be used to correct counts for weather, tide, and date. These corrections were developed in 1995 and are presented in the 1995 and 1996 Annual Reports (see Figure 3). During 1996 and beyond, additional multivariate analyses will be conducted on a site-by-site basis to examine the effects of tide, date, and weather parameters on individual sites and to learn which areas produce the most stable counts and which are the most variable. Behavioral data obtained from satellite transmitters attached to seals as part of this study will help to verify these assumptions. Satellite tags will also help to provide estimates of the proportion of seals hauled out at low tide which can be used to develop correction factors for estimating the total number of seals present, not just those that are hauled out and available to be counted.

Reliable surveys of the trend count route were conducted during the molt in 1984 and 1988-1995. These data will be used for comparisons with data collected in 1996 and later. Analyses of trend count data and comparisons with other years will be conducted following statistical methods used for previous surveys (Frost and Lowry 1994a, b; Frost et al. 1994a; Frost et al. 1995). For each year, daily surveys will be averaged for each site and then sites will be summed to produce yearly estimates for the oiled, unoiled, and total trend count areas. The 95% confidence interval will be estimated by bootstrapping (Efron and Tibshirani 1993). The bootstrap method resamples with replacement from the actual daily counts at each haul-out site to produce a new data set with the same sample size (number of counts) for each site in each year. This resampling will be done 2000 times for each year's data, and then the 2000 bootstrap estimates will be ordered. Ordinarily, the 50th and 1950th ordered bootstrap estimates provide a 95% confidence interval, but as recommended by Efron and Tibshirani (1993), we will use a bias-corrected version that slightly adjusts the choice of the ordered bootstrap estimates for the confidence interval endpoints.

A linear regression model will be fitted to yearly estimates at oiled sites, unoiled sites, and for the trend count area as a whole for data corrected for the effects of date, time, tide, and weather. The regression line for each group will take the form,

$$Y = b_0 + b_1(X)$$

where Y is the mean count/site summed for all sites, $b_0$ is the y intercept of the line, $b_1$ is the slope, and X is the year. The significance of regression coefficients will be tested using analysis of variance (Snedecor and Cochran 1969).

Catching and Sampling Seals (Objectives 2.1, 2.2, 3.1, 7.1, 7.2, 7.4)

Seals will be caught by entanglement in nets placed near the haulouts. Nets will be approximately 100 m long and either 3.7 or 7.4 m deep with standard floats or float line and light lead lines. Mesh openings will be about 30 cm stretched measure. Nets will be deployed from a 6 m boat assisted by one or two other small boats to assist in maneuvering the net and tending it to ensure that all captured seals are quickly detected and removed (see Frost and Lowry 1994b).

When seals become entangled, they will be brought into the boats or to shore, cut free from the tangle net, and placed into hoop nets (large stockings made of 1 cm mesh soft nylon webbing). As necessary, seals will be sedated with a mixture of ketamine and diazepam administered intramuscularly at standard doses (Geraci et al. 1981). Each seal will be weighed, measured, and tagged in both hindflippers with individually numbered plastic tags. Field personnel will collect approximately 50 cc of blood from the extradural intervertebral vein. Ultrasound measurements of blubber thickness will be made whenever possible. Standard blood chemistry panels and virology screens (phocine distemper virus, herpes, and others as indicated) will be run on these samples. The following samples will also be taken: whiskers for stable isotope analysis, a small piece of skin for genetics studies, and a 0.5 cm x 2.5 cm blubber biopsy for fatty acid analysis and analysis of energy content. Seals will be selected by age and sex for instrumentation with satellite tags, as described below.

Seals will be caught in three regions of PWS to coincide with sampling areas being used by other studies (APEX, SEA, and herring studies). These will be Port Gravina; southern PWS near Montague, Green, and Little Green islands; and central PWS near Agnes, Smith, and Seal islands. This will facilitate comparison of data obtained by fish, seabird, and harbor seal researchers about important prey species and responses to changing availability of prey. Hydroacoustic and trawl data will be available from these areasWe will try to catch and sample approximately 50 seals total per year, during April-May and September. If sample analyses indicate that other areas or seasons should be sampled, we will extend or modify our sampling schedule. Depending on tag longevity in 1996, tags may be attached only during September in 1997.

Disease (Objectives 2.1, 2.2, 2.3)

Recent epidemics and mass mortality caused by phocine distemper virus in the eastern North Atlantic have highlighted the possible role of disease in marine mammal population declines (Heide-Jorgensen et al. 1992, Thompson and Hall 1993). Since 1989, as part of this and other harbor seal studies, we have been collecting samples for disease investigations. To date, 84 seals from the study area have been screened for phocine distemper virus (72 negative, 12 positive) and 97 for herpes virus (30 negative, 67 positive) (R. Zarnke, pers. commun.). Serum from 98 other seals sampled since 1991 has been sent in for analysis. Seventeen seals sampled in the Kodiak

area during 1993 were tested for caliciviruses (including San Miguel sea lion virus), and all were negative (J. Lewis, pers. commun.). Swabs and/or serum from 5 Kodiak-area seals and 13 PWS seals have been screened for *Chlamydia*; most samples were negative (J. Lewis, pers. commun.). The only potentially pathogenic bacteria found in bacterial swabs from 27 PWS seals and 5 Kodiak seals sampled in 1993 were *Moraxella* sp., *Paturella* sp., and *Bordatella bronchiseptica*. These organisms can occasionally cause disease in domestic animals. All can occasionally cause pneumonia, and *Moraxella* sp. can cause conjunctivitis. However, in otherwise healthy seals it is unlikely that they would cause a problem (T. Spraker, pers. commun.).

Although at this time it appears unlikely that disease is responsible for the ongoing decline of seals in PWS and the Gulf of Alaska, we will continue to collect samples, conduct some analyses, and archive serum for disease screening. The cost of this component is minimal and it allows us to track the occurrence of disease in seals in the study area. During 1996 and beyond, blood will be collected from all seals that are handled during tagging. Serum will be obtained for screening, and assays will be conducted for phocine distemper virus, seal herpes virus, influenza, calicivirus, *Brucella*, *Toxoplasma*, and any other agents that might become of concern. Additional serum will be archived at ADF&G Fairbanks for future use.

Genetics (Objectives 3.1, 3.2)

Measures of genetic diversity are useful for evaluating gene flow among seals in different geographic locations, and in assessing whether particular groups of seals constitute separate biological stocks. This information is important for several reasons. First, it is not possible to put mortality caused by an event such as the EVOS into perspective without some understanding of population structure. In other words, did the 300 seals that died following the EVOS represent 30% of a central PWS stock, 5%-10% of a stock that includes all of PWS, or a much smaller percent of either a Gulf of Alaska stock or an Alaska-wide stock? Information about stock identity and stock size is also necessary for evaluating the impact of mortality caused by subsistence hunting, incidental take by fisheries, or predation. It is not possible to recommend a safe harvest level for harbor seals in PWS without knowing the size of the stock from which the harvest is taken.

Use of molecular genetic techniques can help clarify whether seals in adjacent areas are genetically discrete from one another, and provide managers with a better concept of the overall harbor seal population structure, including estimates of gene flow between colonies and site fidelity. Lehman et al. (1993) detected geographic partitioning in harbor seals from PWS, Washington, and California based on genetic variation in minisatellite loci. However, only three seals from a single location in Alaska were included in that study. Lamont and Thomas (1994) found considerable diversity in harbor seal mitochondrial DNA sequences from Washington, Oregon, and California. Although in that study many haplotypes were unique to certain localities, small sample sizes precluded conclusions regarding the amount of gene flow.

Mitochondrial sequence diversity will be used to investigate genetic structure among groups of harbor seals in Alaska and within PWS. Small skin samples for genetics analysis will be taken from all seals that are captured during tagging operations in 1996 and beyond. Similar samples

were also obtained from seals captured in PWS during 1993-1995, and from seals collected for food safety testing in 1994 (Project 95279). Comparative samples are available from the NOAA-funded ADF&G harbor seal study in Kodiak and southeast Alaska.

Pieces of skin will be taken from the hind flipper of each seal using a 0.5 cm diameter skin punch, and preserved in DMSO-salt solution until they are analyzed. Analyses will be conducted by the genetics laboratory at the NMFS Southwest Fisheries Science Center in La Jolla, CA. DNA will be amplified using polymerase chain reaction procedures, and fragment and sequence analyses will be conducted. Polymorphic mitochondrial DNA sequences and polymorphic nuclear DNA alleles will be sought as markers for morphological, geographic, and management stocks. Preliminary analyses of samples from harbor seals and spotted seals in Alaska have demonstrated that this technique produces useful results (O'Corry-Crowe and Westlake 1994).

Modeling (Objectives 1.4, 4.3, 5.3, 6.3)

A demographic model that was developed during 1995-1996 will be refined in cooperation with biometricians from the NMFS National Marine Mammal Laboratory, to examine the effects of predation, harvest, and incidental take on the harbor seal population in PWS. The model includes an age-specific mortality curve generated using life tables from PWS harbor seals collected by ADF&G in the 1970s (Pitcher 1977; Pitcher and Calkins 1979). Age-specific fecundity rates have been estimated from pregnancy rates derived from this same data set. Data on the subsistence harvest will come from ADF&G's Division of Subsistence (Project 244 and others), obtained in cooperation with subsistence hunters from Chenega Bay, Tatitlek, Cordova, and Valdez (see Wolfe and Mishler 1993), and from a community-based monitoring program to be developed in 1996 and beyond. Information on killer whale predation will be obtained from the Comprehensive Killer Whale Investigation (Project 012), as well as from other pertinent studies (e.g., Saulitis 1993). Data on incidental take in fisheries will be obtained from NMFS, and other sources such as Wynne (1990).

The preliminary model combines estimates of mortality and reproduction to produce a population model following that proposed by Eberhardt (1985). It is unknown what specific change in mortality or fecundity has occurred since the samples were collected in the mid-1970s; all that is known is that the population has been declining. Neither is there a known change in a specific demographic parameter (for example increased mortality of pups or subadults) which should obviously be used to modify the baseline model. Thus, the demographic parameters will be adjusted by various amounts, first individually and then together, to determine what changes would result in the observed rate of change. The amount of time for which the model will be "allowed" to produce the observed rate of change will not be greater than 10 years, approximately the amount of time between when the samples were collected in the 1970s and the start of the decline.

To address the question of how various mortality factors (subsistence harvest, killer whale predation, commercial fishery kill) may affect the population, we will first determine the estimated annual mortality at the current and 1984 levels. This estimate will be compared with estimates from various mortality factors. The mortality schedule within the model will be adjusted

following the estimates, and the resulting population status explored. This modeling outline is based on the assumption that the population is closed, or that emigration equals immigration. Information from genetics studies and data from satellite-tagged seals will be used to evaluate this assumption.

Satellite-tagging (Objectives 1.2, 3.3, 7.7, 7.8, 7.9)

Satellite-linked telemetry can be used to gather information about habitat use, including site fidelity, movements between haulout sites and in and out of PWS, seasonal changes in hauling out patterns, habitats used for feeding, and feeding and diving behavior. Satellite-linked time-depth recorders (SLTDRs) have provided researchers with the ability to monitor location and diving behavior of marine mammals (Mate 1986, 1989, Hill et al. 1987, Stewart et al. 1989, Lowry et al. 1994, Frost and Lowry 1994b). The SLTDRs transmit to a satellite-based Doppler positioning system that calculates locations and tracks movements of animals with considerable accuracy. When combined with appropriate environmental sensors and microprocessor hardware and software, other information about an animal's environment and behavior can be transmitted to the satellite.

This study has demonstrated that SLTDRs are an effective means of monitoring the movements and haulout locations of harbor seals in PWS. During 1992-1995, significant data were received from SLTDRs attached to 37 harbor seals in PWS, including 19 males and 18 females (Table 2). Twenty-three were adults and 14 were subadults. SLTDRs were attached to 15 seals from areas in central PWS that were oiled by the EVOS (Seal Island, Herring Bay, Bay of Isles, Applegate Rocks); four from eastern PWS (Olsen Bay, Gravina Island); one from northwestern PWS (the Dutch Group); and 17 from unoiled sites in southcentral PWS (Port Chalmers, Stockdale Harbor, Little Green Island, and Channel Island). SLTDRs were operational for up to 10 months, and provided locations for about 80% of those days.

SLTDRs deployed during 1992-1995 indicated that the movements of most harbor seals were confined to within PWS. Many seals hauled out only at the tagging location, although some also used one or two nearby locations (Frost and Lowry 1994b). Movements between terrestrial haulouts in central PWS and glaciers in northern PWS were not uncommon. Several seals made substantial movements to the Gulf of Alaska or the Copper River delta, but later most returned to PWS. One subadult traveled to Yakutat Bay and spent the winter there and offshore in the Gulf of Alaska.

Most areas where seals were diving and probably feeding were within a few kilometers of haulouts. However, one seal spent several days 30 km from the nearest land in the Gulf of Alaska and another spent much of the winter diving in the Gulf offshore from Yakutat. The deepest dive by a tagged seal was 404 m, but most dives were to less than 200 m. SLTDR sensors indicated that 58% of 64,000 dives monitored during 1992-1993 were less than 50 m, 39% were 50-150 m, and only 3% were deeper than 150 m. The usual maximum depth for seals smaller than 50 kg was 100-130 m, compared to 130-150 m for seals larger than 50 km (Frost and Lowry 1994b). In combination with data being collected on abundance and distribution of forage fishes and about the prey being utilized by harbor seals in PWS, these SLTDR data will help us to better

understand feeding behavior of adult and subadult seals. In addition, they should help us to develop correction factors to be used in interpreting aerial survey data (e.g., Harvey 1987).

During 1996 and 1997, SLTDRs will be attached to 12 seals per year at locations chosen because they appear to represent different habitat types, because of their apparent importance to seals, and/or for their proximity to forage fish and oceanographic stations sampled as part of other PWS ecosystem studies. This will include Gravina Bay (important herring area), southern PWS near Montague, Green, and Little Green islands (herring and fish data from here, and a large number of seals); and central PWS near Agnes, Smith, and Seal islands (APEX fish data available, and significant seal haulouts). Actual tagging locations will depend on where seals are present and can be caught. At present we have no method that is suitable for catching seals in areas with drifting glacial ice. If we can develop such a method, we will instrument some seals from glacial fiord areas (Icy Bay, Columbia Bay, etc.).

Emphasis will be placed on instrumenting subadult seals and adult females. Approximately four of the SLTDRs will be put on adult females and the remaining eight units on small subadults of either sex. This sex/age distribution of tags may be modified somewhat based on results of ongoing data analyses and/or conditions experienced in the field. Depending on the performance of tags in 1996 and whether it is considered desirable to tag additional pregnant females, it is likely that in 1997 seals will be instrumented only in September. If a smaller, reliable 0.25-watt transmitter becomes available, we will attempt to tag pups during either September 1996 or during 1997.

Transmitters (14 cm x 10 cm x 4 cm for adults; 14 cm x 5 cm x 4.5 cm for subadults) will be attached to the mid-dorsal surface of the seal by gluing with epoxy resin (Fedak et al. 1984; Stewart et al. 1989). SLTDRs attached in autumn following the molt should remain attached until the next molt, but may not operate that long. Mean duration of operation of SLTDRs attached in fall 1993 was 182 days, with a range of 102-311 days (Frost and Lowry, unpublished). Small units suitable for subadults that were deployed in 1994 lasted up to 150 days. Tagging during the winter months is not considered cost-effective or practical. The weather is often severe, the water extremely cold making it difficult to work, and few seals are hauled out. Some SLTDRs were duty cycled in September 1995. Others will be duty-cycled in September 1996. Based on results from these tags, and if this effectively extends the data acquisition period through the pupping period, we may duty cycle all SLTDRs in 1997.

Data will be acquired from the ARGOS satellite receiving system and initially analyzed using software provided by the manufacturer of the transmitters. Each SLTDR will transmit signals to polar-orbiting satellites whenever the seal is hauled out or when it surfaces sufficiently long for a transmission to occur. An uplink occurs when a satellite is positioned to receive the signal. Information transmitted by the SLTDR is used by Service ARGOS to calculate the geographic location of the seal. Units will be equipped with built-in programmable microprocessors to collect and summarize data for periods when animals are diving and store it for later transmission, as has been done for crabeater seals, Steller sea lions, and spotted seals (Hill et al. 1987; R. Merrick, personal communication; Lowry et al. 1994a). These data will be stored in six hour blocks and transmitted to the satellite once the six hour data collection period is complete. Sensor

information from a pressure transducer and a conductivity switch will be used to indicate when the animal is hauled out. Data from four periods will be stored in memory, providing at least a 24 hour window for transmission before the data are lost. Dive data will be summarized as histograms in depth bins of 4-20 m, 21-50 m, 51-100 m, 101-150 m, 151-200 m, 201-250 m, 251-300 m, 301-350 m, and over 350 m, and duration bins of 0-120 seconds, 121-240 seconds, 241-360 seconds, 361-480 seconds, 481-600 seconds, 601-720 seconds, 721-840 seconds, 841-960 seconds, 961-1080 seconds, and over 1080 seconds. In addition, SLTDRs will store and transmit the amount of time spent in each depth bin and the total time spent at the surface.

Each SLTDR broadcasts a unique identification code so that data can be assigned to a particular seal. Position accuracy for all geographical locational information is rated by Service ARGOS to reflect the predicted accuracy of the calculated locations (Fancy et al. 1988, Stewart et al. 1989). Locations calculated by Service ARGOS will be screened for accuracy and plotted on charts of PWS.

Data on the haulout patterns of tagged seals will be examined for indications of daily or seasonal variations, for example to determine whether there is a change in the frequency of haulout by season, or whether the amount of time spent hauled out changes. Plots of locations where continuous signals are received will be used to determine the degree and regularity of use of particular haulout sites. We expect to receive fewer locations of seals while at sea, because the transmitter antenna will frequently be submerged. At-sea locations will be plotted as an indication of areas used for feeding. Information on depth and pattern of diving will be compiled, and will provide additional information on the general areas used for feeding.

Dive data will be presented as graphs and histograms which indicate the range in individual behavior as well as summary data for all seals combined. Dive data histograms will present the number of dives at different depth increments and by duration of dive. Means and standard deviations for dive depth and duration will be calculated and compared for seals in different locations or habitats and at different times of day and year. Compilation of data on time and location of feeding dives will be used to identify feeding areas near different haulouts, if possible. If sensors indicating whether the seal is on land or at sea become more reliable and the necessary SLTDR software is developed to provide a continuous record of this information, then diving and hauling out cycles will be examined relative to time of day, tide, and season. Summaries of the number and quality of uplink data and at-sea position data will be presented in tabular form.

Tabular summaries will also be prepared for use of different haulouts by individual seals, and frequency of haulout and amount of time spent feeding by season. These data will be used to evaluate site fidelity of seals, to quantify the amount of interchange among haulouts within and outside of the area impacted by the EVOS and within and outside of PWS, to determine seasonal importance of particular haulouts, to identify areas used for feeding, and to examine differences in movements and feeding behavior of subadult and adult seals.

An alternate methodology to satellite-tagging is the use of VHF telemetry. VHF transmitters are inexpensive to purchase. They are quite reliable for short distances when signals are not obstructed by geographic barriers, and are useful for monitoring attendance at particular haulouts

(e.g., Harvey 1987). However, monitoring of VHF transmitters can be expensive and labor intensive; they must be tracked either from aircraft or by field stations near the tagging location. During much of the year, weather in PWS is foggy and stormy, and flying is either precluded or dangerous. Remote monitoring stations are of limited utility because of the topography in PWS. If the seals swim more than a few miles from the monitoring station, or around an island with significant geographic relief, the signals can no longer be acquired. It would be difficult to relocate seals if they swim long distances in unpredictable directions as some of the SLTDR-tagged seals have done. In PWS, VHF technology could only give an indication of some of the haulouts that are used by a tagged seal, and of its activity patterns while it is on that particular haulout. During August 1995, personnel from the National Marine Mammal Laboratory attached VHF transmitters to over 20 seals. These seals were relocated as far away as the Dutch Group in northwestern PWS (Frost, personal observation), suggesting that use of VHFs with remote monitoring stations would not be very effective.

Satellite telemetry is a preferable alternative to VHF telemetry in PWS. SLTDRs transmit data regardless of whether investigators are in the field to monitor them. They do not require the use of aircraft or field stations. Data are transmitted every time that a seal surfaces, and transmission is not limited by weather or time of day. Micro-processors allow data to be stored for a 24-hr period, greatly increasing the probability that data will be transmitted when a satellite is overhead. Such data give a much more complete picture of movements and hauling out behavior than do intermittent VHF data. The SLTDRs provide data on duration and depth of dives, and the time spent in particular depth increments, that are not available from conventional VHF transmitters.

Fatty Acids (Objectives 7.3, 7.4, 7.5, 7.6, 7.9)

Recently, a method has been developed for understanding marine food webs through the use of fatty acid signatures (Iverson 1993). Fatty acids are essentially the building blocks of lipid. Organisms are able to biosynthesize and modify fatty acids, but there are biochemical limitations and differences in these processes depending on the organism. Specific fatty acids cannot be synthesized by animals and therefore can only originate from diet. Because of this, some fatty acids in the food chain can be attributed to specific origins (Cook 1985). Lipids from marine organisms are characterized by a very complex array of fatty acids. There are substantial differences in fatty acid composition among species and prey types, as well as within species by geographic region (e.g., Ackman et al. 1975, Iverson 1993). In marine mammals, dietary fatty acids are often deposited in body tissue without modification (Iverson and Oftedal 1992, Iverson et al. submitted). Consequently, it is possible to trace fatty acids obtained from the diet and to compare arrays in the tissues of the predator to those in the prey consumed.

This concept of fatty acids as trophodynamic tracers can be applied to harbor seals. In general, lipid transfer from prey to deposition in tissue is extremely efficient (Iverson 1988, Iverson et al. submitted). Because certain fatty acids cannot be biosynthesized by seals, they are known to be of dietary origin. For example, a pair of monosaturates that occur in one species of copepod act as a tracer in Atlantic cod and herring (Ackman 1980). Since most seals undergo seasonal periods of fasting and depletion of fat stores (e.g., during the breeding season or the molt) followed by intensive blubber deposition (prior to the subsequent breeding season), blubber fatty

acids usually reflect the integration of diet over a period of several months. In contrast, circulating chylomicrons in blood carry the lipid specifically from the last meal. Thus, fatty acids in blubber and blood provide information on both immediate diet as well as dietary history of the animal. Since many seals tend to feed on only a single or few selected prey species at a given time or season (e.g., Bowen 1990), this facilitates the use of fatty acid signatures.

During 1994-1995, 76 blubber samples were obtained and analyzed. Preliminary analysis of these samples indicated substantial individual and geographic variation, suggesting differences in feeding modes. Fatty acid composition, and therefore diet, of seals from northern and eastern PWS was substantially different than that of seals sampled in southcentral PWS (Channel Island, Stockdale Harbor, and Port Chalmers (Iverson, unpubl. data). Furthermore, seals from Port Chalmers and Stockdale Harbor had eaten very different prey than seals at Channel Island only a few kilometers away. This is unlike harbor seals from Sable Island, Nova Scotia, which show little individual variation (Iverson, pers. commun.). Ratios of particular fatty acids in PWS seals were also quite different than ratios found in seals in the Atlantic or sea lions in California. Over 100 prey samples representing more than a dozen species were analyzed during 1995. Prey species such as pollock, herring, capelin, and flatfish could clearly be distinguished by their fatty acids. The next step in this analysis is to identify the species eaten by harbor seals by matching fatty acid signatures in blubber and prey samples.

The stable isotope composition of the whiskers of PWS seals also showed substantial variability (A. Hirons, pers. commun.). Whiskers of several adults showed large changes in del 13C (-12.5 to -17.5) and del 15N (18 to 13), suggesting changes in diet along the length of the whisker. In contrast, most subadults appeared to have been eating prey at the same trophic level throughout the period represented by the whisker. Their isotope ratios showed little change: del 13C ranged from -15.5 to -16.5 and del 15N from about 17 to 16 (Hirons, unpubl. data). If whiskers grow several centimeters per year, these stable isotope data may suggest that seals utilize different prey as juveniles than as adults, or during some part of their life, or that they feed in different areas during the period represented by the whiskers.

Blubber samples will be taken from seals using routine biopsies (sterile 6 mm biopsy punches). Samples will initially be collected in spring and fall to coincide with possible seasonal changes in feeding behavior and blubber depletion/deposition. Samples will be placed in chloroform and methanol with BHT as an antioxidant, and kept frozen until analyzed. Samples will be collected from all seals that are caught during tagging operations. Blood will be collected from the same animals and centrifuged in the field. If chylomicrons are evident (milky white or cloudy serum, indicating recent feeding) the serum will be separated, preserved, and stored frozen for later fatty acid analysis. In addition, some samples may be available through the biosampling program being conducted by the Alaska Native Harbor Seal Commission. Prey species will also be obtained through APEX and SEA sampling cruises and analyzed by this study.

During 1996-1997, fatty acid analyses of seal blubber and serum and prey samples collected in previous years will be completed. In addition, approximately 50 additional harbor seals per year will be biopsied and analyzed for fatty acids (from both spring and fall, and representing different parts of PWS). Approximately 10 species of prey that are potentially important dietary items will

be sampled during spring and fall. For each species and season, 8-10 individuals of the size range likely to be consumed by seals will be collected and will be analyzed separately for total fat and protein content and fatty acid composition. Prey species determined to be most important in the diet will be examined in more detail. Seals will continue to be sampled from different parts of the study area. A broader range of prey species will be selected only if the initial ones chosen were not appropriate.

Laboratory analysis and evaluation of data will be conducted by Dr. Sara Iverson at Dalhousie University, Nova Scotia. Fatty acids will be extracted from seal blubber and prey according to methods described in Iverson (1988). Blood samples containing chylomicrons will be processed by ultra-centrifugation after adjusting serum density with sodium bromide and layering with various density salt solutions. Chylomicrons will be decanted from other blood lipoproteins and extracted. Fatty acid methyl esters will be prepared directly from aliquots of the chloroform extract, then extracted and purified in hexane. Analysis of fatty acid methyl esters will be performed according to Iverson et al. (1992) using temperature programmed capillary gas liquid chromatography and linked to a computerized integration system. Identifications of rare isomers will be performed using techniques such as hydrogenation and silver nitrate chromatography (Iverson et al. 1992). Approximately 70 fatty acids and isomers can be separated and quantified in most marine lipids. The proper isolation of all components in any sample is critical in assessing diets and prey items; these methods are currently set up and routinely used in the Dalhousie University laboratory of Dr. Iverson.

Fatty acids will be used to evaluate food webs in two ways. The array of fatty acids in seal tissues will be statistically compared to fatty acids in prey species in order to quantify the relative contribution of each prey item to the overall diet. In addition, single unusual or unique components will be used to trace a specific prey. In the analysis and interpretation of data, fatty acids will be grouped as: 1) components which could readily be biosynthesized by the seal; 2) components that could be biosynthesized but at the measured levels are likely mostly of dietary origin; and 3) components that could only come from the diet. Categories 2 and 3 represent the "indicator" fatty acids (Iverson 1993).

Data will be analyzed using a multivariate model called a tree regression analysis (Clark and Pregibon 1992). This model has recently been applied and modified for fatty acid signature analysis (Iverson pers. commun.). The model considers all 70 component fatty acids in each sample and uses the fatty acid arrays of species to determine classification rules for types of signatures. The model builds complex trees through which predator (seal) samples are run for appropriate classification (i.e., diet). Through this method we will attempt to differentiate prey species being consumed, as well as geographical, seasonal, or interannual differences in diet. The quantitative contribution of each prey species to a given seal's diet can be estimated from its total fat content based on proximate analysis and its fatty acid signature.

The use of fatty acids to elucidate diet and trophic relationships is in the developmental stages. It is not a stand-alone method, but neither is any other currently available method for examining marine mammal diets. Stomach contents analysis is limited by our ability to obtain large enough samples, the digestive state of contents, and by the fact that food in a stomach represents a single

meal. In PWS, large tidal fluctuations every 6 hours make it virtually impossible to collect scats from areas where seals haul out. Stable isotopes indicate the trophic level at which seals feed and temporal variations in prey type, but provide little information on specific prey. Studies of prey availability are necessary to establish the "menu" from which seals may choose, but they do not reflect the availability of prey to seals or the energetic costs of capturing different prey. Progress towards answering the question of "Is food limiting harbor seals?" will most likely come through the combination and integration of a variety of approaches, including analyses of fatty acids, stable isotopes, and stomach contents; investigations of the distribution and abundance of potential prey; evaluation of body condition and changes in condition through time; blood chemistry; and analyses of blubber as an energy source. Each of these approaches will provide pieces to a very intricate puzzle, and together they will give us a better understanding of the trophic dynamics of seals in PWS. In aggregate, the studies funded by the Trustee Council for 1996 address this suite of approaches and provide an integrated approach to the "Is it food" question.

## C. Contracts and Other Agency Assistance

Survey aircraft will be chartered from the private sector. Charter aircraft for surveys will not require contracts. ADF&G maintains a list of qualified air charter operators. Aircraft for surveys will be chosen from this list according to state procedures. Vessel support for tagging work will use small vessels contracts that will be completed by the Principal Investigator according the state SOP manual. Vessels will be chartered from the private sector.

Costs of acquiring SLTDR data from Service ARGOS are paid for through a contract with the National Oceanic and Atmospheric Administration (NOAA). This contract covers all ADF&G Division of Wildlife Conservation satellite tagging projects (harbor and spotted seals, and caribou), not just this harbor seal restoration project, and is processed by the Division of Wildlife Conservation. Funds for data acquisition must be encumbered and guaranteed to NOAA in early February. Actual contract processing occurs later in the spring.

Satellite SLTDRs will be purchased under contract award from Wildlife Computers, a private company in Seattle, Washington. The contract award is currently being renegotiated for the duration of this project. Wildlife Computers is the only company in the United States which manufacturers SLTDRs with the capabilities necessary to acquire the data we require about diving behavior of seals.

Fatty acid analyses and interpretation will be done by Dr. Sara Iverson at Dalhousie University through a Cooperative Agreement between ADF&G and Dalhousie. Dr. Iverson is the only person in North America with specific experience in analysis of fatty acids in seal blubber, and particularly with the sophisticated statistical analyses necessary to infer diet from the relative abundance of these fatty acids.

Genetics analyses will be done by Robin Westlake under the supervision of Dr. Greg O'Corry-Crowe at the NOAA/NMFS Southwest Fisheries Science Center through a National Research Council fellowship. Dr. O'Corry-Crowe is currently working with ADF&G on harbor seal

genetics studies in other parts of Alaska and can conduct additional analyses of PWS harbor seals at a very modest cost.

Other assistance and cooperative work towards accomplishing the objectives of this study are provided at no cost to the project by Dr. Randy Davis, Texas A & M University (physiological studies); Kate Wynne, University of Alaska Sea Grant Program (biological sampling and field assistance); Jon Lewis, ADF&G (NOAA-funded harbor seal studies in southeast Alaska and near Kodiak); and Dr. A. D. M. E. Osterhaus, National Institute of Public Health and Environmental Protection, Netherlands (phocine distemper and herpes assays).

## SCHEDULE

### A. Measurable Project Tasks for FY 97 (October 1, 1996 - September 30, 1997)

This project will be conducted during 1996 and 1997, with submission of a final report in 1998. A schedule of field activities, data analysis, and report preparation follows:

1996-1997

| | |
|---|---|
| October - July: | Retrieve ARGOS data |
| October - December: | Analysis of fatty acid samples by Dalhousie |
| October - December: | Analysis of aerial survey data |
| October - September: | Analysis of genetic samples by SWFSC |
| October - April: | Analysis of other data, modeling |
| October - March: | Analyze SLTDR data from previous year |
| October - December: | Meet with hunters about study results, distribute newsletter |
| November - December: | Meet with SWFSC regarding genetics analyses |
| January: | Order SLTDRs for field season |
| January: | Attend restoration workshop |
| January or February: | Coordination meeting with other ADF&G harbor seal projects |
| January - April: | Arrange logistics (boats, airplanes, equipment, contracts, supplies) |
| February: | Reserve ARGOS satellite channels |
| February - March: | Prepare annual report |
| April 15: | Submit annual report |
| April-May: | Catch seals, collect samples; attach SLTDRS as decided |
| June - August: | Analysis of fatty acid samples by Dalhousie |
| August 17-30: | Conduct aerial surveys during molting |
| September 15-30: | Attach 6-12 SLTDRs, sampling |

1997-1998

| | |
|---|---|
| October - September: | Final data analysis |
| October - December: | Prepare final report |
| December 30, 1998: | Submit draft final report |

## B. Project Milestones and Endpoints

| | |
|---|---|
| April 15, 1996: | Report on modeling (Hyp. Obj. 1.4, 4.3, 5.1, 5.2, 6.1, 6.2, 6.3) |
| April/May 1996, 1997: | Sampling seals in PWS (Hyp. Obj. 2.1, 2.2, 2.3, 3.1, 7.1, 7.2) |
| August 1996, 1997: | Aerial surveys during molting (Hyp. Obj. 1.1) |
| April 15, 1996, 1997: | Annual report |
| September 1996, 1997: | Sampling seals in PWS (Hyp. Obj. 2.1, 2.2, 2.3, 3.1, 7.1, 7.2) |
| September 1996, 1997: | Tag 12 harbor seals with SLTDRs (Hyp. Obj. 1.2, 3.3, 7.7, 7.8) |
| Oct/Nov 1996,1997: | Meet with hunter representatives (Hyp. Obj. 6.4) |
| December 1998: | Final Report (Hyp. Obj. 1.5, 1.6, 3.2, 4.2, 7.3, 7.4, 7.5, 7.6, 7.9) |

## D. Completion Date

This project will take place in three fiscal years. Field work and laboratory analyses will be conducted during FFY96 and FFY97. Final data analyses will be conducted and a final report prepared in FFY98. It is likely that, upon completion of this project, a new proposal will be submitted to investigate juvenile survival of harbor seals and to obtain better demographic information for use in population models. Information on survival, especially juvenile survival, is very important in model simulations and for recommending possible strategies for reversing the ongoing harbor seal decline.

## PUBLICATIONS AND REPORTS

| | |
|---|---|
| April 15, 1996: | Annual report for 1995 studies; will include results of pupping and molting surveys including trend analysis; multivariate analysis of factors affecting surveys; analysis of data for SLTDRs deployed in September 1994 and May 1995; report of 1995 modeling efforts; status report on 1995 fatty acid analyses; status report on genetics study |
| May 30, 1996: | Report of field activities for spring field work in PWS (letter form) |
| October 30, 1996: | Report of field activities for August surveys and September tagging |
| January 1997: | Oral/poster presentations at Annual Workshop |
| April 15, 1997: | Annual report for 1996 studies; will include results of molting surveys including trend analysis; analysis of data for SLTDRs deployed in September; report of 1996 modeling efforts; status report on 1996 fatty acid analyses; status report on genetics study |
| October 30, 1997: | Report of field activities for August surveys and September tagging |
| December 31, 1998: | Final report for 1995-1997 harbor seal restoration studies |

During FY 97 it is anticipated that two manuscripts will be submitted for publication. One will be entitled "Monitoring recovery of harbor seals in Prince William Sound, Alaska, after the *Exxon Valdez* oil spill" by K. J. Frost, L. F. Lowry, and J. Ver Hoef. This manuscript will present the results of multivariate analyses of survey data for effects of date and tide, and of power analysis for data that have and have not been adjusted for such effects. It is anticipated that the manuscript will be submitted either to Ecological Applications or Marine Mammal Science.

It is also anticipated that a manuscript will be prepared describing preliminary results of the fatty acids analysis and the application of this technique for describing the diet of seals. The title of the manuscript has not been determined, nor the journal to which it will be submitted. The senior author will be Dr. Sara Iverson at Dalhousie University, and the second author project investigator Kathy Frost.

## PROFESSIONAL CONFERENCES

Project investigators plan to attend the 12th Biennial Conference on the Biology of Marine Mammals in January 1998, where they plan to present results of fatty acids, genetics, and satellite-tagging studies.

## NORMAL AGENCY MANAGEMENT

This project is funded entirely by the Trustee Council as a restoration project. ADF&G conducts no other studies of harbor seals in PWS that are not a part of the restoration program. ADF&G has no management responsibility for harbor seals. ADF&G biologists are conducting this research as principal investigators because of their many years of experience investigating the biology of seals and other marine mammals in Alaska. The Subsistence Division of ADF&G has been funded by the Trustee Council to monitor the harvest of harbor seals in PWS (Project 244) and to conduct food safety testing (Project 279). Subsistence Division also collects and reports harbor seal harvest data for other parts of the State with funding from NOAA.

ADF&G is conducting studies of harbor seals in southeast Alaska and near Kodiak with funding from NOAA/NMFS. Those studies contain similar components to the PWS study and are closely coordinated to ensure that data are collected and analyzed in a similar manner. This will facilitate comparisons of data from declining populations (PWS and Kodiak) and a stable population (southeast Alaska) of harbor seals. Equipment is shared by the two projects. Consequently, it has not been necessary for the PWS project to purchase many equipment items and supplies solely for the use of this study. Because of these other ongoing projects, the PWS harbor seal project has had access to a GIS system with which to analyze tagging data.

Without this project, information on the status and trend of harbor seals in PWS will not be regularly available. There will be no systematic documentation of trend, and whether or not the decline continues will be unknown for a much longer time than if regular monitoring continues. Power analysis of data collected through this study has indicated that a minimum of five consecutive surveys is required to reliably detect a trend. If surveys do not occur on a regular basis, it will be a very long time before a trend can be correctly identified.

Because of Trustee Council-funded projects, progress is being made on communicating information about the decline to the public, in particular to fishermen who may incidentally take harbor seals while fishing and to subsistence hunters from PWS villages. This transfer of

information is making local residents more aware of the factors that may affect the decline, and has resulted in the initiation of a village-based biosampling program that may provide important samples to researchers. One of the significant long-term benefits of this and other harbor seal studies will be the involvement of local hunters in the research and management of harbor seals and the formation of the Alaska Native Harbor Seal Commission.

The statistical methods developed to analyze survey data from PWS (multivariate analysis of effects of date, time, and tide on counts and power analysis) have great application to harbor seal surveys in other regions of Alaska and elsewhere. Other investigators should be able to design more reliable and cost-effective surveys using methodology developed through this Trustee Council-funded project. Similarly, the application of fatty acids analysis to investigations of diet and changes in diet is likely to have significant and far-reaching effects on our ability to investigate the trophic dependencies and interactions of many species.

## COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The project is part of an integrated MARINE MAMMAL ECOSYSTEM package. Other studies in the package include Harbor Seals and EVOS: Blubber and Lipids as Indices of Food Limitation (Project 117-BAA, UAF); and Comprehensive Killer Whale Investigation (Project 012, NMML). Although the study of Isotope Tracers - Food Web Dependencies in PWS (Project 320-I, UAF) is part of the PWS System Investigation, it will also be closely coordinated with this project and may be part of the Marine Mammal Ecosystem package in future years.

This project is a multidisciplinary, inter-agency undertaking. Surveys and satellite tagging will be conducted by ADF&G; lipid analyses and interpretation by Dalhousie University; blood chemistry analyses at UAF; genetics analyses by SWFSC/NMFS; and demographic modeling in conjunction with NMML/NMFS. Inclusion of interdisciplinary components within the same project will ensure that data are shared and interpreted in an interdisciplinary manner.

This project (064) will provide logistics, the MMPA permit to conduct sampling, and access to seals and samples for this study and the study conducted by Dr. Michael Castellini entitled "Condition and Health of Harbor Seals" (Project 001, UAF). Archived harbor seal data and blubber samples will be provided to Castellini/UAF for use in analyses of body condition and blubber. Harbor seal investigators at ADF&G and UAF have been working successfully together for the last three years on harbor seals in PWS and elsewhere, and future collaborations should be equally productive. Regular bi-weekly meetings and seminars are held by marine mammal investigators at UAF and ADF&G Fairbanks to exchange information and ideas.

This study will directly interface with the study entitled "Isotope Ratio Studies of Marine Mammals" (Project 170, UAF). Samples of seal whiskers and seal prey have been and will continue to be provided to that study. Investigators of the two projects (Frost and Schell/Hirons) discuss stable isotope results at regular intervals and are pursuing preparation and publication of a joint manuscript describing preliminary findings of this study.

Prey samples for fatty acid analysis have been and will continue to be obtained through PWS System Investigation studies and the APEX study. Species to be analyzed have been chosen based on their collective importance to harbor seals, seabirds, and killer whales. This project will work with project 121 to avoid duplicative analyses and to share data. Information on distribution and movements of harbor seals, and diving behavior, will be shared with PWS Sound Investigation modeling studies to look at energy flow within PWS, and with forage fish investigators who may examine the effects of predation on fish population dynamics.

This harbor seal study will obtain samples of prey and incorporate results from Herring (ADF&G) and Oceanographic (UAF) studies being submitted under the PWS System Investigation, and from the study Apex Predator Ecosystem Experiment. Harbor seal investigators will assist in prioritization of samples to be collected by Herring and Forage Fish studies for stable isotope and fatty acid analyses. Species to be analyzed will be chosen based on their collective importance to harbor seals, seabirds, and killer whales.

Harbor seal investigators are currently and will continue to participate in interactive discussions with subsistence hunters in PWS and the Gulf of Alaska through Project 244 (Seal and Sea Otter Cooperative Harvest Assistance) and through the Alaska Native Harbor Seal Commission. These discussions include the ongoing harbor seal decline, communication of results of Restoration-funded studies, suggestions for future research, and possibilities for local involvement in harbor seal investigations. The Subsistence Restoration Project - Food Safety Testing (Project 95279) has provided (and will continue to do so if it continues) samples to this harbor seal study for numerous analyses, including: genetics, stable isotopes, fatty acids, blood chemistry, and stomach contents.

ADF&G receives funding from NOAA to conduct complementary studies of harbor seals in the northern Gulf of Alaska and southeast Alaska. This funding provides an "economy of scale" for many aspects of both studies. For example, disease and genetics analyses of PWS seals are done at minimal or no cost to this study, but are instead provided through the NOAA harbor seal study. Equipment is shared and analytical techniques and software developed by one project can be used by the other.

## EVALUATION OF CHANGES IN CONTINUING PROJECTS

Major changes proposed for this project in FY 97 include the elimination of spring pupping surveys; the possible elimination of a spring tagging effort with all tags deployed in September; and less emphasis on disease, genetics, and modeling components of the study. Statistical analyses conducted in FY 95 indicated that pupping surveys are not an effective way to monitor trend in PWS. Improvements in satellite tag efficiency, duty cycling, and focus on juvenile survival are causing us to consider elimination of spring tagging by FY 97. The major focus in FY 97 will be on addressing hypotheses related to food limitation and population trend. This focus will continue in the form of fatty acids analysis, satellite tagging, and surveys, but will include a considerable increase in effort devoted to data analysis. In conjunction with this, there will be continued emphasis on working with subsistence hunters to evaluate the impact of subsistence

hunting on the harbor seal population, and on sharing the harbor seal population model developed in FY 95 and FY 96 with the users.

**PROPOSED PRINCIPAL INVESTIGATOR**

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## PERSONNEL

Kathryn Frost has conducted research on marine mammals in Alaska since 1975. She has undertaken extensive research on natural history and ecology of seals, including aerial and photographic surveys; studies of food habits and trophic interactions; and studies of habitat use using satellite tags. She has conducted extensive aerial surveys of harbor seals in PWS and boat-based observations and sampling of harbor seals as part of NRDA studies following the EVOS. She has conducted satellite tagging studies of harbor seals in PWS from 1991 through 1995.

Lloyd Lowry is the Marine Mammals Coordinator for the State of Alaska. He has conducted research on marine mammals in Alaska since 1975, including studies of the natural history, ecology, distribution, abundance, and food habits of seals. He has participated in all NRDA and Restoration studies on harbor seals, including the development of methodology to catch and attach satellite tags to harbor seals. He has been responsible for project coordination and management of state and federally funded research projects, and is familiar with the federal marine mammal permit system.

Rob DeLong is an Analyst Programmer for ADF&G. He has developed custom software for the analysis of location and dive data from satellite-tagged seals. He was responsible for programming a PC-compatible Geographic Information System (PC ArcInfo and ArcView) that is used in presenting seal location and movements information. Mr. DeLong is also accomplished in seal catching and tagging techniques.

Dr. Jay Ver Hoef is a Biometrician for ADF&G. He has been responsible for statistical analysis of all harbor seal data during NRDA and Restoration studies. He has participated in field work in PWS and is familiar with seal catching and tagging techniques.

Grey Pendleton is a Biometrician for ADF&G. He has an extensive background in analyzing satellite tagging and aerial survey data. He will be responsible for statistical analysis of satellite tagging data for this and other ADF&G harbor seal projects.

Dr. Sara Iverson is an Assistant Professor at the University of Dalhousie. She is currently conducting research at Sable Island, Nova Scotia, on the lipid metabolism of seals and the use of fatty acids to determine marine food webs. She received her Ph.D. in nutritional sciences, conducting studies of the energetics of reproduction and fatty acid metabolism in seals. She developed procedures for analysis of lipids in milk, blubber and tissues of pinnipeds. Dr. Iverson has published extensively on these subjects.

The following is a list of key people and their responsibilities:

| | |
|---|---|
| Kathryn Frost: | Project management and coordination, planning, data analysis, reporting, seal tagging, aerial surveys |
| Lloyd Lowry: | Permitting, tagging, GIS analysis of SLTDR data, coordination of genetics study, coordination with other ADF&G harbor seal studies |
| Robert DeLong: | Tagging, programming, GIS analysis of SLTDR data |

| | |
|---|---|
| Jay Ver Hoef: | Statistical analysis of survey data, tagging |
| Grey Pendleton | Statistical analysis of tagging data |
| Robert Small: | Modeling, tagging |
| Sara Iverson: | Fatty acid analysis and interpretation |
| Greg O'Corry-Crowe: | Genetics analysis and interpretation |
| Randy Zarnke: | Coordination of disease studies, serum archival |

## LITERATURE CITED


Ackman, R. G. 1980. Fish lipids Part 1. Pages 86-103 *In* Connell, J. J. (ed). Advances in fish science and technology. Fishing News Books Ltd., Surry, UK.

Ackman, R. G., C. A. Eaton, and B. A. Linke. 1975. Differentiation of fatty acids in marine specimens of the Atlantic Sturgeon, *Acipenser oxyrhynchus*. Fish. Bull. 73:838-845.

Bowen, W. D., editor. 1990. Population biology of sealworm (*Pseudoterranova decipiens*) in relation to its intermediate and seal hosts. Can. Bull. Fish. Aquat. Sci. 222. 306 pp.

Burns, J. J. 1994. Harbor seal surveys in northern and western Prince William Sound, August 26 to September 6, 1993. Unpubl. Data Rep. to Exxon Company, U.S.A., P. O. Box 2180, Houston, TX. 18 pp.

Calambokidis, J., B. L. Taylor, S. D. Carter, G. H. Steiger, P. K. Dawson, and L. D. Antrim. 1987. Distribution and haul-out behavior of harbor seals in Glacier Bay, Alaska. Can. J. Zool. 65:1391-1396.

Calkins, D., and K. Pitcher. 1984. Pinniped investigations in southern Alaska: 1983-84. Unpubl. Rep. ADF&G, Anchorage, AK. 16 pp.

Clark, L. A. and D. Pregibon. 1992. Pages 377-419 *in* Chambers, J. M. and T. J. Hasti (eds). Statistical models in S. Wadsworth and Brooks, Pacific Grove, CA.

Cook, H. W. 1985. Fatty acid desaturation and chain elongation in eucaryotes. Pages 181-212 *in* Vance, D. E. and J. E. Vance (eds). Biochemistry of lipids and membranes. Benjamin/Cummings Publ. Co., Inc., Menlo Park, CA.

Efron, B., and R. Tibshirani. 1986. Bootstrap methods for standard errors, confidence intervals, and other measures of statistical tendency. Statistical Sci. 1:54-75.

Fancy, S. G., L. F. Pank, D. C. Douglas, C. H. Curby, G. W. Garner, S. C. Amstrup, and W. L. Regelin. 1988. Satellite telemetry: a new tool for wildlife research and management. U. S. Dept. of Interior, Fish and Wildl. Serv. Resource Publ. 172. 54 pp.

Fedak, M. A., S. S. Anderson, and M. G. Curry. 1984. Attachment of a radio tag to the fur of seals. Notes from the Mammal Society 46:298-300.

Frost, K. J. and L. F. Lowry. 1994a. Marine Mammals Study Number 5: Assessment of injury to harbor seals in Prince William Sound, Alaska, and adjacent areas following the *Exxon Valdez* oil spill. State-Federal Natural Resource Damage Assessment for April 1989-December 1991. Final Rep. ADF&G Fairbanks, AK. 154 pp.

Frost, K. F. and L. F. Lowry. 1994b. Habitat use, behavior, and monitoring of harbor seals in Prince William Sound, Alaska. Ann. Rept. to the EVOS Trustee Council. Restoration Study No. 93064. 99 pp.

Frost, K. J., L. F. Lowry, E. Sinclair, J. Ver Hoef, and D. C. McAllister. 1994a. Impacts on distribution, abundance, and productivity of harbor seals. Pages 97-118 *in*: T. R. Loughlin (ed.). Marine Mammals and the *Exxon Valdez*. Academic Press, San Diego, CA.

Frost, K. F., C.-A. Manen, and T. L. Wade. 1994b. Petroleum hydrocarbons in tissues of harbor seals from Prince William Sound and the Gulf of Alaska. Pages 331-358 *in*: T. R. Loughlin (ed.). Marine Mammals and the *Exxon Valdez*. Academic Press, San Diego, CA.

Frost, K. F., L. F. Lowry, and J. Ver Hoef. 1995. Habitat use, behavior, and monitoring of harbor seals in Prince William Sound, Alaska. Ann. Rept. to the EVOS Trustee Council. Restoration Study No. 94064 and 94320-F. 88 pp.

Geraci, J. R., K. Skirnisson, and D. J. St. Aubin. 1981. A safe method for repeatedly immobilizing seals. J. Amer. Vet. Med. Assn. 179:1192-1192.

Harvey, J. T. 1987. Populations dynamics, annual food consumption, movements, and dive behaviors of harbor seals, *Phoca vitulina richardsi*, in Oregon. Ph.D. Thesis, Oregon State Univ.

Heide-Jorgensen, M.-P., T. Harkonen, R. Dietz, and P. M. Thompson. 1992. Retrospective of the 1988 European seal epizootic. Dis. Aquat. Org. 13:37-62.

Hill, R. D., S. E. Hill, and J. L. Bengtson. 1987. An evaluation of the Argos satellite system for recovering data on diving physiology of Antarctic seals. Page 32 *in*: Abstracts of the Seventh Biennial Conference on the Biology of Marine Mammals, Miami, FL.

Iverson, S. J. 1988. Composition, intake and gastric digestion of milk lipids in pinnipeds. Ph.D. Thesis, Univ. of Maryland, College Park, MD.

Iverson, S. J. 1993. Milk secretion in marine mammals in relation to foraging: can milk fatty acids predict diet? Symp. Zool. Soc. London 66:263-291.

Iverson, S. J. and O. T. Oftedal. 1992. Fatty acid composition of black bear (*Ursus americanus*) milk during and after the period of winter dormancy. Lipids 27:940-943.

Iverson, S. J., O. T. Oftedal, W. D. Bowen, D. J. Boness, and J. Sampugna. Submitted. Prenatal and postnatal transfer of fatty acids from mother to pup in the hooded seal. J. Comp. Physiol.

Iverson, S. J., J. Sampugna, and O. T. Oftedal. 1992. Positional specificity of gastric hydrolysis of n-3 polyunsaturated fatty acids of seal milk triglycerides. Lipids 27:870-878.

Lamont, M. M., and W. K. Thomas. 1994. Genetic variability of Pacific harbor seals, *Phoca vitulina richardsi*, from Washington, Oregon, and California. Paper presented at the Symposium on Marine Mammal Genetics, La Jolla, CA., 23-24 September 1994 (abstract only).

Lehman, N., R. K. Wayne, and B. S. Stewart. 1993. Comparative levels of genetic variability in harbour seals and northern elephant seals as determined by genetic fingerprinting. Pages 49-60 *in* I. L. Boyd (ed.) Recent advances in marine mammal science. Symp. Zool. Soc. Lond. (1993) No. 66.

Loughlin, T. R. 1992. Abundance and distribution of harbor seals (*Phoca vitulina richardsi*) in Bristol Bay, Prince William Sound, and Copper River Delta during 1991. Ann. Rep. MMPA Assessment Program, Office of Protected Resources, NMFS, NOAA, 1335 East-West Highway, Silver Spring MD. 26 pp.

Loughlin, T. R. 1993. Abundance and distribution of harbor seals (*Phoca vitulina richardsi*) in the Gulf of Alaska and Prince William Sound in 1992. Ann. Rep. MMPA Assessment Program, Office of Protected Resources, NMFS, NOAA, 1335 East-West Highway, Silver Spring MD. 25 pp.

Lowry, L. F., K. J. Frost, R. Davis, R. S. Suydam, and D. P. DeMaster. 1994a. Movements and behavior of satellite-tagged spotted seals (*Phoca largha*) in the Bering and Chukchi seas. NOAA Tech. Memo. NMFS-AFSC-38. 71 pp.

Lowry, L. F., K. J. Frost, and K. W. Pitcher. 1994b. Observations of oiling of harbor seals in Prince William Sound. Pages 209-225 *in*: T. R. Loughlin (ed). Marine Mammals and the *Exxon Valdez*. Academic Press, San Diego, CA.

Mate, B. R. 1986. Tracking marine mammals by satellite: Identification of critical habitats. Whalewatcher, Summer:8-9.

Mate, B. R. 1989. Satellite monitored radio tracking as a method of studying cetacean movements and behavior. Rep. Intl. Whal. Commn. 39:389-391.

O'Corry-Crowe, G. M. and R. L. Westlake. 1994. Molecular investigation of spotted seals and harbour seals and their relationship in areas of sympatry. Paper presented at the Symposium on Marine Mammal Genetics, La Jolla, CA., 23-24 September 1994 (abstract only).

Pitcher, K. W. 1977. Population productivity and food habits of harbor seals in the Prince William Sound - Copper River Delta area, Alaska. Fin. Rept. to the U. S. Marine Mammal Commission, Contract MM5AC011, AK. Dep. Fish and Game, Anchorage, AK. 36 pp.

Pitcher, K. W., and D. G. Calkins. 1979. Biology of the harbor seal (*Phoca vitulina richardsi*) in the Gulf of Alaska. U. S. Dep. Commerce, NOAA, OCSEAP Final Rep. 19(1983):231-310.

Pitcher, K. W. 1986. Harbor seal trend count surveys in southern Alaska, 1984. Unpubl. Rep. ADF&G, Anchorage, AK. 10 pp.

Pitcher, K. W. 1989. Harbor seal trend count surveys in southern Alaska, 1988. Final Rep. Contract MM4465852-1 to U.S. Marine Mammal Commission, Washington, D C. 15 pp.

Saulitis, E. L. 1993. The behavior and vocalizations of the ""AT" group of killer whales (*Orcinus orca*) in Prince William Sound, Alaska. Masters Thesis, Univ. of Alaska Fairbanks, Fairbanks, AK. 193 pp.

Snedecor, G. W., and W. G. Cochran. 1969. Statistical methods. Iowa State University Press, Ames, Iowa. 593 pp.

Spraker, T. R., L. F. Lowry, and K. J. Frost. 1994. Gross necropsy and histopathological lesions found in harbor seals. Pages 281-311 *in*: T. R. Loughlin (ed). Marine Mammals and the *Exxon Valdez*. Academic Press, San Diego, CA.

Stewart, B. S., S. Leatherwood, P. K. Yochem, and M.-P. Heide-Jorgensen. 1989. Harbor seal tracking and telemetry by satellite. Mar. Mamm. Sci. 5:361-375.

Stratton, L. 1990. Resource harvest and use in Tatitlek, Alaska. Div. Subsistence Tech. Paper 181. ADF&G, Anchorage, AK. 163 pp.

Stratton, L. and E. B. Chisum. 1986. Resource use patterns in Chenega, western Prince William Sound: Chenega in the 1960s and Chenega Bay in 1984-1986. Div. Subsistence Tech. Paper 139. ADF&G, Anchorage, AK. 161 pp.

Thompson, P. M. and A. J. Hall. 1993. Seals and epizootics - what factors might affect the severity of mass mortalities? Mammal Rev.23:149-154.

Wolfe, R. J. and C. Mishler. 1993. The subsistence harvest of harbor seal and sea lion by Alaska Natives in 1992. Tech. Paper No. 229. Part 1. Division of Subsistence, Alaska Dept. Fish and Game, Juneau. 94 pp.

Wynne, K. 1990. Marine mammal interactions with the salmon drift gillnet fishery on the Copper River Delta, Alaska, 1988-1989. Alaska Sea Grant Rep. 90-05, Fairbanks, AK. 36 pp.

Table 1. Prince William Sound harbor seal trend count route.

| Site # | Description | Status relative to EVOS |
|---|---|---|
| 1 | Sheep Bay | unoiled |
| 2 | Gravina Island | unoiled |
| 3 | Gravina Rocks | unoiled |
| 4 | Olsen Bay | unoiled |
| 5 | Porcupine Point | unoiled |
| 6 | Fairmount Island | unoiled |
| 7 | Payday | unoiled |
| 8 | Olsen Island | unoiled |
| 9 | Point Pellew | unoiled |
| 10 | Little Axel Lind Island | unoiled |
| 11 | Storey Island | oiled |
| 12 | Agnes Island | oiled |
| 13 | Little Smith Island | oiled |
| 14 | Big Smith Island | oiled |
| 15 | Seal Island | oiled |
| 16 | Applegate Rocks | oiled |
| 17 | Green Island | oiled |
| 18 | Channel Island | unoiled |
| 19 | Little Green Island | unoiled |
| 20 | Port Chalmers | unoiled |
| 21 | Stockdale Harbor | unoiled |
| 22 | Montague Point | unoiled |
| 23 | Rocky Bay | unoiled |
| 24 | Schooner Point | unoiled |
| 25 | Canoe Passage | unoiled |

Table 2. Harbor seals instrumented with SLTDRs and sampled during 1992-1995. Only SLTDRs from which significant amounts of data were received are included.

| | | SLTDRs | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Location | Date | AdM | SubM | AdF | SubF | DNA | Blood | Fat | Whiskers |
| Applegate Rocks | May 92 | | 3 | 1 | | | 5 | | |
| | May 93 | 2 | | | | 5 | 5 | | |
| | Sep 93 | | | | | 1 | 1 | | 1 |
| | Sep 95 | | | | | 2 | 2 | 2 | 2 |
| Bay of Isles | Sep 93 | 1 | | | | 1 | 1 | | 1 |
| Channel Island | Sep 93 | 1 | | | | 3 | 3 | | 3 |
| | Sep 94 | 2 | | | 1 | 13 | 11 | 13 | 12 |
| | May 95 | | | | | 6 | 6 | 6 | 6 |
| | Sep 95 | | | | | 1 | 1 | 1 | 1 |
| Dutch Group | May 95 | | 1 | | | 4 | 4 | 4 | 4 |
| Gravina Island | Sep 94 | | 1 | | | 3 | 3 | 3 | 3 |
| | Sep 95 | | | | 2 | 2 | 2 | 2 | 2 |
| Green Island | Apr 94 | | | | | 1 | 1 | | 1 |
| Little Green Isl. | Apr 94 | | | | | 1 | 1 | 1 | 1 |
| | Sep 95 | | 1 | 1 | | 9 | 9 | 9 | 9 |
| Lone Island | May 95 | | | | | 1 | 1 | 1 | 1 |
| Olsen Bay | May 95 | | | | 1 | 2 | 2 | 2 | 2 |
| Port Chalmers | Apr 94 | | | | | 2 | 2 | 2 | 2 |
| | Sep 94 | | | 3 | 1 | 10 | 10 | 10 | 10 |
| | May 95 | | | 2 | | 4 | 4 | 4 | 4 |
| | Sep 95 | | | 2 | 1 | 6 | 6 | 6 | 6 |
| Seal Island | May 92 | | | | | 1 | 3 | | |
| | May 93 | 3 | | 1 | | 7 | 7 | | |
| | Sep 93 | 2 | 1 | 1 | | 10 | 10 | | 10 |
| Stockdale Harbor | Apr 94 | | | | | 6 | 6 | 5 | 6 |
| | May 95 | 1 | | | 1 | 5 | 5 | 5 | 5 |
| | **TOTAL** | **12** | **7** | **11** | **7** | **106** | **112** | **76** | **77** |

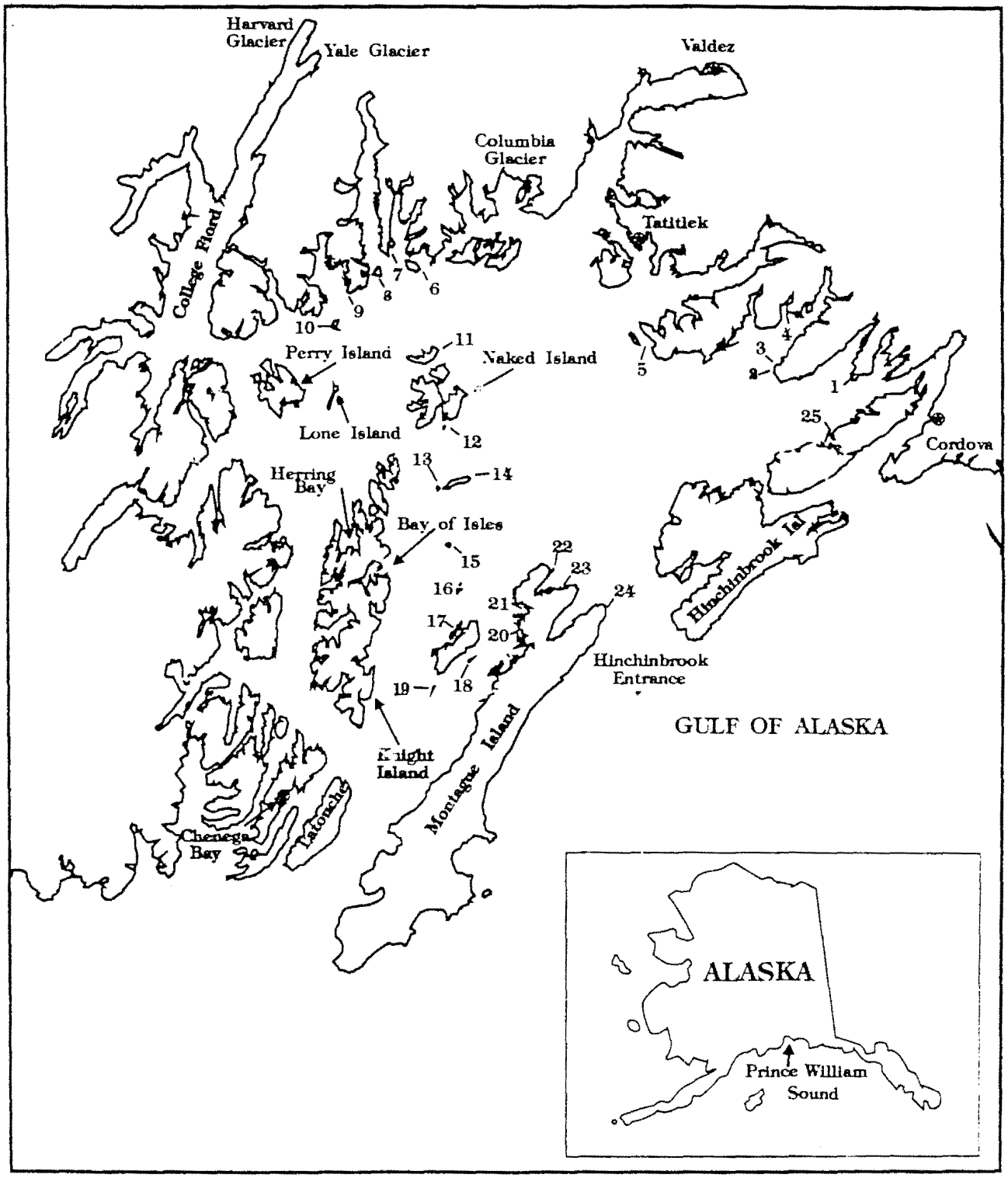


Figure 1. Map of Prince William Sound showing oiled and unoiled trend count sites and other locations referred to in text.

**1997 EXXON VALDEZ TRUS . __ COUNCIL PROJECT BUDGET**

October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1996 | Proposed FFY 1997 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| Personnel | $129.4 | $151.2 | | | | | | |
| Travel | $10.6 | $10.7 | | | | | | |
| Contractual | $118.7 | $95.7 | | | | | | |
| Commodities | $60.9 | $64.5 | | | | | | |
| Equipment | $21.0 | $0.0 | | | | | | |
| Subtotal | $340.6 | $322.1 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| General Administration | $27.7 | $29.4 | | | | | | |
| Project Total | $368.3 | $351.5 | $150.0 | $50.0 | | | | |
| | | | | | | | | |
| Full-time Equivalents (FTE) | 1.8 | 2.5 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

Comments:

**1997**

Project Number: 97064
Project Title: Monitoring Habitat Use and Trophic Interactions of Harbor Seals in Prince William Sound
Agency: AK Dept. of Fish & Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: 18-Mar-96

# 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Personnel Costs: | | GS/Range/ | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|
| Name | Position Description | Step | Budgeted | Costs | Overtime | FFY 1997 |
| 11-2115 | WBIII, Program Coordinator and Mngt | 18K | 10.5 | 6256 | | 65.7 |
| 11-2113 | WBIII,Permits, Data Analysis&Interpretation | 18L | 4.0 | 6449 | | 25.8 |
| 11-2137 | Analyst Programmer III - GIS programming | 17E | 2.0 | 5200 | | 10.4 |
| 11-2206 | Biometrician II - survey statistical analysis | 19E | 1.0 | 5898 | | 5.9 |
| Vacant | WT IV | 13D | 3.0 | 4476 | | 13.4 |
| 11- | Biometrician II - sat tag statistical analysis | 19A | 3.0 | 5164 | | 15.5 |
| Vacant | Graduate intern | 12A | 6.0 | 2411 | | 14.5 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | Subtotal | | 29.5 | 35854.0 | 0.0 | |
| | | | | | Personnel Total | $151.2 |

| Travel Costs: | Ticket | Round | Total | Daily | Proposed |
|---|---|---|---|---|---|
| Description | Price | Trips | Days | Per Diem | FFY 1997 |
| Fbks-Cordova for Sep surveys, 1 person | 464 | 1 | 10 | 115 | 1.6 |
| Fbks-Anchorage, tagging, 2 persons x 2 field trips | 224 | 4 | 2 | 115 | 1.1 |
| PWS-Anchorage 1-way charter, crew rotation | 150 | 2 | 0 | 0 | 0.3 |
| Portage-Whittier by train (2 vehicles per trip) | 406 | 4 | 0 | 0 | 1.6 |
| Fbks-Portage, personal vehicles | 250 | 4 | 0 | 115 | 1.0 |
| Fbks-Cordova, community meetings, 1 person | 464 | 1 | 2 | 115 | 0.7 |
| Cordova-Chenega/Tatitlek, community meeting, 1 person | 250 | 2 | 2 | 95 | 0.7 |
| Fbks-Anchorage, Harbor Seal Commission, 1 person | 224 | 2 | 4 | 95 | 0.8 |
| Fbks-Anchorage, annual workshop, 1 person | 224 | 1 | 5 | 95 | 0.7 |
| Fbks-Anchorage, workshop no advance, 1 person | 300 | 3 | 6 | 95 | 1.5 |
| Fbks-Anchorage, coordination committee, 1 person | 224 | 2 | 3 | 95 | 0.7 |
| | | | | | 0.0 |
| | | | | Travel Total | $10.7 |

**1997**

Prepared: 18-Mar-96

Project Number: 97064
Project Title: Monitoring Habitat Use and Trophic Interactions of Harbor Seals in Prince William Sound
Agency: AK Dept. of Fish & Game

FORM 3B
Personnel
& Travel
DETAIL

**1997 EXXON VALDEZ TRUS . __ COUNCIL PROJECT BUDGET**

October 1, 1996 - September 30, 1997

| **Contractual Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| NOAA contract for ARGOS satellite data, FY96 obligation for Sep 96 tags | 12.0 |
| NOAA contract for ARGOS satellite data, new FY 97 tags | 12.0 |
| Print/graphics (slides for workshops, report production, summary for villages) | 0.5 |
| Long distance phone calls | 1.8 |
| Postage (DHL, courier, etc.) | 0.2 |
| Trailer parking & launch fees, Whittier ($100/trip x 2 trips) | 0.2 |
| Aircraft charter 40 hrs @ $.23/hr x 1 survey during fall molt | 9.2 |
| Vessel charter for tagging/sampling @ 1.8/day x 8 days x 2 trips | 28.8 |
| Lipid analysis contract with Dalhousie University | 30.0 |
| Freight and shipping of samples | 1.0 |
| When a non-trustee organization is used, the form 4A is required. **Contractual Total** | $95.7 |

| **Commodities Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| Genetics supplies for analysis of 50 -100 samples/year | 5.0 |
| Fuel for boats and skiffs | 2.5 |
| Biopsy punches, flipper tags, epoxy. tag supplies, film | 1.5 |
| Small boat supplies (propellers, oars, oil, etc.) | 1.2 |
| Laboratory supplies (cryovials, vacutainers, syringes, gloves, needles, etc.) | 1.0 |
| Repair supplies for skiffs, net, etc. | 3.0 |
| 12 satellite tags @ $4.0/unit (from Wildlife Computers) | 48.0 |
| Misc. field and meeting supplies (waterproof notebooks, bindings, marine charts, batteries, etc.) | 0.3 |
| Computer supplies and software for graphics, GIS, and other analyses | 2.0 |
| **Commodities Total** | $64.5 |

**1997**

Prepared: 18-Mar-96

Project Number: 97064
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FORM 3B
Contractual & Commodities DETAIL

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

| New Equipment Purchases: Description | Number of Units | Unit Price | Proposed FFY 1997 |
|---|---|---|---|
| | | | 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 |
|---|---|---|
| Equipment used by project, purchased with oil spill funds | | |
| Leitz binoculars | 1 | ADF&G |
| HP LIID Printer | 1 | ADF&G |
| Compaq 286 Computer | 1 | ADF&G |
| Zodiac Raft | 1 | ADF&G |
| | | |
| Equipment used by project, but purchased with non-oil spill funds | | |
| 20 ft Boston whaler | 1 | ADF&G |
| 17 ft Boston whaler | 1 | ADF&G |
| Seal nets | 1 | ADF&G |
| 2 486 computers + Plotter | 1 | ADF&G |
| Printer | 2 | ADF&G |
| Color printer | 1 | ADF&G |

**1997**

Project Number: 97064
Project Title: Monitoring Habitat Use and Trophic Interactions of Harbor Seals in Prince William Sound
Agency: AK Dept. of Fish & Game

FORM 3B
Equipment
DETAIL

Prepared: 18-Mar-96

**Project Title: Effects of Oiled Incubation Substrate on Straying and Survival of Wild Pink Salmon**

| | |
|---|---|
| Project Number: | 97076 |
| Restoration Category: | Research |
| Proposer: | Alex Wertheimer and Ronald Heintz<br>NMFS Auke Bay Laboratory |
| Lead Trustee Agency: | NOAA |
| Cooperating Agencies: | |
| Alaska SeaLife Center: | |
| Duration: | 2 years |
| Cost FY97: | $623.2 |
| Cost FY98: | $234.6 |
| Cost FY99: | |
| Cost FY00: | |
| Cost FY01: | |
| Geographic Area: | Little Port Walter, Baranof Island, Southeast Alaska |
| Injured Resource: | Pink salmon |



## ABSTRACT

This project examines the effects of oil exposure during embryonic development on the straying, marine survival, and gamete viability of pink salmon. The objectives are to conduct a related series of controlled experiments on straying of pink salmon to determine the role of oil and other factors on straying so that field studies of straying in PWS after the spill can be interpreted; to determine if the return rate of pink salmon to adult is reduced when they have been exposed to oiled gravel during embryonic development; and to continue investigations into whether such exposure causes heritable damage to reproductive fitness of pink salmon.

## INTRODUCTION

This project will examine the effects of oil exposure during embryonic development of pink salmon on the straying, marine survival, and gamete viability of returning adults. A series of controlled experiments will determine the impact of oil exposure on straying, as well as the effects of other factors (marking, stock, and transplant), so that measurements of straying in PWS after the spill can be interpreted, and the significance of straying on management and restoration strategies can be evaluated. We will also determine if oil exposure during embryonic development reduces the return rate of pink salmon to adult. It continues the investigations into whether such exposure reduces the gamete viability of surviving adults, and if such damage is heritable.

This Restoration Project combines Projects 96076 and 96191B. These projects were closely related studies on direct and indirect toxic effects of crude oil on pink salmon exposed as embryos in oiled gravel. They were combined to achieve logistic and economic efficiencies; for more details, see the section in this Detailed Project Description on "Explanations of Changes in Continuing Projects."

The project will require tagging several hundred thousand fry from wild and experimental treatment groups in 1996, and examining returning adults in natal streams, other streams within 50 km of the natal streams, and caught in an adjacent fishery in 1997. Pink salmon were collected and spawned for the experiments in 1995. For the 1995 exposure experiments, fertilized eggs are being incubated in a controlled simulation of oiled intertidal habitat which occurred in Prince William Sound (PWS) after the *Exxon Valdez* oil spill. Fry from the oil-exposed and control groups will be marked to identify treatments when they emigrate from the incubators, and then released to migrate to the Gulf of Alaska. Corresponding groups of wild fry will also be captured and marked. Progeny of adults returning from Project 96191B are being incubated in freshwater with no additional exposure to crude oil. These fish will also be marked and released to determine if the progeny of oil-exposed fish have inherited reproductive dysfunction.

Recoveries of tagged adults will be used to determine if oil exposure causes differences in straying and marine survival. Escapement and sampling rates in natal and non-natal streams will be estimated so that actual straying rates within the sampling region can be estimated, and the effects of oil, marking, population, and geographic factors on straying rate can be evaluated. Adults from the oil-exposure experiments that return to the release site will be identified as to treatment and then spawned. The fertilized eggs will be incubated in a clean environment. Survival of their progeny to the fry stage will be measured to determine if exposure to oil during incubation impaired reproductive viability, and if such impairment is heritable.

This is a large multi-year study requiring significant logistic support for operations at remote sites. The study is located in southeast Alaska because of the possible influence of prior or continuing oil contamination of pink salmon in PWS. The project was initiated in FY95 and will extend over four years. Annual reports will be prepared each year. A final report will be prepared in 1998 summarizing the results of the study and the analysis of the restoration objectives. A synthesis of the results with previous field studies on pink salmon straying in PWS

will also be prepared to evaluate the impacts of oil on straying of pink salmon, and to assess the implications of direct and indirect damage from crude oil to management and restoration strategies for pink salmon in PWS.

## NEED FOR THE PROJECT

### A. Statement of Problem

Pink salmon were injured at several life-history stages during and shortly after the oil spill. Evidence of long-term damage from the toxic exposures of 1989 continues to build, and a thorough evaluation of the toxic contribution to pink salmon recovery problems became even more important when there was no explanation for the crash in pink salmon and herring in 1993. Three areas of continuing concern are the impacts of oil exposure on: (1) homing and straying behavior; (2) survival of emergent fry in the marine environment; and (3) reproductive viability of exposed fish and their offspring.

Straying was a major concern during the spill; the Trustees supported a multi-million dollar effort to assess straying, and substantial straying of wild and hatchery stocks was observed. Unfortunately, the interpretation of that study is severely limited for several reasons. Consequently, the amount of straying caused by oil is not known, natural straying rates are not known, and straying information cannot be used to develop or adjust restoration or management strategies.

### B. Rationale

Pink salmon will be considered recovered when population indicators, such as growth and survival, are within normal bounds and there is no statistical differences in egg mortality between oiled and unoiled streams. Understanding the toxic effects of the 1989 oiling is a major component of the Trustee Council's program to restore pink salmon. Results from Natural Resource Damage Assessment and Restoration Studies following the spill indicate that the toxic exposures of 1989 have caused persistent, long-term damage to pink salmon. Field studies in PWS after the *Exxon Valdez* oil spill have demonstrated differences in embryo survival between oiled and non-oiled streams. In addition, laboratory studies have shown that differences in survival between oiled and non-oiled streams may be heritable (Restoration Study 94191A). Long-term (7-8 months) intra-gravel exposure of developing pink salmon eggs and alevins caused retarded development, altered emergence timing, decreased survival to eyeing and emergence, and an increased occurrence of gross lesions at emergence; it also had the surprising effect of delayed impacts on marine growth (Restoration Study 95191B). These developmental abnormalities from exposure to oil could persist and affect the behavior and fitness of the fish during subsequent life-history stages, including: (1) homing and straying; (2) survival of emergent fry in the marine environment; and (3) reproductive viability of exposed fish and their offspring.

Straying of pink salmon was a major issue following the spill. The Trustees supported a multi-million dollar effort to assess straying, and substantial straying of wild and hatchery stocks was observed. The ability of salmon to home (to return to their natal stream to spawn) is probably

the most well-known and remarkable characteristic of these fish. Not all salmon return to their natal stream, however; some stray to non-natal streams to spawn. Some degree of straying is important to salmon populations; it is a mechanism for colonization of new habitat, as well as for the recolonization of habitat that has been damaged and subsequently restored. However, disruption in the normal amount of straying could have adverse impacts on the genetic structure of locally-adapted salmon populations. If high straying rates for pink salmon occur naturally in PWS, then the genetic structure of the populations in PWS should be relatively homogeneous, and large-scale mixing of wild stocks and the hatchery stocks derived from them should be of minor concern. Restoration of damaged pink salmon runs would thus be expected to occur naturally through recolonization from healthy stream systems. However, if the presence of oil increased straying from normally low levels, then the genetic diversity among and within wild stocks could be jeopardized from induced straying, and the genetic damage hypothesized to occur as a result of incubation in oiled substrate could be passed on to pink salmon in streams originally not oiled by the *Exxon Valdez*.

Straying rates for wild pink salmon observed in PWS in 1991 averaged 26% and ranged from 8-54% for fish from both oiled and non-oiled streams, based on coded-wire tag (CWT) recoveries in natal and non-natal streams. These straying rates seem high in relation to the concept that salmon normally home. Unfortunately, interpretations of that research are confused because even the wild stocks from non-oiled streams (controls) had to pass through oiled areas, and, thus, were not true controls. Also, marking the fish with CWTs may have affected their straying behavior. Normal levels of straying are not known for pink salmon. Consequently, the amount of straying caused by oil is not known, and straying information cannot be used to adjust restoration or management strategies. This study will conduct controlled straying experiments to permit an evaluation of oil on straying, and to examine the effect of tagging, stock, and transplant on straying. To avoid the confounding effects of prior or continuing exposure to oil, the experiments need to be carried out in a geographic region remote from PWS. By identifying the effects of the various factors on straying, however, the results of these experiments can be directly applied to interpret the previous straying study in PWS.

Pink salmon incubated in oiled gravel experience long-term effects that may lead to reduced fitness but a rigorous demonstration remains to be made. Restoration Study 95191B demonstrated that pink salmon incubated in oiled gravel had reduced growth rates, and matured at a smaller size. In addition, there was strong evidence for reduced marine survival and gamete viability, but statistical analysis failed to reveal differences because of limitations imposed by the experimental designs. These are important findings that support the observations of Bue et al. (1995) and represent the first observations of long-term effects of oil on an economically important species. The large numbers of fish proposed for release in this study will provide adequate numbers of surviving adults to overcome the limitations of the experimental designs in the Restoration Study 95191B. Thus, the observations of reduced growth, marine survival and gamete viability may be corroborated. In addition, we propose to demonstrate the heritability of these effects by coded-wire tagging and releasing the offspring of the fish exposed in Restoration Study 95191B. These fish have been incubated in uncontaminated environments since they were spawned in 1995, and their growth, marine survival and gamete viability will be evaluated when they return in 1997.

## C. Location

The project will be implemented at Little Port Walter (LPW, Figure 1), a research facility of the NMFS Auke Bay Laboratory (ABL). This location is appropriate because of the logistic and infrastructure support the ABL and the LPW station provide for this complex array of experiments. It is also necessary to examine the response of pink salmon straying to oil exposure at a geographic locale remote from PWS, away from the confounding effect of prior or continuing oil exposure. Gametes will be collected from Lovers Cove Creek and Sashin Creek, Baranof Island, southeast Alaska. Eggs will be incubated, and pink salmon fry will be tagged at LPW, near the mouth of Sashin Creek, 10 km from Lovers Cove Creek. Returning adult pink salmon will be recovered from streams on the eastern coast of Baranof Island and the west coast of Kuiu Island, within 50 km of LPW.

Technical support provided at this location includes the use of the research station at LPW as a base for the fieldwork. This station will provide housing for project personnel, a wet lab for egg incubation, a weir across Sashin Creek for recovery of adult pink salmon, microscopes for the decoding of CWTs, and facilities for the spawning of adult pink salmon. The ABL will provide four tagging machines, vessel support, computer services, analysis of GC/MS samples, and communication and administrative support. Materials and personnel will be transported to and from LPW via the NOAA vessel R/V *John N. Cobb*, as well as contracted air taxi charters.

## COMMUNITY INVOLVEMENT

Scientists involved in this study will regularly present progress reports and results in scientific and public forums, including the annual workshop. They will be available to talk with interested public and will provide information for Trustee Council newsletters and annual reports as appropriate.

This project will be located in southeast Alaska out of the spill area because of the need to avoid the confounding effects of previous or continuing oil contamination in PWS. However, it will require substantial labor for fish marking and stream surveys, as well as contracts for vessel charters. Agency hiring restrictions may limit us to contract hires for the intensive labor needs. In the first two years of this project, we have contracted people from communities in the area of the study (Juneau, Sitka, Petersburg, and Port Alexander), and anticipate similar contractual arrangements in FY97 for labor and vessels. We have also given the Port Alexander School a standing invitation for bringing students to the facility to view the operations and learn about scientific inquiry in general and oil toxicity studies on salmon in particular. We will continue to provide information to interested public (primarily fishermen) who visit the station; we will be displaying at the facility the posters developed for the Restoration Workshop for 95191B and 95076 as interpretative tools.

## PROJECT DESIGN

Pink salmon were injured at several life-history stages during and shortly after the oil spill. Evidence of long-term damage from the toxic exposures of 1989 continues to build, and a thorough evaluation of the toxic contribution to pink salmon recovery problems became even more important when there was no explanation for the crash in pink salmon and herring in 1993. Straying was a major concern during the spill; the Trustees supported a multi-million dollar effort to assess straying, and substantial straying of wild and hatchery stocks was observed (Sharp et al. 1995). Unfortunately, interpretation of that study is severely limited for several reasons. Consequently, the amount of straying caused by oil is not known, natural straying rates are not known, and straying information cannot be used to adjust restoration or management strategies. This project contributes to the understanding of the toxic effects of the oil spill and to the recovery process by examining the effects of oil exposure during incubation on the straying, marine survival, and gamete viability of pink salmon.

After the unexpected crash of pink salmon in 1993, two major research thrusts emerged: (1) evaluation of the ecosystem and its ability to support recovery of populations (SEA plan) and, (2) evaluation of long-term damage from earlier oil exposure. Long-term damage was not originally suspected, even though there was ample evidence of short-term damage such as reduced embryo survival (Bue et al. 1995), reduced marine growth (Wertheimer and Celewycz 1995; Willette 1995), and population effects (Geiger et al. 1995). Bue et al. (1995) found that elevated egg mortalities continued in oiled streams beyond the initial years of heavy oiling in intertidal spawning zones. They hypothesized that these persistent effects resulted from heritable damage passed on to subsequent generations. One model of how oil contamination could cause this damage is based on the biology of pink salmon egg-alevin development: Pink salmon spawn in contaminated intertidal zones of streams; the embryos incubate in contaminated streams for 7-8 months; and oil, which is extremely lipophillic, is readily absorbed into the large yolk reserves of the embryos. This exposure then causes both lethal and non-lethal damage to developing embryos. The non-lethal damage can result in subtle developmental changes with potentially large implications in later life history stages, such as reduced marine survival and increased straying.

This model of exposure and damage is supported by controlled laboratory exposures to pink salmon eggs at Little Port Walter (LPW). This research, stimulated by the Alaska Department of Fish and Game (ADFG) field studies, has shown that long-term (7-8 months) intra-gravel exposure of developing pink salmon eggs and alevins caused the predicted short-term effects (retarded development, altered emergence timing, decreased survival to eyeing and emergence, an increased occurrence of gross lesions at emergence) and also had the surprising effect of delayed impacts on marine growth (Restoration Study 94191B). These developmental abnormalities from exposure to oil could persist and affect the behavior and fitness of the fish during subsequent life-history stages, including (1) homing and straying; (2) survival of emergent fry in the marine environment; and (3) reproductive viability of exposed fish and their offspring.

**Straying**

Substantial straying was observed in PWS after the oil spill in 1991 in a large tagging effort of both wild and hatchery pink salmon (Sharp et al. 1995). Interpretations of the study are confused because of concern that tagging caused some of the straying (pers. comm., J. Seeb, ADFG, Anchorage), and because even the wild stocks from non-oiled streams (controls) had to pass through oiled areas and were thus not true controls. Normal levels of straying are not known for pink salmon, and so it is difficult to evaluate the consequences of the observed straying. This study will conduct controlled experiments to permit an evaluation of the effects of oil incubation, tagging, stock, and transplant on straying. To avoid the confounding effects of prior or continuing exposure to oil, the experiments need to be carried out in a geographic region remote from PWS. By identifying the effects of the various factors on straying, however, the results of these experiments can be directly applied to interpretation of the previous straying study in PWS.

Straying rates for wild pink salmon observed in PWS in 1991 averaged 26% for fish from both oiled and non-oiled streams, based on coded-wire tag (CWT) recoveries in natal and non-natal streams (Sharp et al. 1995). Straying was highly variable, ranging from 8% to 54% for the six wild populations marked; straying rates were higher on average for wild fish than for hatchery fish. These high straying rates were surprising, but interpretation and use of the data were severely limited for several reasons. First, natural straying rates for pink salmon are not known for PWS or other areas. Second, the "controls" were wild stocks from non-oiled streams, but these fish had to migrate along contaminated shores, and were not true controls. Thus no measure of normal rates exists. Furthermore, if oil contamination continues, or heritable damaged was indeed passed on, then "normal" rates cannot now be measured in PWS. Third, concern exists that placing CWTs in small pink salmon fry may cause damage responsible for some or most of the straying. Consequently, while substantial straying was measured in both oiled and non-oiled areas, clear interpretation of the results is not possible, and the significance of the measured straying remains unknown.

Straying rates of 26% seem high in relation to the concept that salmon normally home. However, virtually no other quantitative information exists on straying rates of wild pink salmon in their natural range for comparison. Reported straying rates in other species of salmon are highly variable. Examples are: Labelle (1992) observed an average straying rate of 2% for five stocks of wild and enhanced coho salmon, with a range of 0-11%; straying rates tended to be lowest for hatchery fish and highest for stocks subjected to certain supplementation practices. Pascual and Quinn (1994) reported highly precise homing of hatchery chinook salmon to the Columbia River even if the fish were transplanted into the river. However, straying within the river was extremely variable among hatcheries, ranging from 1% to 95%, and was influenced by both environmental and genetic factors (Pascual and Quinn 1994). Tallman and Healey (1994) measured the straying rates for chum salmon in two streams located 2 km apart in the same bay; the straying rate from Walker Creek to Bush Creek was around 50%, while the straying rate from Bush Creek to Walker Creek was less than 2%.

The ability of salmon to home (to return to their natal stream to spawn) is probably the most well-known and remarkable characteristic of these fish. This tendency permits the establishment of discrete, locally adapted populations which are the basis of the stock concept in salmon

management (McDonald 1981). Not all salmon return to their natal stream, however; some stray to non-natal streams to spawn. Straying is in itself a highly adaptive behavior. It is a mechanism for the colonization of new habitat (Milner and Bailey 1989), as well as for the recolonization of habitat that has been damaged and subsequently restored (Roys 1971; Leider 1989). Alexanderdottir (1987) and Quinn (1984) have speculated that pink salmon, which do not have overlapping generations because of their two year life cycle, may have relatively high rates of straying to provide a spatial population structure as a buffer against the risks inherent in a fluctuating environment.

The occurrence of strays in a spawning population does not necessarily mean that the strays are successful in transferring genetic information into the population. Tallman and Healey (1994) found that the gene flow was substantially lower than the straying rate among three populations of chum salmon, suggesting that strays have lower reproductive success than the native fish. However, higher gene flow was associated with higher straying rates. The rate and pattern of straying can still be considered indicative of the potential level of genetic interaction among populations and of the capacity of the species for recolonization of a site (Pascual and Quinn 1994).

Three possible explanations have been proposed for the high rates of straying observed for pink salmon in PWS. One is that oil exposure of the embryos induced high straying. No information exists on whether the developmental abnormalities associated with such exposure could also include deterioration of imprinting and homing. Previous research on the effects of oil on straying has focused on exposing returning adult salmon to oil for a short period of time (1-2 hours). Short-term exposure to oil had no deleterious effect on homing of either chinook salmon (Brannon et al. 1986) or coho salmon (Nakatani et al. 1985). Short-term oil exposure did cause temporary disorientation in migrating adult pink salmon, but did not prevent the eventual return to the home stream (Dames and Moore 1989). Straying rates observed in PWS by Sharp et al. (1995) were similar for fish from both oiled and non-oiled streams; however, the results were confounded because fry from non-oiled streams may have been exposed to oil as they migrated along oiled beaches.

The second explanation is that CWTs contributed to the observed straying rates. Morrison and Zajac (1987) reported that improperly injected CWTs can damage the olfactory nerves of small chum salmon. Pink salmon fry are smaller than chum salmon fry, and thus may be more easily damaged by tag injection. Seeb (pers. comm., ADF&G) found that many of the tags from pink salmon that had strayed in PWS were not in the ideal location in the head.

The third explanation is that the straying rates observed were indeed representative of wild stocks in PWS. Sharp et al. (1995) speculated that pink salmon originating from the intertidal reaches of streams may not imprint as strongly as do pink salmon spawned in upstream reaches of a stream, and may thus return to a general region rather than a specific stream. Up to 75% of pink salmon spawning in PWS occurs in intertidal stream reaches. Pascual and Quinn (1994) also found that chinook salmon released into tributaries to the estuary of the Columbia River had higher straying rates than did the same group of fish released from locations higher upstream, suggesting that longer migration time or distance in freshwater may improve imprinting and homing. For pink salmon returning to LPW from Project 95191B that were recovered,

Wertheimer et al. (1996) estimated straying rates of 3.7-15%, depending on the assumptions used about frequency of strays in pink salmon escapements within approximately 30 km of LPW. If 80% of pink salmon strays occur within 30 km of the natal stream (Sharp et al. 1995), then total straying rates of 95191B pink salmon could have been as high as 19%. However, these observations are also confounded by coded-wire tagging and by transplant of gametes from their parental origin.

The degree of straying of wild pink salmon is an important issue in the restoration and management of wild pink salmon populations in PWS. Information on the spatial patterns of straying, and the factors that affect them, can have direct bearing on such issues as the genetic interaction of wild and hatchery stocks (Pascual and Quinn 1994). If high straying rates occur naturally, then the genetic structure of the populations in PWS should be relatively homogeneous, and large-scale mixing of wild stocks and the hatchery stocks derived from them should be of minor concern. Restoration of damaged pink salmon runs would thus be expected to occur naturally through recolonization from healthy stream systems. However, if the presence of oil increases straying from normally low levels, then genetic diversity among and within wild stocks could be jeopardized from induced straying, and the genetic damage hypothesized to occur as a result of incubation in oiled substrate could be passed on to pink salmon in streams originally not oiled by the *Exxon Valdez*.

**Marine Survival**

The average marine survival was lowest for fish that were exposed to the highest dose of oil in Project 95191B. In 1993, pink salmon were incubated in gravel contaminated with three different amounts of oil and uncontaminated gravel. When they emerged in 1994, they were coded-wire tagged and released. There were four batches of coded-wire tagged fish, and each dose was represented by a single tag code in a batch. Survival among groups representing unexposed fish had a mean survival of 2.0±0.7% compared to 1.6 ±1.1% for groups representing fish exposed to the highest dose (281 µg oil/g gravel), and within batches, fish exposed to the highest dose experienced the poorest survival three out of four times. The exception was the first batch where survival appeared to be related to the order the groups were tagged; unexposed fish were tagged first, and fish exposed to the highest dose were tagged last. To better estimate differences in return rate, taggers should practice tagging fish prior to tagging the experimental groups.

**Gamete Viability**

Offspring of parents exposed during Project 95191B had the lowest average survival to eyeing. Three separate experiments were performed, and average offspring survival among progeny of fish exposed to the highest dose was lowest in all three experiments, with differences between unexposed and high dose groups as great as 25%. Unfortunately, statistical verification of the results was prevented in each of the experiments by limitations in the experimental designs. In the first case, the design did not account for an observed interaction between spawning date and treatment, and the two remaining experiments were underpowered. However, the consistency of the results coupled with the field observations (Bue et al. 1995) and reductions in growth indicates the need for more detailed analysis. The designs of the three experiments were

hampered by the relatively small numbers of returning fish, and this study is designed to remedy the problem by releasing much larger numbers of exposed fish.

The primary objective of Study 95191B was to evaluate the heritability of the long-term damage acquired by pink salmon incubated in oiled gravel. This is now an objective of this study. Parents (P1) that were incubated in oiled gravel beginning in 1993 were spawned when they matured in 1995. Their offspring (F1) were incubated in a clean environment and will be coded-wire tagged and released in the spring of 1996. When the F1 mature in 1997, they will be spawned and the survival of their offspring (F2) will be evaluated. Any differences in survival of the F2 will be related to differences in the exposure histories of the P1 generation.

## A. Objectives

This project has six major objectives related to straying of pink salmon. The design also permits evaluation of two additional objectives concerning the effects of oil exposure during incubation on marine survival and gamete viability.

1. Determine if oil exposure during incubation affects straying of pink salmon.
   **Hypothesis:** Oil exposure during embryonic development increases the straying of pink salmon.

2. Estimate natural straying rates of two stocks of pink salmon. Accomplishing this objective requires a sampling program that can estimate the total strays within a specific geographic area, and evaluation of the influence on straying of such factors as tagging, stock, and transplant (Objectives 3-6).

3. Determine if coded-wire tagging of pink salmon fry affects straying rate.
   **Hypothesis:** Coded-wire tagging of pink salmon fry increases the straying of pink salmon.

4. Determine if stock type affects the straying rate of pink salmon.
   **Hypothesis:**. Stock origin (upstream vs. intertidal) affects the straying rate of pink salmon.

5. Determine if first-generation transplant affects the straying rate of pink salmon.
   **Hypothesis:** Transplant of gametes from a stream to a hatchery incubation and release site affects the straying rate of pink salmon.

6. Develop a synthesis of pink salmon straying research, including the results of this study and use it to evaluate the implications for management and restoration strategies.

7. Determine if oil exposure during incubation affects the marine survival of pink salmon fry.
   **Hypothesis:**. Oil exposure during embryonic development decreases the marine survival of pink salmon.

8. Determine if oil exposure during incubation affects the gamete viability of pink salmon.
**Hypothesis:** Oil exposure during embryonic development decreases the gamete viability of pink salmon.

9. Determine if reduced reproductive viability due to oil exposure during incubation is heritable.
**Hypothesis:** Reduced gamete viability caused by exposure to oil during embryonic development is heritable; progeny of exposed parents will have lower gamete viability than progeny of unexposed parents.

## B. Methods

a. Overview

This project has been designed to examine the effects of oil exposure during embryonic development of pink salmon on: 1) straying rate, 2) marine survival, and 3) gamete viability of returning adults. Pink salmon gametes were taken from fish returning to Lovers Cove Creek, an intertidal spawning population on southeast Baranof Island (Figure 1), and from fish returning to LPW from 95191B releases. The embryos were incubated at Little Port Walter (LPW) near the terminus of Sashin Creek. The embryos from Lovers Cove Creek were placed in a controlled simulation of oiled intertidal habitat which occurred in PWS after the *Exxon Valdez* oil spill. Fresh water and salt water for incubation was provided from Sashin Creek and the LPW estuary, respectively. The embryos from 95191B returns were incubated in freshwater with no additional exposure to crude oil. Fry will be tagged with CWTs to identify treatments (Table 1, Objectives 1, 7, 8,9) and released to migrate to the Gulf of Alaska. Returning adults will be recovered at the release site, from the Armstrong Keta, Inc. (AKI) hatchery brood stock return, and at other streams within 50 km of the release site. The cost-recovery fishery at AKI hatchery will also be sampled as a proxy for the commercial fishery. Recoveries of tagged adults will be used to determine treatment-specific straying rates and marine survival. Tagged adults returning to the release site will be held and spawned, and the fertilized eggs will be incubated in a clean environment to determine gamete viability of fish from the original treatment groups.

Because the effects of oil incubation on straying may be confounded by other factors that could affect straying, the influence of CWTs, stock, and transplant on straying will also be experimentally tested. These comparisons will utilize wild fry emigrating from both Sashin Creek and Lovers Cove Creek, as well as pink salmon fry from the control group of the oil-exposure experiment. The CWT effect will be examined by comparing straying rates of two groups of CWT fry with similar fish marked with fin clips only (Table 1, Objective 3). The stock effect will be tested by comparing straying rates of Sashin Creek wild emigrants and Lovers Cove Creek wild emigrants (Table 1, Objective 4). The transplant effect will be tested by comparing straying rates of Lovers Cove Creek wild emigrants with the control group of the oil-exposure experiment (Table 1, Objective 5). These comparisons will also be repeated for both brood years.

b. Sampling design: assumptions and power

*Assumptions.* An empirical model was developed to determine the power to detect differences in straying between oil-exposure treatment groups at the release group sizes and sampling regimes proposed. A number of assumptions were necessary to simulate the numbers of strays available for recovery, including marine survival, effects of oil exposure and marking and tagging on survival, straying rate, and sampling rate in non-weired streams.

Survival rates to return were based on the historical weir records for Sashin Creek (Olsen and McNeil 1967; Vallion et al. 1981). Survival to the weir ranged from 0.2 to 23.1%, averaged 3.7%, and had a median of 1.6% for 31 years for which data are available during the period 1939-1980. Because the distribution of survivals was highly skewed, the median was used as the assumption for "normal" survival. An estimate of 0.9% was used for "low" survival; over 70% of the observed survivals for Sashin Creek wild fry have been greater than or equal to this value.

Marking fish can be expected to reduce survival. No literature value is available for the effect of the CWT on small pink salmon. However, Bailey (1995) found that chum salmon fry marked with the adipose fin clip and CWT had 50% lower survival than unmarked fry. This rate includes the effects of tag loss subsequent to release. We used this as an adjustment to the survival assumptions, which gives a range of 0.5-0.8% survival to the weir. Wild pink fry marked with CWTs at Auke Creek, Alaska, for four brood years averaged 2.2% survival to return to the Auke Creek weir, with a range of 0.8-3.8% (Mortensen 1991). Return rates of coded-wire tagged 95191B fish in 1995 ranged from 1.6-2.0% (Heintz et al. 1996). Our assumptions on survival are conservative relative to these observations.

Exposure to oil may also reduce marine survival (Hypothesis 2), which could affect our ability to detect differences in straying between treatments. We tested two levels of reduction in our survival assumption due to effects of oil--20% and 50%.

The same survival rate was also assumed for adipose/pelvic fin-clipped fish. Although Blankenship (pers. comm., L. Blankenship, Washington Dept. Fish., Olympia, Wash.) observed lower survival for pelvic fin-clipped coho and chinook salmon smolts than for adipose fin-clipped, CWT smolts, Bailey (1995) observed higher survival for chum salmon fry with only pelvic fin clips and fish with both adipose and pelvic fin clips compared to adipose fin-clipped, CWT chum salmon fry. At Sashin Creek weir, returns of pink salmon marked with pelvic fin clips in 1976 ranged from 2.9 to 4.8% (Vallion et al. 1981).

We refined our estimates of straying used in the model relative to the 96076 DPD, based on straying rates observed from tagged pink salmon returning from Project 95191B. The low rate (3.7%) was the observed rate of straying to Big Port Walter streams; the intermediate (9.2%) and high (15.0%) were based on differing assumptions about the frequency of strays in pink salmon escapements within approximately 30 km of LPW (Wertheimer et al. 1996).

Based on the observations of stray pink salmon in PWS, we assume that the number of strays will decline with increasing distance from the natal stream. Sharp et al. (1995) recovered 79% of their total strays 30 km or less from the natal stream. We used this figure to estimate the number

of strays that will be available in pink salmon streams within approximately 30 km from LPW, and developed a sampling design to intensively sample fish in streams within this distance. We assume that strays will be distributed proportionately to the escapement within this 30-km area. More distant sites will also be sampled, but at a lower effort.

Quantitative sampling effort will be focused on streams within approximately 30 km from LPW. Two weired and eight unweired streams will be regularly surveyed (Table 2). In the unweired streams, we assume we will sample at least 50% of the return as carcasses. This assumption was validated by Wertheimer et al. (1996). Escapement to these streams will also be estimated to provide a measure of sampling fraction.

Streams were selected for sampling based on the relative magnitude of the escapements within the sampling area. An index of escapement was generated using ADFG peak escapement counts from aerial surveys. The peak counts were expanded by a factor of 2.5 (from Sharr et al. 1993) to account for counting bias relative to the exact counts at the weired streams. Based on this index, the streams selected provide >86% escapement coverage within the 30 km sampling region (Table 2).

*Power of sampling design.* We ran simulations of the model predicting number of strays recovered, using the different combinations of survival, straying, and fishery exploitation estimates. Preliminary runs showed that the optimal number of CWTs per oil-exposure treatment was 70,000, given the limitations on the minimum number of treatment groups and the number of fry that could feasibly be marked (Table 1). Logistics of the wild fry marking limited treatment groups of wild fish to 60,000.

Simulations were then run to determine what level of difference between a dose and control could be detected with 95% confidence at the tagging and sampling levels proposed. Strays were assumed to be recovered only from the 30-km sampling region.

Results of the simulations showed that the magnitude of increase in straying detected is sensitive to the assumptions of survival and the straying rate of the controls (Figure 2). At the median survival and low straying rate for the control, a 75% increase in straying (from 3.7% to 6.5%) can be detected. At low survival and low straying for the control, a 100% increase in straying can be detected. For high straying rates, detectable differences in straying of the treatment groups range from increases of 25% at high survival (15% control straying vs. 18.8% treatment straying) to 50% at low survival assumptions (15% control straying vs. 22.5% treatment straying.

The ability to detect differences in marine survival under these same assumptions was also evaluated. We could consistently detect a 20% decrease in marine survival at high (2% to 1.6%), median (0.8% to 0.6%), or low (0.5% to 0.4%) survival assumptions at the tagging and sampling levels proposed.

c. Gamete collection, egg incubation, and fry marking

Pink salmon gametes were collected in the fall of 1995 from Lovers Cove Creek, Baranof Island, southeastern Alaska, and from adults returning to Sashin Creek from experimental groups of

1993 brood pink salmon. Details on spawning methods, incubation, and survival through the eyed stage of development are given by Heintz et al. 1996 and Wertheimer et al. 1996.

Upon emergence, fry will be moved to separate estuarine net pens for each treatment group to be held for tagging and fin-marking. Marking will begin as soon as sufficient fish (~10%) have emerged. In the spring of 1996 a total of 210,000 pink salmon fry (70,000 per exposure treatment) from the experimental gravel incubator array will have their adipose fin removed and be coded-wire tagged (Table 1, Hypotheses 1-3). An additional 70,000 fry will be marked by removing the adipose fin and the left pelvic fin (Table 1, Hypothesis 1A). Approximately 8-10,000 fry can be marked daily.

Marking of fish emerging from the gravel incubators will be stratified into seven time periods to randomize the effects of handling and time of release. For each time stratum, a subgroup of 10,000 fry will be marked from each of the four experimental groups. Approximately 2000-2500 fry from each treatment will be marked each day in a random sequence until the 10,000 fry per treatment-release groups are completed. Fry from all four subgroups within a time stratum will be released at the same time, approximately 64 h after the tagging of all subgroups within the time stratum is completed. Tag placement and clip quality will be checked regularly throughout each marking day. Subsamples will he held for tag retention for each release time, and checked 24 h and 7 d post-tagging; these fish will be destroyed after the tag retention check. Mortalities following marking will be assessed daily until the fish are released.

To determine if long-term effects of incubating in oiled gravel are heritable, the progeny (F1) of fish exposed to uncontaminated and contaminated gravel will be coded-wire tagged and released. In 1993 fish were incubated in oiled gravel (P1). They were spawned when they matured in 1995, and their progeny (F1) were incubated in uncontaminated water. In the spring of 1996, the F1 of fish exposed to 281 µg oil/g gravel and uncontaminated gravel will be coded-wire tagged and released. Two release groups will be tagged, and each group comprises a tag lot representing exposed and unexposed parents. The groups differ in the amount of genetic variability as a result of the experimental designs used to create them. For a detailed description of the experimental designs used to create the groups see Heintz (1996). The first group consists of F1 with the maximum amount of genetic variability and is represented by 7,500 fish per tag lot. The second group consists of F1 with less genetic variabiltiy represented by 2,750 fish per tag lot. Tag lots in a group will be tagged in random order, and the low genetic variability group will be tagged first. Fish will be tagged shortly after ponding, but after the taggers have tagged at least 5,000 pink salmon. Prior to release, fish will be fed with a commercial diet using automatic feeders. The release will be timed to coincide with peak fry production from Sashin Creek and rearing in netpens will not exceed 8 weeks.

d. Capture and Tagging of Wild Fry.

Wild pink salmon fry emigrating from Sashin Creek and Lovers Cove Creek in 1996 will be captured, marked, and released (Table 1, Objectives 2,3,4,5). In Sashin Creek, fry will be captured using fyke nets or a floating screw trap (Wertheimer et al. 1996). In Lovers Cove Creek, fry will be captured fyke nets. From each stream, 60,000 fry will be tagged with CWTs in code lots of 10,000 tags (Table 1, Objectives 2,4,5). At Sashin Creek, an additional 60,000 fry

will be marked by removing the adipose fin and the right pelvic fin (Table 1, Objective 3). Fry at Sashin Creek will be marked with CWTs or pelvic fin-clipped on alternate days. Fish will be held in pens adjacent to the traps for 64 hr. Tag placement and clip quality will be checked regularly throughout each marking day. Subsamples for tag retention for each CWT subgroup will be taken after 24 hr and 7 d; these fish will not be released. Mortalities following marking will be assessed daily until the fish are released. Historical data from Sashin Creek show that emigration timing is highly variable, and can extend from early April until early June (Olsen and McNeil 1967), requiring an extensive trapping period to ensure sufficient coverage. From 3-4 people will be required at each site, depending on the number of fish to be handled and marked.

e. Adult recoveries

*Stream Recoveries.* To assess the rate of homing vs. straying behavior, returning marked pink salmon will be recovered from natal and non-natal streams on Baranof Island and Kuiu Island (Figure 1). Quantitative sampling will be focused on streams within 30-35 km of Sashin Creek (Table 2). The sampling period will extend from mid-August through mid-October, 1997.

Two of the streams to be sampled have weirs--Sashin Creek and the AKI hatchery brood stock raceway at Jetty Lake Creek in Port Armstrong. Close to 100% of the fish returning to these locations will be sampled. The fish returning to AKI as brood represent 40% of the estimated pink salmon escapement within 30-35 km of Sashin Creek (Table 2). AKI Hatchery personnel will be contracted to examine all pink salmon that enter the facility and are spawned, in order to identify and recover strays from the various treatment groups. Any fish with a missing adipose fin will be retained for scanning for CWT and examination for missing pelvic fins.

All pink salmon entering Sashin Creek will be checked for missing adipose fins. The weir will be operated so that fish cannot leave after entering, in order to provide a precise count of the number of fish in the creek. Fish with adipose fins will be passed into the creek. Fish without adipose fins will be checked for a missing pelvic fin. Pink salmon entering Sashin Creek that are missing a pelvic fin will be counted and killed. If both pelvic fins are present, the fish will be placed in a pen and held until mature for spawning for the gamete viability experiment. At that time, the fish will be killed, scanned for a tag, and the tag removed and decoded (if present). A CWT fish will be considered to have homed to Sashin Creek, unless the fish is from the Lovers Cove wild fry group.

Eight unweired steams within 30-35 km of Sashin Creek will be sampled for frequency of tagged fish and estimation of total escapement. These streams represent 60% of the estimated total escapement within 30-35 km of Sashin Creek (excluding the return to Sashin Creek from the total). Thus 86-90% of the total escapement within this distance will be sampled quantitatively (Table 2).

A four-person crew based at LPW will sample Lovers Cove Creek and Borodino Creek. The streams will be accessed from LPW using a 5.1-m Boston Whaler skiff, and will be checked twice weekly from September 1-October 15. Each carcass will be counted, checked for a missing adipose fin, and marked with a Floy tag through the gill operculum. The jaw tag will identify on subsequent surveys that the carcass has been already examined for marks. The jaw tag is also a

critical component of the escapement estimation technique for each stream, described below. If a fish is missing the adipose fin, the head and the pelvic girdle (with fins attached) will be removed for later scanning for the presence of a CWT or a pelvic fin clip. In addition to the systematic sampling of these two streams, this crew will check carcasses in other minor pink salmon streams from Port Herbert to Port Conclusion as time permits. This sampling will be for frequency of tags only; escapements will not be estimated.

The other six unweired streams to be sampled systematically are located 20-33 km from Sashin Creek. These include watersheds on the east coast of Baranof Island and the west coast of Kuiu Island (Figure 1). The 30-km arc does not intersect all of Tebenkof Bay on Kuiu Island. Tebenkof Bay has four major embayments. We included in Stratum 2 streams in those embayments (Piledriver Cove and Thetis Bay) that are intersected by the 30-km arc, even if the streams were slightly (< 3 km) east of the arc. These streams will be sampled by four-person crews based on two charter vessels for both the occurrence of tagged fish and to estimate total escapement. The vessel-based operation will allow safe transit of Chatham Strait to sample streams in Tebenkof Bay, Port Malmesbury, and Patterson Bay (Figure 1). The crew will be able to sample during the day, then move safely to the next location after completing a survey. Each crew will be responsible for three of the streams.

Each stream will be sampled twice weekly from September 1-October 15. Each carcass will be counted, checked for a missing adipose fin, and marked with a Floy tag through the gill operculum. The jaw tag will identify on subsequent surveys that the carcass has been already examined for marks. If a fish is missing the adipose fin, the head and the pelvic girdle (with fins attached) will be removed for later scanning for the presence of a CWT or a pelvic fin clip.

Other pink salmon streams located 35-50 km from Sashin Creek will be sampled for frequency of tagged fish on an intermittent basis. These include watersheds on the east and west coast of Baranof Island, and on the west coast of Kuiu Island. The stream with the largest ADFG escapement index count in each of four bays will be sampled: Red Bluff Bay, Rowan Bay, Bay of Pillars, Gut Bay, and the inner portion of Tebenkof Bay. If time permits, streams in Table Bay on southwest Kuiu Island and Puffin Bay and Branch Bay on southwest Baranof Island will also be surveyed (Table 3). The survey crews will not attempt to estimate escapement for these streams; the emphasis will be on checking carcasses for tags and tag occurrence rate as a check of the assumption that stray recovery rate is proportionate to distance from natal stream. It may be possible, however, to get a rough estimate of sampling proportion using ADFG aerial survey counts for streams on which escapements were estimated, and generating an average expansion factor for the sampling year for the aerial surveys.

These streams will be sampled by the charter vessel crews when and if time permits. Because of differences in run timing some of the systems, we expect periods when time requirements for systematic sampled streams are low, and the more distant streams can be included in the sampling. In addition, we have requested three weeks of vessel time for the NOAA vessel *R/V John N. Cobb*. If this vessel is available, a three-person crew will be able to sample each of the seven streams listed in Table 3 once per week. During the survey, the crew will count and examine as many pink salmon carcasses as possible for a missing adipose fin. If a fish is missing its adipose fin, the head and the pelvic girdle (with fins attached) will be removed for later

scanning for the presence of a CWT or a pelvic fin clip. The tail will be cut off of carcasses with adipose fins so that they can be identified on subsequent surveys as having been previously examined .

*Tag Location.* The location of CWTs within the heads of returning adult pink salmon will be examined to determine whether straying was influenced by where the tag was placed within the snout. Heads from adipose fin-clipped adults will be X-rayed so that tag location in fish that stray can be compared with tag location in fish that home. Samples of up to 100 heads will be X-rayed from each of three recovery categories--Sashin Creek, Lovers Cove Creek, and other area streams. The samples from Lovers Cove Creek and the other area streams will be from spawning or spawned-out fish. At Sashin Creek, however, because all adipose fin-clipped fish returning to the weir will be held alive after capture, and the tag will be removed and decoded at spawning in order to identify the treatment group, only fish that die in the holding net prior to spawning will available to X-ray for tag location.

*Estimation of Escapement.* To estimate escapement into the systematically sampled unweired streams we will use the modified Jolly-Seber technique for carcass counts provided by Sykes and Botsford (1985). This population size estimator assumes an open population, and is relatively insensitive to violations of the assumptions of age-dependent catchability and survival (in our case, catchability and survival refer to the detectability and persistence of the carcasses over time). Standard errors are provided by simulation. Surveys of index streams will include recovering heads and ventral fins from adipose clipped fish, counting the number of carcasses in the stream, marking a representative fraction of the carcasses with Floy tags, and noting the number of carcasses marked with Floy tags on subsequent visits. The feasibility of this method was confirmed in Lovers Cove Creek in 1995 (Wertheimer et al. 1996).

f. Fisheries Recoveries

The number of fish harvested in the commercial fishery is not critical to our estimates of return rate and straying if the assumed survival rates are representative of post-fishery survival, and if the treatment groups are equally distributed in the fisheries. However, if oil does affect homing behavior, then exposed groups might mill around more and thus be differentially vulnerable to the fishery. Pink salmon returning to Sashin Creek are thought to enter Chatham Strait from the south (Hoffman 1982). Adult tagging studies indicate that some Sashin Creek fish move up Chatham Strait as far as Frederick Sound before returning to their natal stream. Fish harvested in lower Chatham Strait, however, are exclusively of lower Chatham origin (Hoffman 1981). Over the last four years, pink salmon harvest in area 109 from Frederick Sound to Cape Ommaney has averaged 17 million fish (pers. comm., H. Savikko, ADFG, Juneau). Fishery exploitation of Sashin Creek pink salmon is thought to be around 30% (pers. comm., Ben Van Alen, ADFG, Juneau). We estimate that the tag incidence rate for each treatment would be 1 in 30,000-50,000 fish in the general harvest area.

Sampling this large and widely-dispersed fishery would be expensive and difficult. At this time, we propose instead to sample the AKI Hatchery cost-recovery fishery as a proxy for the common property fishery. Projected harvest for this fishery is 1,000,000 pink salmon (pers. comm., Dana Owens, Armstrong Keta Inc., Juneau). We can reasonably expect to cost-effectively sample at

least 30% of this harvest to test whether treatment groups were exposed to differential harvest rates. No estimate of the power of the test is possible. At this time, AKI plans to deliver its fish to a floating processor located near the hatchery (pers. comm., Dana Owens, Armstrong-Keta Inc., Juneau). Sampling this harvest will require arranging with the processor to permit two samplers to examine pink salmon and remove those with a missing adipose fin as the fish are delivered to the processing lines. The samplers will be housed at Port Armstrong or on the processor for the duration of the harvest (3-4 weeks); heads and pelvic girdles from fish with missing adipose fins will be picked up and taken to LPW for examination for tags and fin clips and tag recovery and decoding at least twice weekly.

We will also meet with ADFG management and research biologists in October of 1996 to determine if a cooperative sampling arrangement for the lower 109 seine fishery in 1997. If, by sharing resources, a broader sampling effort is possible for a cost similar to sampling the AKI cost-recovery fishery, then we will switch to this approach for examining distributional changes in the fisheries in relation to treatment.

g. Analysis of Straying and Survival

The G-test of independence (Sokal and Rohlf 1981) will be used to test for statistical differences ($P = 0.05$) in straying between treatments for the oil-exposure and tagging-effects experiments (Objective 1, 3). The number of strays observed in all escapement sampling strata and the number of homing fish recovered at Sashin Creek weir will be compared between treatments. For the oil-exposure test (Objective 1), if a significant difference is detected between the three groups, all three possible paired comparisons will be made, with the rejection criterion adjusted for multiple comparisons so that overall $P = 0.05$. For the effect of tagging experiment (Objective 3), two-way contingency tables comparing the CWT and fin-marked releases will be analyzed.

Comparisons of straying rates between Lovers Cove Creek wild fish and Sashin Creek wild fish (Objective 4), and Lovers Cove Creek wild fish and transplanted Lovers Cove Creek fish (Objective 5) cannot be tested with the G-test because we will not have a complete count of the number of homing fish at Lovers Cove Creek. The total homing to Lovers Cove must be estimated by expanding observed tags by the sampling fraction. Comparisons for these objectives must thus be made using the estimated straying rates and associated variances, rather than observed recoveries.

Straying rates will be estimated for the various treatment groups by estimating the total number of strays, S, in non-natal streams within the 30-km sampling region, and the total number of homing fish, H, in the natal stream (Objective 2). S is calculated by

$$S_j = (\Sigma s_{ij}) / p,$$

where $s_{ij}$ is the estimated number of strays for a particular treatment, $j$, in each non-natal stream surveyed, $I$, and p is the proportion of the escapement sampled within 30 km. Each $s_{ij}$ is the observed number of strays expanded for the proportion of the escapement sampled for tags in stream $I$. H is the count of homing fish to Sashin Creek for all treatments, except Lovers Cove

Creek wild fish; in that case, H is the observed number of homing fish in Lovers Cove Creek, expanded for the proportion of the escapement sampled for tags. The straying rate, $f$, is then

$$f_j = S_j /(S_j + H_j).$$

The variance of this proportion can be calculated from the variances of S and H. For S,

$$\text{var}(S_j) = \Sigma \text{var}(s_{ij}).$$

The variance of each $s_{ij}$ is derived from the variance of the escapement estimate used to calculate the proportion sampled for tags in stream $I$. For H, var (H) = 0 for Sashin Creek, because H is a total count. At Lovers Cove Creek, the variance of H is also derived from the variance of the escapement estimate used to calculate the proportion sampled. Variance of $f$ is then

$$\text{var}(f_j) = [H^2(\text{var}(S)) + S^2(\text{var}(H))]/(S + H)^4.$$

A linear logistic model will be used to describe the relationship between straying rates and various factors, following the model used by Labelle (1992) for coho salmon. The objective is to predict the probability of straying for particular combinations of treatment, population, and geographic factors. The model used is

$$E[S/(S+H)] = \exp(b_0 + b_1 x_1 + b_2 x_2 + \ldots) / [1 + \exp(b_0 + b_1 x_1 + b_2 x_2 + \ldots)]$$

where $f$ is the frequency of straying, $b_n$ are parameters estimated by the model, and $x_n$ are the predictor factors. We will use oil treatment, mark type, stock, transplant, distance from natal stream, direction from natal stream, and magnitude of non-natal stream as predictor factors.

Effects of oil exposure on marine survival (Objective 7) will be tested using the G-test. The contingency table for the comparison will be a 2 x 3 table, comprised of the three groups and the number of survivors and non-survivors for each group. The number of survivors for a treatment will be the sum of the observed number of tags at Sashin Creek weir, the observed number of tags recovered as strays, and the observed number of tags in the AKI fishery. The number of non-survivors for a treatment will be the number of "good" tags released (the number of fish tagged for a treatment adjusted for tag retention) minus the number of survivors. If a significant difference is detected between the three groups, the three possible paired comparisons will be made, with the rejection criterion adjusted for multiple comparisons so that overall $P = 0.05$.

h. Reproductive viability

*P-1 returns.* Gamete viability will be determined for the oil treatment and the control groups (Objective 8). Tagged adults captured at Sashin Creek weir in 1997 will be held for spawning when their coded-wire tag will be removed and decoded to identify the oil-treatment group. Two experiments will be performed to evaluate the reproductive viability of the parents. The objective of the first experiment will be to determine the average offspring survival of parents exposed to different amounts of oil during incubation and the objective of the second experiment will be to estimate how much of the variability in offspring survival is due to individual

variation. The benefit of the first experiment is that all the possible crosses within an exposure group can be made and the overall average survival measured, however the primary source of variation will be measurement error and no information will be available on individual variation. The benefit of the second experiment is determine individual variability and thus provide control for the interpretation of the results of the first experiment. In both experiments survival will be measured to fertilization, eyeing, and emergent fry stages. The numbers of defective or dead progeny will be compared between treatment groups. Because these gametes will not be incubated in an oiled environment, any observed increases in mortality or defective individuals can be attributed to oiling effects upon the first generation.

Average offspring survival will be estimated in the first experiment by measuring the survival in pools of gametes comprising all the possible pairwise crosses. On each day of spawning, 2 embryo pools will be formed per treatment. Upon formation of an embryo pool, 6 subsamples, each of approximately 150 embryos, will be randomly selected and incubated in an individual cell within a Heath tray. On a given day, pools will be formed by randomly assigning half the males and females from a treatment group to one of two subgroups. Each female in a subgroup will contribute approximately 900 eggs to a common pool, the pool will be mixed and the mixture divided into a number of aliquots equal to the number of males in the subgroup. Each male in the subgroup will fertilize one aliquot, and the fertilized eggs will be recombined in a common container, mixed and divided into six aliquots that will be incubated in randomly assigned locations. Thus, the average survival of a treatment group on a given day will be the mean of the average survivals in each of the two subgroups.

The estimates of mean survival of the treatment groups will be compare with *t* tests after assuming that variability between groups of like-treated incubators is negligible. A *t* test between, for example, treatment 1 and 2, when there are *d* spawning days, *q* treatments, *p* subgroups per treatment, and *r* cells per subgroup will have the following form:

$$t_{((p-1)*q*d)\,df} = \frac{\frac{1}{d}[\overline{sv_{11}} + \ldots \overline{sv_{1d}} - \overline{sv_{21}} \ldots - \overline{sv_{2d}}]}{\sqrt{\frac{1}{d^2} * \frac{s_c^2}{p*r} * 2*d}}$$

where,

$\overline{sv_{ij}}$ = Survival rate for treatment *i* on day *j*

$s^2_c$ = Combined Between-Pools Mean Square obtained by ANOVA.

Comparisons will be made between each of the doses and the control and the overall $\alpha$ will be maintained at 0.05.

For the second experiment, fish from each oil dose and from the control will be mated using a fully-crossed half-sib design (Falconer 1981). In this design, the remaining eggs from an exposed female and a control female are each split into two aliquots. One aliquot from each female is fertilized with aliquots of sperm from the same oil-exposed male, and one aliquot from each female is fertilized with aliquots of sperm from the same control male. This 2 x 2 breeding matrix will be replicated so that every female is represented in a breeding matrix or until there are 30 breeding matrices for each treatment, whichever is greater. Each half-sib family will be incubated in an individual container. An alternative design for this experiment is provided in a proposal submitted by the University of Alaska Fairbanks (UAF) (Restoration of PWS Pink Salmon: Quantitative Genetic Assessment of Embryo Mortality and Developmental Stability in Offspring of Oiled Pink Salmon. No project number assigned). Executing the design proposed by UA, would not preclude our requirements for experiment 2.

*F-1 returns.* A similar set of experiments will be performed with the F1 returns.

**Cooperating Agencies, Contracts and Other Agency Assistance**

Experimental design to determine oil exposure impacts are being developed with ADFG and UAF researchers. UAF researchers will be directly involved with the breeding experiment components, either as part of this project, or in a more intensive role if the UAF restoration proposal for high resolution quantitative genetics on the returning fish at LPW is accepted. Personnel for the tagging and stream crews will be hired by contract. The AKI Hatchery will be contracted to screen their returning adult pink salmon for any tagged pink salmon from this study that have strayed to their facility. Vessels to transport and support stream survey crews will also be contracted.

## SCHEDULE

### A. Measurable Project Tasks for FY 97

| | |
|---|---|
| October - March: | Complete contractual arrangements for labor, vessel support, fishery and weir sampling. |
| April: | Complete 1996 Annual Report. |
| May-July: | Plumb, configure incubation matrix for breeding experiment progeny |
| July-August: | Set up weir, adult holding facility at LPW |
| March-April: | Evaluate survival in incubators to fry emigration |
| August-September: | Adult recovery operations at weired and unweired streams. |
| September: | Collect and spawn pink salmon from P-1 and F-1 returns to LPW.( |

### B. Project Milestones and Endpoints

| Milestones | Completion Date |
|---|---|
| Spawning of 1995 brood adults | Completed |
| Oil exposure of 1995 brood embryos | Completed |

| | |
|---|---|
| Marking of 1995 brood fry | May 1996 |
| Recovery of 1995 brood marked fish | Oct 1997 |
| Estimation of 1997 natal, non-natal stream escapements | Oct 1997 |
| Spawning of 1997 brood adults | Sep 1997 |
| Determination of 1997 brood gamete viability | Apr 1998 |

Endpoints

1. Objective 1: Determine if oil exposure during incubation affects straying of pink salmon.

   Completion Date: **January 1998**.

2. Objective 2: Estimate natural straying rates of two stocks of pink salmon. Accomplishing this objective requires a sampling program that can estimate the total strays within a specific geographic area, and evaluation of the influence on straying of such factors as tagging, stock, and transplant (Objectives 3-6).
   Completion Date: **January 1998**.

3. Objective 3: Determine if coded-wire tagging of pink salmon fry affects the straying rate of pink salmon.
   Completion Date: **January 1998**.

4. Objective 4. Determine if stock type affects the straying rate of pink salmon.
   Completion Date: **January 1998**.

5. Objective 5. Determine if first-generation transplant affects the straying rate of pink salmon.
   Completion Date: **January 1998**.

6. Objective 6. Develop a synthesis of pink salmon straying research, including the results of this study, and use it to evaluate the implications for management and restoration strategies.
   Completion Date: **December 1998**.

7. Objective 7. Determine if oil exposure during incubation decreases the marine survival of pink salmon fry.
   Completion Date: **January 1998**.

8. Objective 8. Determine if oil exposure during incubation decreases the gamete viability of pink salmon.
   Completion Date: **July 1998**.

9. Determine if reduced reproductive viability due to oil exposure during incubation is heritable.
   Completion Date: **July 1998**.

## C. Completion Date

This project will extend over the entire life-history of the 1995 brood of pink salmon and will also include the egg/alevin life-history stage of their progeny. Oil exposures and marking of experimental groups will be completed in 1996. Recovery of returning adults will be completed in 1997. Evaluation of the viability of gametes of returning adults will be completed in 1998. The final report summarizing the results and detailing the accomplishment of the project's restoration objectives will be submitted in 1998.

## PUBLICATIONS AND REPORTS

In FY97, one peer-reviewed publication in planned by Heintz et al., describing the small but significant reduction in embryo survival resulting from exposures to slight amounts of oil in the incubation gravel of pink salmon.

In FY98, five peer-reviewed publications are planned:

Celewycz et al. Homing and straying of pink salmon exposed to oiled gravel during embryonic development.

Wertheimer et al. Effects of incubation in oiled substrate on the return rate, size, and migration timing of pink salmon.

Thedinga et al. Effects of coded-wire tagging and transplant on the homing and straying behavior of two stocks of pink salmon.

Heintz et al. Effects of incubation in oiled substrate on the reproductive viability of pink salmon.

Heintz et al. Heritability of reproductive damage in pink salmon caused by incubation in oiled substrate

Annual progress reports will be submitted in April of 1996, 1997, 1998.

| | |
|---|---|
| 1996 annual report: | Details of the spawning of adult pink salmon in September, 1995, and the incubation of embryos (1995 brood). **Completed.** |
| 1997 annual report: | Details of the tagging and release of pink salmon fry (1995 brood); analysis of 44 GC/MS samples (1995 brood); survival of embryos to fry emigration by treatment. |
| 1998 annual report: | The recovery and spawning of adult pink salmon (1995 brood) in September and October, 1997; and preliminary analysis of straying rates, marine survival, and gamete viability of the 1995 brood. |

The final report will be submitted in December, 1998.

## PROFESSIONAL CONFERENCES

November 17 - 21, 1996. Society for Environmental Toxicology and Chemistry. 17th Annual Meeting. Long-term Effects of Crude Oil on Pink Salmon that Incubated in Oiled Gravel.

## NORMAL AGENCY MANAGEMENT

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

## COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Research by NMFS on effects of oil exposure to pink salmon has been closely coordinated with concurrent research efforts by ADFG and UAF. This project combines Restoration Study No. 96191 and 96076 to ensure full coordination and economic efficiency. ADFG and UAF researchers will participate in the design and the implementation of the breeding experiments. The project will be directly linked to the UAF proposal for partitioning the heritable components of reduced gamete viability due to oil exposure.

## EXPLANATION OF CHANGES IN CONTINUING PROJECTS

Substantial changes have been made in this restoration project in response to peer review comments and the results of the 1995 field season. Project 97076 has been reduced from a two brood-year study ending in 1999 to a one brood-year study ending in 1998. This was done to constrain costs of the 076 research. The 1995 field work identified the need for increased effort on stream surveys for recovering tagged fish and estimating escapements (Wertheimer et al. 1996). Because such effort would have significantly increased the cost of a two brood-year study, the project was reduced to one brood-year to keep the budget within the amount originally proposed to the Trustee Council in the 96076 DPD.

Project 97076 is also now a combination of 96076 and 96191B. Incorporating the continuation of the 191B studies with 97076 was done to obtain logistic and economic efficiencies. As a result of these changes, the estimated total cost of the combined projects for FY96-FY98 (191B and 076) has been reduced to $ 1792K, compared to the $ 2271 K estimated in the 1996 DPDs.

## PROPOSED PRINCIPAL INVESTIGATOR

Alex Wertheimer
National Marine Fisheries Service
Auke Bay Laboratory
11305 Glacier Hwy.
Juneau, AK 99801
(907) 789-6040 (phone)
(907) 789-6094 (fax)

**PERSONNEL**

GM-13 Fishery Biologist - Alex C. Wertheimer. BS Fisheries Science, Oregon State University (1979); MS Fisheries Science, University of Alaska (1984). Currently employed by National Marine Fisheries Service, Auke Bay Laboratory as a Supervisory Fishery Biologist, Task Leader of Early Ocean Salmon Research. Author of over 20 peer-reviewed papers and 30 agency reports on various aspects of the biology and culture of Pacific salmon. Research on Pacific salmon has included determining early marine growth, distribution, and migration; in nearshore habitat utilization; predator/prey relationships; by-catch mortality; the effects of hydrocarbon contamination on juvenile salmon in the marine environment; the association of early marine conditions with year-class success of salmon; salmon aquaculture and genetics; and status of stocks. Principle Investigator *Exxon Valdez* NRDA Fish/Shellfish 4, NMFS Component, 1989 through project completion in 1993.

GM-14 Physiologist - Stanley D. Rice. Received BA (1966) and MA (1968) in Biology from Chico State University, and PhD (1971) in Comparative Physiology from Kent State University. Employed at Auke Bay Fisheries Laboratory since 1971 as a research physiologist, task leader and Habitat Program Manager since 1986. Rice has researched oil effects problems since 1971, and has published over 70 papers, including over 50 on oil effects. Studies have ranged from field to lab tests, behavioral to physiological to biochemical studies, from salmonids to invertebrates to larvae to meiofauna. Rice has conducted and managed externally-funded projects since 1974, including the Auke Bay Laboratory *Exxon Valdez* damage assessment studies since 1989. Activities since the oil spill have included leadership and management of up to 10 damage assessment projects, fieldwork in PWS, direct research effort in some studies, establishment of state of the art chemistry labs and analyses in response to the spill, quality assurance procedures in biological-chemical-statistical analyses, establishment of hydrocarbon database management, servicing principal investigators and program managers in NOAA and other agencies with reviews and interpretations, provided direct input into agency decisions, interacted with other agencies in various ways (logistics coordination, critique experimental designs, interpret observations, etc.).

GS-11 Fisheries Biologist (Research) - Ron A. Heintz. Education: BS Ecology, University of Illinois (1979); MS Fisheries Science, University of Alaska (1986). He has worked for the National Marine Fisheries Service, Auke Bay Laboratory since 1985 concentrating his efforts on salmon enhancement research and salmon genetics. He is the principal investigator and co-investigator on several salmon genetics projects.

GS-11 Fisheries Biologist (Research) - Adrian G. Celewycz. BS Biology, University of Illinois (1979); MS Fisheries Science, University of Alaska (1985). He has worked for the National Marine Fisheries Service, Auke Bay Laboratory since 1981, studying distribution, growth, habitat utilization, predator/prey relationships of juvenile salmon migrations. In addition to being recognized as "The Outstanding Student of Fisheries and Science" by the University of Alaska at Juneau in 1985, he was awarded Certificates of Recognition for superior performance by NOAA in 1989, 1990, and 1993. He served as co-investigator on *Exxon Valdez* NRDA Fish/Shellfish

Study No. 4, and was awarded Certificates of Recognition by NOAA for outstanding contributions serving the public trust in response to the *Exxon Valdez* oil spill in 1989 and 1990.

GS-11 Fisheries Biologist (Research) - John F. Thedinga. BS Fisheries and Wildlife Management, University of North Dakota (1975); MS Fisheries Science, University of Alaska (1986). He has been employed by the National Marine Fisheries Service, Auke Bay Laboratory since 1978 specializing in research on the effects of logging on salmon and freshwater habitat. He has been principle investigator and co-investigator on several projects and has published over 25 scientific papers.

Performance will be monitored by ongoing evaluation of time-specific milestones identified in the project schedule. Annual reports will document the accomplishment of project milestones. In FY-97, a GM-14 physiologist (Rice) will oversee and provide quality control for the whole project. A GM-13 biologist (Wertheimer) will be the project leader. A GS-13 chemist (Short) will establish a dosing protocol, determine hydrocarbon concentrations, and evaluate results of hydrocarbon analysis. A GS-11 biologist (Heintz) will help with the design of the project, and with data management and analysis. A GS-11 biologist (Celewycz) will be task leader for the artificial incubation and oil-exposure components, and a GS-11 biologist (John Thedinga) will be task leader for the wild fry capture and marking. Two GS-9 biologists (Bradshaw, Maselko) will assist in setting up the experiments, collecting data, analyzing data, and reporting results. Other ABL biologists (Orsi, Mortensen) will provide logistic coordination and serve as crew leaders on remote marking and stream survey operations, as needed. This project is undertaken as part of the research activities of the Auke Bay Laboratory (ABL) and will be supported by the laboratory infrastructure. The ABL will provide backups if any personnel changes occur. Bruce Wright, Trustee Council staff, will be responsible for coordination of this and other NOAA projects with the Trustee Council.

## LITERATURE CITED


Alexandersdottir, M. 1987. Life history of pink salmon (*Oncorhynchus gorbuscha*) in southeastern Alaska and implications for management.

Bailey, D. 1995. Cook Creek mark mortality study. Unpublished ms. Department of Fisheries and Oceans Canada. Vancouver, British Columbia.

Brannon, E. L., T. P. Quinn, R. P. Whitman, A. E. Nevissi, R. E. Nakatani, and C. D. McAuliffe. 1986. Homing of adult chinook salmon after brief exposure to whole and dispersed crude oil. Transactions of American Fisheries Society 115:823-827.

Bue, B. G., S. Sharr, S. D. Moffitt, and A. Craig. 1995. Injury to salmon eggs and preemergent fry due to the T/V *Exxon Valdez* oil spill. *In* S.D. Rice, R.B. Spies, D.A. Wolfe, and B. A. Wright (Eds.), *Exxon Valdez* Oil Spill Symposium Proceedings. American Fisheries Society Symposium Number 18.

Dames and Moore. 1989. Effects of petroleum contaminated waterways on migratory behavior of adult pink salmon. Final report, Contract No. 50-ABNC-8-00012, prepared for National Oceanic and Atmospheric Administration, Ocean Assessment Division, Anchorage, Alaska, and Minerals Management Service, Alaska OCS Region, Anchorage, Alaska. Dames and Moore, 500 Market Place Tower, 2025 1st Avenue, Seattle, Washington, 98121.

Falconer, D. S. 1981. Introduction to Quantitative Genetics. Longman House, Essex, United Kingdom.

Geiger, H. J., B. G. Bue, S. Sharr, A. C. Wertheimer, and T. M. Willette. In Press. A life history approach to the damage to Prince William Sound pink salmon from the *Exxon Valdez* oil spill. *In* S.D. Rice, R.B. Spies, D.A. Wolfe, and B.A. Wright (Eds.). *Exxon Valdez* Oil Spill Symposium Proceedings. American Fisheries Society Symposium Number 18.

Heintz, R. and S. D. Rice. Effects of incubating in oiled gravel on pink salmon part II: Delayed effects on growth marine survival and reproduction. In Preparation.

Hoffman, S. H. 1982. Northern southeastern Alaska pink salmon (*Oncorhynchus gorbuscha*) tagging investigations, 1977-1980. Alaska Dept. Fish and Game Information Leaflet 196.

Labelle, M. 1992. Straying patterns of coho salmon (*Oncorhynchus kisutch*) stocks from southeast Vancouver Island, British Columbia. Can. J. Fish. Aquat. Sci. 49:1843-1855.

Leider, S. A. 1989. Increased straying by adult steelhead trout, *Salmo gairdneri,* following the 1980 eruption of Mount St. Helens. Envir. Biol. Fishes 24:219-229.

McDonald, J. 1981. The stock concept and its application to British Columbia salmon fisheries. Can. J. Fish. Aquat. Sci. 38:1657-1664.

Milner, A. M. and R. G. Bailey. 1989. Salmonid colonization of new streams in Glacier Bay National Park. Aquaculture and Fisheries Manag. 20:179-192.

Morrison, J. and D. Zajac. 1987. Histological effect of coded-wire tagging in chum salmon. N. Amer. J. Fish. Manag. 7:439-441.

Mortensen, D. M., J. H. Landingham, A. C. Wertheimer, and S. G. Taylor. 1991. Relationship of early marine growth and survival of juvenile pink salmon to marine water temperature and secondary production in Auke Bay, Alaska. p. 38-49. In B. White and I. Guthrie (eds.) Proc. 15th Northeast Pink and Chum Salmon Workshop. Pacific Salmon Comm., Vancouver, Canada.

Nakatani, R. E. and A. E. Nevissi. 1991. Effect of Prudhoe Bay crude oil on the homing of coho salmon in marine waters. N. Amer. J. of Fish. Man. 11:160-166.

Nevissi, A. E. and R. E. Nakatani. 1990. Effects of crude oil spill on homing migration of Pacific Salmon. Northwest Environmental Journal 6:79-84.

Olsen, J. M. and W. J. Mcneil. 1967. Research on pink salmon at Little Port Walter, Alaska, 1934-64. U.S. Fish Wildl. Serv. Data Report 17.

Pascual, M. A. and T. P. Quinn. 1994. Geographical patterns of straying of fall chinook salmon,

*Oncorhynchus tshawytscha*, from Columbia River (USA) hatcheries. Aquaculture and Fisheries Management 25, Supplement 2:17-30.

Quinn, T. P. 1984. Homing and straying in Pacific salmon. p. 357-362 *in* J. D. McCleave, G. P. Arnold, J. J. Dodson, and W. H. McNeil (eds.), Mechanisms of migration in fishes. Plenum, New York.

Roys, R. S. 1971. Effect of tectonic deformation on pink salmon runs in Prince William Sound. p. 220-237. *In* The great Alaska earthquake: biology. National Academy of Sciences, Washington, D. C.

Sharp, D., S. Sharr, and C. Peckham. 1995. Homing and straying patterns of coded wire tagged pink salmon in Prince William Sound. Unpublished manuscript, Alaska Department of Fish and Game, Cordova, AK.

Sharr, S., D. Sharp, and B. G. Bue. 1993. Pink salmon spawning escapement estimation in Prince
William Sound. Pages 124-127 *in Exxon Valdez* Oil Spill Symposium Abstracts. Oil Spill Public Information Center, Anchorage, Alaska.

Sykes, S. D. and L. W. Botsford. 1985. Chinook salmon, *Oncorhynchus tshawytscha,* spawning escapement based on multiple mark-recapture of carcasses. Fish. Bull. 84:2 261-270.

Sokal, R.R. and F. J. Rohlf. 1981. Biometry. W. H. Freeman, New York.

Tallman, R. F. and M. C. Healey. 1994. Homing, straying, and gene flow among seasonally separated populations of chum salmon (*Oncorhynchus keta*). Can. J. Fish. Aquat. Sci. 51:577-588.

Vallion, A. C., A. C. Wertheimer, W. R. Heard, and R. M. Martin. 1981. Summary of data and research pertaining to the pink salmon population at Little Port Walter, Alaska, 1964-80. NWAFC Auke Bay Laboratory Processed Report 81-10, Juneau, Alaska.

Wertheimer, A. C. and A. G. Celewycz. In Press. Abundance and Growth of Juvenile Pink Salmon in Oiled and Non-oiled Locations of Western Prince William Sound After the *Exxon Valdez* Oil Spill. *In* S.D. Rice, R.B. Spies, D.A. Wolfe, and B.A. Wright (Eds.), *Exxon Valdez* Oil Spill Symposium Proceedings. American Fisheries Society Symposium Number 18.

Wertheimer, A. C., S. D. Rice, A. G. Celewycz, J. F. Thedinga, R. A.Heintz, R. F. Bradshaw, and J. Maselko. 1996. Effects of oiled incubation substrate on straying and survival of wild pink salmon. Restoration Project 95076 Annual Report. *Exxon Valdez* Trustee Council, Anchorage, AK.

Willette, T. M. In press. Impacts of the *Exxon Valdez* oil spill on the migration, growth, and survival of juvenile pink salmon in Prince William Sound. *In* S.D. Rice, R.B. Spies, D.A. Wolfe, and B.A. Wright (Eds.), *Exxon Valdez* Oil Spill Symposium Proceedings. American Fisheries Society Symposium Number 18.

Table 1. Mark type and number marked for the experimental groups used to test specific hypotheses relating to the effects of oil exposure during embryonic development of pink salmon on straying behavior, marine survival, and gamete viability; and the effects of mark type, stock and transplant on straying behavior. See page 5 of the proposal for a description of the hypotheses. Highlighted treatment groups are used in more than one comparison. CWT = coded-wire tag.

| Treatment | Mark Type | Number Marked | |
|---|---|---|---|
| | | 1995 | 1996 |
| **Objectives 1,6,7: Effects of oil exposure** | | | |
| High Dose | CWT | 70 K | 70 K |
| Intermediate Dose | CWT | 70 K | 70 K |
| Exposure Control | CWT | 70 K | 70 K |
| **Objective 3: Mark Effect** | | | |
| Exposure Control | CWT | 70 K | 70 K |
| Wet Lab Control | Ad-Pelvic | 70 K | 70 K |
| Sashin Creek Wild | CWT | 60 K | 60 K |
| Sashin Creek Wild | Ad-Pelvic | 60 K | 60 K |
| **Objective 2,4,5: Stock and Transplant Effect** | | | |
| Lovers Cove Wild | CWT | 60 K | 60 K |
| Sashin Creek Wild | CWT | 60 K | 60 K |
| Exposure Control | CWT | 70 K | 70 K |

**Total Tags:**
**330 K**
**Total Fin Marks:**
**130 K**

Table 2. Weir and peak aerial survey counts for pink salmon streams within approximately 30 km of Little Port Walter. The column for 1997 surveys indicates whether escapement will be both estimated and sampled for tagged pink salmon returning in 1997. The adjusted peak count is the 10-yr mean peak count for unweired streams expanded by 2.5.

| Stream Number | Stream Name | 1997 Surveys | 10-yr Mean Peak Count | Adjusted Peak Count |
|---|---|---|---|---|
| | AKI Weir[1] | Yes | 85,712 | 85,712 |
| 109-10-006 | Sashin Creek[2] | Yes | 29,064 | 72,660 |
| 109-10-007 | Borodino Creek | Yes | NA | NA |
| 109-10-009 | Lovers Cove Creek | Yes | 26,973 | 67,432 |
| 109-10-023 | Deep Cove NW Head | Yes | 10,336 | 25,840 |
| 109-10-028 | Parry Creek | Yes | 11,220 | 28,050 |
| 109-52-050 | Pillar Bay SW Side | No | 1,304 | 3,260 |
| 109-62-003 | Piledriver Cove Cr. | Yes | 8,118 | 20,295 |
| 109-62-005 | Happy Cove Creek | No | 300 | 750 |
| 109-62-028 | William Creek | Yes | 5,446 | 13,615 |
| 109-62-029 | Wolf Creek | Yes | 7,973 | 19,932 |
| 109-62-030 | Thetis Bay SW Head | No | 1,693 | 4,323 |
| 109-62-031 | Thetis Bay Salt Chuck | No | 1,439 | 3,598 |
| 109-62-034 | South Explorer Basin | No | 125 | 318 |
| 109-62-036 | Neal Creek | No | 2,546 | 6,365 |
| 109-62-038 | Gedney Harbor | No | 2,350 | 5,875 |
| 109-63-001 | God's Pocket West | No | 779 | 1,948 |
| 109-63-002 | God's Pocket North | No | 553 | 1,383 |
| 109-63-003 | Malmesbury W of Joyce | No | 1,500 | 3,750 |
| 109-63-004 | Malmesbury NW Joyce | No | 633 | 1,582 |
| 109-63-005 | Joyce Creek | Yes | 7,533 | 18,832 |
| 109-63-007 | Malmesbury N Arm E | No | 603 | 1,508 |

Table 5. (continued)

| | | | | |
|---|---|---|---|---|
| 109-63-009 | Malmesbury N Arm S | No | 17 | 42 |
| 109-63-012 | Malmesbury Lake Creek | No | 1,689 | 4,222 |
| 109-63-015 | Malmesbury S Arm S | No | 638 | 1,595 |
| 109-63-017 | Malmesbury S Arm S | No | 629 | 1,573 |
| 109-63-020 | Tavin Creek | No | 417 | 1,042 |
| | Total for Area[3] | | 180,524 | 322,842 |
| | Total, Surveyed Streams[3] | | 163,311 | 279,708 |
| | % Total Surveyed 1997[3] | | 90.5% | 86.6% |

[1] AKI = Armstrong Keta Incorporated. Numbers are weir counts of fish entering hatchery adult capture and holding traps.

[2] Numbers are from aerial survey counts. Weir count at Sashin Creek in 1995 was 117,000.

[3] Excludes Sashin Creek

Table 3. Stream number, name, and average peak aerial survey count for streams surveyed in each sampling stratum.

| Stream Number | Name | Average Peak Count DIVIDE BY 2.5 |
|---|---|---|
| 109-20-006 | Gut Bay | 2,260 |
| 109-52-007 | Rowan Cr., Rowan Bay | 20,196 |
| 109-52-055 | Kwatahein Cr., Bay of Pillars | 7,769 |
| 109-62-012 | Alecks Creek - Tebenkof | 30,938 |
| 109-20-106 | Red Bluff Bay | 104,400 |
| 113-12-001 | Branch Bay | * |
| 113-11-009 | Puffin Bay | * |
| 109-61-011 | Table Bay | 325 |

* These streams are not regularly surveyed by ADFG, no estimates of escapement exist.

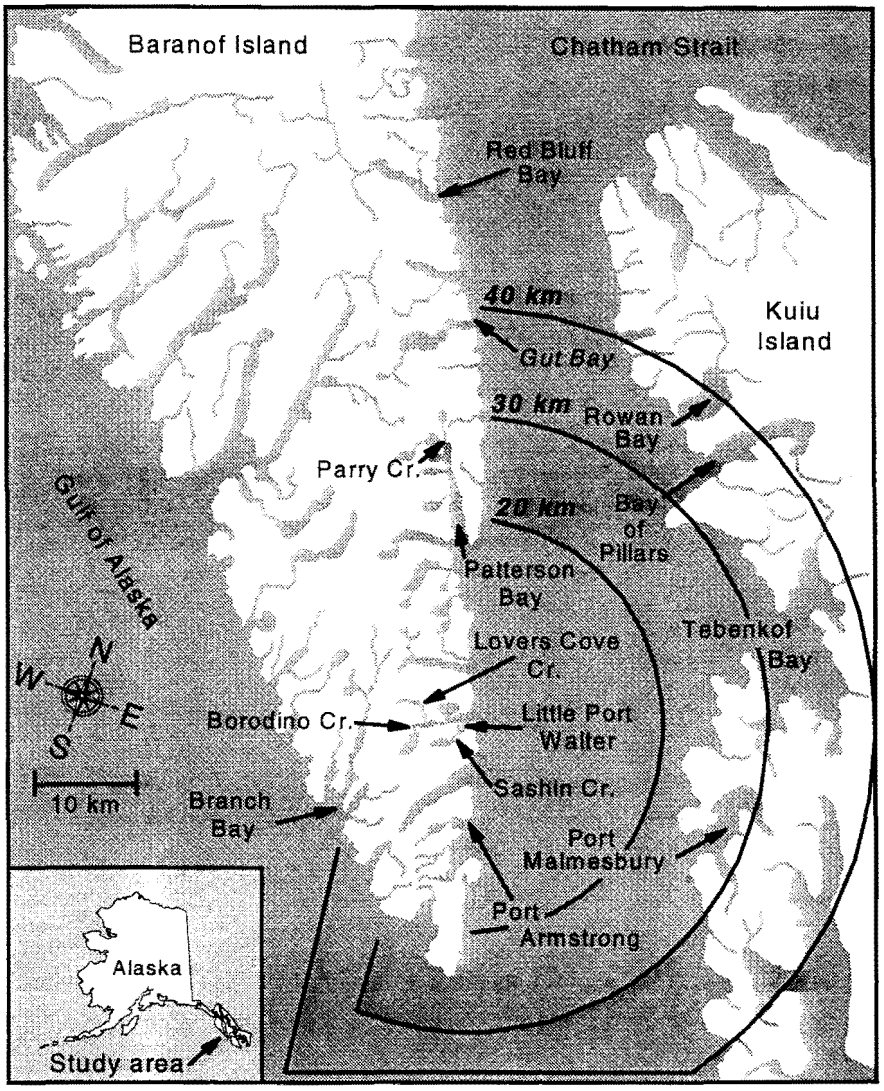


Figure 1. Map of Little Port Walter and vicinity.

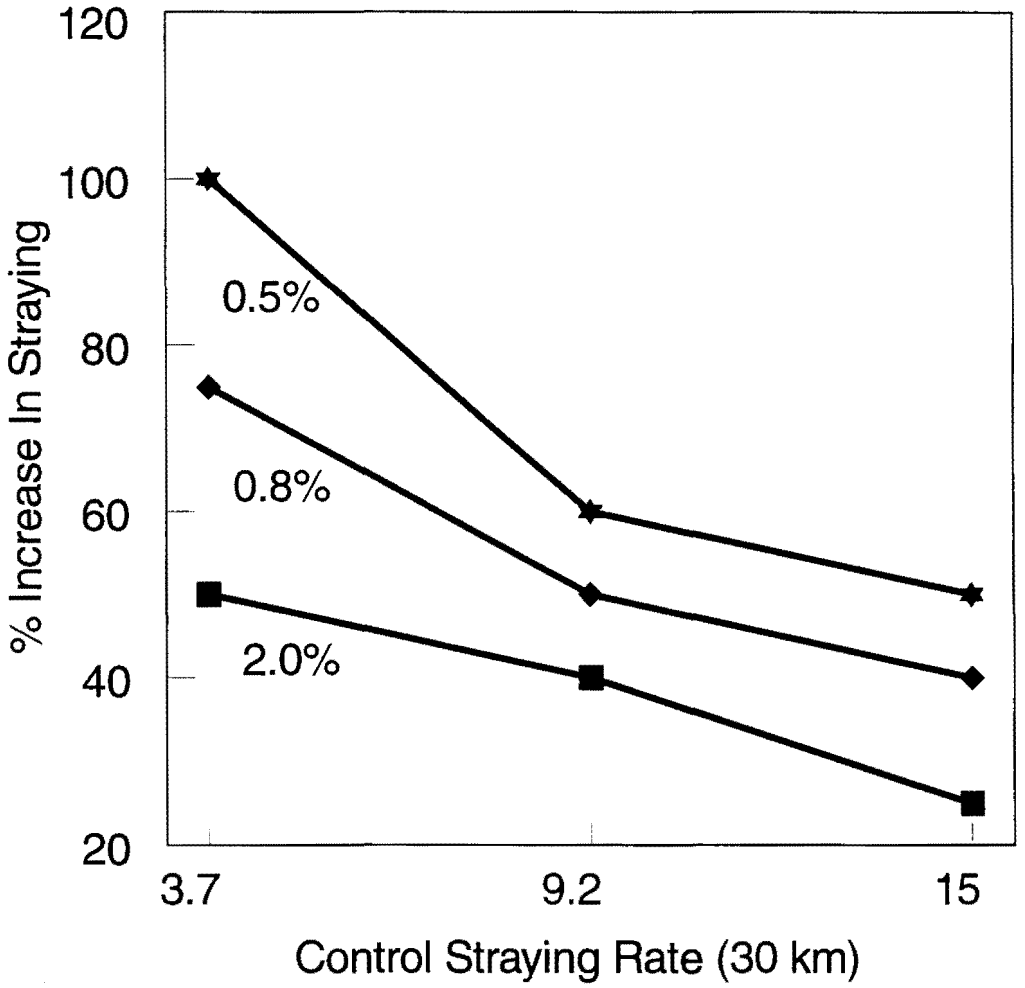


Figure 2. Differences in straying rate detectable at $P < 0.005$ for three different straying and return rate assumptions.

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1996 | Proposed FFY 1997 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Personnel | $193.2 | $265.8 | | | | | | |
| Travel | $36.4 | $33.3 | | | | | | |
| Contractual | $61.8 | $207.8 | | | | | | |
| Commodities | $69.0 | $53.5 | | | | | | |
| Equipment | $0.0 | $8.4 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
| Subtotal | $360.4 | $568.8 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| General Administration | $33.3 | $54.4 | | | | | | |
| Project Total | $393.7 | $623.2 | $234.6 | | | | | |
| Full-time Equivalents (FTE) | 3.0 | 4.0 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | $262.0 | $307.5 | $160.5 | | | | | |

Comments:
This project includes elements of 96191B.

NOAA Contribution:
Habitat Investigation Program Manager, S. Rice, 2 mo = $23.2K
Salmon Program Manager, B. Heard, 1 mo = $11.6K
Principal Investigator, A. Wertheimer, 11 mo = $96.8K
Little Port Walter Station Manager, R. Martin, 4 mo = $34.4K
Fishery Research Biologist, D. Mortensen, 2 mo = $12.4K
Fishery Research Biologist, J. Orsi, 2 mo = $12.4K
Fishery Research Biologist, J. Joyce, 2 mo = $12.4K
Fishery Research Biologist, J. Thedinga, 4 mo = $27.2K
Estimated vessel JOHN N COBB: 21 d @ $3.0k = $63.0K
Additional operating costs of Little Port Walter Field Station = $26.5K

For a total NOAA Contribution of $307.5K

**1997**

Project Number: 97076
Project Title: Oil Effects on Pink Salmon Straying
Agency: National Oceanic & Atmospheric Administration

FORM 3A
TRUSTEE
AGENCY
SUMMARY

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1996 - September 30, 1997

| **Personnel Costs:** | | GS/Range/ | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|
| Name | Position Description | Step | Budgeted | Costs | Overtime | FFY 1997 |
| A Celewycz | Co-PI: Fishery Research Biologist | 11/5 | 11.0 | 6.2 | | 68.2 |
| R Heintz | Fishery Research Biologist | 11/5 | 9.0 | 6.0 | | 54.0 |
| J Thedinga | Fishery Research Biologist | 12/3 | 4.0 | 6.8 | | 27.2 |
| R Bradshaw | Fishery Research Biologist | 9/5 | 12.0 | 5.0 | | 60.0 |
| J Maselko | Fishery Research Biologist | 9/3 | 12.0 | 4.7 | | 56.4 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | Subtotal | | 48.0 | 28.7 | 0.0 | |
| | | | | | **Personnel Total** | $265.8 |

| **Travel Costs:** | Ticket | Round | Total | Daily | Proposed |
|---|---|---|---|---|---|
| Description | Price | Trips | Days | Per Diem | FFY 1997 |
| | | | | | 0.0 |
| Anchorage, January Workshop/coordination mtgs., 6 | 0.4 | 6 | 18 | 0.3 | 7.8 |
| Miscellaneous | | | | | 1.0 |
| | | | | | 0.0 |
| Unidentified scientific meeting: present paper | | | | | 1.5 |
| | | | | | 0.0 |
| Little Port Walter Field Station--6 staff, 10 crew, multiple trips | | | | | 0.0 |
| Beaver Charter | 1.0 | 15 | | | 15.0 |
| Cessna Charter | 0.6 | 10 | | | 6.0 |
| Miscellaneous | | | | | 2.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | **Travel Total** | $33.3 |

**1997**

Prepared: 2 of 4

Project Number: 97076
Project Title: Oil Effects on Pink Salmon Straying
Agency: National Oceanic & Atmospheric Administration

FORM 3B
Personnel
& Travel
DETAIL

4/16/96

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| **Contractual Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| Vessel Charters to support remote recovery crews | |
| 2 charters x 42 d ea x $ 1100 | 92.4 |
| NOAA Contract labor (recovery crew) | |
| 8 x $14.25/h x 400h ea | 45.6 |
| 8 x $11.50/h x 400h ea | 36.8 |
| Armstrong Keta Hatchery--provide sampling of brood stock for our tags | 8.0 |
| Fishery Sampling--for pink salmon tags at procesors in cost-recovery fishery | 25.0 |
| When a non-trustee organization is used, the form 4A is required. **Contractual Total** | $207.8 |

| **Commodities Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| Recovery gear (spears, buckets, knives, packs, etc.) | 16.0 |
| Floy tags | 18.5 |
| Protective & Safety Gear | 7.5 |
| Groceries | 8.0 |
| Fuel | 2.5 |
| Film, report production costs | 1.0 |
| **Commodities Total** | $53.5 |

**1997**

Prepared: 3 of 4

Project Number: 97076
Project Title: Oil Effects on Pink Salmon Straying
Agency: National Oceanic & Atmospheric Administration

FORM 3B
Contractual & Commodities DETAIL

4/16/96

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| | **New Equipment Purchases:** Description | Number of Units | Unit Price | Proposed FFY 1997 |
|---|---|---|---|---|
| | | | | 0.0 |
| R | (Partial) | | | 0.0 |
| | Outboard Motors | 4 | 2100.0 | 8.4 |
| | | | | 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** | | $8.4 |

| **Existing Equipment Usage:** Description | Number of Units | Inventory Agency |
|---|---|---|
| Outboard motors | 1 | NOAA |
| Video Camera | 1 | NOAA |
| Containment Tank | 1 | NOAA |
| Computers/NEC Monitors | 2 | NOAA |
| Palette Recorder | 1 | NOAA |

**1997**

Project Number: 97076
Project Title: Oil Effects on Pink Salmon Straying
Agency: National Oceanic & Atmospheric Administration

FORM 3B
Equipment
DETAIL

## Project Title: Mussel Bed Restoration and Monitoring

| | |
|---|---|
| Project Number: | 97090 |
| Restoration Category: | General restoration; monitoring |
| Proposers: | Malin M. Babcock<br>NMFS Auke Bay Laboratory |
| Lead Trustee Agency: | NOAA |
| Cooperating Agencies: | |
| Alaska SeaLife Center: | |
| Duration: | 3 months (Total project = 5 years, 3 mo) |
| Cost FY97: | $ 16,000 |
| Cost FY98: | |
| Cost FY99: | |
| Cost FY00: | |
| Cost FY01: | |
| Cost FY02: | |
| Geographic Area: | Not Applicable |
| Injured Resources/Service: | Mussels; indirectly Harlequin ducks, Black oystercatchers, Subsistence, Recreation |



### ABSTRACT

This proposal is for finalizing 3 additional manuscripts from the four-year, comprehensive final report due 30 September 1996.

## INTRODUCTION

This project for FY 97 will produce three additional manuscripts for publication in the peer-reviewed literature. The four-year Final Report is due 30 September 1996.

The persistence of *Exxon Valdez* crude oil underlying some dense mussel (*Mytilus trossulus*) beds in Prince William Sound (PWS) and along the Gulf of Alaska (GOA) began to cause concern in the spring of 1991 and was confirmed in surveys by NOAA's Auke Bay Laboratory (ABL) and the National Park Service (NPS). This project has been funded from 1992 through 1996 under Trustee Council Studies No. R103, 93036, 94090, 95090, and 96090.

Substantial amounts of petroleum hydrocarbons (HCs) from the *Exxon Valdez* oil (EVO) spill remain entrained in sediments underlying some dense mussel beds situated along the shorelines impacted by the spill. In 1992 and 1993 (only limited sampling survey sampling was conducted in 1994), ABL and NPS sampled mussels and sediments from 88 beds to determine the presence and level of oiling. Sediments collected from 31 of these beds in PWS had total petroleum hydrocarbons (TPH) concentrations greater than 10,000 $\mu$g/g wet weight and 5 of the beds along the GOA showed greater than 5,000 $\mu$g/g. Decreases in HC concentrations between the years was only moderate and dependent on site location and exposure to storm activity.

In 1994, cooperatively with the Alaska Department of Environmental Conservation and residents from Chenega, Alaska, twelve mussel beds at five different locations were restored. Oiled sediment underlying the mussels was removed and replaced with uncontaminated sediment. Restored beds ranged in size from 9 $m^2$ to 35 $m^2$. Sediment concentrations of petroleum hydrocarbons at all restored beds showed marked reductions. By August of 1995, sediments underlying the restored bed showed an average decrease of total petroleum hydrocarbons of 98% (range, 94-100%). Decreases in August, 1994 averaged 88% (range, 66-100%), and in May, 1995, averaged 89% (49-100%).

Preliminary evaluation of sediment data from untreated sites also indicates reductions in hydrocarbons but not as marked as in the restored beds. Data from mussel chemistry is still to be evaluated. Further monitoring of the untreated and restored beds will probably be proposed for 1997 or 1998.

Other research conducted under this study, 1992-1993, included within-bed variability of oil distribution, stripping and patch removal of mussels to acceleate flushing of the oil, and examination of various biological indices of chronic exposure to EVO in mussels.

## NEED FOR PROJECT

### A. Statement of Problem and
### B. Rationale

Two manuscripts are "in press". Three additional manuscripts planned following the production of the final report, 30 September 1996, are planned. While the Trustee Council has revised

guidelines allowing incorporation, by citation, of peer-reviewed manuscripts into Final Reports; we feel that this process is not appropriate and satisfactory for this particular four-year study.

### C. Location

All work will be conducted at NOAA's Auke Bay Laboratory in Juneau, Alaska.

## COMMUNITY INVOLVEMENT

For the production of manuscripts only, this section does not apply.

## PROJECT DESIGN

A. Objectives

Finalize and submit 3 manuscript for publication in the scientific literature.

Previous objectives have been:

1. Establish the geographic extent and intensity of oiling in contaminated mussel beds in PWS and GOA.
2. Determine within-bed distribution of crude oil in sediments underlying contaminated mussel beds.
3. Test minimally instrusive methods (stripping and patch removal) of decreasing the amount of EVO underlying oiled mussel beds.
4. Test for physiological and biological differences between chronically exposed mussels and clean mussels.
5. Manually restore selected oiled mussel beds with relatively high levels of contamination.

### B. Methods

There is no field work or sampling proposed for 1997.

### C. Cooperating Agencies, Contracts and Other Agency Assistance

None are anticipated.

## SCHEDULE

### A. Measurable Project Tasks for FY 97 and
### B. Project Milestones and Endpoints

| | |
|---|---|
| 15 October 1996 | Submission of histopathology paper to journal |
| 1 November 1996 | Submission of Final Report as NOAA Technical Memoranda |
| 20-24 Nov. 1966 | Presentation of Mussel Bed Restoration at the International Conference on Shellfish Restoration |
| 1 December 1996 | Submission of Survey paper to journal |
| 1 December 1996 | Submission of Restoration paper to journal |

### C. Completion Date

31 December 1996

## PUBLICATION AND REPORTS

"Oiled Mussel Beds, 1992-1995, in Prince William Sound and the Gulf of Alaska Resulting from the 1989 *Exxon Valdez* Accident."

"Restoration of Selected Oiled Mussel Beds in Prince William Sound, Alaska."

Proposed as companion articles for either Marine Environmental Review or the Canadian Journal of Fisheries and Aquatic Sciences.

"Observations on the Histopathology of Bay Mussels, *Mytilus trossulus*, from Sites Oiled by the *Exxon Valdez* Oil Spill."

Target journal: Either Journal of Fish Diseases or Canadian Journal of Zoology

Project Final Report will be submitted as a NOAA Technical Memorandum.

An annual report will be submitted 15 April 1997.

## PROFESSIONAL CONFERENCES

International Conference on Shellfish Restoration: Improving the Health of Coastal Ecosystems through Shellfish Restoration. 20-24 November 1996 at Hilton Head, South Carolina. Present paper on the restoration work completed on selected oiled mussel beds.

## COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Not applicable.

**PROPOSED PRINCIPAL INVESTIGATOR**

Malin M. Babcock
NOAA/NMFS Auke Bay Laboratory
11305 Glacier Highway
Juneau, AK 99801-8626
Phone 907-789-6018
FAX 907-789-6094
e-Mail mbabcock@ABL.AFSC.NOAA.gov

**PERSONNEL**

MALIN M. BABCOCK
Education: Oregon State University, 1963. B. S., Zoology
University of Alaska Fairbanks, 1968. M. S., Zoology (Fisheries)

Experience: 1969-present. Researcher and Task Leader, Auke Bay Laboratory, National Marine Fisheries Service, Juneau, Alaska. Field, lab, and analytical expertise, and data analyses and interpretation particularly with effects of petroleum hydrocarbons on aquatic fish and shellfish. Studies have included Prince William Sound chemical baseline, short term and long term water-soluble fraction of crude oil and sediment toxicity tests assessing physiological and biochemical impacts - including growth and reproduction. I became Task Leader for the Coastal Habitat task within Habitat Investigations, ABL, in 1988 and directly supervise several staff scientists in varied research projects. I have strong participation in overall Habitat Investigations research planning, budget management and staffing.

After the *Exxon Valdez* oil spill, I was co-principal investigator for the EVOS Coastal Habitat Study "Pre-spill and post-spill hydrocarbon concentrations in mussels and sediments in Prince William Sound", becoming Principal Investigator of this project in 1991 and 1992; was also Principal Investigator for the NRDA study "Injury to Oysters" in 1989. In 1991, I participated in the interagency planning for investigating an evolving problem - that of the effects of contaminated mussel beds on higher consumer organisms, and led the preliminary field effort for identifying these beds and sampling parameters to establish the extent and intensity of petroleum hydrocarbons contamination.

I have been Project Leader for NOAA for the PWS portion of Mussel Bed Restoration and Monitoring - coordinating and leading a staff to investigate extent and intensity of oiling; distribution of HCs within a mussel bed; effects of minimally intrusive manipulative techniques to reduce HCs by increasing exposure of oiled sediments; effects of chronic oiling on mussels (byssal thread production, condition and reproductive indices, glycogen stores, feeding rates, growth, and histopathological abnormalities).
In 1994, with staff from the Alaska Department of Environmental Conservation and Chenega residents, we manually restored 12 oiled mussel beds in Prince William Sound.

Additionally, staff under my direct supervision are involved in many aspects of EVOS Restoration program for several studies, training all NRDA study personnel in sampling for hydrocarbons, the NRDA/Restoration database, sample custody and tracking, etc.

Relevant Publications: Over 25 publication/reports - most of which involve effects of exposure to petroleum hydrocarbons on various Alaskan species of fish and shellfish. Over 20 public presentations of scientific studies.

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1996 | Proposed FFY 1997 |
|---|---|---|
| Personnel | $197.3 | $10.6 |
| Travel | $16.3 | $3.3 |
| Contractual | $39.6 | $0.0 |
| Commodities | $22.5 | $2.1 |
| Equipment | $0.0 | $0.0 |
| Subtotal | $275.7 | $16.0 |
| General Administration | $32.4 | $1.6 |
| Project Total | $308.1 | $17.6 |
| Full-time Equivalents (FTE) | 3.2 | 0.2 |
| Other Resources | $89.8 | $16.0 |

LONG RANGE FUNDING REQUIREMENTS

Dollar amounts are shown in thousands of dollars.

| Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
|---|---|---|---|---|---|
| | | | | | |

Comments:
This budget is for publication of 3 manuscripts in peer-reviewed literature.
NOAA Contribution: Principal Investigator, M Babcock 2 mo = $16K

**1997**

Prepared:



Project Number: 97090
Project Title: Oiled Mussel Bed Restoration and Monitoring
Agency: National Oceanic & Atmospheric Administration

FORM 3A
TRUSTEE
AGENCY
SUMMARY

4/12/96

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1996 - September 30, 1997

| **Personnel Costs:** | | GS/Range/ | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|
| Name | Position Description | Step | Budgeted | Costs | Overtime | FFY 1997 |
| P Harris | Zoologist | 11//1 | 2.0 | 5.3 | | 10.6 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | Subtotal | | 2.0 | 5.3 | 0.0 | |
| | | | | | **Personnel Total** | $10.6 |

| **Travel Costs:** | Ticket | Round | Total | Daily | Proposed |
|---|---|---|---|---|---|
| Description | Price | Trips | Days | Per Diem | FFY 1997 |
| | | | | | 0.0 |
| Anchorage Workshop | 0.4 | 1 | 3 | 0.2 | 1.0 |
| C Brodersen to present synthesis poster on project | | | | | 0.0 |
| Meeting: "Improving the Health of Coastal Ecosystems through | 1.5 | 1 | 5 | 0.1 | 2.0 |
| Shellfish Restoration", South Carolina, Principal Investigator | | | | | 0.0 |
| to present paper which will be peer-reviewed and published. | | | | | 0.0 |
| Miscellaneous | | | | | 0.3 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | **Travel Total** | $3.3 |

**1997**

Prepared:

Project Number: 97090
Project Title: Oiled Mussel Bed Restoration and Monitoring
Agency: National Oceanic & Atmospheric Administration

FORM 3B
Personnel
& Travel
DETAIL



4/12/96

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| **Contractual Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| | |
| When a non-trustee organization is used, the form 4A is required. **Contractual Total** | $0.0 |

| **Commodities Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| Page charges on 3 manuscripts | 2.0 |
| Other associated costs | 0.1 |
| **Commodities Total** | $2.1 |

**1997**

Prepared:

Project Number: 97090
Project Title: Oiled Mussel Bed Restoration and Monitoring
Agency: National Oceanic & Atmospheric Administration

FORM 3B
Contractual & Commodities DETAIL



4/12/96

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1996 - September 30, 1997

| **New Equipment Purchases:** Description | Number of Units | Unit Price | Proposed FFY 1997 |
|---|---|---|---|
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| Those purchases associated with replacement equipment should be indicated by placement of an R. | | **New Equipment Total** | $0.0 |

| **Existing Equipment Usage:** Description | Number of Units | Inventory Agency |
|---|---|---|
| Computer | 1 | NOAA |
| NEC Monitor | 1 | NOAA |

**1997**

Project Number: 97090
Project Title: Oiled Mussel Bed Restoration and Monitoring
Agency: National Oceanic & Atmospheric Administration

FORM 3B
Equipment
DETAIL

Prepared:



4/12/96

**Restoration of Prince William Sound Pink Salmon by Diversion of Harvest Effort**

| | |
|---|---|
| **Project Number:** | 97093 |
| **Restoration Category:** | General Restoration |
| **Proposer:** | Prince William Sound Aquaculture Corporation |
| **Lead Trustee Agency:** | Alaska Department of Fish and Game |
| **Expected Project Duration:** | 1st year, 5 year project |
| **Cost FY 97:** | $484,700 |
| **Cost FY 98:** | $195,000 |
| **Cost FY 99:** | $170,000 |
| **Cost FY 00:** | $170,000 |
| **Cost FY 01:** | $170,000 |
| **Geographic Area of Project:** | Prince William Sound |
| **Injured Resource/Service:** | Pink salmon, commercial fishing, subsistence |



## ABSTRACT

Pink salmon egg mortality attributed to oiling of anadromous streams from the *Exxon Valdez* oil spill has contributed to a reduction in adult pink salmon returns. Natural populations of pink salmon are harvested with large numbers of hatchery pink salmon in mixed stock fisheries, which may limit escapement to damaged streams and thereby delay recovery. This project will be directed at changes in hatchery production to reduce exploitation of injured wild stocks. The project will focus on changing the location and timing of hatchery returns in western Prince William Sound. Funding for FY97 will be for equipment and supplies for remote release of hatchery stock fry. Assessment of stock composition of adult returns in the proposed remote release area will be provided by PWSAC in FY97.

## INTRODUCTION

Natural spawning populations of pink salmon in western Prince William Sound were among the resources injured by oil from the *Exxon Valdez* oil spill (EVOS). These populations are harvested with large numbers of hatchery pink salmon in mixed stock fisheries, which may limit their ability to recover from the effects of the spill. To reduce harvest pressure on injured wild stocks, hatchery salmon targeted by commercial fishermen can be isolated spatially or temporally from the injured wild populations. Restoration of injured pink salmon populations through separation from hatchery fish is based on the assumption that spawning escapement of injured wild stock adults will increase because of reduced harvest pressure. Hatchery pink salmon, for example could be released in the Eastern, Northern, or Montague Districts, thereby distributing the commercial fleet away from injured stocks in the Eshamy, Northwestern and Southwestern Districts. Hatchery pink salmon can also be replaced with species or populations that have different return timing from wild pink salmon populations currently harvested in fisheries targeting hatchery salmon. By modifying hatchery production to separate hatchery and wild salmon returns, fisheries can be managed to minimize pressure on injured populations.

The extent to which the hatchery contribution to the pink salmon fishery in western PWS should be reduced to aid the recovery of injured populations, however, is unknown. Evidence has shown that oil impacted streams experienced higher embryo mortality than non-oiled streams, but that differences between oiled and non-oiled streams are declining. If the high embryo mortality in injured streams does not persist, the escapement needed to achieve pre-spill levels of abundance would change accordingly. Moreover, differences in survival between hatchery and wild fish may complicate the assessment of changes that result from remote release or altered run timing of hatchery fish. Consequently, this project is designed to reduce the hatchery contribution to the mixed stock fishery, rather than increase escapement into injured streams. This project will reduce the number of hatchery pink salmon fry released annually into Prince William Sound by 45 million. Based on the historic marine survival of 4%, approximately 1.8 million hatchery pink salmon will be removed from the mixed stock fishery.

Equally important, however, is the need to determine whether changes in the hatchery program may impact wild populations through straying and genetic hybridization. For example, the remote release of hatchery fish may result in local straying if the fisheries do not harvest all of the adult return. Temporal or spatial overlap of characteristics such as spawning time and habitat can increase the potential for hybridization and gene flow between hatchery and wild populations. The implications of straying by hatchery fish into natural spawning populations are not well known, and should be considered in evaluating changes in the hatchery program.

Efforts by PWSAC to restore injured pink salmon populations to pre-spill conditions will be directed toward:

1. **Relocating hatchery runs by remote release into areas that minimize fishing pressure on injured wild stocks.**

2. **Replacing current late run pink salmon production with hatchery chum salmon of earlier run timing.**

## NEED FOR PROJECT

### A. Statement of Problem

Egg mortality attributed to oiling of anadromous streams has persisted through several generations, which may be contributing to reduced pink salmon returns. This has reduced the escapement of natural spawning populations and the economic benefits of users and communities that derive income from the resource. In addition, commercial fishing harvests in Western Prince William Sound that target mixed wild stock and hatchery stocks of salmon may expose injured wild stocks to levels of exploitation which limit wild stock escapement to oil damaged streams, thereby further suppressing recovery.

### B. Rationale

Without steps to reduce harvest pressure on injured wild populations, it may take many generations before these recover to pre-spill levels. If no action is taken, injured populations will remain subject to pressures that prevent their full contribution to the biodiversity of the PWS ecosystem. Moreover, services related to salmon harvesting such as fishing, processing and economies of the PWS communities will continue to suffer economic distress. Curtailment of fishing to protect pink salmon (*EVOS* Restoration Plan, 1994) and to allow injured stocks to achieve higher spawning escapement will only further injure associated services. Diversion of fishing effort to reduce harvest pressure on injured stocks while maintaining fishing services and economies based on fishing can aid in increasing spawning escapement and maintain services at the highest degree possible until injured stocks return to prespill levels of abundance. Information from this project will increase the options available to fishery managers to maximize the economic benefits from enhancement programs while ensuring wild stock protection.

### C. Location

Project 97093 will take place in Prince William Sound. Location of the remote release and test fishing activities will be Naked Island. Hatchery chum fry for release will be provided from Wally Noerenberg Hatchery.

## COMMUNITY INVOLVEMENT

Alaska state law requires that PWSAC, as the regional aquaculture corporation in PWS, be comprised of representatives from all interested user groups and possess a board of directors "which includes no less than one representative of each user group that belongs to the association". The concept of a regional association is intended to allow active public participation in the salmon rehabilitation program. The PWSAC board of directors is comprised of: commercial / sport / subsistence / personal use fisherman, native representatives from villages in PWS and the Copper River region, representatives of the fish processing industry and representatives of the communities in PWS. To the extent that PWSAC is directed by a board of all interested users of the salmon resources in PWS, PWSAC will direct this project with the goal of benefiting all user groups through salmon restoration efforts.

## PROJECT DESIGN

### A. Objectives

This project will assist the restoration of naturally spawning populations of pink salmon in PWS through **modification** of the existing hatchery program. **It will reduce the production of hatchery pink salmon fry.** The project approach will involve the remote release of early returning hatchery chum salmon to reduce the interception of late returning natural populations of pink salmon. Additional work will involve assessment of migration routes and timing of natural and hatchery salmon populations through the remote release area, and stream surveys to determine the extent of straying by adult hatchery salmon produced from this project. Test fishing and stream surveys will be conducted by PWSAC through a cooperative agreement with ADF&G as part of the permitting process for the release. PWSAC does not intend to seek funding for stream surveys. Guided by site recommendations listed with the Prince William Sound/Copper River Phase 3 Comprehensive Salmon Plan (1994), the project will target Naked Island and Montague Island as potential remote release sites. The specific objectives are:

1. Remote release approximately 24 million early returning hatchery chum salmon fry outside the migratory corridor of late returning pink salmon in western PWS.

2. Reduce the number of late returning hatchery pink salmon fry released annually into the waters of western PWS by approximately 45 million.

### B. Methods

This project is intended to achieve a reduction of hatchery pink salmon returning in the mixed stock fisheries in Western PWS. It involves a reduction in the number of pink salmon fry released annually from PWSAC hatcheries by 45 million. To offset this

reduction, PWSAC proposes to remote release 24 million early returning chum salmon fry at a site in central (Naked Island) or southern (Montague Island) PWS.

## 1. Assessment of Adult Migration Routes and Timing

Three areas have been identified by the Prince William Sound - Copper River Regional Planning Team that have practical potential for remote release of hatchery produced early chum fry: Naked Island, Nelson Bay and Montague Island. Nelson Bay would require the use of local stock for remote release, which effectively limits release numbers for 2-3 generations and significantly inflates operational costs. Consequently, further consideration is not warranted. Montague Island has been included in the SEA sampling program (9X320E Juvenile Salmon and Herring Integration) and PWSAC has released early run chum fry there since 1994. PWSAC conducted test fishing near Montague Island in 1994 and 1995. Assessment of adult migration routes and timing will, therefore, be conducted only at Naked Island.

Development of a remote release project to help restore injured pink salmon stocks in PWS will require baseline information of the abundance, composition and timing of natural and hatchery populations of salmon that migrate through the remote release area. Test fishing to acquire this information will be conducted by PWSAC in 1996 in 1997. Test fishing in the area of Naked Island will be similar in design and method to that conducted by PWSAC at Montague Island in 1994 and 1995. Fishing for adult salmon will be conducted from mid- June to late July which approximates the return timing of early chum returns to Wally Norenberg Hatchery. A purse seine vessel will sample eight survey locations for two 12- hour periods per week. Nets will be 150 fathom, 3 strip seines set on a right- handed hook haul and fished for 20 minutes. Each vessel will have one technician to record catch by species. These data will be used to determine whether Naked Island provides adequate separation between hatchery and wild stocks for harvest.

## 2. Remote Release of Chum Salmon Fry

Growth and survival of salmon fry in near shore marine environment are closely related to temperature, food availability, and predation (Cooney 1995). Information obtained from the EVOS funded SEA Investigations indicate that these conditions vary annually and regionally within PWS and are driven by physical oceanographic conditions in the Gulf of Alaska. More specifically, evidence suggests that surface and deep water circulation patterns provide a link between temperature and plankton abundance in the two regions, and that plankton abundance may influence predation through prey switching. In years of low plankton abundance, species such as walleye pollock appear to switch from feeding primarily on macrozooplankton to juvenile salmon, and that smaller salmon (< 60 mm) experience higher rates of mortality. Similar size dependent mortality of juvenile salmon during early marine residence has been observed elsewhere (Cooney, R.T. 1995, Hargreaves, N.B., and R.J. LeBrasseur 1986, Kaeriyama, M. 1989, Linley T.J. 1993, Parker, R.R. 1971, Whitmus, C.J. 1985). The survival advantage of larger fry is evidently related to growth: large fry grow faster and spend less time foraging in near shore areas where predators are more abundant. Data from EVOS funded Experimental Pink Salmon Fry Release support these observations. Larger pink fry released in 1994 at 1-1.5 grams (50 - 60 mm) in mid- June experienced survival rates ~ 10 times greater than those released into the plankton bloom at 0.25-0.4 grams in early May.

This project will apply the results from these studies and extend the investigation to determine the optimum time at release. Fry will be reared to ~ 1.5 - 2.0 grams and released in two groups on differing dates: mid- to late May and early to mid- June. The release groups will be otolith marked to evaluate survival from the adult returns.

Fry will be transported by seine vessel in mid- to late March and transferred to sea water net pens (12m x 12m x 5m) at 3 million per pen. Feed rations will be determine by fry size and rearing water temperature. Density at release will be ~ 6 -8 $kg/m^3$, which will require ~ 60,000 kg of feed.

On site environmental monitoring will include hourly recording of temperature and salinity using remote continuous recorder/loggers installed on site. Zooplankton sampling will be conducted twice weekly from mid- March to mid- June. Samples will be collected with a 0.5 meter plankton net (0.25 mm). Replicate 20 meter vertical tows will be taken at two locations at each site, preserved in 10 percent formalin and shipped to UAF for analysis. Weekly hydroacoustic surveys will be conducted to identify aggregations of potential predator species of fish in the near shore area (~ 1 km radius).

Feed will stored on flat deck barge (minimum deck dimensions 12m x 6m), housed in weather proof tent (i.e. structural aluminum frame, reinforced nylon cover). Project personnel (2) will require accommodations for ~ 3 months. Living quarters can be water or shore based, but require areas for cooking and sleeping, power, and systems for potable water and domestic waste. Shore based facilities are preferable for safety purposes, and PWSAC intends to explore a cooperative arrangement with the U.S. Forest Service to

develop such housing.

### 3. Genetic Impact Evaluations

Straying of hatchery fish into natural spawning populations can lead to hybridization, alter phenotypic characteristics important for local adaptation, and potentially reduce fitness (i.e. production). Concern for genetic introgression of hatchery fish into the wild populations has been an important consideration in the ADF&G Genetics Policy for salmon enhancement programs in Alaska. The policy is based, in part, on evidence that hatchery and wild populations have, to varying degrees, adapted to their specific environments through natural selection. Consequently, introgression of hatchery genotypes into natural populations has the potential to reduce survival directly (i.e. natural selection against hybrids), or alter coadaptive genomes of natural populations and reduce survival in future generations (ie. natural selection neutral or favoring hybrids).

The ADF&G genetics policy stipulates that local populations be given priority in developing hatchery broods because genetic differences between populations often increase with geographical distance, and therefore the impacts of hybridization will presumably be greater from selecting non-local, rather than local population. Because the hatchery chum salmon to be released at Naked Island are primarily local stock (i.e.Wells River, Port Wells), straying is less likely to impact wild populations than the introduction of a non-local stock. However, similarity in characteristics such as spawning time and habitat also provide more opportunity for hybridization and gene flow, and could increase the risk to natural populations. A future objective of this project will be to determine the degree of straying by remote released fish in to natural spawning populations of early returning chum salmon. PWSAC and ADF&G will develop a cooperative project to conduct stream surveys in 2001 and 2002 to measure straying of hatchery fish.

## C. Cooperating Agencies, Contracts and Other Agency Assistance

### 1. Environmental Compliance and Monitoring

Technical support will include the services of:

- PWSAC project management & fish culture staff
- ADF&G biologists and technicians
- permitting agencies including ADF&G, Department of Army, Corps of Engineers,
- Department of Natural Resources
- ADF&G otolith mark analysis lab

Contracts will be established for vessel charter for test fishing to and assess the abundance, composition and timing of salmon stocks through the remote release area.

The Alaska Dept. of Fish and Game will conduct NEPA review. It is likely a categorical exclusion (CE) will be required for most field work, including test fishing. Remote releases typically have additional permitting requirements including:

- hatchery permit alteration (PAR), ADF&G
- fry transport permit (FTP), ADF&G
- DOA Army Corp permit to anchor netpen in navigable waters;
- DNR tidelands lease, bond and insurance;
- Coastal Zone Management Consistency determination;
- letter of permit from uplands owner to support tidelands lease;
- US Coast Guard permit, netpen lighting designation, and annual notification of netpen installation and removal.

Additionally, should shore based field camps be developed to support the project, special use permits may be required if selected sites are within the Chugach National Forest.

**2. Public Process**

PWSAC is a regional association which by law (AS 16.05.380.) must include on their boards representatives of sport fishermen, municipalities, and Native organizations, in addition to commercial fishermen and processors. It is PWSAC's mission to optimally produce salmon for the benefit of all user groups.

As a mechanism to restore PWS salmon resources and services, the salmon restoration project will incorporate existing research results achieved through projects previously and currently publicly reviewed and funded through the *EVOS* Trustee Council process. Project 95093 has also been reviewed and recommended for funding by the *EVOS* Public Advisory Group (October, 1994). While project 95093 was designed and recommended by commercial and subsistence resource users of PWS salmon, the project has further been subject to intense scientific debate at the *EVOS* sponsored "Supplementation Workshop" (January, 1995) and the *EVOS* Trustee Council "Science Planning Workshop" (January, 1995). Subsequent to these public and scientific reviews, 95093 was presented to the PWS/Copper River Regional Planning Team (March, 1995) at which occasion this advisory group, in public session, approved to write to the Trustee Council "supportive of the direction of the project...and fully supports the purpose of the project" which states "to change the time and area of hatchery returns in western PWS to reduce the interception of oil-impacted wild salmon stocks". Further, the Regional Planning Team "sees this as a major project of benefit to PWS which will require a significant commitment of funding over a period of approximately five years."

## SCHEDULE

### A. Measurable Project Tasks for FY 97

| | |
|---|---|
| June 1 - July 30, 1996: | Test fishing |
| June 1 - Sept 30, 1996: | Complete NEPA requirements |
| July 1 - July 25: | Egg take early run chum |
| July 1 1996 - Mar. 15, 1997: | Incubation |
| Mar. 15 - Apr. 10 1997: | Fry transfer |
| Mar. 15 - June 15, 1997: | Rearing and release |
| Sept. 1 - Oct. 30 1997: | Report |

## B. Project Milestones and Endpoints

| | |
|---|---|
| July 1996 - Mar. 1997: | Purchase equipment, develop support facilities |
| June 1997 - June 2001: | Chum fry remote release |
| July 1996 - July 2000: | Reduce hatchery pink salmon egg take |
| July 1999 - July 2004: | Stream surveys (straying) |

**Completion Date:** FY 01

## PUBLICATIONS AND REPORTS

Annual Reports: Restoration of Prince William Sound Pink Salmon
by Diversion of Harvest Effort, 1996 - 2004

## COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Project 95093 is intended to reduce the number of hatchery pink salmon fry and adults produced in western Prince William Sound. This reduction will aid fishery managers in achieving escapement levels of natural spawning populations of pink salmon. In conjunction with 97093 to reduce hatchery production of pink salmon, the project will draw on work being conducted SEA Investigations. In this regard, physical and biological oceanographic conditions under assessment at proposed remote release sites (97320M Observational Physical Oceanography in Prince William Sound and the Gulf of Alaska, 97320G SEA: Phytoplankton and Nutrients, 97320H SEA-ZOO: The Role of Zooplankton in the Prince William Sound Ecosystem, 97320N Nekton-Plankton Acoustics, 97320E Juvenile Salmon and Herring Integration, 97320A Juvenile Salmon Growth and Mortality) will aid in evaluation of rearing and release strategies.

In conjunction with the program to reduce harvest pressure on injured stocks, the otolith marking project (95320C) funded by the *EVOS* Trustee Council will aid both inseason management of the fishery through detection, evaluation and more specific management of mixed stocks harvested in the fishery. The technology will also be utilized to support the evaluation programs related to straying interactions between hatchery and wild stock pink salmon.

## PROPOSED PRINCIPAL INVESTIGATOR

Timothy J. Linley, Project Leader
PWSAC - Chief Scientist
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## LITERATURE CITED

Cooney, R.T. 1995. Sound Ecosystem Assessment (SEA) - An integrated science plan for the restoration of injured species in Prince William Sound. Draft 1994 final report to the Exxon Valdez Oil Spill Trustee Council.

Hargreaves, N.B., and R.J. LeBrasseur. 1986 Size selectivity of coho (*Oncorhynchus kisutch*) preying on juvenile chum salmon (*O. keta*). Can. J. Fish. Aquat. Sci. 43:581-586.

Kaeriyama, M. 1989. Aspects of salmon ranching in Japan. Physiol. Eco. Japan, Spec. Vol. 1:625-638.

Linley, T.J. 1993. Forecasting returns of hatchery reared chum salmon (*Oncorhynchus keta*). Proceedings of the 16th Northeast Pacific Pink and Chum Salmon Workshop: 123-130.

Parker, R.R. 1971. Size selective predation among juvenile salmonid fishes in a British Columbia inlet. J. Fish. Res. Board Can. 28:1503-1510.

Whitmus, C.J. 1985. The influence of size on the migration and mortality of early marine life history of juvenile chum salmon (*Oncorhynchus keta*). M.Sc. thesis. University of Washington, Seattle, WA 69p.

## 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1996 | Proposed FFY 1997 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Personnel | | $0.0 | | | | | | |
| Travel | | $0.0 | | | | | | |
| Contractual | | $462.9 | | | | | | |
| Commodities | | $0.0 | | | | | | |
| Equipment | | $0.0 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
| Subtotal | | $462.9 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| General Administration | | $21.8 | | | | | | |
| Project Total | | $484.7 | $195.0 | $170.0 | $170.0 | $170.0 | $0.0 | |
| Full-time Equivalents (FTE) | | 0.0 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

Comments:

**1997**

Prepared:



Project Number: 97093
Project Title: PWSAC - Diversion of Harvest Effort - Remote Release
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

4/16/96

## 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Personnel Costs: | | GS/Range/ | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|
| Name | Position Description | Step | Budgeted | Costs | Overtime | FFY 1997 |
| | | | | | | 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 | FFY 1997 |
| | | | | | 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 |

1997

Prepared:



Project Number: 97093
Project Title: PWSAC - Diversion of Harvest Effort - Remote Release
Agency: Alaska Department of Fish and Game

FORM 3B
Personnel
& Travel
DETAIL

4/16/96

## 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Contractual Costs: | Proposed FFY 1997 |
|---|---|
| Description | |
| Contract with the Prince William Sound Aquaculture Corporation | 462.9 |
| When a non-trustee organization is used, the form 4A is required. **Contractual Total** | $462.9 |

| Commodities Costs: | Proposed FFY 1997 |
|---|---|
| Description | |
| **Commodities Total** | $0.0 |

**1997**

Prepared:

Project Number: 97093
Project Title: PWSAC - Diversion of Harvest Effort - Remote Release
Agency: Alaska Department of Fish and Game

FORM 3B
Contractual & Commodities DETAIL



4/16/96

## 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

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

**1997**

Project Number: 97093
Project Title: PWSAC - Diversion of Harvest Effort - Remote Release
Agency: Alaska Department of Fish and Game

FORM 3B
Equipment
DETAIL

Prepared:



4/16/96

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1996 | Proposed FFY 1997 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| Personnel | $2.6 | $21.1 | | | | | | |
| Travel | $0.0 | $0.7 | | | | | | |
| Contractual | $2.0 | $23.0 | | | | | | |
| Commodities | $1.5 | $77.0 | | | | | | |
| Equipment | $10.0 | $299.0 | | | | | | |
| Subtotal | $16.1 | $420.8 | | | | | | |
| Indirect | $2.0 | $42.1 | | | | | | |
| Project Total | $18.1 | $462.9 | $183.7 | $163.7 | $163.7 | $163.7 | $0.0 | |
| Full-time Equivalents (FTE) | | 7.5 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

Comments: Indirect cost is for corporate administration @ 10%. No additional resources will be applied to the project.

**1997**

Prepared:



Project Number: 97093
Project Title: PWSAC - Diversion of Harvest Effort - Remote Release
Name: Prince William Sound Aquaculture Corporation

FORM 4A
Non-Trustee
SUMMARY

4/16/96

## 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Personnel Costs: | | | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|
| | Name | Position Description | Budgeted | Costs | Overtime | FFY 1997 |
| | T. Linley | Principal Investigator | 1.0 | 5375.0 | | 5.4 |
| | J. Milton | Project Manager | 0.5 | 4300.0 | | 2.2 |
| | Vacant | Fish Culturist | 3 | 2500.0 | | 7.5 |
| | Vacant | Project Technician | 3.0 | 2000.0 | | 6.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | Subtotal | 7.5 | 14175.0 | 0.0 | |
| | | | | | Personnel Total | $21.1 |

| Travel Costs: | | Ticket | Round | Total | Daily | Proposed |
|---|---|---|---|---|---|---|
| | Description | Price | Trips | Days | Per Diem | FFY 1997 |
| | Two round trips to Anchorage for project leader: RT @ $224 | 224.0 | 2 | | | 0.4 |
| | $150 per day perdiem for 2 days. | | | 2 | 150.0 | 0.3 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | Travel Total | $0.7 |

**1997**

Prepared:



Project Number: 97093
Project Title: PWSAC - Diversion of Harvest Effort - Remote Release
Name: Prince William Sound Aquaculture Corporation

FORM 4B
Personnel
& Travel
DETAIL

4/16/96

## 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Contractual Costs: | Proposed |
|---|---|
| Description | FFY 1997 |
| Fry Transfer Charter $1000/day @ 8 days | 8.0 |
| Equipment installation and breakdown | 15.0 |
| **Contractual Total** | $23.0 |

| Commodities Costs: | Proposed |
|---|---|
| Description | FFY 1997 |
| Fish Food 36,000 pounds at $2/lb | 72.0 |
| Fuel - Otolith marking 5,000 gallons @ $1/gallon | 5.0 |
| **Commodities Total** | $77.0 |

**1997**

Prepared:



Project Number: 97093
Project Title: PWSAC - Diversion of Harvest Effort - Remote Release
Name: Prince William Sound Aquaculture Corporation

FORM 4B
Contractual & Commodities DETAIL

4/16/96

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| New Equipment Purchases: Description | Number of Units | Unit Price | Proposed FFY 1997 |
|---|---|---|---|
| Net Pen Complex | 8 | 18.0 | 144.0 |
| Anchoring | 1 | 20.0 | 20.0 |
| Support Barge | 1 | 30.0 | 30.0 |
| Living Quarters | 1 | 15.0 | 15.0 |
| Raceways (transfer holding) | 2 | 45.0 | 90.0 |
| | | | 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** | $299.0 |

| Existing Equipment Usage: Description | Number of Units | |
|---|---|---|
| | | |

**1997**

Project Number: 97093
Project Title: PWSAC - Diversion of Harvest Effort - Remote Release
Name: Prince William Sound Aquaculture Corporation

FORM 4B
Equipment
DETAIL

Prepared:



4/16/96

# Implementation of the Sound Waste Management Plan: Environmental Operations and Used Oil Management System

| | |
|---|---|
| Project Number: | 97115 |
| Restoration Category: | General Restoration |
| Proposed by: | Prince William Sound Economic Development Council |
| Lead Trustee Agency: | ADEC |
| Duration: | 3rd year, 4 year project |
| Cost FY 97: | $1,130,584 |
| Cost FY 98: | $75,000 |
| Geographic Area: | Prince William Sound |
| Injured Resource/Service: | Intertidal and subtidal organisms, harlequin ducks, black oystercatchers, sea otters, harbor seals, and other seabirds, shorebirds, and marine mammals. The services most likely to benefit are subsistence and recreation, both of which are affected by the adverse environmental and visual effects of pollution. |



## ABSTRACT

This project will help prevent marine pollution that is generated from land-based sources within the five Prince William Sound communities. The recently completed Sound Waste Management Plan was developed to address community-based sources of marine pollution. This project will provide a portion of the funding needed to implement two of the five recommendations contained in the Sound Waste Management Plan: 1) construction of Environmental Operation Stations to improve the overall management of solid and oily wastes; and 2) creation of a comprehensive used oil management system in each community. The communities will provide substantial funding to help implement the recommendations contained in the Sound Waste Management Plan.

## INTRODUCTION

A wide range of waste streams are generated within Prince William Sound communities. These include used oil generated from vehicles and vessels, hazardous wastes generated by households, and municipal solid waste. These waste streams constitute a major and chronic source of marine pollution.

Communities currently face serious problems with managing these wastes, including inadequate facilities to properly manage used oil, landfills that are located in areas of potential groundwater and surface water contamination, and hazardous household wastes disposed of in community landfills where they may leach into surrounding land and water. As a result of these problems, pollution from these sources is entering Prince William Sound on an on-going basis.

The Sound Waste Management Plan was developed by Prince William Sound communities to find solutions to these problems. It is the first collaborative planning effort among the communities of Cordova, Valdez, Whittier, Chenega Bay and Tatitlek and was made possible with funding from the *Exxon Valdez* Oil Spill Trustee Council. The Sound Waste Management Plan, completed in February 1996, contains five recommendations for improving waste management and decreasing pollution to Prince William Sound:

- create a comprehensive used oil management system in each community;
- establish a regional household hazardous waste collection and training program;
- institute community-sponsored drop-off recycling programs;
- construct EnVironmental Operation Stations in each community; and
- determine how and where municipal solid waste will be disposed of over the long term.

These recommendations are based on extensive community-specific analysis and discussion to identify the priority environmental management problems in each community and to develop practical and cost-effective waste management solutions. Several of the recommended solutions are innovative in that they are regional solutions, which take advantage of the cost efficiencies (e.g., in planning, equipment purchase, construction design) made possible by communities working together to plan and implement the solutions.

Strong community support exists for the recommendations. This support is evidenced by the council resolutions which each community has passed endorsing the Sound Waste Management Plan; the time and effort spent by community representatives in the year-long development of the Plan; and the willingness of the communities to devote substantial resources to implementing the Plan's recommendations.

This proposal requests funding from EVOS to provide a portion of the one-time capital costs needed to implement two of the five recommendations: 1) construction of Environmental Operation Stations; and 2) establishment of a comprehensive used oil management system. This proposal will benefit all of the communities in Prince William Sound. Communities will

fund all ongoing operation and maintenance costs and a portion of the capital costs needed to implement the projects. In addition, communities will seek funding assistance from sources other than EVOS to implement the remaining three project recommendations.

The purpose of constructing EnVironmental Operation Stations (or EVOS) is to provide the physical, sheltered space necessary to safely manage and store used oil, household hazardous waste, and recyclable solid waste. The EnVironmental Operation stations will also centralize used oil, household hazardous waste, and recycling operations and will encourage participation by residents by providing a convenient "one-stop" drop-off location for the wastes.

A comprehensive used oil management system will be created in each community by upgrading equipment as needed to enable all sources of used oil (engine oil, oily bilge water, and oily materials) to be properly managed at all stages (collection, storage, and burning for energy recovery). This will ensure that used oil is collected from all sources and that it is managed safely.

These are viable solutions to reducing the impact to Prince William Sound caused by inadequate management of used oil, household hazardous wastes and recyclable solid waste generated within each of the communities. Proper management of these waste streams is difficult to enforce and therefore improved management must rely upon the provision of adequate and convenient facilities to encourage their use by residents and businesses so that the maximum volume of these wastes are collected and managed safely.

This is one of two proposals being submitted to EVOS to help implement the Sound Waste Management Plan recommendations. The second proposal is being submitted by the City of Cordova to help fund a portion of the capital costs needed to construct a new landfill in Cordova.

Funding is being requested from EVOS for only a portion of the overall "package" of recommendations contained in the Sound Waste Management Plan. Communities are pursuing a variety of funding sources for the other Plan recommendations including the communities, the private sector (e.g., Alyeska Pipeline Service Co.), the Cordova Road Settlement Fund, the Department of Environmental Conservation, Native Alaskan organizations, and EVOS. (The table on the following page shows the recommendations, associated costs, and potential funding sources).

Communities have already obtained some of the funding needed to implement the recommendations (e.g., a regional household hazardous waste collection and training program has been established in coordination with the Department of Environmental Conservation). In addition to this very concrete progress, the Sound Waste Management Plan project has improved communication and created "general good will" among communities which will help ensure that positive changes in waste management practices are possible and can be sustained over time.

## TABLE 1: SOUND WASTE MANAGEMENT PLAN RECOMMENDATIONS

| *What environmental issues does the region face?* | *What are the solutions?* | *What is the cost?* | *Who will provide funding?* | *What is the start date?* |
|---|---|---|---|---|
| **Used Oil**<br>Lack of adequate management facilities, which increases risk of spills and illegal dumping | 1. **Create a Comprehensive Used Oil Management System** | $336,000 (capital)<br>$50,000 (annual) | Exxon Valdez Oil Spil Trustee Council<br>Communities | Fall 1996 |
| **Household Hazardous Waste**<br>Current disposal in community landfills unsafe due to potential to leach out into land and water | 2. **Establish a Regional Household Hazardous Waste System** | $60,000 (annual) | Communities, Dept. of Environmental Conservation, Private Sector | Spring 1996 |
| **Solid Waste Recycling**<br>Communities are not recycling despite potential for revenue and resource conservation | 3. **Institute Drop-Off Recycling Programs** | $60,000 (capital & annual)<br>($77,000 revenues) | Communities | Summer 1996 |
| **Operation of Waste Management System**<br>Current operations are inefficient due to lack of centralization | 4. **Construct EnVironmental Operation Stations** | $580,000 (capital)<br>$150,000 (capital)<br>$75,000 (annual) | Exxon Valdez Oil Spil Trustee Council<br>Communities<br>Communities | Summer 1997 |
| **Solid Waste Disposal**<br>Communities need to make landfill siting decisions because landfills are filling up and/or permits are expiring | 5. **Choose Solid Waste Disposal Sites and Methods** | $9-$20 million (capital & annual) depending on option selected | Communities, State/Federal Grant or Settlement Monies | Summer 1997 (for selection of options) |

*The communities are: Chenega Bay, Cordova, Tatitlek, Valdez, and Whittier*

*Costs shown are for the region as a whole.*

## NEED FOR THE PROJECT

### A. Statement of Problem

This project addresses pollution entering Prince William Sound from a wide variety of community-based sources, including households, businesses, boats, and automobiles. These sources generate used oil, oily bilge water, hazardous wastes, and solid wastes on an on-going basis. Communities are struggling to provide proper management of the wastes but currently do not have the equipment, facilities, and training necessary to ensure prevention of spills, of illegal dumping/discharges of solid and oily wastes, and of on-going contamination of ground and surface water from current disposal practices. As a result wastes from community sources are entering Prince William Sound on an on-going basis.

According to a recent study (United Nations, 1995), 80% of marine pollution is generated by land-based sources. Marine pollution in Prince William Sound affects the following injured resources: intertidal and subtidal organisms, harlequin ducks, black oystercatchers, sea otters, harbor seals, and other seabirds, shorebirds, and marine mammals. The services most likely affected are subsistence and recreation, both of which are affected by the adverse environmental and visual effects of pollution.

### B. Rationale/Link to Restoration

The waste streams generated within communities and which are entering Prince William Sound on an on-going basis are affecting fish, wildlife, and human uses injured by the spill, including disruption of important habitat. Any decrease in local pollution would have the efffect of decreasing the stress on injured fish and wildlfe that rely on clean water. The fish and wildlife likely to benefit the most are those that feed in the intertidal or near-shore waters in the vicinity of community waterfronts and small boat harbors. Those most likely to benefit are subsistence and recreation both of which are affected by the recognition of pollution.

Chronic pollution from community sources is believed to have significant adverse effects on the marine environment:

- refined petroleum products tend to be even more toxic to fish and wildlife than crude oil;
- the cumulative effectsof chronic marine pollution can substantiallly increase the stress on fish and wildlife resources; and
- with regard to the mortality of seabirds, chronic marine pollution is believed to be at least as important as large-scale spills.

Two examples show the potential benefits of this project to restoration. The first, Valdez Duck Fleats, is adjacent to the Valdez Small-baot Harbor. It includes 450 acres of mud flats and 460 acres of saltwater marsh. It provides habitat for rearing salmon and has been recognized by state and federal agencies as providing essential waterfowl habitat for species injured by the

spill. The habitat of the Duck Flats may be degraded by the storm water runoff which empties into the area, or by discharges from boats outside the harbor, landfill contamination flowing down Valdez Creek, or sewage disposal in the Port.

Orca Inlet, outside Cordova has the largest pupping concentration of sea otters in Prince William Sound and is also important for sport fishing, hunting, and is seasonally used by large concentration of seabirds and waterfowl, including many resources injured by the spill. It is part of the largest contiguous wetland in the western hemisphere which, during migrations, hosts the largest concentration of shorebirds in the world. The Cordova waterfront hosts most of the waste management problems described in this proposal. The shoreline includes the solid waste landfill, which is built in part on tidelands and is inundated by the tide twice each day; storm-water and sewer outfalls, and outfalls for fish processing offal which have created an anaerobic zone on the inlet floor.

Implementation of the project will assure that marine pollution from communities does not further degrade the marine habitat of Prince William Sound. By assuring that wastes are properly handled and do not contaminate the marine environment, natural recovery of the resources and services will continue without interference.

### C. Location

The project will be implemented in five Prince William Sound communities: Cordova, Valdez, Whittier, Chenega Bay and Tatitlek. The project will improve the health of Prince William Sound, thereby improving marine habitat for injured species, and will assist in restoring recreation and other injured services. A clean environment is necessary to maintain a good "quality of life" which attracts recreation-oriented visitors as well as new businesses and residents.

## COMMUNITY INVOLVEMENT

The Prince William Sound communities will have extensive involvement in this project. Public and private sector representatives from each of the five communities, who comprise the Prince William Sound Economic Development Council (PWSEDC) Waste Management Committee, were responsible for developing the Sound Waste Management Plan. These same representatives will be involved in the implementation of this proposed project through monthly project meetings and/or teleconferences. The community representatives will be responsible for working closely with the contractor and the PWSEDC to ensure that their project needs are met through review of design plans and providing project direction and oversight. Each of the community representatives will also be responsible for conducting public education to ensure that the city/village councils and community residents are aware of the proposed projects and are kept informed as they are implemented.

## PROJECT DESIGN

### A. Objectives

1. To decrease pollution that is entering Prince William Sound from solid waste sites, mishandling of the wastes (e.g., spills) and illegal dumping of solid, hazardous, and oily wastes.

2. To decrease the flow of used oil into Prince William Sound from vessels, boats, vehicles and other community-based sources due to the lack of sufficient management equipment.

### B. Methods

***Description of proposed project***

Construction of EnVironmental Operation Stations

An EnVironmental Operation Station (or EVOS) is a building which will provide the physical, sheltered space necessary to safely collect and store used oil, household hazardous wastes, and recyclable solid wastes. An EVOS station will help to prevent spills, leaks, and illegal dumping of these wastes by providing:

- a collection point for the wastes within each community;
- sufficient capacity to store the wastes prior to recycling or disposal; and
- safety features for proper management of the wastes such as bermed areas and fire suppression systems as needed for each waste type.

Each community currently lacks collection facilities, storage capacity, and/or safety equipment. For example, in Tatitlek and Chenega Bay household hazardous wastes and recyclable solid wastes are not collected. Used oil is collected sporadically in the two villages but is currently stored in old rusting drums or tanks. Used oil is collected in the three larger communities, but current collection and storage operations are not sheltered from the weather and lack some of the safety equipment needed to prevent contamination from spills and leaks.

In addition to providing the physical space necessary for safe collection and storage of the wastes, the EVOS Stations will maximize the amount of wastes that are collected by providing a user-friendly and convenient "one-stop" drop-off location of the wastes by residents. Further, the EVOS Stations will also minimize the number of staff needed by centralizing the collection and storage of the waste streams at the EVOS Station.

An EVOS station will be comprised of 20' by 20' building modules. Each building module will be used to manage a different waste stream (used oil, household hazardous waste, and

recyclable solid wastes). The building modules will be layed out in either a linear fashion or back to back, depending on the preference of each community.

The building modules will be constructed with steel columns and steel joist roof rafters with a metal roof skin. The floor will be concrete slab. The building modules will vary somewhat based on the type of wastes which will be collected. The used oil and household hazardous waste modules will be enclosed for safety and to enable electrical power to be run to them. In addition, the floor of the household hazardous waste module will have curbs to assure proper containment of materials. The recycling module will not be enclosed.

Preliminary design concepts for the modules are shown on the following pages. The initial step in the project will be to develop the detailed design for the modules. The costs of designing and constructing the EVOS Stations will be minimized because they are all comprised of the same basic building module, which can be duplicated or expanded without detailed design.

The cost of the EVOS Stations will vary from $50.00 to $200.00 per square foot based on whether or not the module is enclosed. Each community has somewhat different needs for the number, type, and configuration of the building modules that will comprise its EVOS Station. Table 2 on the following page shows the number, type, and estimated capital costs of the building modules in each community.

In Valdez and Cordova, the used oil and household hazardous modules are estimated to cost $200.00 per square foot based on the communities' plan to enclose them. Cordova and Valdez would also have the equivalent of two building modules for their recycling operations, based on the volume of materials which will be collected.

In Tatitlek and Chenega Bay, only two building modules will be constructed (one each for used oil and for recycling), because they have recently constructed a household hazardous waste module using federal funding. The two building modules for the villages will each cost approximately $50.00 per square foot and will not be enclosed, due to the relatively small volume of wastes generated in the villages.

In Whittier, one building module for used oil will be constructed at an estimated cost of $200.00 per square foot.[1]

The total estimated capital costs for the region for the EnVironmental Operation Stations are $580,000. In addition to these costs, there is approximately $70,000 for engineering/design, $63,000 for construction management and inspection, $60,000 for personnel, and $21,584

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[1] Whittier plans to collect household hazardous waste, but will immediately ship it for disposal rather than storing it. For its recyclable solid waste, Whittier is requesting funding for three collection dumpsters rather than construction of a central collection module. The total estimated cost of the dumpsters (a total of $20,000) is equal to the cost of an unenclosed building module.

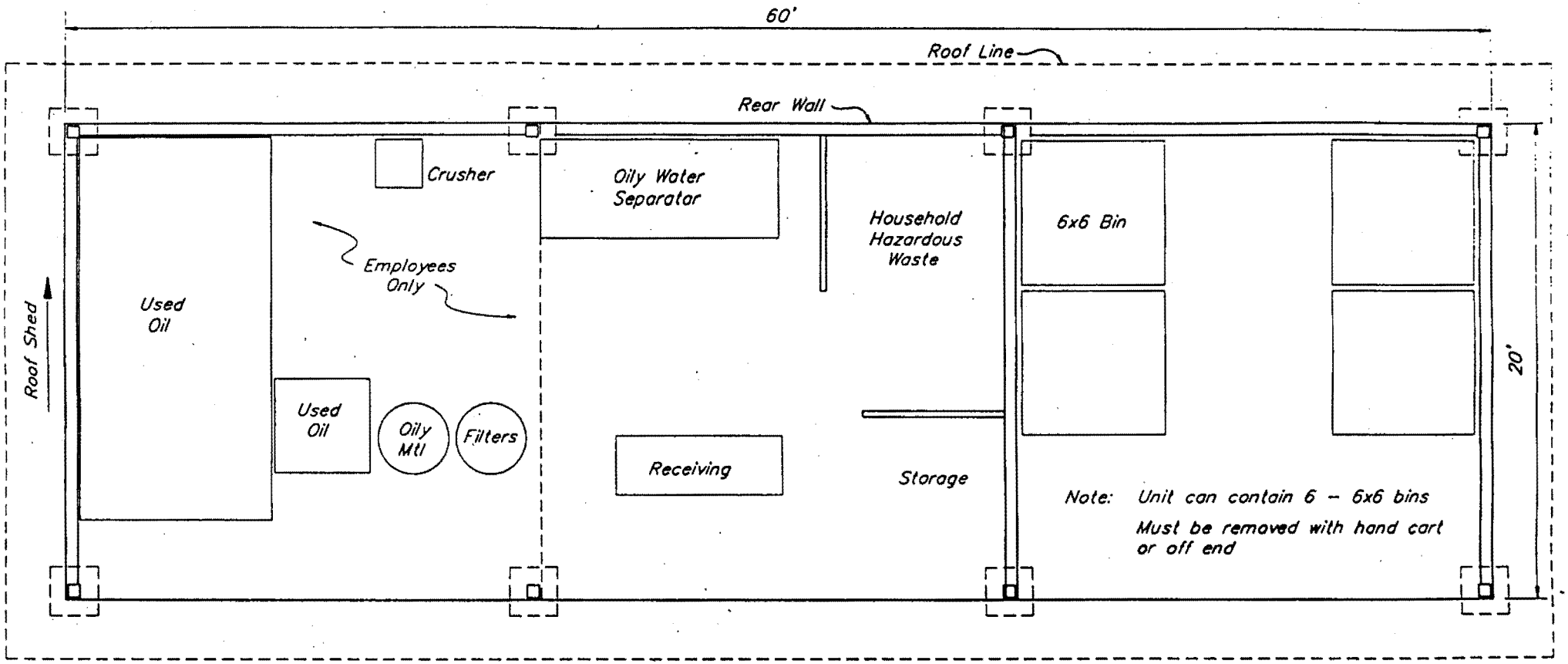
**TABLE 2: ENVIRONMENTAL OPERATION STATIONS [1]**

| Location | Recycle | Used Oil | HHW [2] | TOTAL |
|---|---|---|---|---|
| **CHENEGA BAY** | | | | |
| # of modules | 1 | 1 | | 2 |
| Cost | $20,000 | $20,000 | | $40,000 |
| **TATITLEK** | | | | |
| # of modules | 1 | 1 | | 2 |
| Cost | $20,000 | $20,000 | | $40,000 |
| **WHITTIER** | | | | |
| # of modules | | 1 | | 1 |
| Cost | $20,000 [3] | $80,000 | | $100,000 |
| **CORDOVA** | | | | |
| # of modules | 2 | 1 | 1 | 4 |
| Cost | $40,000 | $80,000 | $80,000 | $200,000 |
| **VALDEZ** | | | | |
| # of modules | 2 | 1 | 1 | 4 |
| Cost | $40,000 | $80,000 | $80,000 | $200,000 |
| $$ TOTAL | $140,000 | $280,000 | $160,000 | $580,000 |
| MODULE TOTAL | 6 | 5 | 2 | 13 |

[1] Cost estimate based on $50/sf minimum, $200/sf maximum. Cost estimates are for modules each measuring 20'x20'. Cost estimates variable mostly due to anticipated code interpretations.

[2] Chenega Bay and Tatitlek will have HHW storage depots beginning in 1996. Whittier will hold an annual HHW collection event, but will ship the HHW for disposal at the end of the event and therefore will not need an EVOS station to store the waste.

[3] Whittier will use three separate recycling collection dumpsters (at $7000) instead of a central collection station.



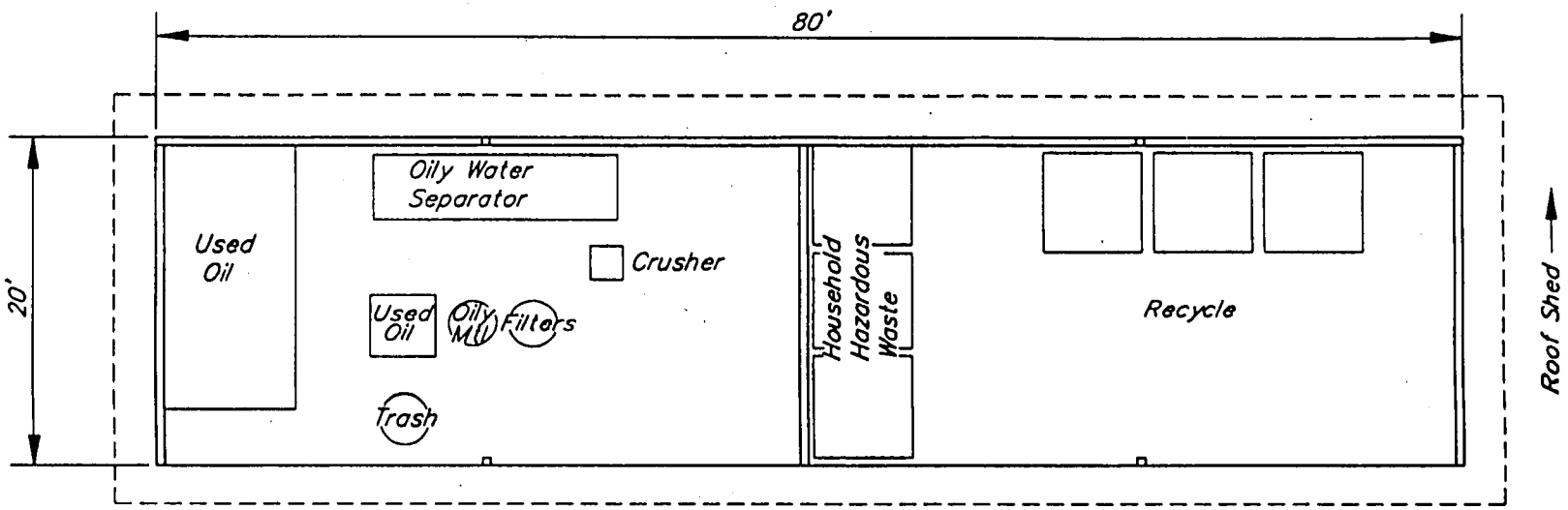

LINEAR LAYOUT

*Scale: 1/4" = 1'-0"*

SOUND WASTE MANAGEMENT PLAN
March 1996

FLOOR PLAN

ENVIRONMENTAL OPERATION STATION



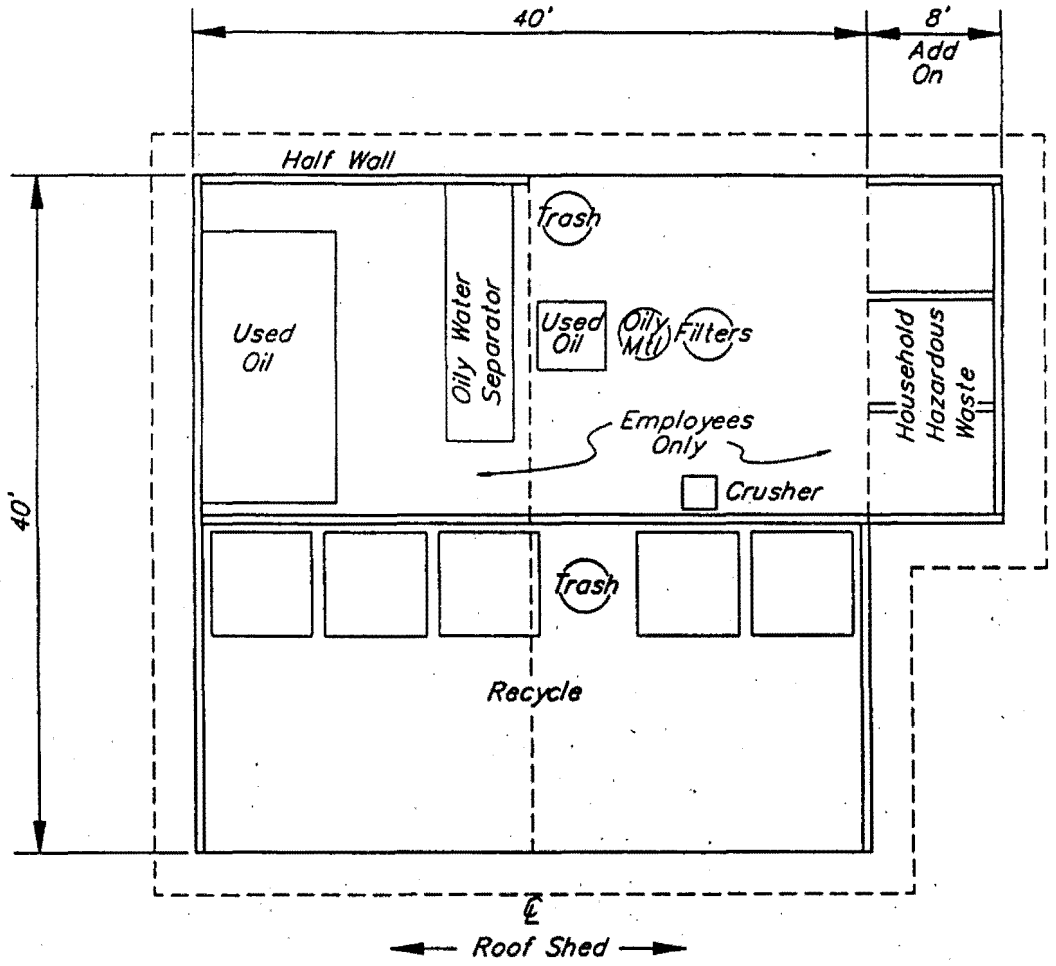

LINEAR LAYOUT

Scale: 1/8" = 1'-0"

SOUND WASTE MANAGEMENT PLAN
March 1996

FLOOR PLAN

ENVIRONMENTAL OPERATION STATION

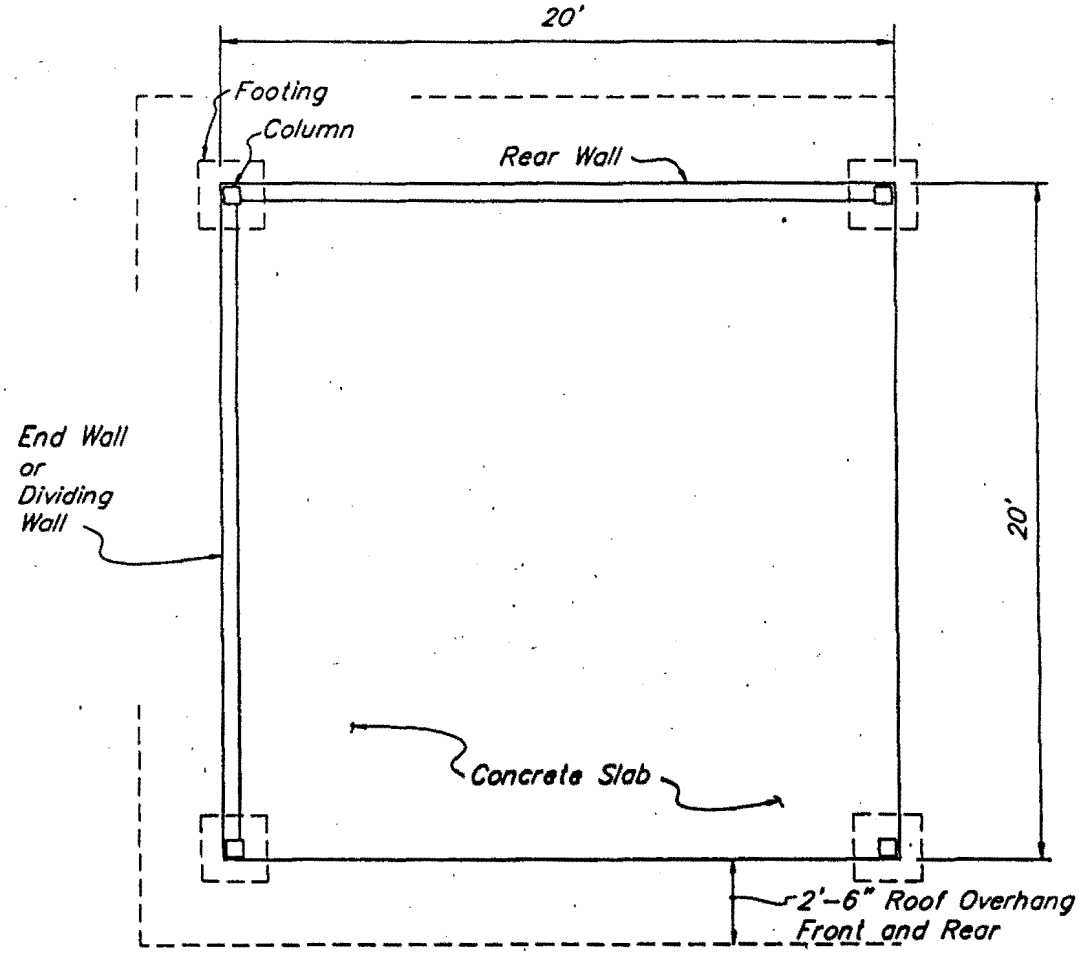



BACK TO BACK LAYOUT

*Scale: 1/8" = 1'-0"*

SOUND WASTE MANAGEMENT PLAN
March 1996

FLOOR PLAN
ENVIRONMENTAL OPERATION STATION




TYPICAL MODULE

Scale: 1/4" = 1'-0"

FLOOR PLAN

ENVIRONMENTAL
OPERATION STATION

SOUND WASTE
MANAGEMENT PLAN
March 1996

for travel for community representatives to facilitate planning and implementation. Combining these figures, the total estimated project cost requested from the Trustee Council for the EnVironmental Operations Stations is $794,584.

The communities will fund the annual operation and maintenance of the EVOS Stations, which includes staffing the stations on either a full-time or part-time basis. Each community will also maintain ownership of the EVOS Stations and will provide the land on which the stations will be located. Each community's annual costs and land value contributions are estimated below. The total annual costs for the region are estimated to be $75,000 per year. The total value of the land to be provided by the region is estimated at $150,000.

Table 3: Community Funding To Be Provided for the EVOS Stations

| | Annual O&M | Land Value |
|---|---|---|
| Cordova | $40,000 | $90,000 |
| Valdez | $22,000 | $20,000 |
| Whittier | $6,000 | $35,000 |
| Chenega Bay | $3,000 | $2,500 |
| Tatitlek | $3,000 | $2,500 |
| TOTAL | $75,000 | $150,000 |

Used oil management equipment

In addition to the collection and storage space to be provided by the EVOS Stations, the proposed project will also upgrade used oil management equipment as necessary to ensure that used oil from all sources can be processed and recycled (through burning for energy recovery). This equipment will be housed in the EVOS Station.

The equipment requested will ensure the comprehensive management of all used oil through enabling:

- "cradle to grave" management of the used oil–collection, storage, filtering, transfer, and burning used oil for energy recovery; and
- management of all sources of used oil–engine oil, oily bilge water, and oil-contaminated materials (e.g., rags and other materials).

Table 4 shows the equipment components of a comprehensive used oil management system and the function which each component serves.

TABLE 4: PROPOSED USED OIL MANAGEMENT SYSTEM

| | |
|---|---|
| **Double Walled Collection Tank** | Convenient and safe interim storage/collection point. |
| **Storage Tank** | Provides a minimum one-year capacity of used oil. |
| **Vacuum Pumper System** | Efficient, clean, maintenance-friendly for transfer of used oil from collection tank and bilges to storage tank and to recycling site(s). |
| **Oily Water Separator** | Device to remove oils from bilge water and other oil-contaminated water. |
| **Filter System** | Installed in-line to remove impurities prior to burning. |
| **Used Oil Burner for Energy Recovery** | Recovers energy from used oil in the form of heat (for buildings, etc.) |
| **Filter Crusher** | Maximizes residual oil removal from filters. |
| **Oily Material Burner** | Efficient and cost effective device for oily material destruction. Heat recovery possible. |
| **Bilge Water Buffer Tank** | Utilized to control flow of bilge water through oily water separator for maximum efficiency. |

To determine the equipment needs in each community, community-specific assessments were made of each communities' current used oil management system. Table 5 shows the aspects of the current management system in each community which require modification.

Table 6 shows the estimated costs of the equipment needed in each community. The costs are based on price quotes from equipment vendors. The equipment specifications shown were developed in conjunction with each community. The specifications for each community vary depending on local conditions. For example, in the villages a relatively small amount of used oil is generated and a basic set of equipment is primarily what is needed to manage used oil in a safe and efficient manner. Other communities have the basic equipment but need additional equipment to improve the management of the larger volumes of used oil they generate.

The total estimated capital costs for the used oil management equipment are $336,000. This is the amount requested from the Trustee Council. The communities will fund the annual operation and maintenance of the equipment, estimated at $50,000 per year. The amounts to be provided by each community are summarized below.

Table 7: Community Funding of Annual Used Oil Management System Costs

| | |
|---|---|
| Cordova | $20,000 |
| Valdez | $20,000 |
| Whittier | $5,000 |
| Chenega Bay | $2,500 |
| Tatitlek | $2,500 |

***Project Implementation***

The Prince William Sound Economic Development Council (PWSEDC) will coordinate the design and construction process. This will entail working with the communities to select a designer, developing and issuing construction bid documents, ensuring inspection of the construction work, and developing a written report on the project for the Trustee Council.

The PWSEDC Solid Waste Committee, which developed the Sound Waste Management Plan, will provide direction to the PWSEDC staff coordinating the design and construction process. The Committee is comprised of representatives of each of the Prince William Sound communities.

A contractor will be hired for the design and construction of the EVOS Stations and to purchase the used oil equipment. The contractor will work closely with the PWSEDC and the communities to ensure that community-specific needs and conditions are met.

TABLE 5: USED OIL MANAGEMENT NEEDS

| Elements of a Comprehensive System | Adequacy of Existing System | | | | |
|---|---|---|---|---|---|
| | Cordova | Valdez | Whittier | Tatitlek | Ch. Bay |
| **Collection Facility** | | | | | |
| · Sizable entry funnel with screen, lid | 👍 | 👍 | 👎 | 👎 | 👎 |
| · Double-Wall tank or bermed area | 👍 | 👍 | 👎 | 👎 | 👎 |
| · "Used Oil" Signage | 👍 | 👍 | 👍 | 👎 | 👎 |
| **Processing and Transfer to Storage** | | | | | |
| · Clor-D-Tec Test | 👍 | 👎 | 👎 | 👎 | 👎 |
| · Standardized Pump - Vacuum | 👎 | 👎 | 👎 | 👎 | 👎 |
| · Oil/Water Separator | 👎 | 👎 | 👎 | 👎 | 👎 |
| · Filter System | 👎 | 👎 | 👎 | 👎 | 👎 |
| **Storage** | | | | | |
| · 12-month volume capacity | 👎 | 👎 | 👎 | n/a | n/a |
| · Double-Wall Tank or Diked | 👍 | 👍 | 👍 | n/a | n/a |
| · "Used Oil" Signage | 👍 | 👍 | 👍 | n/a | n/a |
| · Lab Test when @ Capacity | 👍 | 👎 | 👍 | n/a | n/a |
| **Burn for Energy Recovery** | | | | | |
| · Sufficient Capacity to Burn Used Oil | 👎 | 👎 | 👎 | 👎 | 👎 |
| **Other Issues** | | | | | |
| · Oily Bilge Water Management System | 👎 | 👎 | 👎 | 👎 | 👎 |
| · Oily Materials Incinerator | 👍 | 👎 | 👎 | 👎 | 👎 |
| · Filter Crusher | 👎 | 👎 | 👎 | n/a | n/a |

👍 – Adequate
👎 – Requires modification
n/a – Component not needed given local conditions

TABLE 6: USED OIL SYSTEM COSTS

| Component | Specification | Cost | Equipment Needed in Community | | | | |
|---|---|---|---|---|---|---|---|
| | | | Tatititlek | Ch. Bay | Cordova | Valdez | Whittier |
| **Double Walled Collection Tank** | 500 gallons | $3,000 | $3,000 | $3,000 | | | $3,000 |
| | 1,000 gallons | $4,500 | | | | | |
| | 2,000 gallons | $5,500 | | | | | |
| **Storage Tank** | 1,000 gallons | $4,500 | | | $4,500 | $4,500 | $4,500 |
| | 5,000 gallons | $11,000 | | | | $11,000 | $11,000 |
| | 10,000 gallons | $17,000 | | | | | |
| **Vacuum Pumper System** | 1,000 gallons | $18,000 | | | $18,000 | $18,000 | $18,000 |
| with hose | 2,000 feet | $2,000 | $2,000 | $2,000 | | $2,000 | |
| fixed piping | 1,000 feet | $10,000 | | | $10,000 | | |
| portable unit | 100 gallons | $12,000 | $12,000 | $12,000 | | | $12,000 |
| **Oily Water Separator** | 400 gallons | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 |
| **Filter System** | | $500 | $500 | $500 | $500 | $500 | $500 |
| **Used Oil Burner for Energy Recovery** | 125,000 btu | $3,500 | $3,500 | $3,500 | | | |
| | 175,000 btu | $4,500 | | | $4,500 | $9,000 | $9,000 |
| | 350,000 btu | $6,500 | | | $6,500 | | |
| **Filter Crusher** | | $2,500 | | | $2,500 | $2,500 | $2,500 |
| **Oily Material Burner** | | $3,500 | $3,500 | $3,500 | $14,000 | $7,000 | $7,000 |
| **Bilge Water Buffer Tank** | 500 gallons | $1,000 | $1,000 | $1,000 | $1,000 | $1,000 | $1,000 |
| **TOTAL:** | | | **$45,500** | **$45,500** | **$81,500** | **$75,500** | **$88,500** |
| **TOTAL (all equipment):** | | | | | **$336,500** | | |

## C. Cooperating Agencies, Contracts, and Other Agency Assistance

The Alaska Department of Environmental Conservation will be an ex-officio member of the community-based committee which will be implementing the project.

## SCHEDULE

### A. Measurable Project Tasks for FY 97

| | |
|---|---|
| September 1 - October 15 | Select Designer for EVOS Stations |
| October 15 - December 15 | Complete EVOS station design |
| December 15 - February 15 | Develop bid documents for construction and acquisition of used oil management equipment |
| February 15 - March 31 | Solicit Bids |
| April 1 - April 30 | Bid Opening and Contract Award |
| May 1 - May 31 | Start of Contract Period |
| June 1 - September 30 | Construction of EVOS Stations and purchase of used oil equipment |
| October 1 - October 31 | Project Report for EVOS Trustee Council |

### B. Project Milestones and Endpoints

| | |
|---|---|
| December 31, 1996 | Complete EVOS Station design |
| March 31, 1997 | Issue RFP for EVOS Station construction and acquisition of used oil management equipment |
| June 30, 1997 | Begin construction of EVOS stations and purchase of used oil equipment |
| September 30, 1997 | Improve overall management of waste streams to decrease direct and indirect discharge of waste to the Sound. |
| September 30, 1997 | Decrease direct flow of used oil to Prince William Sound |

### C. Completion Date

The project work will be completed by September 30, 1997. After the September 30th completion of the construction of the EVOS stations, a project report describing the project's activities and accomplishments will be written and submitted to the EVOS Trustee Council.

## PUBLICATIONS AND REPORTS, PROFESSIONAL CONFERENCES

The project plans to make a presentation at the annual Alaska Municipal League meeting. The project team will attend any other conferences to which it is invited and/or assist in providing information to any organization which requests it.

## COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project will be coordinated with any other restoration efforts as needed. There are currently no other similar projects which have been funded by the Trustee Council.

## EXPLANATION OF CHANGES IN CONTINUING PROJECTS

No changes have been made from the original scope and content of this project.

## PROPOSED PRINCIPAL INVESTIGATOR


| | |
|---|---|
| Name | Paul Roetman |
| Affiliation | Executive Director, Prince William Sound Economic Development Council |
| Mailing address | 128 Pioneer Dr., Valdez, AK, 99686 |
| Phone number | (907) 835-3775 |
| Fax number | (907) 835-5770 |
| E-mail address | pwsedc@alaska.net |

## 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1996 | Proposed FFY 1997 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Personnel | $12.8 | $63.6 | | | | | | |
| Travel | $6.0 | $23.1 | | | | | | |
| Contractual | $245.6 | $1,046.0 | | | | | | |
| Commodities | $1.0 | $0.0 | | | | | | |
| Equipment | $0.0 | $0.0 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
| Subtotal | $265.4 | $1,132.7 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| Indirect | | | | | | | | |
| Project Total | $265.4 | $1,132.7 | $75.0 | | | | | |
| Full-time Equivalents (FTE) | | 12.0 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

Comments:
Prince William Sound communities will fund all of the annual operation and maintenance costs associated with this proposed project. These annual costs total $125,000 per year for the region. In addition, communities will be providing approximately $150,000 in capital assets (in land) for the project.

**1997**

Prepared: 4.15.96



Project Number: 97115
Project Title: SWMP II: Environmental Operations and Used Oil Management System
Name: Prince William Sound Economic Development Council

**FORM 4A**
**Non-Trustee**
**SUMMARY**

4/15/96

## 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Personnel Costs: | | | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|
| Name | Position Description | | Budgeted | Costs | Overtime | FFY 1997 |
| | | | | | | 0.0 |
| PWSEDC | Project Manager | | 12.0 | 5.3 | 0.0 | 63.6 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | Subtotal | | 12.0 | 5.3 | 0.0 | |
| | | | | | Personnel Total | $63.6 |

| Travel Costs: | Ticket | Round | Total | Daily | Proposed |
|---|---|---|---|---|---|
| Description | Price | Trips | Days | Per Diem | FFY 1997 |
| | | | | | 0.0 |
| Chenega Representative to Anchorage - for committee meeting | 1.0 | 4 | 4 | 0.1 | 4.4 |
| Tatitlek representative to Anchorage- for committee meeting | 0.5 | 4 | 4 | 0.1 | 2.4 |
| 3 Valdez representatives to Anchorage - for committee meeting | 0.2 | 15 | 4 | 0.1 | 3.4 |
| 2 Cordova representatives to Anchorage - for committee meeting | 0.2 | 10 | 5 | 0.1 | 2.5 |
| | | | | | 0.0 |
| Project Manager from Valdez to Chenega | 1.1 | 4 | 4 | 0.0 | 4.4 |
| Project Manager from Valdez to Tatitlek | 0.5 | 4 | 4 | 0.0 | 2.0 |
| Project Manager from Valdez to Whittier | 0.4 | 4 | 4 | 0.1 | 2.0 |
| Project Manager from Valdez to Cordova | 0.4 | 4 | 4 | 0.1 | 2.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | Travel Total | $23.1 |

**1997**

Prepared: 4.15.96



Project Number: 97115
Project Title: SWMP II: Environmental Operations and Used Oil Management System
Name: vacant

FORM 4B
Personnel
& Travel
DETAIL

4/15/96

## 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Contractual Costs: | Proposed |
|---|---|
| Description | FFY 1997 |
| NEPA Environmentatl Assessment | 10.0 |
| Engineering / Design of the EVOS Stations | 60.0 |
| Purchase of used oil equipment | 336.0 |
| Construction management | 60.0 |
| Contingency | 75.0 |
| Constuction | 505.0 |
| **Contractual Total** | **$1,046.0** |

| Commodities Costs: | Proposed |
|---|---|
| Description | FFY 1997 |
| There are no commodities costs for this project | 0.0 |
| **Commodities Total** | **$0.0** |

**1997**

Prepared:
4.15.96 3 of 4

Project Number: 97115
Project Title: SWMP II: Environmental Operations and Used Oil Management System
Name: Prince William Sound Economic Development Council

FORM 4B
Contractual & Commodities DETAIL

4/15/96

## 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| New Equipment Purchases: | Number | Unit | Proposed |
|---|---|---|---|
| Description | of Units | Price | FFY 1997 |
| We have included under the contractual costs $336.0 for used oil management equipment. It is included in the contractual category because the contractor will be responsible for its purchase. | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| Those purchases associated with replacement equipment should be indicated by placement of an R. | | New Equipment Total | $0.0 |

| Existing Equipment Usage: | Number |
|---|---|
| Description | of Units |
| | |

**1997**

Project Number: 97115
Project Title: SWMP II: Environmental Operations and Used Oil Management System
Name: Prince William Sound Economic Development Council

FORM 4B
Equipment
DETAIL

Prepared: 4.15.96

**Habitat Protection and Acquisition Support**

**Project Number:** 97126

**Restoration Category:** Habitat Protection

**Proposer:** AK Dept. of Natural Resources

**Lead Trustee Agency:** ADNR, USFS

**Cooperating Agencies:** ADF&G, USFS, DOI

**Duration:** FFY 1997 - TBD

**Cost FY 97:** $ To be determined

**Cost FY 98:** $ To be determined

**Cost FY 99:** $ To be determined

**Cost FY 00:** $ To be determined

**Geographic Area:** Prince William Sound, Kenai Peninsula, Alaska Peninsula Kodiak Archipelago

**Injured Resource/Service:** Multiple Resources



## ABSTRACT

Project 97126 provides negotiation support to the Trustee Council in order to reach closure on habitat protection priorities. This support includes those services such as title reports, appraisals, on site inspections, hazardous materials surveys, surveys, timber cruises and reviews, and other services necessary for the successful completion of habitat protection negotiations.

## INTRODUCTION

This project is designed to support habitat protection activities of the Trustee Council and is a continuation of the Comprehensive Habitat Protection Process. These activities include evaluations by the Habitat Work Group, appraisals, title searches, hazardous materials surveys and other efforts necessary for the Trustee Council to achieve habitat protection objectives. In 1993, the Restoration Team, Habitat Protection Work Group conducted a survey and assessment of selected large parcels of private land (>1000 acres) within the oil spill zone. The lands were mapped, scored and ranked to determine the restoration value of these areas to injured resources and services and the benefits that could be achieved through habitat protection. Successful negotiations were conducted with owners of lands within Kachemak Bay State Park and on northern Afognak Island resulting in the purchase of the park inholdings and in the establishment of the Afognak Island State Park. In addition, negotiations were recently completed with Akhiok Kaguyak and Old Harbor Native Corporation for the purchase of habitat protection rights on lands located within the Kodiak National Wildlife Refuge and with Eyak Corporation for timber rights in the Orca Narrows viewshed.

In 1995, Volume III of the Comprehensive Habitat Protection Process, *Small Parcel Process, Evaluation and Ranking* was completed. Responses to the solicitation for nominations of small parcels were processed and evaluated. A second round of small parcel nominations were received and evaluated. It is expected that the Trustee Council will move forward with a suite of small parcel nominations that best meet the restoration goals and objectives identified by the Trustee Council.

Negotiations continue with several large parcel landowners as well as with numerous small parcel landowners.Reaching closure on these agreements requires substantial technical support It is expected that Trustee Council efforts in this area while reaching closure on many fronts will continue in the near term.

## NEED FOR THE PROJECT

The objective of habitat protection is to identify and protect essential wildlife and fisheries habitats and associated services and to prevent further environmental damage to resources injured by the *Exxon Valdez* oil spill. Nineteen resources and services injured by the spill are linked to protection of upland and nearshore habitats (See Section D). Protection of lands containing these habitats prevents additional injury to resources and services and natural support systems while recovery is taking place. Active negotiations with landowners for packages of ranked parcels are currently taking place and anticipated to continue into the Fall. Evaluations, starting with field surveys, of large and small parcels submitted this Spring will also continue into the Fall. This project provides support for HWG to provide technical support to the negotiators and the Executive Director and to conduct these additional evaluations.

## COMMUNITY INVOLVEMENT

The public has reviewed and commented favorably on all habitat protection efforts and has been highly supportive of habitat protection as a major restoration strategy into the future. All reports published as part of the Comprehensive Habitat Protection Process have been reviewed by the public. Input from natural resource and services specialists in the public sector was collected in a workshop conducted by The Nature Conservancy.

Members of local communities have previously had the opportunity to review habitat protection evaluation and ranking results and Trustee Council priorities. The Trustee Council continues to be receptive and responsive to public comment pertinent to habitat protection priorities and acquisitions. This project is the completion of the habitat protection effort and no further community involvement is expected at this time. The Trustee Council is always willing to entertain comment from interested individuals.

## PROJECT DESIGN

### A. Objectives

Habitat protection and acquisition is designed to protect lands linked to resources and services that were injured by the Exxon Valdez oil spill. Protection of these lands prevents additional injury to living resources and habitats, services and natural support systems while recovery is taking place. Habitat protection addresses cases where existing regulations affecting private land use are inadequate to protect essential habitats of recovering resources and services. In situations where natural recovery is slow to occur or where direct restoration is neither technically feasible or cost effective, other measures need to be considered to mitigate injury. These may include replacement of injured resources and services with those that are equivalent {Replacement or acquisition of the equivalent means compensation for an injured, lost or destroyed resource by substituting another resource that provides the same or substantially similar services as the injured resource (56 Federal Register **8899 [March 1, 1991]).**

The affected injured resources and associated services are listed below. Habitat protection objectives and benefits for each of these resources and services would differ depending on the particular parcel and the options acquired, however, general objectives and benefits are outlined below.

Pink salmon, sockeye salmon, cutthroat trout, Dolly varden, herring: ensure maintenance of adequate water quality, riparian habitat and intertidal habitat for spawning and rearing.

Bald eagle: ensure maintenance of adequate nesting habitat and reduce disturbance in feeding and roosting areas.

Black oystercatcher: reduce disturbance to feeding and nesting sites.

Common murre: reduce disturbance in nearshore feeding areas and near nesting colonies.

Harbor seal and sea otters: reduce disturbance at haul-out sites, pupping sites, and in nearshore feeding areas.

Harlequin duck: ensure maintenance of adequate riparian habitat for nesting and brood rearing, and reduce disturbance to nearshore feeding, molting, and brood-rearing habitats.

Intertidal/subtidal biota: maintain water quality along shoreline and reduce disturbance in nearshore areas.

Marbled murrelet: ensure maintenance of adequate nesting habitat and reduce disturbance to nearshore feeding and broodrearing habitats.

River otter: ensure maintenance of adequate riparian and shoreline habitats for feeding and denning.

Recreation: Maintain or enhance public access for recreational opportunities, reduce disturbances that would create visual impacts.

Wilderness: Maintain wilderness qualities, reduce impacts to wilderness qualities.

Cultural resources: Maintain or reduce disturbance to cultural resource sites.

Subsistence: Ensure subsistence opportunities in known harvest areas.

## B. Methods:

The *Habitat Protection and Acquisition Process* is the method for acquiring lands or partial interests in lands that contain habitats linked to resources and/or services injured by the oil spill. Protection tools that will be considered for use by the Trustee Council include: fee acquisition, conservation easements, acquisition of partial interests, cooperative management agreements, and others. Following purchase, acquired parcels will be managed by the appropriate resource agency in a manner that is consistent with the restoration of the affected resources and/or services. The Trustee Council will decide which agency will manage the land or may create a new management authority.

Funds from this project will be used to acquire full title or partial interests in lands, subject to approval by the Trustee Council, that contain habitats/sites linked to resources and services that were injured by the Exxon Valdez oil spill. Acquisition of lands or interests in lands will be accomplished according to accepted realty principles and practices. All acquisitions will require title evidence, appraisals of fair market value, litigation reports, hazardous substances surveys, legal review of title, and negotiations. Some acquisitions may require land surveys and additional ecological surveys.

## C. Contracts and Other Agency Assistance

Various components of this project will be contracted out to the private sector. Contracting is managed by the agency responsible for acquisition of habitat protection rights and future management. Various agencies handle various realty requirements differently depending upon agency requirements and in house expertise.

## SCHEDULE

This project is a continuation of 93064, 94126, 95126, 96126, and does not lend itself to a specific timetable. Activities associated with this project are subject to influence from landowners, negotiators and various contractors.

## COORDINATION AND INTEGRATION OF RESTORATION EFFORT

All habitat protection efforts including this project are dependent upon the results of on-going research and monitoring projects. For example, the Large Parcel Element used information from the anadromous fish stream catalog, colonial seabird catalog, bald eagle nesting maps, and data from Trustee Council funded studies on black oystercatchers, marbled murrelets and pigeon guillemots.

## EXPLANATION OF CHANGES IN CONTINUING PROJECTS

There is no substantive change anticipated for FY 97. It is anticipated that the approach to habitat protection acquisitions pursused by the Trustee Council will remain essentailly the same. Negotiations are ongoing with both large and small parcel landowners.

## ENVIRONMENTAL COMPLIANCE

Previous acquisitions have received a categorical exclusions. The appropriate federal agencies, US Dept. of the Interior or US Forest Service will comply with NEPA where appropriate.

## PERSONNEL

### Project Leaders

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# 1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1995 | Proposed FFY 1996 | PROPOSED FFY 1996 TRUSTEE AGENCIES TOTALS | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | ADEC | ADF&G | ADNR | USFS | NPS | FWS |
| | | | | $18.3 | $295.4 | $203.3 | $16.2 | $414.3 |
| Personnel | $188.0 | $370.0 | | | | | | |
| Travel | $37.3 | $43.4 | | | | | | |
| Contractual | $558.0 | $436.6 | | | | | | |
| Commodities | $11.5 | $8.2 | | | | | | |
| Equipment | $3.0 | $3.2 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
| Subtotal | $797.8 | $861.4 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| General Administration | $60.0 | $86.1 | | | | | | |
| Project Total | $857.8 | $947.5 | $320.0 | $265.0 | $115.0 | $0.0 | $0.0 | $0.0 |
| | | | | | | | | |
| Full-time Equivalents (FTE) | 1.0 | 6.4 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | $0.0 | $0.0 | $0.0 | $0.0 | $0.0 | $0.0 | $0.0 | $0.0 |

NOTE: This project is a continuation of Project 96126. This budget is being prepared for the April 15 submittal.

This budget is based upon the current status of ongoing negotiations as of April 12, 1996. It is expected that negotiations will continue throughout the summer causing further revisions of this budget as the status of these negotiations change. This budget is based upon the assumption that negotiations with Afognak Joint Venture, several small parcels, Eyak, and Chugach Alaska Corporation will require additional work.

**1996**

Prepared:

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Lead Agency: AK Dept. of Natural Resources

FORM 2A
PROJECT
DETAIL

**1996 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET**

October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1995 | Proposed FFY 1996 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Personnel | $49.0 | $20.4 | | | | | | |
| Travel | $5.3 | $2.9 | | | | | | |
| Contractual | $273.0 | $251.0 | | | | | | |
| Commodities | $3.5 | $0.5 | | | | | | |
| Equipment | $0.0 | $0.0 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
| Subtotal | $330.8 | $274.8 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| General Administration | $20.8 | $20.6 | | | | | | |
| Project Total | $351.6 | $295.4 | $100.0 | $50.0 | $50.0 | | | |
| Full-time Equivalents (FTE) | 0.6 | 0.3 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

These numbers are estimates based upon information available prior to the April 15 submittal date. These budget figures will be revised prior to the August Trustee Council meeting to reflect the status of ongoing negotiations at that time.

**1996**

Prepared:

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: AK Dept. of Natural Resources

FORM 3A
AGENCY
PROJECT
DETAIL

**1996 EXXON VALDEZ TRUST COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| Personnel Costs: | | | GS/Range/ | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|---|
| PM | Name | Position Description | Step | Budgeted | Costs | Overtime | FFY 1996 |
| | TBD | Natural Resource Manager II | 20 | 1.0 | 7,000 | 0 | 7.0 |
| | TBD | Natural Resource Manager I | 18 | 2.0 | 6,700 | | 13.4 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | Subtotal | | 3.0 | 13,700 | 0 | |
| Those costs associated with program management should be indicated by placement of an *. | | | | | | **Personnel Total** | $20.4 |

| Travel Costs: | | Ticket | Round | Total | Daily | Proposed |
|---|---|---|---|---|---|---|
| PM | Description | Price | Trips | Days | Per Diem | FFY 1996 |
| | | | | | | 0.0 |
| | Travel to Prince William Sound and Gulf of Alaska for purposes of survey, title verification, and recordation, appraisal review and site inspections. | 300 | 3 | 5 | 150 | 0.0<br>1.7 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | Travel to Juneau for Trustee Council briefings, presentations. | 444 | 2 | 2 | 150 | 1.2 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| Those costs associated with program management should be indicated by placement of an *. | | | | | **Travel Total** | $2.9 |

**1996**

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: AK Dept. of Natural Resources

FORM 3B
Personnel
& Travel
DETAIL

**1996 EXXON VALDEZ TRUS[illegible] COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| **Contractual Costs:** | Proposed |
|---|---|
| Description | FFY 1996 |
| Printing and Map Production, maps and data analysis for negotiators, appraisers, land status verification | 20.0 |
| Aircraft charters to uplands to further refine parcel boundaries (8 hours @ $250.00/hour) | 2.0 |
| Services necessary for the Trustee Council to reach closure on purchase agreement for parcels under negotiation. This may include, title reports, litigation reports, appraisal reviews, timber reviews, hazardous materials assessments. | 110.0 |
| Advertising | 1.0 |
| Document production and printing costs. | 3.0 |
| Small Parcel Title Insurance | 20.0 |
| Small Parcel Appraisals | 30.0 |
| Recordation of final title documents, surveys, purchase agreements. This will involve travel to local recording districts. | 30.0 |
| Hazardous Materials Review - AJV, Small Parcels | 35.0 |
| When a non-trustee organization is used, the form 4A is required. **Contractual Total** | $251.0 |

| **Commodities Costs:** | Proposed |
|---|---|
| Description | FFY 1996 |
| Office and field supplies (toner cartridges, data cassettes, waterproof notebooks) | 0.5 |
| **Commodities Total** | $0.5 |

**1996**

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: AK Dept. of Natural Resources

FORM 3B
Contractual & Commodities DETAIL

**1996 EXXON VALDEZ TRUST COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| New Equipment Purchases: Description | Number of Units | Unit Price | Proposed FFY 1996 |
|---|---|---|---|
| | | | 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 |
|---|---|---|
| | | |

**1996**

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: AK Dept. of Natural Resources

FORM 3B
Equipment
DETAIL

**1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1995 | Proposed FFY 1996 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Personnel | $36.0 | $13.0 | | | | | | |
| Travel | $6.0 | $2.8 | | | | | | |
| Contractual | $3.0 | $0.3 | | | | | | |
| Commodities | $4.0 | $0.2 | | | | | | |
| Equipment | $0.0 | $0.0 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
| Subtotal | $49.0 | $16.3 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| General Administration | $5.6 | $2.0 | | | | | | |
| Project Total | $54.6 | $18.3 | $20.0 | $15.0 | $15.0 | | | |
| Full-time Equivalents (FTE) | | 0.2 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

Comments:

**1996**

Prepared:

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: AK Dept. of Fish & Game

FORM 3A
AGENCY
PROJECT
DETAIL

**1996 EXXON VALDEZ TRUST COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| Personnel Costs: | | | GS/Range/ | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|---|
| PM | Name | Position Description | Step | Budgeted | Costs | Overtime | FFY 1996 |
| | TBD | Habitat Biologist III | 18 | 2.0 | 6,500 | | 13.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | Subtotal | | 2.0 | 6,500 | 0 | |
| Those costs associated with program management should be indicated by placement of an *. | | | | | | **Personnel Total** | $13.0 |

| Travel Costs: | | Ticket | Round | Total | Daily | Proposed |
|---|---|---|---|---|---|---|
| PM | Description | Price | Trips | Days | Per Diem | FFY 1996 |
| | | | | | | 0.0 |
| | Travel to PWS and Gulf of Alaska to address post acquisition management concerns. | 350 | 2 | 6 | 150 | 1.6 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | Travel to Juneau to attend Trustee Council briefings re small parcel acquisitions. | 444 | 2 | 2 | 150 | 0.0 |
| | | | | | | 1.2 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| Those costs associated with program management should be indicated by placement of an *. | | | | | **Travel Total** | $2.8 |

**1996**

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: AK Dept. of Fish & Game

FORM 3B
Personnel
& Travel
DETAIL

**1996 EXXON VALDEZ TRUS. _ _ COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| **Contractual Costs:** | Proposed |
|---|---|
| Description | FFY 1996 |
| Document reproduction. | 0.3 |
| When a non-trustee organization is used, the form 4A is required. **Contractual Total** | $0.3 |

| **Commodities Costs:** | Proposed |
|---|---|
| Description | FFY 1996 |
| Office supplies, paper, toner cartridges. | 0.2 |
| **Commodities Total** | $0.2 |

**1996**

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: AK Dept. of Fish & Game

FORM 3B
Contractual & Commodities DETAIL

**1996 EXXON VALDEZ TRUS. _ _ COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| **New Equipment Purchases:** | Number | Unit | Proposed |
|---|---|---|---|
| Description | of Units | Price | FFY 1996 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| Those purchases associated with replacement equipment should be indicated by placement of an R. | | **New Equipment Total** | $0.0 |

| **Existing Equipment Usage:** | Number | Inventory |
|---|---|---|
| Description | of Units | Agency |
| | | |

**1996**

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: AK Dept. of Fish & Game

FORM 3B
Equipment
DETAIL

**1996 EXXON VALDEZ TRUST__ COUNCIL PROJECT BUDGET**

October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1995 | Proposed FFY 1996 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| Personnel | $28.0 | $11.8 | | | | | | |
| Travel | $2.0 | $2.6 | | | | | | |
| Contractual | $0.0 | $0.0 | | | | | | |
| Commodities | $0.0 | $0.0 | | | | | | |
| Equipment | $0.0 | $0.0 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
| Subtotal | $30.0 | $14.4 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| General Administration | $4.2 | $1.8 | | | | | | |
| Project Total | $34.2 | $16.2 | | | | | | |
| | | | | | | | | |
| Full-time Equivalents (FTE) | 0.4 | 0.2 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

Comments:

**1996**

Prepared:

Project Number: 95126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Interior, National Park Service

FORM 3A
AGENCY
PROJECT
DETAIL

**1996 EXXON VALDEZ TRUST _ COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| Personnel Costs: | | | GS/Range/ | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|---|
| PM | Name | Position Description | Step | Budgeted | Costs | Overtime | FFY 1996 |
| | | | | | | | 0.0 |
| | Charles Gilbert | Realty Officer | 13 | 1.0 | 5,900 | | 5.9 |
| | Stuart Snyder | Appraiser | 13 | 1.0 | 5,900 | | 5.9 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | Subtotal | | 2.0 | 11,800 | 0 | |
| Those costs associated with program management should be indicated by placement of an *. | | | | | | **Personnel Total** | $11.8 |

| Travel Costs: | | Ticket | Round | Total | Daily | Proposed |
|---|---|---|---|---|---|---|
| PM | Description | Price | Trips | Days | Per Diem | FFY 1996 |
| | | | | | | 0.0 |
| | Travel to Seward to conduct site visits, meet with negotiators. | 100 | 4 | 4 | 150 | 1.0 |
| | Travel to Port Graham and English Bay to conduct site visits and meet with negotiators. | 250 | 4 | 4 | 150 | 1.6 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| Those costs associated with program management should be indicated by placement of an *. | | | | | **Travel Total** | $2.6 |

**1996**

Project Number: 95126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Interior, National Park Service

FORM 3B
Personnel
& Travel
DETAIL

| Contractual Costs: | Proposed FFY 1996 |
|---|---|
| Description | |
| | |
| When a non-trustee organization is used, the form 4A is required. **Contractual Total** | $0.0 |

| Commodities Costs: | Proposed FFY 1996 |
|---|---|
| Description | |
| | |
| **Commodities Total** | $0.0 |

**1996**

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Interior, National Park Service

FORM 3B
Contractual & Commodities DETAIL

**1996 EXXON VALDEZ TRUST_ _ COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| New Equipment Purchases: Description | Number of Units | Unit Price | Proposed FFY 1996 |
|---|---|---|---|
| | | | 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 |
|---|---|---|
| | | |

**1996**

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Interior, National Park Service

FORM 3B
Equipment
DETAIL

**1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1995 | Proposed FFY 1996 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Personnel | | $255.2 | | | | | | |
| Travel | | $27.2 | | | | | | |
| Contractual | | $86.1 | | | | | | |
| Commodities | | $1.5 | | | | | | |
| Equipment | | $0.0 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
| Subtotal | $0.0 | $370.0 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| General Administration | | $44.3 | | | | | | |
| Project Total | $0.0 | $414.3 | $150.0 | $150.0 | | | | |
| Full-time Equivalents (FTE) | | 4.8 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

Comments:

**1996**

Prepared:

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Interior, Fish & Wildlife Service

FORM 3A
AGENCY
PROJECT
DETAIL

**1996 EXXON VALDEZ TRUST_ _ COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| Personnel Costs: | | | GS/Range/ | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|---|
| PM | Name | Position Description | Step | Budgeted | Costs | Overtime | FFY 1996 |
| | | Appraiser | 12/4 | 6.0 | 5,970 | | 35.8 |
| | | Review Appraiser | 13/7 | 4.0 | 5,133 | | 20.5 |
| | | Realty Specialist | 12/8 | 12.0 | 5,909 | | 70.9 |
| | | Realty Specialist | 9/2 | 12.0 | 3,769 | | 45.2 |
| | | Realty Assistant | 6/2 | 7.0 | 3,073 | | 21.5 |
| | | Carto Tech | 7/1 | 11.0 | 3,290 | | 36.2 |
| | | Biologist | 11/4 | 5.0 | 5,017 | | 25.1 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | Subtotal | | 57.0 | 32,161 | 0 | |
| Those costs associated with program management should be indicated by placement of an *. | | | | | | **Personnel Total** | $255.2 |

| Travel Costs: | | Ticket | Round | Total | Daily | Proposed |
|---|---|---|---|---|---|---|
| PM | Description | Price | Trips | Days | Per Diem | FFY 1996 |
| | | | | | | 0.0 |
| | Kodiak - Includes 10 acre parcels, AKI Exchange, AKI 4th Closing, Koniag 3rd closing, Koniag, phase 2. | 0.2 | 19 | 45 | 0.14 | 0.0<br>10.1 |
| | | | | | | 0.0 |
| | Kodiak - Charter air service to specific tracts | 1 | 12 | 12 | 0.14 | 13.7 |
| | | | | | | 0.0 |
| | Kenai - KNA and Salamatof | 0.1 | 5 | 7 | 0.14 | 1.5 |
| | | | | | | 0.0 |
| | Kenai - Charter air service | 0.8 | 2 | 2 | 0.14 | 1.9 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| Those costs associated with program management should be indicated by placement of an *. | | | | | **Travel Total** | $27.2 |

**1996**

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Interior, Fish & Wildlife Service

FORM 3B
Personnel
& Travel
DETAIL

**1996 EXXON VALDEZ TRUST[illegible] COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| **Contractual Costs:** | Proposed |
|---|---|
| Description | FFY 1996 |
| Title Insurance and related fees. | 66.1 |
| Survey of 14 (C) sites - Kodiak (about 10 sites for exclusion from AKI - 4th closing and exchange) | 20.0 |
| When a non-trustee organization is used, the form 4A is required. **Contractual Total** | $86.1 |

| **Commodities Costs:** | Proposed |
|---|---|
| Description | FFY 1996 |
| Office Supplies | 1.5 |
| **Commodities Total** | $1.5 |

**1996**

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Interior, Fish & Wildlife Service

FORM 3B
Contractual & Commodities DETAIL

| New Equipment Purchases: Description | Number of Units | Unit Price | Proposed FFY 1996 |
|---|---|---|---|
| | | | 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 |
|---|---|---|
| | | |

**1996**

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Interior, Fish & Wildlife Service

FORM 3B
Equipment
DETAIL

## 1996 EXXON VALDEZ TRUST_ _ COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1995 | Proposed FFY 1996 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Personnel | $75.0 | $69.6 | | | | | | |
| Travel | $24.0 | $7.9 | | | | | | |
| Contractual | $282.0 | $99.2 | | | | | | |
| Commodities | $4.0 | $6.0 | | | | | | |
| Equipment | $3.0 | $3.2 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
| Subtotal | $388.0 | $185.9 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2001 | |
| General Administration | $29.4 | $17.4 | | | | | | |
| Project Total | $417.4 | $203.3 | $50.0 | $50.0 | $50.0 | | | |
| Full-time Equivalents (FTE) | | 0.9 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

Comments: This project is a continuation of project 96126.
This is an estimated budget prepared for the April 15 submittal. The budget is based upon negotiations continuing with Eyak Corp. and Chugach Alaska Corp. and one small parcel. This budget will be refined before the August Trustee Council meeting, based upon progress in Habitat Protection activities.

**NOTE:** If posting and marking are required for acquired Chenega and Tatitlek lands additional funding will be requested.

**NOTE:** Mineral appraisals will be needed for all subsurface. Costs will be determined by the August Trustee Council meeting.

**1996**

Prepared:

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Agriculture, Forest Service

FORM 3A
AGENCY
PROJECT
DETAIL

**1996 EXXON VALDEZ TRUS'. __ COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| Personnel Costs: | | | GS/Range/ Step | Months Budgeted | Monthly Costs | Overtime | Proposed FFY 1996 |
|---|---|---|---|---|---|---|---|
| PM | Name | Position Description | | | | | |
| | J. Harmening | Negotiator | 13.0 | 1.0 | 7500.0 | | 7.5 |
| | B. McElmurry | Contract/Budget analysis | 11.0 | 0.5 | 5000.0 | | 2.5 |
| | J. Wolf | Negotiator | 15.0 | 3.0 | 8700.0 | | 26.1 |
| | R. Goosens | Appraiser | 13.0 | 1.0 | 6100.0 | | 6.1 |
| | Jim Piierce | Timber appraiser/reviewer | 13.0 | 1.0 | 6100.0 | | 6.1 |
| | L. Keeler | Lands Specialist | 12.0 | 1.0 | 5400.0 | | 5.4 |
| | Vacant | Realty/Land parcel specialist | 12.0 | 3.0 | 5300.0 | | 15.9 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | | | | | | 0.0 |
| | | Subtotal | | 10.5 | 44,100 | 0 | |
| Those costs associated with program management should be indicated by placement of an *. | | | | | | **Personnel Total** | $69.6 |

| Travel Costs: | | Ticket Price | Round Trips | Total Days | Daily Per Diem | Proposed FFY 1996 |
|---|---|---|---|---|---|---|
| PM | Description | | | | | |
| | | | | | | 0.0 |
| | RT Juneau to Anchorage to meet with review appraisers, contract appraisers and negotiators. | 0.44 | 7 | 21 | 0.23 | 7.9 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| Those costs associated with program management should be indicated by placement of an *. | | | | | **Travel Total** | $7.9 |

**1996**

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Agriculture, Forest Service

FORM 3B
Personnel
& Travel
DETAIL

**1996 EXXON VALDEZ TRUS. __ COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| **Contractual Costs:** | Proposed |
|---|---|
| Description | FFY 1996 |
| Title documents, title reports, purchase agreements, hazmat surveys. | 16.0 |
| Air Charters (8 hours @ $400/hour) | 3.2 |
| Title Insurance and closing costs for Eyak, Chugach Alaska Corp. and small parcels.. | 10.0 |
| Appraisals (timber, land, minerals) | 70.0 |
| When a non-trustee organization is used, the form 4A is required. **Contractual Total** | $99.2 |

| **Commodities Costs:** | Proposed |
|---|---|
| Description | FFY 1996 |
| Office Supplies including paper, toner cartridges, software upgrades, binders, etc. | 2.0 |
| Duplication | 2.0 |
| Maps | 2.0 |
| **Commodities Total** | $6.0 |

**1996**

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Agriculture, Forest Service

FORM 3B
Contractual & Commodities DETAIL

| New Equipment Purchases: Description | Number of Units | Unit Price | Proposed FFY 1996 |
|---|---|---|---|
| Computer (P5-133, CD, 16 Mg Ram, tape) | 1 | 3.2 | 3.2 |
| | | | 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** | $3.2 |

| Existing Equipment Usage: Description | Number of Units | Inventory Agency |
|---|---|---|
| | | |

**1996**

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Agriculture, Forest Service

FORM 3B
Equipment
DETAIL

## Tatitlek Coho Salmon Release

| | |
|---|---|
| Project Number: | 97127 |
| Restoration Category: | General Restoration |
| Proposer: | Tatitlek IRA Council |
| Lead Trustee Agency: | ADF&G |
| Cooperating Agencies: | Tatitlek IRA Council |
| Alaska SeaLife Center: | |
| Duration: | 3rd year, 4 year project |
| Cost FY 97: | $12,000 |
| Cost FY 98: | $15,900 |
| Cost FY 99: | |
| Geographic Area: | Boulder Bay, Prince William Sound |
| Injured Resource/Service: | Salmon/Subsistence |



### ABSTRACT

Project will create a coho salmon return to Boulder Bay near Tatitlek village. Enough coho eggs to produce 50,000 smolt will be collected from an ADF&G approved stream, incubated and reared to smolt at the Solomon Gulch Hatchery transported and held for two weeks in net pens in Boulder Bay before release. Release will produce a 2,000 to 3,000 adult return to Boulder Bay for harvest in a subsistence fishery.

## A. INTRODUCTION

Subsistence fisheries available to residents of Tatitlek village were severely disrupted by the *Exxon Valdez* oil spill. This project is intended to enhance subsistence resources near Tatitlek by creating a 2,000 to 3,000 coho salmon return to Boulder Bay which is immediately adjacent to Tatitlek village. This resource is intended to partially replace for the near term other subsistence resources, such as harbor seal, that were injured by the spill

This coho salmon return will be created through an annual release of 50,000 coho salmon smolt in Boulder Bay. The smolt are produced at the Solomon Gulch Salmon Hatchery under an agreement between its operator, the Valdez Fisheries Development Corporation and the Tatitlek IRA Council. The coho salmon eggs needed to produce the smolt come from a wild coho run that has been approved by ADF&G for the egg take. The eggs are taken to the Solomon Gulch hatchery for incubation and rearing to the smolt stage. The sea ready smolt are then transported by boat to Boulder Bay and are imprinted to the bay by placing them in net pens for about a two week period before being released into the wild.

This project was approved by the EVOS Trustee Council in FY 95. Funds were appropriated to underwrite the environmental assessment, a draft of which has been produced. Funds received in FY 96 and beyond will be used to produce the coho salmon returns to Boulder Bay.

## NEED FOR THE PROJECT

### A. Statement of Problem

Subsistence harvests by Tatitlek village residents have declined considerably since the oil spill. Most marine resources that were utilized for subsistence by Tatitlek villagers have not substantially improved since the spill. Subsistence harvests are still a lot less then they were prior to the spill.

### B. Rationale/Link to Restoration

This project would enhance the recovery of the local salmon resource that is utilized for subsistence and provide a means for lessening the impacts of continued harvests on other subsistence harvests injured by the spill such as harbor seals.

### C. Location

This project will be undertakes at the Solomon Gulch Hatchery and in Boulder Bay near Tatitlek. The benefits will be realized by those participating in the subsistence fishery created by this project. These will mainly be residents from Tatitlek.

## COMMUNITY INVOLVEMENT

This project was initiated at the request of the Tatitlek Bay IRA Council. The council negotiated the agreement with the Valdez Fisheries Development Corporation to produce the smolt for the project. Members of the village set up the net pen site each year in Boulder Bay and hold and feed the smolt each year prior to release. The villagers participate in the subsistence fishery on the returning adults.

## PROJECT DESIGN

### A. Objectives

1. Continue agreement with the Valdez Fisheries Development Corporation to produce 50,000 coho salmon smolt for release in Boulder Bay.

2. Imprint smolt to Boulder Bay by holding and feeding them in net pens in the bay for two weeks prior to release into the wild.

3. Harvest for subsistence 2,000 to 3,000 coho salmon annually upon their return to the imprint site.

### B. Methods

The purpose of this project is to create a run of coho salmon in Boulder Bay near Tatitlek for subsistence use. The project would be undertaken annually and could be classified as "put and take" since it is unlikely that the coho returns produced by this project would establish a wild run. There are four basic steps to the project; egg take, incubation and rearing to the smolt stage, imprinting and release of smolt and the subsistence harvest.

The Solomon Gulch hatchery is responsible for the egg take and smolt production, Tatitlek village is responsible for imprinting and releasing the smolt into the wild. The subsistence fishery is open to all, but mostly consists of Tatitlek village residents.

The eggs are taken from a coho run approved by ADF&G for use in this project. Enough eggs are taken to produce 50,000 smolt. They are taken to the Solomon Gulch hatchery where standard fish culture practices are utilized to incubate the eggs and rear the resultant fry to the smolt stage. The smolt are then transported by boat to Boulder Bay where they are placed in net pens and held (and fed) for a two week period during which time they imprint to Boulder Bay. The smolt are then released into the wild and proceed to their ocean rearing grounds returning back to Boulder Bay approximately 12 months later as adults. Around 2,000 to 3,000 adult coho salmon return to Boulder Bay from the smolt release. As many of these fish as possible (usually 75% to 85%) are harvested in a subsistence fishery that has been set up specifically for this purpose. The unharvested fish die without spawning.

### C. Cooperating Agencies, Contracts and Other Agency Assistance

The Tatitlek IRA Council is contracted by ADF&G to oversee this project. The council in turn contracts with the Valdez Fisheries Development Corporation to take the eggs and produce the smolt.

## SCHEDULE

### A. Measurable Project Tasks for FY 97

| | |
|---|---|
| August, 1996 | Egg take |
| May 20 to 25, 1997 | Smolt transported to Boulder Bay and placed in net pens. |
| June 3 to 8, 1997 | Smolt released into Boulder Bay |
| August, 1997 | Egg take |

### B. Project Milestones and Endpoints

| | |
|---|---|
| Objective 1. | Initial agreement in place. Will be reviewed and renewed by April 15 each year. |
| Objective 2. | Completed by June 15 each year. |
| Objective 3. | Completed by July 15 annually. |

### C. Completion Date

This project will continue until the subsistence resources injured by the spill have fully recovered.

## PUBLICATIONS AND REPORTS

| | |
|---|---|
| Annual reports | Describe project activities for each fiscal year. Due April 15 following the fiscal year being reported on. |
| Final report | Synopsis of each year's activities and analysis of project as a whole. Due April 1 following the year in which the final adult return occurs. |

## PROFESSIONAL CONFERENCES

No travel to professional conferences is planned under this project.

## COORDINATION AND INTEGRATION OF RESTORATION EFFORT

There appear to be no opportunities to coordinate or integrate this project with other restoration efforts.

## EXPLANATION OF CHANGES IN CONTINUING PROJECTS

There are no project design or schedule changes in this proposal from the DPD approved by the Trustee Council for FY 96.

## PROPOSED PRINCIPAL INVESTIGATOR

Gary Kompkoff, President
Tatitlek IRA Council
Box 171
Tatitlek, AK 99677
Phone (907) 325-2311
Fax (907) 325-2298

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1996 | Proposed FFY 1997 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| Personnel | $6.3 | $0.0 | | | | | | |
| Travel | $0.0 | $0.0 | | | | | | |
| Contractual | $18.1 | $11.2 | | | | | | |
| Commodities | $0.0 | $0.0 | | | | | | |
| Equipment | $0.0 | $0.0 | | | | | | |
| Subtotal | $24.4 | $11.2 | | | | | | |
| General Administration | $2.2 | $0.8 | | | | | | |
| Project Total | $26.6 | $12.0 | $15.9 | $15.9 | $0.0 | $0.0 | $0.0 | |
| Full-time Equivalents (FTE) | | 0.0 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

Comments:
Funding for this project would be contracted through the Prince William Sound Economic Development Council via a Standard Agreement written by the ADF&G. They would in turn subcontract with the Tatitlek IRA council.

The VFDA, Solomon Gulch Hatchery will provide 20,000 coho smolts to the project at no charge. They will also provide the fish food necessary for the net pen rearing.

**1997**

Prepared:



Project Number: 97127
Project Title: Tatitlek Coho Salmon release
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

4/15/96

## 1997 EXXON VALDEZ TRUST COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Personnel Costs: | | GS/Range/ | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|
| Name | Position Description | Step | Budgeted | Costs | Overtime | FFY 1997 |
| | | | | | | 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 | FFY 1997 |
| | | | | | 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 |

1997

Project Number: 97127
Project Title: Tatitlek Coho Salmon release
Agency: Alaska Department of Fish and Game

FORM 3B
Personnel
& Travel
DETAIL

Prepared:



4/15/96

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| **Contractual Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| Contract with the Prince William Sound Economic Development Council | 11.2 |
| When a non-trustee organization is used, the form 4A is required. **Contractual Total** | $11.2 |

| **Commodities Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| **Commodities Total** | $0.0 |

**1997**

Prepared:

Project Number: 97127
Project Title: Tatitlek Coho Salmon release
Agency: Alaska Department of Fish and Game

FORM 3B
Contractual & Commodities
DETAIL



4/15/96

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

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

**1997**

Project Number: 97127
Project Title: Tatitlek Coho Salmon release
Agency: Alaska Department of Fish and Game

FORM 3B
Equipment
DETAIL

Prepared:



4/15/96

## 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1996 | Proposed FFY 1997 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| Personnel | $2.6 | $2.6 | | | | | | |
| Travel | $0.0 | $0.8 | | | | | | |
| Contractual | $2.0 | $2.6 | | | | | | |
| Commodities | $1.5 | $1.6 | | | | | | |
| Equipment | $10.0 | $0.0 | | | | | | |
| Subtotal | $16.1 | $7.6 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| Indirect | $2.0 | $3.6 | | | | | | |
| Project Total | $18.1 | $11.2 | $10.0 | $10.0 | $0.0 | $0.0 | $0.0 | |
| | | | | | | | | |
| Full-time Equivalents (FTE) | | 1.0 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

Comments: Funding for this project would be contracted through the Prince William Sound Economic Development Council via a Standard Agreement written by the ADF&G. They would in turn subcontract with the Tatitlek IRA council.

**1997**

Prepared:



Project Number: 97127
Project Title: Tatitlek Coho Salmon Release
Name: Tatitlek IRA Council

FORM 4A
Non-Trustee
SUMMARY

4/15/96

**1997 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET**

October 1, 1996 - September 30, 1997

| Personnel Costs: | | | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|
| Name | Position Description | | Budgeted | Costs | Overtime | FFY 1997 |
| | Net Pen Worker | | 0.5 | 2500 | | 1.3 |
| | Net Pen Worker | | 0.5 | 2500 | | 1.3 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | Subtotal | | 1.0 | 5000.0 | 0.0 | |
| | | | | | Personnel Total | $2.6 |

| Travel Costs: | | Ticket | Round | Total | Daily | Proposed |
|---|---|---|---|---|---|---|
| Description | | Price | Trips | Days | Per Diem | FFY 1997 |
| Round Trip Valdez to Tatitlek | | 400.0 | 2 | | | 0.8 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | Travel Total | $0.8 |

**1997**

Prepared:



Project Number: 97127
Project Title: Tatitlek Coho Salmon Release
Name: Tatitlek IRA Council

FORM 4B
Personnel
& Travel
DETAIL

4/15/96

**1997 EXXON VALDEZ TRUST COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| Contractual Costs: | Proposed |
|---|---|
| Description | FFY 1997 |
| Transport 20,000 coho smolt to Boulder Bay. | 2.0 |
| Village skiff rental | 0.6 |
| **Contractual Total** | $2.6 |

| Commodities Costs: | Proposed |
|---|---|
| Description | FFY 1997 |
| Fish Food | 1.2 |
| Skiff fuel/oil | 0.2 |
| Misc. Supplies | 0.2 |
| **Commodities Total** | $1.6 |

**1997**

Prepared:

Project Number: 97127
Project Title: Tatitlek Coho Salmon Release
Name: Tatitlek IRA Council

FORM 4B
Contractual & Commodities DETAIL



4/15/96

**1997 EXXON VALDEZ TRUST COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

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

**1997**

Project Number: 97127
Project Title: Tatitlek Coho Salmon Release
Name: Tatitlek IRA Council

FORM 4B
Equipment
DETAIL

Prepared:



4/15/96

## Project Title: Chugach Native Region Clam Restoration

| | |
|---|---|
| Project Number: | 97131 |
| Restoration Category: | General Restoration |
| Proposer: | Chugach Regional Resources Commission |
| Lead Trustee Agency: | Alaska Department of Fish & Game |
| Cooperating Agencies: | Chugach Regional Resources Commission, Native Villages of Tatitlek, Nanwalek, Port Graham and Eyak |
| Alaska SeaLife Center | |
| Duration: | 3rd year, 5-year project |
| Cost FY 97: | $401,400 |
| Cost FY 98: | $417,400 |
| Cost FY 99 | $417,400 |
| Geographic Areas: | Native vil lages in Prince William Sound, lower Cook Inlet and Kodiak |
| Injured Resource/Service: | Clams/Subsistence |



### ABSTRACT

Cost effective procedures for establishing safe, easily accessible subsistence clam populations near Native villages in the oil spill region will be established. The Qutekcak hatchery in Seward will annually provide about 800,000 juvenile littleneck clams and cockles. Historical information, local and agency expertise, and research will be used to identify areas to seed and method. Total seeded area during project will not exceed 5 hectares. Follow-up research on success of seeding will be conducted. Development work will be confined to areas near the Native villages of Eyak, Tatitlek, Nanwalek and Port Graham. Other Native villages in the oil spill region interested in becoming part of the project will only have preliminary beach survey work done.

## A. INTRODUCTION

The purpose of this project is to develop cost effective procedures for establishing managed populations of clams in areas that are readily accessible from Native villages in the oil spill region. These clams will be used as a source for subsistence food to replace the natural clam resource that has been lost, damaged or depleted. The villages of Port Graham, Nanwalek, Tatitlek and Eyak will take part in the development process. Other villages in the oil spill region that want to take part in the program will have an initial survey conducted to determine beach conditions and existing clam populations.

Clams were once an important subsistence food in the Native villages. Clam populations in areas that are reasonably accessible to the villages have decreased to very low levels in recent years. Consequently, the role of clams in the subsistence diet in these villages has been greatly reduced. And, with a few exceptions, the role of clams in the subsistence diet of most Native villages in the oil spill area is a lot less than it was historically.

There are likely a number of reasons why local clam populations are currently at low levels. Since clams are basically an unmanaged resource in the oil spill area, there are no quantifiable data available that could point to the actual circumstances that lead to the sharp reduction in these clam populations. However, there are events that likely played a major role. These include changes in beach configurations resulting from the 1964 earthquake, increasingly heavy sea otter predation, human over-harvest and the *Exxon Valdez* oil spill.

The oil spill impacted the wild clam populations and their importance as a subsistence food in two ways. First, many clam beds suffered from direct oiling. The impact of the oil on the clam beds in Windy Bay, for instance, destroyed one of the more important clam beds in the lower Kenai Peninsula. With the current timber harvesting operations soon to provide road access from Port Graham and Nanwalek to the Windy Bay area, the loss of the clam resource there had a major impact on these villages. Second, even though many clams weren't killed from the oil, they have a tendency to accumulate and concentrate the toxic contaminants from non-lethal amounts of oil. This has badly eroded the confidence of the villagers in the healthfulness of the remaining wild clam populations as a subsistence food.

In order to reestablish local clam populations as a subsistence resource for the Native villages a program needs to be developed to enhance the depleted stocks and the replace damaged ones. Over the past ten years the nursery systems and field growout technologies have sufficiently evolved to make clam enhancement and reseeding efforts feasible. This technology can be readily applied to increasing the clam resource near the villages to determine which applications would be best suited for the task at hand.

This program was initiated in FY 95 as a demonstration project. The first year objectives were to decide what species of clams will be used for the project, determine the potential of the Qutekcak Shellfish Hatchery to produce seed for the project and develop the system for identifying the growout areas near the villages of Port Graham/Nanwalek and Tatitlek.

After consultation with the Native villagers, experts in clam production techniques and a literature search, littleneck clams (*Protothaca staminea*) and cockles (*Clinocardium nuttalli*) were selected as the species that will be used in the restoration effort. The butter clam (*Saxidomus giganteus*), a popular species with the Native villagers, was rejected because of its slow growth characteristics and propensity to retain the Paralytic Shellfish Poison toxin for extended periods.

Littleneck clam broodsource for both Port Graham/Nanwalek and Tatitlek have been cleared for use in the Qutekcak Shellfish Hatchery in Seward. A Nanwalek/Port Graham broodsource of cockles has also been cleared for hatchery use, but clearance for a Tatitlek cockle broodsource is being withheld pending further analysis by the state fish pathologist.

At this point the hatchery has produced several 200,000 to 300,000 batches of littleneck clam seed. The last few batches were grown to the 5mm size within the 19 week time objective set by this project. This past year two small batches of 10 mm littleneck clams were produced in the nursery ponds that adjoin the hatchery. No hatchery work has yet been done with cockles.

As part of the study to identify growout areas near the villages a literature search was conducted through the University of Alaska to identify all previous research on littleneck clam life histories and population surveys. Time was spent with Alaska Department of Fish & Game (ADF&G) shellfish biologists from lower Cook Inlet and Prince William Sound to review and discuss clam surveys and management plans, and residents of the villages of Port Graham, Nanwalek and Tatitlek were interviewed to identify nearby areas that either now or once had significant populations of littleneck clams. Beach surveys were then conducted near Port Graham, Nanwalek and Tatitlek. Several sites were identified as suitable for use in this project.

In FY 96 the project will continue to improve hatchery production techniques. An experienced hatchery technician (see attached resume) is being brought into the hatchery to ensure that the proper culture procedures are in place. Dr. Ken Brooks of Aquatic Environmental Sciences in Washington state has been contracted to develop the protocols for the hatchery/nursery production of cockles. A tidally driven fluidized upwelling nursery system (tidal FLUPSY) will be set up near Tatitlek to test its potential for nursery production. Test plots on beaches near Tatitlek, Nanwalek and Port Graham will be seeded with littleneck clams for growth, mortality and predator control studies, and predator control coverings will be tested on razor clam beaches near Eyak. Initial beach surveys will also be conducted on beaches near the villages of Chenega Bay in Prince William Sound and Ouzinkie on Kodiak Island.

In FY 97 the project will initiate hatchery production of cockles, improve hatchery techniques and increase production of littleneck clams in the hatchery, continue work with the nursery ponds adjacent to the hatchery as well as work with the tidal FLUPSY, continue and expand littleneck clam growth and mortality studies and predator control work, initiate cockle growth and mortality studies, continue the razor clam predator control studies, and conduct preliminary beach surveys at two Native villages in the oil spill region that are interested in clam restoration work in their area.

In early FY 97 (October/November) the project anticipates moving into the new hatchery facility now being built by the state. The hatchery will be leased and operated by the Qutekcak Native Tribe who will contract with the project to conduct the hatchery and nursery work. This new facility will greatly enhance operations and allow the project to increase production as well as expand into cockles. The facility will have increased algae production capabilities which, in addition to permitting increased seed production, will allow the project to expand investigations on nursery production at the hatchery. The fish culture expert brought into the hatchery in FY 96 will remain on staff for at least the duration of this project to train other hatchery staff and ensure that proper operational procedures are in place and functioning.

It is hoped that the hatchery protocols for cockles that are being developed in FY 96 will be ready in time to allow at least limited seed production in FY 97. This seed would be used to initiate the cockle growth and mortality studies as well as provide the hatchery with cockle seed production experience.

The growth and mortality and predator control studies on littleneck clams and the predator control studies on razor clams that were initiated in FY 96 will continue and probably expand in FY 97 depending on what is learned in FY 96. Additional growout methods will be tested for littleneck clams as well as determining growth and mortality in tide levels greater than the +1.5 foot being tested in FY 96. Since razor clam grow slowly very little may be learned from the predator control studies in FY 96. Different types of predator control screening and or different screen anchoring systems may be tested in FY 97 if better ones can be found or if those used in FY 96 prove to be insufficient.

The project has been contacted by other villages about being included in the project. The four villages (Tatitlek, Eyak, Nanwalek and Port Graham) that are currently involved in the various beach studies offer enough variety to accommodate all facets of the development phase. Including additional villages at this time would only detract from the project by spreading the limited resources over a larger geographic area.

In FY 96 a policy was put in place to accommodate additional villages that want to join the project. This involved conducting a baseline tidelands survey near each interested village to determine the extent of existing shellfish resources and the potential for enhancement. In FY 96 the villages of Chenega Bay and Ouzinkie will have baseline surveys conducted. In FY 97 two more villages will be selected from those wanting to join the program for baseline survey. Two additional will be added in each of the following years of the project until either the project is ended or all interested villages have had a baseline survey conducted. When growout techniques are developed, and seed stock becomes available, these village beaches will then be treated with the appropriate enhancement procedures.

Because very little culture or enhancement work has been done previously with littleneck clams (*Protothaca staminea*) or cockles (*Clinocardium nuttalli*), this project is breaking a lot of new ground. This is perhaps good news from the standpoint of contributing to the knowledge pool, but it is slowing the project down. The hatchery, nursery and growout procedures that are being developed for this project must be adapted from previous work on other species. The growout

work will first require the development of a data base on growth and mortality for both species to help determine the best enhancement approach.

The progress that the project has experienced so far gives the investigators great confidence that successful hatchery, nursery and growout procedures will be developed. This knowledge can then be put to work in providing safe, reliable subsistence clam resources for the villages in the oil spill region.

## NEED FOR THE PROJECT

### A. Statement of Problem

Local shellfish populations, especially clams have been severely reduced as a subsistence food source for Native villages. Part of the reduced use is a loss of confidence in the safety of consuming shellfish as a result of the Exxon Valdez Oil Spill. In addition, local shellfish populations have been greatly reduced as result of hydrocarbon toxicity, sea otter predation, human overharvest and beach changes from the 1964 earthquake.

### B. Rationale

This project will accomplish two things. One, it will help restore the clam resource base in the oil spill area, and two, it will enhance subsistence gathering by providing a safe, easily accessible source of clams for subsistence use.

### C. Location

The hatchery and nursery work will be carried out at the Qutekcak Shellfish Hatchery/Nursery in Seward. Growout operations and sampling will occur in the area around the villages of Tatitlek and Eyak in Prince William Sound and in the Port Graham/Nanwalek area in Lower Cook Inlet. In addition to the above villages baseline surveys have been conducted at Chenega Bay and Ouzinkie with two additional villages scheduled for FY 97. Pathology work will be conducted in Anchorage and Juneau. PSP sampling will occur at the DEC lab in Palmer. Data Analysis and project oversight will be conducted from CRRC offices in Anchorage and Moose Pass.

## COMMUNITY INVOLVEMENT

The communities named in this project will be directly involved in it. Each community decided whether or not it wanted to be involved in the project initially. Local residents will be heavily relied upon to help locate existing clam populations and the areas for reseeding. Project work involving the villages will be done with local labor. Community leaders will be kept appraised of how the project is progressing.

## PROJECT DESIGN

### A. Objectives

1. Hatchery Processes- Develop reliable, cost effective hatchery techniques for the littleneck clam (*Protothaca staminea*) and the cockle (*Clinocardium nutalli*). Produce a 5mm seed in the hatchery within 19 weeks after spawning.

2. Nursery- Develop cost effective, reliable techniques to grow 5mm hatchery seed to an out-planting size of 10mm - 15mm within 12 weeks.

3. Growout - Describe current local clam populations through interviews and resource assessments. Locate sites, develop reliable, cost effective growout techniques, and evaluate the efficacy of proposed methods. Develop permanent subsistence beaches.

4. Management Plan - In concert with appropriate state resource management agencies and in compliance with policies and regulations of the Alaska Board of Fisheries, develop a management plan for the subsistence beaches that will ensure the orderly harvest and long term viability of these beaches and that the clams from these beaches are safe for consumption.

### B. Methods

The following is an outline of the methods that will be applied to accomplish each objective. In the pursuit of all the objectives the principal investigators will rely heavily on the advise and assistance of experts in the field. The technology for hard clam aquaculture on both the east and west coasts of the U. S. and Canada has been advancing rapidly in recent years. In order to keep abreast of the developments, determine which ones would be best suited for adapting to Alaska and avoid repeating mistakes that others have made, it will be necessary to keep in contact with the leaders of this technological advance.

For the hatchery, nursery and growout objectives, experts will be brought in to set up production or testing programs and train hatchery staff or Native villagers in clam production and/or enhancement techniques. In all cases project investigators will keep abreast of the literature and in contact with experts in the various disciplines that make up this project.

#### OBJECTIVE 1. HATCHERY

The Qutekcak Shellfish Hatchery located on the Institute of Marine Science grounds in Seward has been in operation since October 1993. During this time the hatchery was designed and assembled and has evolved into a small production scale operation. The staff has successfully set larvae of the Pacific oyster *Crossastrea gigas* and raised them to 15mm for the aquatic farm industry. In addition, the hatchery has successfully conditioned, spawned, set and raised the native littleneck *Protothaca staminea* to 10mm. As part of this project the hatchery will also attempt to produce cockle *Clinocardium nutalli* seed.

Although a great deal has been accomplished at the hatchery, hatchery operations and procedures needed to become more efficient and reliable for the program to succeed over the long term. To address this problem an experienced shellfish culturist with several years of practical hatchery experience is being brought on staff (see attached resume). He will likely remain on staff for the duration of this project at least and will be responsible for developing operational policies and procedures, training staff and making hatchery operations more reliable and efficient.

The present facility was intended to operate for a limited period of time until a new and permanent hatchery could be built. Construction on the new facility is scheduled to begin in April, 1996 with an anticipated completion date of late October - early November, 1996. The new facility will be owned by the state and leased to the Qutekcak Native Tribe. It is anticipated that the project will move into the new facility as soon as it is completed.

With the new facility on line littleneck seed production can be increased. The littleneck clam seed production goal for FY 97 is a minimum of 250,000. The new facility will also cockle culture to begin. The task for developing techniques and procedures for producing cockle seedstock was contracted out in FY 96. It is assumed that these procedures will be perfected in time to allow cockle seedstock to be produced in the new facility in FY 97. The cockle seed production goal for FY 97 is a minimum of 50,000.

## OBJECTIVE 2. NURSERY SYSTEM

### A. Algae Production Pond

The QSH utilizes a 1 million liter pond to culture algae for its nursery. The 10m by 10m pond is 3 meters at it's deepest point. Raw seawater from a 60 meter deep intake is pumped into the pond to bring in nutrient rich water. The flow can controlled to allow for adequate flushing yet maintain the ambient air temperature. An air pump can be used to bubble and circulate water in the pond for adequate mixing and prohibit stratification. Water temperature and salinity along with nitrogen, phosphorous and silica levels can be checked on a regular basis.

The flora of the pond changes seasonally with *Chatecerous* dominating in the early months of the summer and pennate diatoms taking over after July. Natural cell densities of Resurrection Bay are 5,000 cells/ml while the pond can be manipulated to produce 250,000 cells/ml for feeding the shellfish.

Although the nursery pond has produced 10+ mm seed, the results have been erratic. Several different tests will be initiated in FY 96 to determine the best approach to using the algal pond. A upwelling system will be installed to see if this will improve seedstock growth. The pond will be fertilized on a regular basis to encourage the growth of favorable algal species, the pond cleaned and re-inoculated with favorable algal species and a test system of pumping pond water into land based clam seed boxes will be tried to determine if such a system offers better seed growth characteristics. This work will be carried over into FY 97 which will have a production goal of at least one 250,000 batch of 15+mm littleneck clam seed and a 50,000 batch of 15+ mm cockle seed.

### B. Remote Nursery Systems

Remote nursery systems offer several advantages over nursery culture at the hatchery. One is that it frees up hatchery space and personnel that can be better used in hatchery production. Another is that several remote nursery systems offer a redundancy of supply in case one of the systems fails. A third is that remote nursery systems can be located near the growout areas thus reducing transport costs. The big disadvantage to remote nursery systems is that the cost of pumping water at a remote location in Alaska made them impractical.

Recently, work conducted under the South Carolina Sea Grant program lead to the development of a tidally driven remote nursery system. This system, called a Tidally Driven Floating Upwelling System (tidal FLUPSY) uses the strength of tidal currents to force sea water, with its accompanying load of phytoplankton, through cages containing small clams. The system appears to work quite well and is easy to maintain. Because the system is driven by a natural energy source readily available in Alaska, it appears to have great promise here.

A prototype FLUPSY will be built and tested in FY 96 in Tatitlek where the unit can be subjected to various tidal current speeds in areas that offer fairly good protection from the weather. These tests will be carried over and expanded in FY 97. The production objective for a tidal FLUPSY will be to produce 15+mm littleneck clam seed in a 12 week period between April 15 and October 15.

## OBJECTIVE 3. GROWOUT

### A. Baseline Surveys

Baseline surveys were conducted on beaches near Nanwalek, Port Graham and Tatitlek in 1995. They form the basis for the littleneck clam enhancement studies which will be initiated in the summer of 1996 and will carry over to FY 97 and beyond. Other villages in the oil spill region that are interested in becoming part of the clam restoration project will also have baseline beach surveys conducted at the rate of two villages per year until all interested villages have been surveyed. However, no clam enhancement work will be done near these villages until a workable subsistence clam enhancement program has been developed.

In FY 97 baseline surveys will be conducted at two villages; one in lower Cook Inlet and one on Kodiak Island. Each survey will be conducted over a 2 day period during a low tide series where the tides uncover at least 2.5 feet below MLLW. The following protocols will used in conducting these surveys.

**I. Interviews.** Tribal elders should be contacted at each of these villages and interviewed to answer as many of the questions as possible. Interviews and survey site selection will be conducted the day before sampling is scheduled.

Based on these interviews, one or two potential beaches near each village will be identified for survey. Each beach chosen for survey will require one day for sample collection and analysis, 'f

his information will be reviewed following the field work and used as a basis for making enhancement recommendations.

**II. Beach surveys.** Surveys should be scheduled to coincide with a reasonably low tide (minimum of -2.5' MLLW). Depending on travel time between beaches, a crew of four to five will be able to survey a single beach during a low tide, Each of the beaches should be surveyed in the following manner:

The crew should arrive on the first beach at least four hours prior to low tide. Upon arrival, a series of test digs will be made to help stratify the beach. Test digs will begin at a height where no clams are anticipated and proceed waterward until the first clams are encountered. At that point a systematic survey, normal to the beach line, will begin. Addition test digs will be made when more than one strata is evident. The width of the beach will be divided by eight and a random number between one and the quotient determined. The first sample will be taken at that point. Addition samples will be collected at intervals equal to the quotient. Each sample will involve the removal of all substrate from a 0 .1 $M^2$ quadrat to a depth of 20 to 30 centimeters. Quadrats used in these samples are constructed of aluminum and are driven into the substrate to form rigid walls that prevent sloughing. Doubled, heavy duty plastic bags will be used to contain and transport the samples for field processing. Each bag will have a pre-numbered label attached to the outside and have an identical inside label that will follow the sample until processing is finished. Three of these normal transacts will be run on the beach at equal intervals along its length. That will result in the collection of 24 quantitative samples.

In addition. where appropriate, a forth systematic random sample will be collected along a transect running parallel to the beach. Eight samples will be collected along this transect. If the beach contains more than one strata, then additional parallel transacts will be examined running through the center of each strata.

A sediment sample will be collected from the top four inches of the substrate at randomly selected stations along each of the orthogonal transacts. The RPD will be measured at each of these points and a second sediment sample retained for total volatile solids analysis. The substrate will be characterized to include the following:

A. Substrate color
B. Presence of attached macroalgae
C. Presence of predators
D. Evidence of excessive littoral drift or log damage
E. Oily sheen
F. Odor (hydrogen sulfide, ammonia or petroleum)
G. Suitability for specific culture techniques.
H. A photographic record of the site will be made to include at least 1-0 pictures describing the general area, shoreline, fetch, and substrate type.
I. A small drogue will be placed in the water on arrival and its progress along the shoreline monitored during the period of study to assess currents.
J. A transit will be used to measure the elevation of the water height at a specific time and of each sample station on the transacts run orthogonal to the beach. (See Appendix 2).

K. Water temperature, dissolved oxygen and salinity will be measured. A 500 ml water sample will be retained for total suspended solids and total volatile solids analysis.

L. At a minimum, each beach survey will include:

1. 24 shellfish samples
2. 4 sediment samples (50 gm each) for sediment grains size analysis
3. 4 sediment samples for Total Volatile Solids analysis.
4. One 500 ml water sample

**3. Sample processing.** Bags containing the substrate removed from the quadrat will be moved to the high tide line. They will then be sieved in a 1/4" sieve followed by a I mm sieve. All clams will be removed from each of these sieves and placed in pre-labeled, one gallon, ZIPLOCK bags. The free label in the bucket or bag will follow the sample into the ZIPLOCK bag.

All samples will be place on ice, in a cooler and shipped via overnight mail to Aquatic Environmental Sciences, 644 Old Eaglemount Road, Port Townsend, WA. Samples will be frozen at AES while awaiting processing.

All clams in each sample will be individually aged, weighed and their valve length measured to the nearest 0.01 mm. Wet tissues in clams with valve lengths greater than 20 mm will then be shucked. weighed, dried, and a dry tissue condition factor determined.
Tissue drying is accomplished at 90 'C.

Sediment grain size will be determined using the sieve and pipette method. Sediments greater than I c-n will be pooled. Additional sieves sizes will include 2 mm, 1 mm, 500 µm, 125 µm, 63 µm. Silt (>3.9 gm) and clay (<3.9 µm) will be differentiated using the pipette method.

Sediment Total Volatile Solids will be determined by drying a sediment sample at 103 $\pm$ 2° C until no further weight reduction is observed and then ashing the sample at 550° C until no further weight loss is recorded.

Water Total Suspended Solids and Total Volatile Solids. A 0.45 µm glass filter is ashed at 550'C and weighed. A 350 ml sample of thoroughly mixed water is suction filtered and the residue dried at 103$\pm$2° C to determine TSS. Total volatile solids is determined following ashing of the sample at 550° C.

## B. Growout Techniques

The enhancement procedures that will ultimately be used under this project must be cost effective and efficient in producing harvestable clams in a reasonable time frame, and be compatible with the subsistence concept. For instance, it may be cost effective and efficient to grow cockles to harvestable size in a tidal FLUPSY however, managing a subsistence harvest from the FLUPSY could prove difficult.

At this point it appears that the most reasonable approach to providing clams for subsistence

harvest is from beach growout systems. It is likely that predator control covering will be a necessary component of an enhanced beach area, but setting up a system of uncovering an area for harvest and then recovering it would seem a relatively easy task. Because of this much of the work under this project will be aimed at producing cost effective and efficient beach growout systems.

This does not preclude the use of hanging, floating or caged culture systems in this project. Some of these will be used during the development phase as learning tools to gain an understanding of growth and mortality under diverse conditions. It may also be that some of these systems prove so cost effective and/or efficient that they will need to be incorporated into the subsistence management plan for one or more of the villages.

## 1. Seeding Intertidal Areas

Work initiated in FY 96 will be carried over into FY 97 and beyond. The following procedures will be used for each of the clam species included in the project.

**Littleneck Clams**
The littleneck clam study will involve placement of seed clams (5 mm to 15 mm valve length) in a replicate, blocked design which will examine growth and mortality as a function of tidal height and in the presence or absence of protective predator exclusion devices. A uniform seeding density of 30 seed clams per square foot will be utilized.

**Growth and mortality of caged clams.** One hundred seed clams will be placed in "Norplex™" clam bags for a detailed growth and mortality study. The valve lengths of all clams placed in there bags will be measured to the nearest 0.01 mm using vernier calipers. Clams placed in bags will be a random sample from the seed used in other parts of the study. Therefore, the mean lengths of clams in the bags will be used as the mean lengths of the clams seeded into other parts of the study.

Clam bag ends will be secured with electrical ties on one end and a 1" piece of split PVC pipe on the other end. Each bag will receive a shovelfull of sieved (1/2" sieve) gravel. Bags will then be nestled into the substrate to a minimum depth of 6". The top surfaces of each bag will extend a minimum of 1" above the substrate. Each bag will be secured to a piece of 1/2" rebar driven into the substrate to a minimum depth of 18" or when hitting bedrock. Identical study lay-outs will be used at all three Villages.

Bags will be retrieved at three month intervals and all contents removed from the bags. The number of surviving clams, and the number of empty clam shells, will be determined. The valve length of each clam will be measured and recorded. Fouling organisms will be removed from the bags and clams will be replaced in the bags with a shovelfull of sieved (1/2") gravel. Clam bags will be carefully nestled in the sediment. It should take less than 20 minutes per bag to accomplish this. Clam bags should be retrieved individually, measured and replaced before the next bag is removed. This will minimize stress in the clams.

**Growth and mortality of clams in Mexican trays.** Two stacks of three Mexican trays will be set up on the study beach at the MLLW tide level. The bottom two stacks will be filled with sieved (1/2" sieve) gravel and randomly selected seed clams at a density of 30/ft$^2$. The top stack will act as a cover. The stacks will be secured with a "T" stake driven into the substrate through the hole in the center of the stack.

The clams will be checked at three month intervals. At this time all the contents of the two bottom trays will be removed. The number of surviving clams, and the number of empty clam shells, will be determined. The valve length of each clam will be measured and recorded. All live clams will be replaced in the trays along with fresh sieved (1/2") gravel.

**Clam enhancement evaluation**. A minimum of 4 feet will be required between each treatment and block. This will provide access without disturbing adjacent plots. Car-cover netting will be precut to a dimension of 7'x5'. It will be secured in a trench an all four aides of each 1.0 meter by 2.0 meter plot. Each plot will be marked with four pieces of PVC pipe driven into the substrate at each corner. Each piece of PVC pipe will have the plot number written on it (A +1.5). After all plots are seeded, the tidal elevation of the center of each plot or bag will be measured against a known tidal elevation. Sediment samples will be taken adjacent to each set of netted, un-netted and bagged samples for analysis of total volatile solids and sediment grain size. In addition to treatment samples, control stations will be sampled annually and processed in a similar manner.

**Seeding**. All large (>10.0 cm diameter) rock and cobble will be removed from the area to be seeded. The area will be dug to remove all clams larger than 1.0 cm. The valve length of clams removed will be measured and recorded. Three random samples of seed for each beach will be weighed and counted to obtain an average weight per clam. A total clam weight equivalent to 600 clams will be seeded into each 1.0 x 2.0 meter area as the tide floods. Clams will be seeded through the car cover netting. This will require a total of 600 clams/station x 2 treatments (netted and uncovered) x 2 tidal heights (+I.5 feet and -1.5'MLLW) x 3 replicates =

**Maintenance**. Village culturists will need to monitor these studies on a weekly basis, or as tidal conditions permit. All rips in the netting must be repaired and all predators removed. Badly damaged nets should be replaced with as little disturbance to the culture as possible.

**Data recording**. Clams in the enhancement evaluation will be examined annually during the 1997, 1998 and 1999 field work. Clam plots will be evaluated by noting the presence of predators, and covering the netted plots and collecting three randomly selected 0.1 M$^2$ samples from each plot. The clams in the samples will be counted, measured in-situ and immediately replaced at a shallow depth with the substrate taken from the quadrat. New netting will then be installed.

A sediment sample will be collected from the top four inches of the substrate at randomly selected stations along each of the orthogonal transacts. The RPD will be measured at each of these points and a second sediment sample retained for total volatile solids analysis. The substrate will be characterized to include the following:

A. Substrate color

B. Presence of attached macroalgae
C. Presence of predators
D. Evidence of excessive littoral drift or log damage
E. Oily sheen
F. Odor (hydrogen sulfide, ammonia or petroleum)
G. Suitability for specific culture techniques.
H. A photographic record of the site will be made to include at least 20 pictures describing the general area, shoreline, fetch, and substrate type.
I. A small drogue will be placed in the water on arrival and its progress along the shoreline monitored during the period of study to assess currents.
J. A transit will be used to measure the elevation of the water height at a specific time and of each sample station on the transects run orthogonal to the beach, (See Appendix 2).
K. Water temperature, dissolved oxygen and salinity will be measured. A 500 ml water sample will be retained for total suspended solids and total volatile solids analysis.
L. At a minimum, each beach survey will include:
    1. 12 shellfish samples
    2. 4 sediment samples (50 gm each) for sediment grains size analysis
    3. 4 sediment samples for Total Volatile Solids analysis.
    4. One 500 ml water sample

Sediment grain size will be determined using the sieve and pipette method. Sediments greater than 1 cm will be pooled. Additional sieves sizes will include 2 mm, 1 mm, 500 μm, 125 μm, 63 μm. Silt (>3.9 μm) and clay (<3.9 μm) will be differentiated using the pipette method.

Sediment Total Volatile Solids will be determined by drying a sediment sample at 103 ± 2° C until no further weight reduction is observed and then ashing the sample at 550° C until no further weight loss is recorded.

Water Total Suspended Solids and Total Volatile Solids. A 0.45 μm glass filter is ashed at 550° C and weighed. A 350 ml sample of thoroughly mixed water is suction filtered and the residue dried at 103 ± 2° C to determine TSS. Total volatile solids is determined following ashing of the sample at 550° C.

**Cockles**

The natural history of cockles is a lot different than littleneck clams. In FY 97 the emphasis for cockles will be on determining growth and mortality in different substrates and at different seeding densities.

Cockle seedling will be placed in "Norplex™" clam bags at densities of 5, 15 and 30 seed per $ft^2$. A set of these bags will be placed on the same beaches as the littleneck clams and another set will be placed on beaches with substrate similar to what cockles use in the wild. The procedures for filling, securing and recording cockle growth and mortality over time will be the same as those used for the littleneck clam studies.

**Testing Predator Control Measures on Existing Sub-Harvestable Razor Clam Populations**

Work done in Puget Sound and Canada suggests that it may be possible to enhance clam populations merely by applying predator control screening. Razor clams were once an important subsistence food for Eyak villagers, however razor clams of harvestable size are now very difficult to find. There is an intertidal beach area near the village with large numbers of sub-harvestable razor clams. An anti-predator netting study is being initiated in FY 96 on this beach to determine its potential for allowing the clams to grow to harvest size.

A razor clam bed will be located within the study area. Three pairs of 10' x 10' plots will be randomly located within the clam bed. All the razor clams from each of the six plots will be removed, measured and replaced with a sample taken for aging. One plot from each pair will then be covered with standard predator control netting and the other plot will be left uncovered.

The covered plots will be checked on a regular basis to make sure the screens remain in place. If the screens have been ripped up they will be replaced by tougher screening and anchoring measures as appropriate. Screening up to and including chain link fencing may be used. Three randomly selected 1ft$^2$ areas within each of the six plots will be sampled for length and weight in October and again in March or April. All sampled clams will be returned to the plot from which it came.

**OBJECTIVE 4. MANAGEMENT PLAN**

The management plans for the subsistence beaches that will be developed under this project are important for two reasons. First, the enhanced clam populations created by this project will have some sort of predator protection making public access to this resource difficult. A management plan would establish procedures for making the clams available for public harvest while ensuring the long term viability of the subsistence beaches. Second, an important aspect of creating the subsistence clam beaches is instituting a testing program for paralytic shellfish poisoning (PSP). The Alaska Department of Environmental Conservation (DEC), the agency responsible for PSP testing, will only establish PSP testing programs on beaches that have a harvest management plan.

In FY 97 the project will initiate a dialog with the Alaska Department of Fish & Game, The Alaska Department of Natural Resources and DEC, to begin the process of developing management plans for the subsistence beaches.

## C. Cooperating Agencies, Contracts and Other Agency Assistance

This project will be conducted by the Chugach Regional Resources Commission (CRRC), a consortium of Native villages and associations in the Chugach Native Region that deals with natural resource issues and development, under a contract with the Alaska Department of Fish &

Game. CRRC will be contracting with the Qutekcak Shellfish Hatchery in Seward to develop spawning and culturing techniques for clams and the 10 mm to 15 mm seed for growout. CRRC may also be contracting with various mariculture experts for technical advise and assistance.

## SCHEDULE

### A. Measurable Project Tasks for FY 97

| | |
|---|---|
| 10/96 - 4/97 | continue to collect broodstock, obtain clearance and transport to hatchery |
| 10/96-8/97 | continue to develop techniques to mature and spawn broodstock |
| 10/96 - 4/97 | continue to develop techniques for producing 5 mm seed in hatchery |
| 3/96 - 7/97 | transfer 5 mm seed to hatchery nursery and FLUPSY |
| 4/1/97 | submit annual project report for FY 96 |
| 4/97 - ongoing | continue develop techniques for producing 10 mm to 15 mm seed for growout |
| 10/96 - ongoing | continue work on nursery production in tidal FLUPSY at Tatitlek |
| 10/96 - ongoing | continue predator control studies on razor clam beaches near Eyak. |
| 5/97 - 8/97 | conduct baseline shellfish surveys of tidelands near two villages in the oil spill region. |
| 10/96 - ongoing | Obtain permits and continue growth/mortality and predator control studies for littleneck clams; initiate seeding density and substrate adaptability studies on cockles. |
| 4/1/98 | submit annual project report for FY 96. |

### B. Project Milestones and Endpoints

| | |
|---|---|
| Objective 1. | |
| June, 1995 | initial procedure developed for Littleneck clam |
| June, 1997 | completed for littleneck clam |
| Nov, 1996 | initial procedure developed for cockle |
| June, 1998 | completed for cockle |
| Objective 2. | |
| September, 1997 | Littleneck clam in hatchery |
| November, 1998 | Cockle in hatchery |
| October, 1998 | Complete tests on tidal FLUPSY. |
| Objective 3. | |
| August, 1995 | Describe current local clam populations for Tatitlek and Port Graham/ Nanwalek areas. |
| September, 1995 | Locate sites in Tatitlek and Port Graham/Nanwalek areas for developing beach growout methods. |
| March, 1996 | Obtain permits and begin field work at growout sites at Tatitlek and Port Graham/Nanwalek. |
| April, 1996 | Initiate predator control studies on razor clam beaches near Eyak. |
| June/July, 1996 | Conduct baseline beach survey at Chenega Bay and Ouzinkie. |

| | |
|---|---|
| June/July, 1997 | Conduct baseline beach survey at two additional villages in oil spill region.<br>Initiate process for establishing permanent subsistence beaches at Tatitlek and Port Graham/Nanwalek. |
| June/July, 1998 | Conduct baseline beach survey at two additional villages in oil spill region. |
| September, 1998 | Initiate process for incorporating predator control |

Objective 4.

| | |
|---|---|
| June, 1997 | Initiate PSP sampling on beaches in Port Graham, Nanwalek and Eyak (Tatitlek will be covered by nearby commercial mariculture activities.) |
| November, 1997 | Reach agreement with state resource management agencies on how management plans for enhanced subsistence beaches will be developed |
| December, 1999 | Have management plans for enhanced subsistence beaches in Eyak, Tatitlek, Port Graham and Nanwalek in place. |

### C. Completion Date

The objectives of this project will be met in FY 2000.

## PUBLICATIONS AND REPORTS

| | |
|---|---|
| April 15, 1996 | FY 95 annual report due. Report will discuss progress to date, compare accomplishments against stated objectives and make recommendations regarding future work. |
| April 15, 1997 | FY 96 annual report due. Report will discuss progress to date, compare accomplishments against stated objectives and make recommendations regarding future work. |
| April 15, 1998 | FY 97 annual report due. Report will discuss progress to date, compare accomplishments against stated objectives and make recommendations regarding future work. |
| April 15, 1999 | FY 98 annual report due. Report will discuss progress to date, compare accomplishments against stated objectives and make recommendations regarding future work. |
| April 15, 2000 | FY 99 annual report due. Report will discuss progress to date and compare accomplishments against stated objectives. |
| June 30, 2000 | Final report due. |

## PROFESSIONAL CONFERENCES

Two staff from the Qutekcak Shellfish Hatchery will attend the Pacific Northwest Shellfish Conference, which will likely be held in Seattle or Portland, to present papers on hatchery and nursery culture techniques for littleneck clams and cockles. This conference is sponsored by the

Pacific Coast Shellfish Growers Association and the Sea Grant Program from the University of Washington and/or Oregon State University.

## COORDINATION AND INTERGRATION OF RESTORATION EFFORT

The project (96131) will complement Fish/Shellfish Study 13 Effects of Hydrocarbons on Bivalves conducted under State/Federal Natural Resource Damage Assessment. That project studied shellfish populations throughout the oil impacted area and conducted growth and mortality studies, collected age and size information and examined reciprocal transplants from oiled and control beaches. It was determined that littleneck clam populations were adversely affected through increased mortality and reduced growth rates.

The Clam Restoration Project (96131) will provide future resources for subsistence harvest and will be valuable for Projects 95279( Subsistence Restoration Projects Food Safety) and 95052 (Community Interaction/ Traditional Knowledge) to develop harvest plans. Information from 95052 can be used in the community survey, population assessment described in Objective 3.

## EXPLANATION OF CHANGES IN CONTINUING PROJECTS

At this point there are no major changes in the FY 97 proposal from how the work was envisioned to progress in the FY 96 approved DPD. The project milestones, endpoints and completion are basically the same as those presented in the FY 96 DPD.

## PROPOSED PRINCIPAL INVESTIGATOR(S)

Dave Daisy/ Jeff Hetrick
Chugach Regional Resources Commission
4201 Tudor Centre Drive, Suite 300
Anchorage, AK 99508
Phone: (907) 562-6647
Fax: (907) 562-4939

## PERSONNEL

**PATRICIA BROWN SCHWALENBERG**
**6450 Andover Drive**
**Anchorage, Alaska 99516**
**907 345-2187**

**Employment:**
June 1994 to Present: Executive Director Chugach Regional Resource Commission. Responsible for Natural Resource and Fisheries development for the seven native villages in the Chugach region. This includes administering office staff, village projects in mariculture and fisheries and protecting and enhancing subsistence opportunities.

October 92 to June 1994: Office Manager Bering Sea Commercial Fisheries Development Foundation. Responsibilities included maintaining all management systems for the organization including financial, personnel, property and central filing. Responsible for financial management and accountability of all grants of the Foundation payroll, taxes and financial statements, organizing and overseeing Foundation public relations.

October 1987 to June 1992 Society Administrator /Public Relations Director. Native American Fish and Wildlife Society. Assisted in the establishment and development of a national office for the Native American Fish and Wildlife Society. Implemented personnel policies and procedures, property management policies, record and financial management systems. Implemented strategies to obtain goals and objectives of the society.

**Education:**
Business Administration University of Alaska-Anchorage (ongoing).
Certification of Completion. 1977 Humboldt Institute

**DAVID DAISY**
**3936 Westwood Drive**
**Anchorage, Alaska 99517**
**(907) 243-8544**

**Employment:**
October, 1987-Present: Fisheries consultant with emphasis on aquaculture. Contractor to Chugach Regional Resource Commission developing salmonid hatcheries at Port Graham and Nanwalek and oyster mariculture operations at Tatitlek and Chenega Bay. Oversight and management of these projects involves grant writing and financial and activity reporting to granting agencies.

February, 1979 to October, 1987: Regional Program Manager, Region II, Fisheries Rehabilitation, Enhancement and Development (FRED) Division, Alaska Department of Fish & Game. Under general supervision of the FRED Director, responsible for the planning, development, operation and control of the State's salmonid enhancement and rehabilitation program in Region II which encompasses all of Alaska except Southeast.

November, 1977 to February, 1979: Regional Project Manager: Cook Inlet - Prince William Sound, Fisheries Rehabilitation, Enhancement and Development (FRED) Division, Alaska Department of Fish & Game. Under supervision of the Regional Program Manager responsible for the implementation and control of salmon enhancement research and development projects in the Prince William Sound and Cook Inlet areas. Assisted the Regional Program Manager in hatchery development planning.
April, 1968 to February, 1979: Management Biologist, Commercial Fisheries Division, Alaska Department of Fish and Game. Ketchikan, Cook Inlet and Upper Cook Inlet. Oversaw various management projects (weirs, counting towers, fisheries sampling) determined and set fishing periods for herring and salmon and responsible for meeting escapement and recruitment goals.

**Education:**
B.Sc. Fisheries, University of Massachusetts, Amherst, 1965.

**JEFF HETRICK**
**P. O. Box 7**
**Moose Pass, Alaska 99631**
**(907) 288-3667**

**Employment:**
1987- Present: Hatchery Manager Cook Inlet Aquaculture Association. Manage Trail Lakes Hatchery which produces 12 million sockeye salmon fry and 2 million sockeye salmon smolts annually.

1988-Present: Consultant for Shellfish Culture. Clients include:
Chugach Regional Resource Commission- develop oyster farms at Chenega Bay and Tatitlek. Included permitting, farm design, training and marketing.
Qutekcak Native Tribe- Design and develop first shellfish hatchery in Alaska.

1983-1987 Assistant Manager. Alaska Department of Fish and Game.
Assistant manager at Main Bay (Chum and Sockeye Salmon) and Cannery Creek (Pink Salmon) Hatcheries in Prince William Sound.

**Education:**
MBA California Coast University- Thesis under review
B.Sc. Biological Sciences. University of Maryland, 1980

**DR. KENNETH M. BROOKS**
**644 old Eaglemount Road**
**Port Townsend, WA 98368**
**(360) 732-4464**

**Employment**

| | |
|---|---|
| 1959-1979 | U.S. Navy Officer - retired in 1959 |
| 1979-1992 | Owner/operator of Black Angus ranch |
| 1982-1992 | Environmental mediator for Washington state |
| 1988-1990 | Battelle Marine Science Laboratory, NORCUS grant |
| 1989-present | President, Aquatic Environmental Sciences, Port Townsend, WA |
| 1993-present | Director, Fisheries Technology Program, Peninsula College |

**Education**
B. Sc. - Physics, Naval Postgraduate School (NPS), 1973
M. Sc. - Physics, NPS, 1974
Ph.D. - College of Ocean Sciences and Fisheries, University of Washington, 1991
**John L. Agosti**
**P. O. Box 369**
**Seward, AK 99664**
**(907) 224-5181**

**Employment**

| | |
|---|---|
| 1983-1984 | Hatchery Technician, Westcott Bay Sea Farm, Friday Harbor, WA |
| 1984-1986 | Research Consultant, Ketron Island Sea Farm, Stellacoom, WA |
| 1986-1996 | Assistant Hatchery Manager, Westcott Bay Sea Farm, Friday Harbor, WA |
| 1996-prersent | Hatchery Manager, Qutekcak Shellfish Hatchery, Seward, AK |

**Education**
B. Sc., Biological Oceanography, Humbolt State University, 1984

## REFERENCES

Adams, C. et al. 1991. Investing in Commercial Hardclam Culture: A Comprehensive Guide to the South Atlantic States. Florida Sea Grant College Program (SGR-104).

Alaska Department of Fish & Game, 1992 Annual Report on Aquatic Farming, PO Box 3-2000 Juneau, AK 99802.

Broadley, T. A., Clayton, W.E.L., 1988. British Columbia Manila Clam Culture Workshop. IEC Collaborative Research and Development, Ltd. 206-2639 Fifth Street, Victoria, B.

C. Canada V8T4X6

Fall, J. and R. Maraglia, 1994 . Personal communication. Alaska Department of Fish & Game, Subsistence Division 333 Raspberry Road, Anchorage, AK 99518.

Horn, S. 1993. Shellfish Development in Kachemak Bay: Resource Directory. Kenai Peninsula Borough Economic Development District, Inc. 110 South Willow Street, Suite 106, Kenai, AK 99611.

Manzi, J.J., M. Castagna, (Editors) 1989. Clam Culture in North America. Developments in Aquaculture and Fisheries Science, Volume 19, Elsevier Science Publishing, 665 Avenue of the Americas, New York, NY 10010.

Orth, Franklin et al. 1975. The Alaska Clam Fishery: A survey and Analysis of Economic Potential. U of Alaska Institute of Marine Science report No. R75-3; Alaska Sea Grant Report No. 75-5 U of A, IMS, Fairbanks, AK 99701.

Paul, A.J., Feder, Howard 1976. Clam, Mussel and Oyster Resources of Alaska. U of Alaska Institute of Marine Science Report No. 76-4 U of A, IMS, Fairbanks, AK 99701.

South Carolina Sea Grant Program 1994. Harnessing the Tides for Clam Aquaculture: An Emerging Technology. S. C. Sea Grant video Charleston, SC 29401.

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1996 | Proposed FFY 1997 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Personnel | $6.3 | $0.0 | | | | | | |
| Travel | $0.0 | $0.0 | | | | | | |
| Contractual | $250.2 | $381.3 | | | | | | |
| Commodities | $0.0 | $0.0 | | | | | | |
| Equipment | $0.0 | $0.0 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
| Subtotal | $256.5 | $381.3 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| General Administration | $18.4 | $20.1 | | | | | | |
| Project Total | $274.9 | $401.4 | $417.4 | $417.4 | $0.0 | $0.0 | $0.0 | |
| Full-time Equivalents (FTE) | | 0.0 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

Comments:

**1997**

Prepared:



Project Number: 97131
Project Title: Chugach Native Region Clam Restoration
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY
4/11/96

## 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Personnel Costs: | | GS/Range/ | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|
| Name | Position Description | Step | Budgeted | Costs | Overtime | FFY 1997 |
| | | | | | | 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 | FFY 1997 |
| | | | | | 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 |

**1997**

Prepared:



Project Number: 97131
Project Title: Chugach Native Region Clam Restoration
Agency: Alaska Department of Fish and Game

FORM 3B
Personnel
& Travel
DETAIL

4/11/96

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| **Contractual Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| Contract with the Chugach Regional Resource Commission | 381.3 |
| When a non-trustee organization is used, the form 4A is required. **Contractual Total** | $381.3 |

| **Commodities Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| **Commodities Total** | $0.0 |

**1997**

Project Number: 97131
Project Title: Chugach Native Region Clam Restoration
Agency: Alaska Department of Fish and Game

FORM 3B
Contractual & Commodities DETAIL

Prepared: 4/11/96

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

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

**1997**

Project Number: 97131
Project Title: Chugach Native Region Clam Restoration
Agency: Alaska Department of Fish and Game

FORM 3B
Equipment
DETAIL

Prepared:



4/11/96

## 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1996 | Proposed FFY 1997 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Personnel | $30.3 | $85.4 | | | | | | |
| Travel | $8.9 | $11.0 | | | | | | |
| Contractual | $162.5 | $231.3 | | | | | | |
| Commodities | $1.5 | $3.6 | | | | | | |
| Equipment | $17.0 | $0.0 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
| Subtotal | $220.2 | $331.3 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| Indirect | $30.0 | $50.0 | | | | | | |
| Project Total | $250.2 | $381.3 | $385.0 | $385.0 | $0.0 | $0.0 | $0.0 | |
| Full-time Equivalents (FTE) | | 26.0 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

Comments: The Shellfish Culture and Hatchery Operations Specialist will be employed by CRRC and not by the Qutekcak Shellfish Hatchery. The boat and crew rental for the Eyak razor clam program includes a large sized boat capable of reaching the razor clam study area from Cordova and two crewmen. The skiff rentals for the two baseline survey villages and Tatitlek, Port Graham and Nanwalek are for just a skiff and outboard.

**1997**

Project Number: 97131
Project Title: Chugach Native Region Clam Restoration
Name: Chugach Regional Resources Commission

FORM 4A
Non-Trustee
SUMMARY

Prepared: 4/11/96

## 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Personnel Costs: | | | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|
| Name | Position Description | | Budgeted | Costs | Overtime | FFY 1997 |
| 3 positions | village project leader | | 9.0 | 2562 | | 23.1 |
| 4 positions | village project worker | | 5.0 | 2412 | | 12.1 |
| 1 position | shellfish culture & hatchery operations specialist | | 12.0 | 4180 | | 50.2 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | Subtotal | | 26.0 | 9154 | 0.0 | |
| | | | | | **Personnel Total** | $85.4 |

| Travel Costs: | | Ticket | Round | Total | Daily | Proposed |
|---|---|---|---|---|---|---|
| Description | | Price | Trips | Days | Per Diem | FFY 1997 |
| Staff meeting/training session - Seward | | 430 | 9 | 3 | 100 | 4.2 |
| Meet with experts/tour facilities U.S. & Canada | | 850 | 4 | 11 | 120 | 4.7 |
| 2 hatchery staff to present papers at Pacific Northwest shellfish conference | | 550 | 2 | 8 | 120 | 2.1 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | **Travel Total** | $11.0 |

**1997**

Prepared:



Project Number: 97131
Project Title: Chugach Native Region Clam Restoration
Name: Chugach Regional Resources Commission

FORM 4B
Personnel
& Travel
DETAIL

4/11/96

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 1996 - September 30, 1997

| Contractual Costs: | Proposed |
|---|---|
| Description | FFY 1997 |
| Broodstock development and seed production at Qutekcak Shellfish Hatchery | 161.9 |
| Contracts for technical assistance in hatchery, nursery and growout operations | 53.0 |
| Skiff rental - Two baseline surveys - 4 days @ $150/day | 0.6 |
| Boat & crew for Eyak razor clams 15 days @ $900/day | 13.5 |
| Skiff rental at Tatitlek, Port Graham and Nanwalek 15 days @ $150/day | 2.3 |
| **Contractual Total** | $231.3 |

| Commodities Costs: | Proposed |
|---|---|
| Description | FFY 1997 |
| Calm growout gear (vexar bags, predator covering, hanging culture bags, anchoring systems) | 2.7 |
| Safety and work gear for beach crews (life vests, boots, rain gear, gloves) | 0.9 |
| **Commodities Total** | $3.6 |

**1997**

Prepared:

Project Number: 97131
Project Title: Chugach Native Region Clam Restoration
Name: Chugach Regional Resources Commission

FORM 4B
Contractual & Commodities DETAIL

4/11/96

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

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

**1997**

Project Number: 97131
Project Title: Chugach Native Region Clam Restoration
Name: Chugach Regional Resources Commission

FORM 4B
Equipment
DETAIL

Prepared: 4/11/96

Corrected

**Salmon Instream Habitat and Stock Restoration - L. Waterfall Barrier Bypass Improvement**

RECEIVED
MAY 8 1996
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

| | |
|---|---|
| **Project ID number:** | 97139A1 |
| **Restoration Category:** | General Restoration |
| **Proposer:** | Alaska Department of Fish and Game |
| **Lead Trustee Agency:** | Alaska Department of Fish and Game |
| **Cooperating Agencies:** | None |
| **Duration:** | October 1, 1996 through September 30, 1997; 3rd year, 4-year project (5th year for final report writing only). |
| **Cost FY97:** | $26.4 |
| **Cost FY 98:** | $23.0 |
| **Cost FY 99:** | $14.0 |
| **Geographic Area:** | Afognak Island (Kodiak Island) |
| **Injured Resource/Service:** | The project is intended to mitigate for and restore pink and coho salmon resources on Afognak Island. |

## ABSTRACT

This proposal will provide for continuation of Project 96139A1 and will focus on evaluation of barrier bypass improvement at Little Waterfall Creek, as indicated by pink (*Onchorynchus gorbuscha*) and coho salmon (*Onchorynchus kisutch*) use of the bypass. The renovation of the bypass (decreased grades and additional resting pools) was completed in FY96 and is expected to facilitate increased spawning habitat use by existing pink and coho salmon populations, thus will increase salmon production to optimum levels in ensuing years. Studies in FY 97 will include bypass inspections to document salmon passage, spawner enumeration, and juvenile salmon abundance monitoring.

## INTRODUCTION

The proposed project is a continuation of restoration efforts initiated in 1994 (Project 94139A1) which began as result of surveys (Restoration Study 93063) conducted on Kodiak Island which evaluated instream habitat and stock restoration techniques for wild salmon stocks (Willette et al. 1994). The emphasis of this evaluation was to improve or develop spawning habitat at systems with barriers to salmon passage which have historically prevented access. Surveys focused on systems which were directly impacted or were located in proximity to areas impacted by the *Exxon Valdez* oil spill (EVOS) with the intent of mitigating for injured spawning habitat (Figure 1). Data collected from these surveys were analyzed, including a cost to benefit analysis, (Hartman and Richardson 1993) to determine the most effective mitigation techniques for Kodiak Island salmon systems (Willette et al. 1994). As result of these surveys, The Exxon Valdez Oil Spill Trustee Council selected L. Waterfall Creek as a site for spawning habitat mitigation.

In FY95, pre-construction production parameters were assessed (coho salmon escapement), final engineering surveys completed, and design for bypass improvements finalized. In addition, engineering documents were completed for the contract bidding process, and the contract was awarded to SeaCoast Construction. Construction , however, scheduled to begin in July, and be completed near the end of the fiscal year, was delayed due to poor work conditions as result of high water events. Thus, construction did not begin until FY 96, and was completed in November. The delay in construction prevented evaluation of bypass use since salmon were not present in L.Waterfall Creek at that time. However, the evaluation of pre- project production continued with salmon escapement and juvenile rearing abundance surveys, and egg to fry abundance estimates conducted. For the remainder of FY 96, upon inspection of the renovated bypass, any additional work required to complete bypass improvements will be conducted with contingency funds previously allocated. In addition, juvenile rearing abundance surveys, bypass use evaluation and spawner distribution surveys will be conducted.

The proposed work for FY 97 will include continued evaluation of the bypass for salmon usage, juvenile salmon abundance indexing and adult salmon spawner distribution estimates. A man-month of Fishery Biologist salary for report writing has been added for FY 97, with other costs associated with the evaluation work, remaining similar to FY 96. Previous reporting requirements have been funded by ADFG general fund.

## NEED FOR THE PROJECT

### A. Statement of Problem

Several beaches on Afognak Island were heavily oiled as result of the *Exxon Valdez* oil spill (EVOS) in 1989, and remained oiled in 1990 (Willette et al. 1994; Figure 1). Little Waterfall Bay (Little Waterfall Creek drainage) was directly impacted by oil. Similar impacts in Prince William Sound (PWS) damaged salmon stocks (Willette et al. 1994).

Three barriers in Little Waterfall Creek have been bypassed with structures allowing increased pink and coho salmon passage to previously unused spawning habitat (Edmundson et al. 1994; Figure 2). Pink salmon escapements at Little Waterfall have averaged 39,600 from 1968-1995, with a pre-bypass (1968-1980) average of 5,200 compared to a post-bypass (1981-1995) average of 60,600 (ADFG unpublished data). Although the system has benefited from the installation of the barrier bypasses as indicated by the

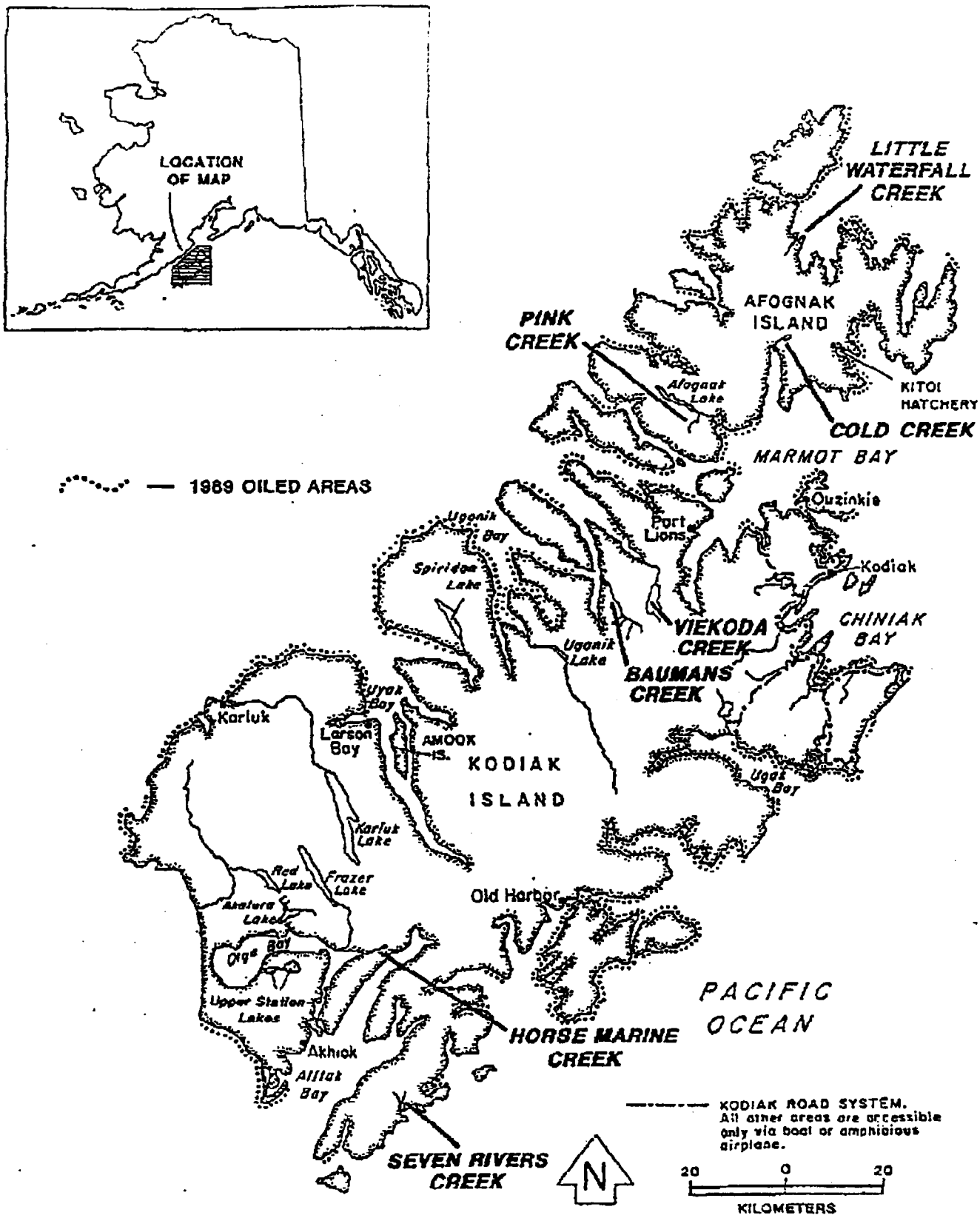


Figure 1. Location of 1989 oiled areas and salmon restoration/mitigation systems.

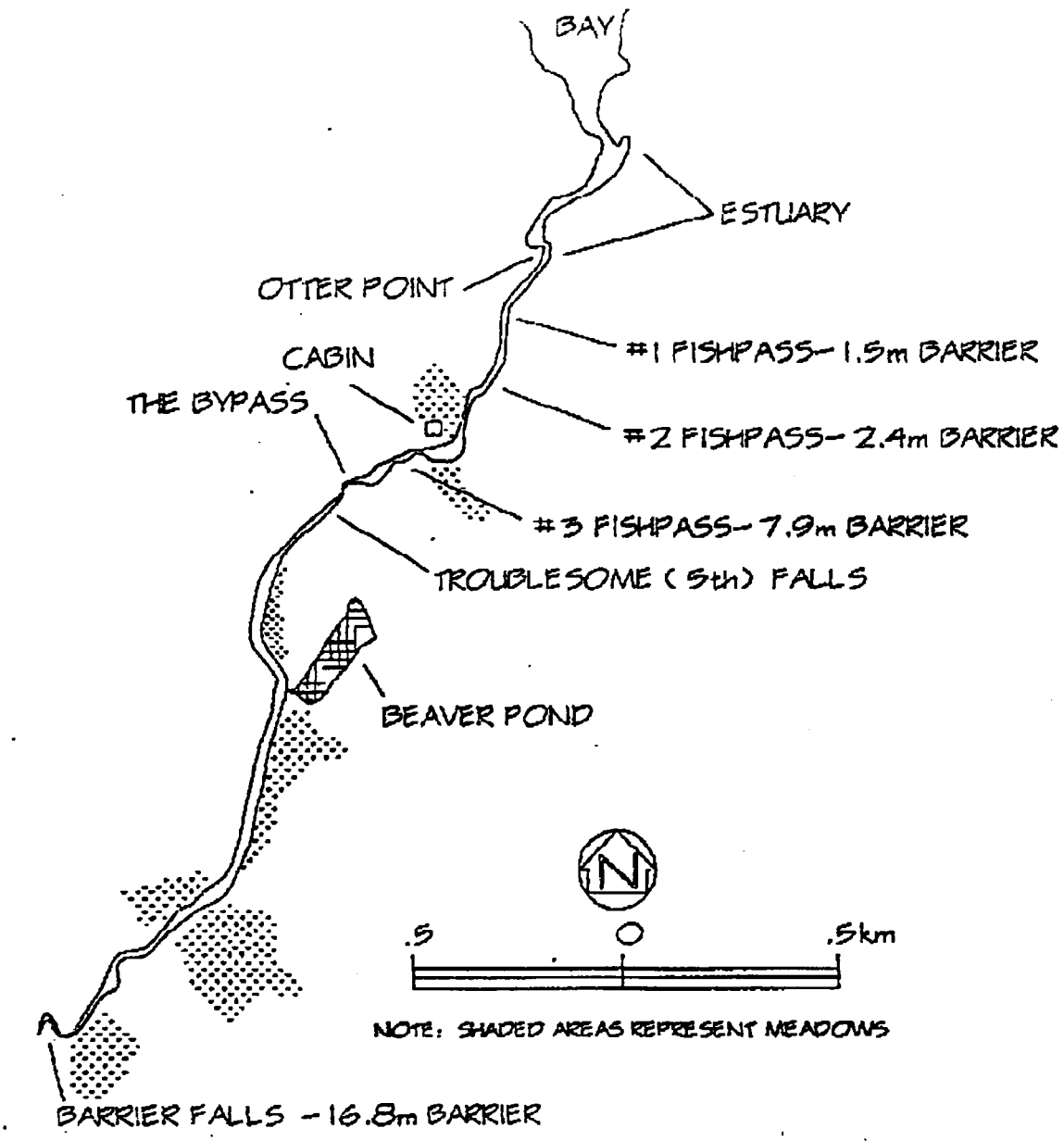


FIGURE 2. LOCATION OF FISHPASSES AND UPSTREAM SPAWNING HABITAT AT LITTLE WATERFALL CREEK.

increased pink salmon escapement, the largest barrier bypass structure has not operated efficiently and has impeded salmon passage into the largest portion of spawning habitat (Willette et al. 1994). Since the installation of this bypass, pink salmon escapement to upstream habitat has averaged 11,400. Coho salmon escapement data is incomplete due to enumeration deficiencies (ADFG unpublished data), however, foot survey counts have ranged from 0 (several years from 1980 -1993) to 104 (1994). Juvenile production data parallels the adult escapement data with pink fry abundance indices less upstream of the bypass (0.54 fry/$m^2$ in 1986; 95.5 fry/$m^2$ in 1992) compared to downstream (338.1 fry/$m^2$ in 1986; 224.9 fry per $m^2$ in 1992) samples (ADFG unpublished data). Coho fry have not been identified during any pre-emergent sampling efforts. However, fewer coho fry reared above the barrier (0.20 CPUE) than below (0.44 CPUE) the barrier as indicated by minnow trapping in August 1995 (ADFG unpublished data).

Barrier height, the quality and quantity of spawning habitat above barriers, and the degree of utilization of available spawning habitat significantly affects the efficiency and cost effectiveness of barrier bypasses (fish passes) (Willette et al. 1994). Habitat utilization rates considerably less than estimated capacity is common (McDaniel 1981). Previous evaluation of the habitat above the bypass, conducted as described by Olsen and Wenger (1991) characterized the useable habitat (Chambers et al. 1955) comprising approximately 80% (~17,000 $m^2$) of the total stream habitat (Willette et al 1994). Using a 1:1 sex ratio (ADFG unpublished data), and optimum female density for pink and coho salmon of 0.7 (Heard 1978) and 0.08 (Sheng et al. 1990), respectively, approximately 24,000 pink and 2,700 coho salmon can be supported above the bypass.

The result of an evaluation of the design and operation of the largest bypass structure determined several deficiencies, impacting salmon passage (Willette et al. 1994). The grade of the bypass is 27%, which is considered too steep (Bruce McCurtain, ADF&G, personal communication). For example, a slope of 22% or less is recommended for sockeye salmon when resting pools (similar to those at Little Waterfall) are employed (Blackett 1987). Pink salmon, a less vigorous fish, may require even less slope (Honnold 1991). Thus, the existing data indicated that the gradient of this bypass should be reduced. Furthermore, engineering data indicated that the existing concrete resting tanks needed to be removed, the lower portion of the bypass extended, and two new resting tanks added (Honnold 1995; Figure 3).

**B. Rationale/Link to Restoration**

The 1989 EVOS deposited oil on beaches in Little Waterfall Bay and adjacent areas on Afognak Island (Willette et al. 1994). Oil persisted in 1990, and may have resulted in similar impacts to resident salmon populations as were documented in PWS. Additional impacts as result of the EVOS include lost harvest opportunities due to fishery closures in 1989 (Schmidt et al. 1993; Swanton et al. 1993) and loss of income to local economies (Willette et al. 1994). Projects which provide increased salmon production, thus more harvest opportunities for local residents of the Kodiak and Afognak Island Areas will, potentially, offset economic impacts from EVOS. In addition, projects that target systems in close proximity of documented oiling may provide more area specific benefits.

Barrier bypass (fish ladders) projects have been used extensively on Afognak Island to restore and enhance sockeye, coho, and pink salmon runs (Honnold 1991; Honnold and Edmundson 1993 and Edmundson et al. 1994). For example, the Laura Lake sockeye and coho salmon runs, historically significant producers, were initially started by construction of two bypasses to enable spawner access to underutilized habitat (Honnold and Edmundson 1993). Similarly, pink salmon production at Little

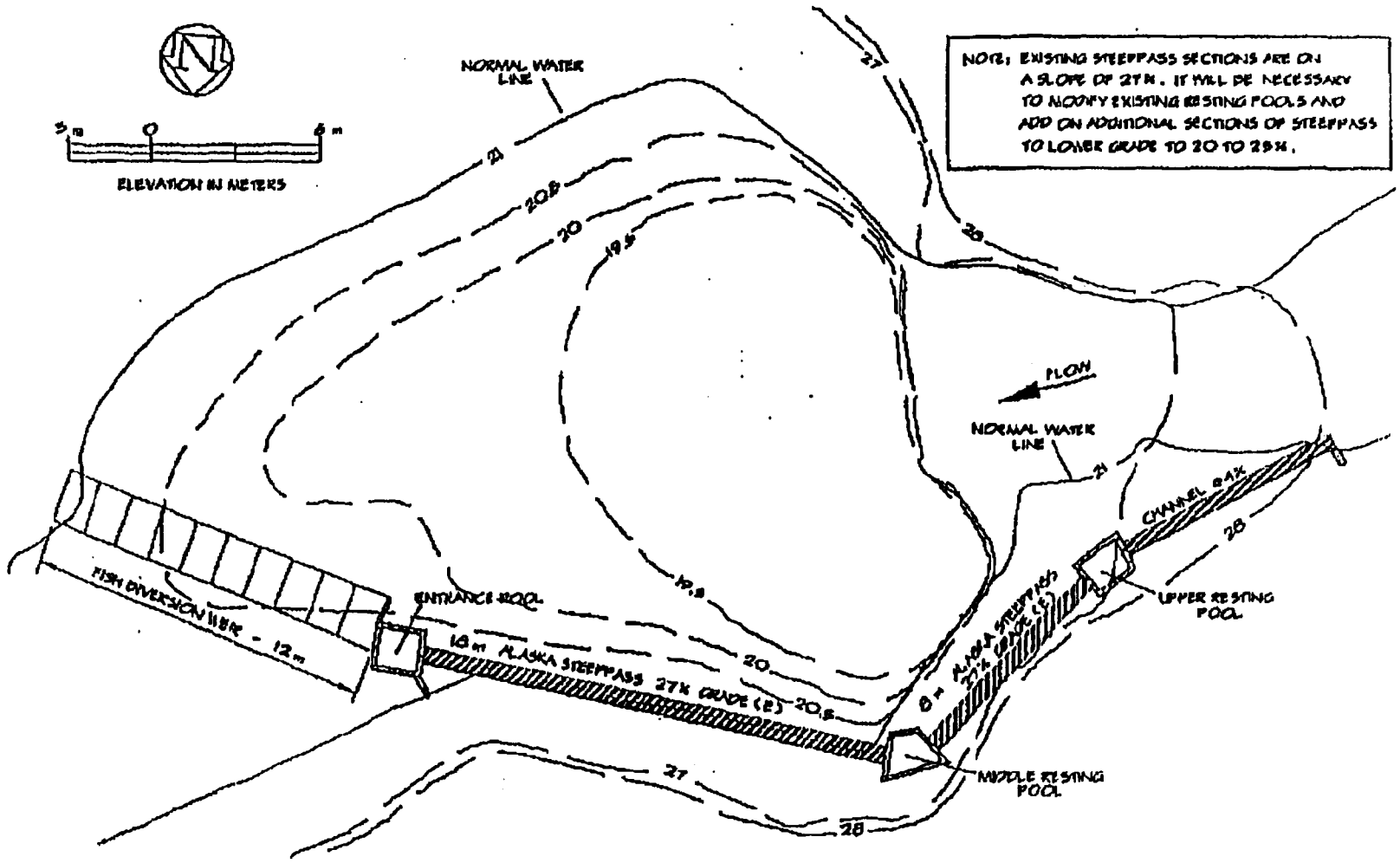


FIGURE 3. DESIGN OF PRESENT BARRIER BYPASS AT 7.9 METER FALLS AND RECOMMENDED MODIFICATIONS TO IMPROVE SALMON PASSAGE.

Waterfall has been significantly improved through bypasses and increased spawning habitat use (ADFG unpublished data). The barrier bypass modifications completed in FY 96 as result of this project will increase spawning habitat use for existing pink and coho salmon populations to optimum levels of colonization and provide for increased exploitation. At optimum levels of production, the potential harvest will be approximately 24,000 and 14,000 pink and coho salmon, respectively ( Willete et al. 1994; Table 1). Cost to benefit data indicates that this project would have benefits greater than costs of production (Hartman and Richardson 1993).

Table 1. Spawner density, fecundity, survivals and exploitation rates used as planning assumptions to forecast pink and coho salmon production benefits for Little Waterfall Restoration project:

**Pink Salmon**

| parameter | Mean | Source (Area) |
|---|---|---|
| Optimum female density (#/sq.m) | 0.7 | Heard (1978) |
| Average fecundity | 1858 | PWS(PWS aquaculture assoc. 1986) |
| Egg-fry survival (%) | 6.4 | SE Alaska (unpublished ADFG data) |
| Marine survival rate (%) | 3.1 | Alaska (Sharr et al. 1993) |
| Exploitation rate (%) | 54 | Kodiak (unpublished ADFG data) |

**Coho Salmon**

| parameter | Mean | Source (Area) |
|---|---|---|
| Optimum female density (#/sq.m) | 0.08 | Sheng et al (1990) |
| Average fecundity | 4835 | Alaska (ADFG unpublished data) |
| Egg-fry survival (%) | 7.4 | Kodiak (Honnold and Edmundson 1993) |
| Marine survival rate (%) | 4.1 | Washington, California |
| Exploitation rate (%) | 75 | Chapman (1986) |

This project will assist in achieving the objective, stated in the *Exxon Valdez Oil Spill Restoration Plan*, of accelerating the rate of recovery of damaged pink salmon resources on Afognak Island, and will also replace for injured spawning habitat in other areas of Kodiak Island. The primary focus of FY 97 work will be monitoring and evaluation of the barrier bypass modifications, as required by supplementation criteria to assess the likelihood of success and potential risks of supplementation.

## C. Location

The project is located at Little Waterfall Creek (stream number 251-822) on Afognak Island (Figure 1). Little Waterfall Creek drains into Little Waterfall Bay on northern Afognak Island (Figure 4). The benefits of this project will be realized by increasing pink and coho salmon returns to this system, providing approximately 24,000 and 15,000 pink and coho salmon annually for harvest, respectively. The residents of the city of Kodiak, northern Afognak Island will benefit economically from this project through direct commercial fishery receipts and all associated business enhancement. In addition, sport fishers, guides, and lodge owners as well as subsistence fishers, will benefit directly and provide direct economic return to the associated communities.

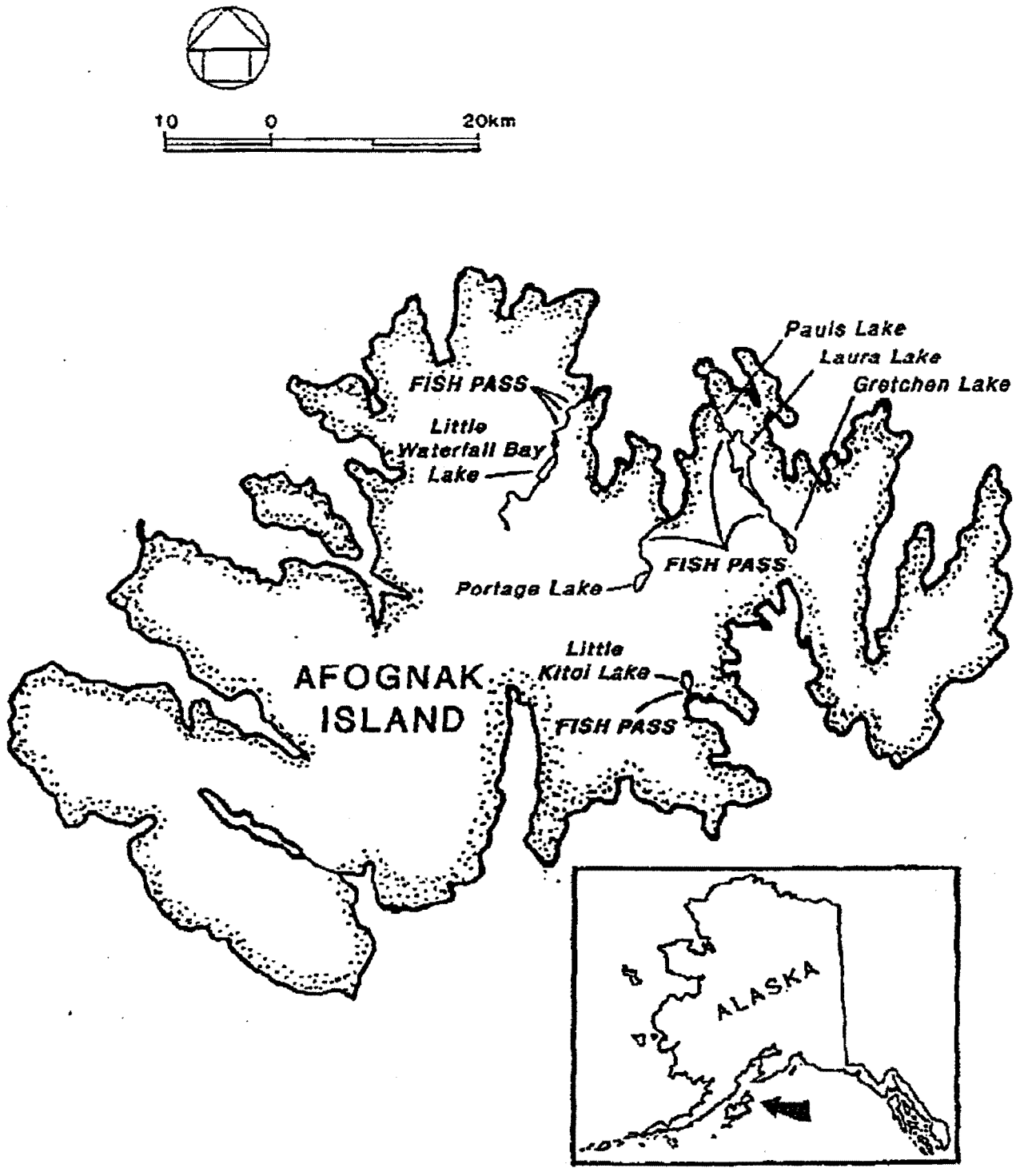


Figure 4. Location of operational fish passes on Afognak Island.

## COMMUNITY INVOLVEMENT

The residents of Kodiak and Afognak Islands will continue to be involved in this project through the EVOS Trustee Council planning process. Information is provided to the communities through restoration work sessions, project planning documents, the Community Involvement Project, and media coverage. In addition, members of the Kodiak Regional Aquaculture Association (KRAA), composed of area fishers, are informed of project proposals and status of ongoing projects at board meeting open to the public. The Kodiak Regional Planning Team (KRTP), composed of KRAA, ADF&G and U.S. Fish and Wildlife Service participants assists with development of project proposals. The KRPT meetings are open to the public and representatives from the Kodiak Area Native Association, Kodiak Tribal Council, and the ADFG Subsistence Division are encouraged to attend. When applicable, local and traditional knowledge will be utilized for this project.

## PROJECT DESIGN

### A. Objectives

The project objectives for FY97 are designed to evaluate the success of the barrier bypass improvement.

1. Estimate the number of salmon spawning in habitat upstream and downstream of the improved bypass.

2. Determine the relative abundance of juvenile salmon in habitat upstream of the improved bypass as compared to downstream areas.

3. Document project progress and results.

4. Comply with supplementation criteria and guidelines.

### B. Methods:

1. Estimate the number of salmon spawning in habitat upstream and downstream of the improved bypass.

Salmon spawning habitat usage will be determined by conducting foot surveys of L.Waterfall Creek from 15 August through 30 September. Live and dead salmon will enumerated during each survey in each section of the creek (Figure 2). Peak live counts will be used to determine indexed escapement of pink and coho salmon to upstream habitat (Barrett et al. 1990). Analysis of variance (ANOVA) or covariance (ANOCOVA) will be used to test for pre and post bypass improvement differences in indexed escapements, depending on which statistical method is appropriate (Vining pers. comm). In addition, escapement variability (run strength; odd/even year differences) will be accounted for by comparing proportions of spawners upstream and downstream of the bypass before and after the improvements. Statistical analysis of this comparison will be defined once data is available.

2. Determine the relative abundance of juvenile salmon in habitat upstream of the improved bypass as compared to downstream areas.

Prior to fry emergence, spawning redds downstream and upstream of the barrier will be sampled for a relative index of fry abundance (Donnelly 1983; Swanton et al. 1993) and egg-to-fry survival. Ten redds, in both locations, will be pumped as described by White (1980; 1986) to capture eggs and fry which will be enumerated by species (Swanton et al. 1993; White 1988; McNeil 1964). ANOVA or ANOCOVA will be used to test for pre and post bypass improvement differences in emergent fry indices and egg-to-fry survivals, depending on which statistical method is appropriate (Vining pers. comm).

The relative abundance (catch-per-unit-effort) of juvenile coho salmon rearing downstream and upstream of the barrier will also be determined. Baited minnow traps ( Gray et al. 1984; Kyle 1990) will be set each month from June through September at permanent sampling locations. All juvenile fish captured after a 24 hour trapping period will enumerated by species and released. ANOVA or ANOCOVA will be used to test for pre and post bypass improvement differences in coho fry CPUE, depending on which statistical method is appropriate (Vining pers. comm).

3. Document project progress and results.

The necessary documentation of project progress and results will be accomplished on schedule as outlined by the Trustee Council. This will include presenting a project progress report at the annual Restoration Workshop, writing a FY 96 annual report and providing requested information in response to peer review comments.

4. Comply with supplementation criteria and guidelines.

The supplementation criteria and guidelines developed by the Trustee Council will be followed.

The project will provide improved spawning habitat for pink and coho salmon Coho salmon will also have access to additional rearing habitat. The barrier bypasses in place at Little Waterfall Creek have been operational since the late 1970's (Honnold 1991), thus the populations and sub populations of pink and coho salmon have had almost 20 years to adapt to initial system changes. This project is not expected to change the genetic variation or compositions of these populations. Since new stocks will not be introduced to the system hybridization will not occur.

Resident species, such as Dolly Varden char (*Salvelinus malma*), rainbow or steelhead trout (*O. mykiss*), three-spine stickleback (*Gasterosteus aculeatus*), freshwater sculpin (*Cottus aleuticus*) and sockeye salmon (*O. nerka*) are not expected to be negatively impacted by this project (Appendix 1). Improved spawning habitat access and increased salmon fry production (forage) may benefit resident species. The potential for interspecific competition (pink and coho salmon) reducing the benefit of this project is assumed to be minimal (Appendix 1). Although there is overlap in habitat use by pink and coho salmon, temporal and spatial separation minimizes competition. Both species will have equal opportunity to utilize the improved bypass, thus spawn in upstream habitat.

This project will provide additional pink and coho salmon for harvest in Little Waterfall Bay and other area waters. Mixed-stock fisheries problems are not anticipated as result of this project. Harvest regulations are currently in place to harvest pink salmon produced at Little Waterfall Creek

(Prokopowich, pers. comm.; Appendix ). This project will not affect these regulations. Coho harvest regulations are also maintained for Perenosa Bay fisheries (Figure 5), and will allow adequate management of the increased coho runs.

Finally, all permit requirements for this project have been met. This includes land use approval by Afognak Joint Ventures, habitat impact assessment by ADFG, and NEPA compliance requirements.

### C. Cooperating Agencies, Contracts and Other Agency Assistance:

The Kodiak Regional Aquaculture Association (KRAA) funds an ADFG project located at Perenosa Bay. A portion of the Perenosa Bay rehabilitation and enhancement project includes work at Little Waterfall Creek. KRAA will provide assistance to the Little Waterfall Restoration project through sharing of personnel, equipment and logistics.

## SCHEDULE

### A. Measurable Project Tasks for FY 97 (October 1, 1996 - September 30, 1997)

This project will include a period of evaluation to determine the effectiveness of barrier bypass improvement and subsequent use of upstream spawning habitat. The FY 97 work plan is outlined as follows:

| | |
|---|---|
| Spawner abundance and distribution surveys | October 1- 15, 1996 |
| Data summary/ - Restoration Workshop | December 15, 1996 - January 30, 1997 |
| Prepare FY 96 annual report/ FY 98 DPD | March 1-April 15 |
| Egg-to-fry survival sampling | March 15 - 30 |
| Juvenile coho abundance sampling | June 15 -September 15 |
| Spawner abundance and distribution surveys | August 10 - September 30 |

### B. Project Milestones and Endpoints

1. Estimate the number of salmon spawning in habitat upstream and downstream of the improved bypass.

This objective will be addressed in FY 97 and completed by September 30, 1998 (FY 98).

2. Determine the relative abundance of juvenile salmon in habitat upstream of the improved bypass as compared to downstream areas.

This objective will be addressed in FY 97 and completed by September 30, 1998 (FY 98). If data analysis reveals the necessity for additional emergent fry data, a final sample may be collected in March 1999 (FY 99).

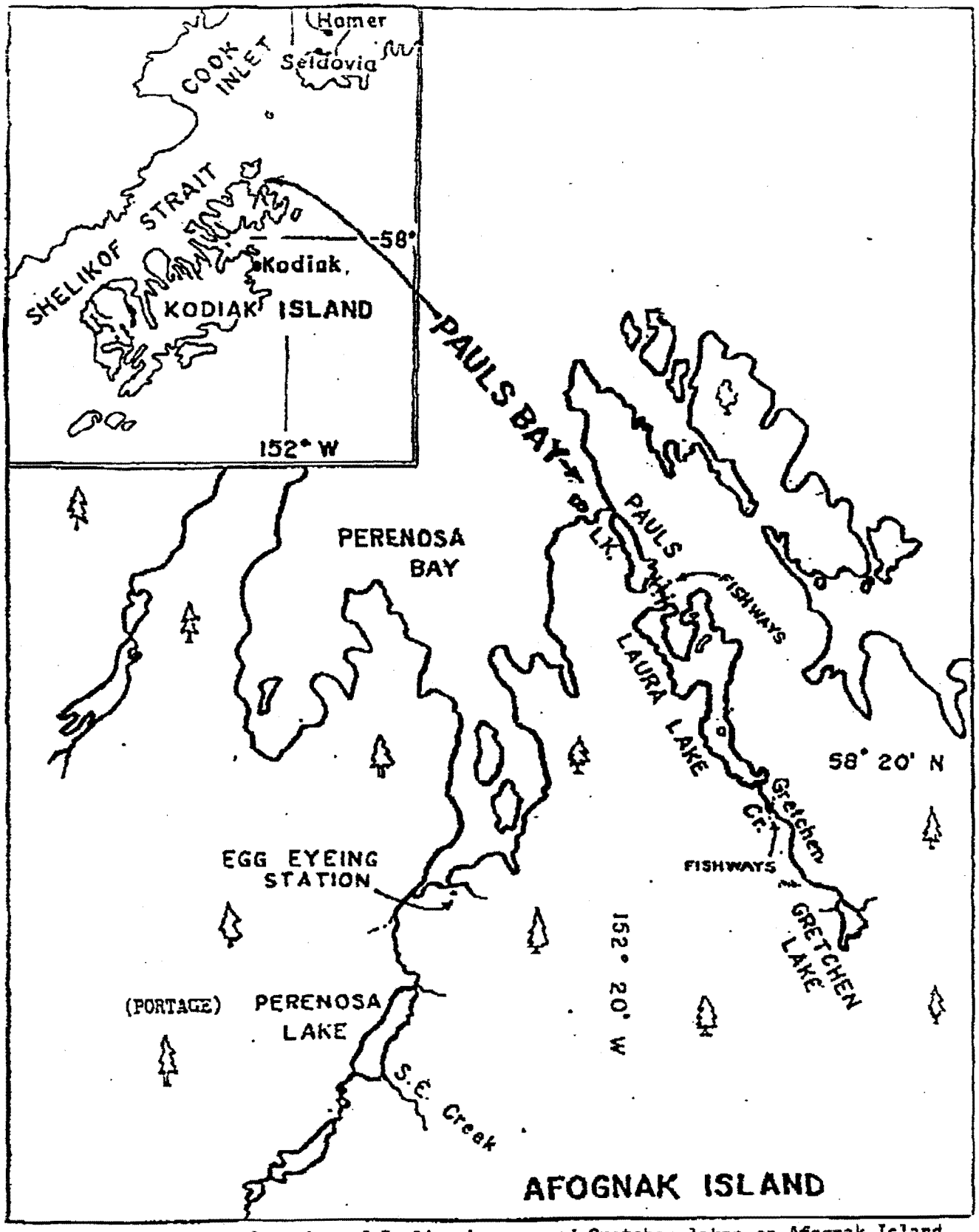


Figure 5. Geographic location of Paul's, Laura, and Gretchen lakes on Afognak Island.

3. Document project progress and results.

This objective will be addressed in FY 97 and completed in FY 99 with submission of final report.

4. Comply with supplementation criteria and guidelines.

This objective will be an ongoing part of the project until completion in FY 99.

**C. Completion Date**

The project field work is scheduled to be completed by the end of FY98 (September 30, 1998). Additional juvenile study may be necessary in FY 99, however, should not extend the final report beyond FY 99.

**PUBLICATIONS AND REPORTS**

A project annual report (FY 96) will be submitted for peer review April 15, 1997. The Detailed Project Description for proposed work in FY 98 will be submitted to the Restoration Office by April 15, 1997.

**PROFESSIONAL CONFERENCES**

The principal investigator will attend the annual Restoration Workshop in FY 97 and present a project progress report. The workshop is not firmly scheduled at this time, however, is anticipated to occur in Anchorage.

**NORMAL AGENCY MANAGEMENT**

The ADF&G, CFMD Division, Development Section operates a sockeye and pink salmon development project at Little Waterfall Creek. Little Waterfall Creek has three existing barrier bypass structures which currently enhance pink salmon production. Little Waterfall Lake is stocked with sockeye salmon from Pillar Creek Hatchery which is operated by KRAA. The Department conducts all maintenance, monitoring and evaluation activities associated with this fisheries development program with funding provide by KRAA through program receipts. This includes lake enrichment, smolt sampling, limnological sampling, and weir operation. In addition, the Finfish Management Section of CFMD Division conducts fisheries management operations in the area which includes egg-to-fry survival indexing at Little Waterfall Creek.

Other programs that are operated in the northern Afognak area by the ADF&G include: Paul's Lake adult salmon weir, Paul's, Laura and Gretchen Creek barrier bypass operation; lake assessment and smolt studies at Laura, Paul's, Portage, and Hidden Lakes; lake enrichment at Portage, Little Waterfall, and Laura Lakes; and egg-to-fry survival indexing at various streams. With the exception of egg-to-fry survival indexing, all portions of these programs are funded through KRAA program receipts. Also, KRAA operates a sockeye stocking program facilitated through Pillar Creek Hatchery, at Hidden Lake. In addition, KRAA operates Kitoi Bay Hatchery on northern Afognak Island, producing pink, coho, chum and sockeye salmon for commercial harvest. All evaluation associated with Pillar Creek and Kitoi Bay hatcheries is conducted by ADF&G with funds provided by KRAA program receipts. Lastly, the Alaska Department of Natural Resources, Kodiak State Parks operates several coho escapement weirs on

Shuyak Island, located just north of Afognak Island. The ADF&G provides equipment and logistical support, as well as conducting aerial salmon escapement surveys in the area.

The commercial fishery management activities associated with all of the preceding programs are provided by ADF&G, CFMD Division with general fund monies.

Table 2. Agency and non-agency contributions to this project or relating to the resource or service area.

| Program | Funding Source | Amount FY 96 ($1,000's) |
|---|---|---|
| Perenosa Rehab/Dev.<br>L. Waterfall<br>Portage<br>Paul's | ADF&G-Program Receipts | 46.0 |
| Lake Assess<br>L.Waterfall<br>Portage<br>Laura<br>Hidden<br>L. Kitoi<br>B. Kitoi<br>Sorg<br>Ruth | ADF&G-Program Receipts | 30.0 |
| Kitoi Eval. | ADF&G-Program Receipts | 47.0 |
| Hidden Lake Eval. | ADF&G-Program Receipts | 28.0 |
| Pre-emerg. sample | ADF&G-General Funds | 5.9 |
| Aerial Surveys | ADF&G-General Funds | 1.4 |
| Shuyak Weirs | ADNR-General Funds | 10.2 |
| Shuyak support/Mgmt. | ADF&G-General Funds | 1.1 |
| Lake Enrich.<br>L. Waterfall<br>Portage<br>Laura | KRAA | 69.0 |
| Kitoi Hatchery | KRAA | 1264.0 |
| Pillar Hatchery | KRAA | 97.2 |

The proposed work for FY 97 will provide for a thorough evaluation of the barrier bypass improvements at Little Waterfall Creek. Similar evaluation work has been conducted by ADFG personnel with KRAA funds in the past, however, only pink salmon escapement has been monitored. This monitoring has been scaled back by ADFG, thus Trustee Council funding will allow for escapement surveys adequate to evaluate the project. In addition, ADFG and KRAA have not previously conducted juvenile pink and coho monitoring, with the exception of pre-emergent samples downstream of the bypass. This project

will allow for pre-emergent sampling upstream of the bypass, as well as sampling for coho salmon rearing abundance. Lastly, normal agency funds are currently limiting thorough reporting of data collected at Little Waterfall. Trustee Council funding will provide for thorough reporting of the results of the project.

## COORDINATION OF INTEGRATED RESEARCH EFFORT

This project will be coordinated with existing ADF&G restoration studies in the northern Afognak area. Ongoing restoration and development programs at Little Waterfall Creek will assist this project by providing technical and logistical support. Previous methodology employed by ADF&G staff such as barrier bypass construction and maintenance, spawner enumeration, and egg-to-fry survival estimates, will be utilized on this project. This project will build on a program at Little Waterfall that was initiated in the 1970's, as well as other similar programs on Afognak Island, initiated as early as 1952. Project planning, permitting, operation, data analysis and reporting, will be coordinated through the Kodiak CFMD Division staff and Regional Director of KRAA.

This project compliments ADF&G management programs, as well as KRAA enhancement activities by providing data on escapements, and juvenile salmon survivals that are not normal agency duties. Likewise, staffing, equipment, and baseline data that have been and are currently part of the ADF&G and KRAA programs at L. Waterfall and nearby areas assist with this project.

## EXPLANATION OF CHANGES IN CONTINUING PROJECTS

The Project Design and Schedule described in this DPD differ from the FY 96 DPD due to barrier bypass modification (construction) delays. The contractor's schedule and poor weather conditions, prevented construction to be complete in FY 95 as scheduled. The construction was finished in November 1996, thus the evaluation of the project, scheduled to begin in FY 96, will begin in FY 97. In addition, peer review comments (Appendix 1) have been incorporated into this DPD to strengthen methodology. Primarily, the focus of these changes addresses, production assumptions, supplementation criteria and literature citations. Lastly, statistical tests have been incorporated into the project to assess differences in pre and post project salmon production .

## PRINCIPAL INVESTIGATOR

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**PERSONNEL**

Steven G. Honnold
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March, 1989 to present. Fisheries Biologist - Assistant Area Biologist, Fisheries Enhancement Rehabilitation and Development Division (FRED), Alaska Department of Fish and Game (ADF&G), Kodiak, Alaska. The merger of FRED and Commercial Fisheries Divisions of ADF&G (July 1, 1994) upgraded this position to Area Development Biologist.

Responsibilities include: planning, implementation, data analysis, and report writing for all Kodiak FRED/OSIAR (H&R) Division damage assessment studies and restoration programs, as result of EVOS. Studies included early marine life history damage assessment (this study was in the late planning phase when canceled), juvenile sockeye damage assessment via hydroacoustic surveys and limnological assessment of Red and Akalura Lakes, Red Lake restoration planning and NEPA reporting, and instream habitat and stock restoration feasibility - barrier bypass technique evaluation. Additional responsibilities include all Kodiak and Afognak Island rehabilitation, enhancement or development projects conducted by the Development Section of CFMD Division. Projects include Spiridon Lake sockeye salmon development, Kitoi Hatchery evaluation, Kodiak lake limnology, Perenosa Rehab./Enhance., Malina and Afognak Lakes Rehabilitation, Ugak Development and Hidden Lake Development. Duties associated with these projects include: barrier bypass construction, maintenance and evaluation, sockeye stocking and subsequent smolt and fingerling monitoring and evaluation, lake limnology studies, and all associated planning, personnel supervision, data quality control and analysis, budget development, report writing, and presentation of results at professional and public forums. Lastly, he is responsible for a program on the Alaska Peninsula to assess the feasibility of coho and sockeye salmon development.

The Project Leader (Steven G. Honnold - PCN 11-7045) and associated support personnel contribute significant time to the project with funding provided by existing agency programs.

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July, 1995 to present. Biometrician II (this position requires a minimum of a Masters Degree in either statistics or biostatistics, my Masters degree is in biostatistics). My responsibilities center around developing, analyzing, and reporting fisheries studies associated with stock population parameters including population abundance, multi-stock and age seperation, growth rates, survival rates, and maturity models. The species which these types of work were done are: king crab (blue and red), Tanner crab (opilio, bairdi and tanneri), Korean hair crab, spot shrimp, salmon (sockeye, coho, chinook, chum and pink), herring and several speices of groundfish (specifically pollock, black rockfish, sablefish and Pacific cod). The data collected for these studies has been from weir samples, dip-net samples (both within a river system and hatchery), trawl surveys, pot surveys, and catch samples. The job also requires assisting biologists on simple and complicated presentations and reports which must be submitted to such agencies as the Alaska Board of Fisheries and the North

Pacific Fisheries Management Council and reviewing written material for publication. The job has recently required setting up and using GIS packages. Lastly, this job requires supervising two other biometricians (Biometrician I's).

October ,1991-June, 1995. Biometrician I (same requirements as Biometrician I). The responsibilites for this position are the same as for the Biometrician I, except it did not require supervising anyone.

## LITERATURE CITED


Barrett, B. M., C. O. Swanton, and P. A. Roche. 1990. An estimate of the 1989 Kodiak management area salmon catch, escapement, and run number had there been a normal fishery without the *Exxon Valdez* Oil Spill. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K90-35.

Blackett, R. F. 1987. Development and performance of an Alaska steeppass fishway for sockeye salmon (*Oncorhynchus nerka*). Canadian Journal of Fisheries and Aquatic Sciences. Vol. 44, No. 1. p. 66-76.

Chambers, J. S., G. H. Allen and R. T. Presley. 1955. Research relating to the study of spawning grounds in natural areas. *In* W. R. Meehan (ed.) Influence of forest and rangeland management on anadromous fish habitat in the Western United States and Canada. USDA Forest Service. General Technical Report PNW-96.

Chapman, D. W. 1986. Salmon and steelhead abundance in the Columbie River in the nineteenth century. American Fisheries Society 115:662-670.

Donnelly, R. F. 1983. Factors affecting the abundance of Kodiak Archapelago pink salmon (*Oncorynchus gorbuscha*). A dissertation submitted in partial fulfillment of the requirement for the degree of Doctor of Philosophy, University of Washington. 157 p.

Edmundson, J. A. , S. G. Honnold, and G. B. Kyle. 1994. Trophic responses to juvenile sockeye salmon (*Oncorhynchus nerka)* stocking and nutrient enrichment in barren Little Waterfall lake. Alaska Department of Fish and Game, Regional Information Report No. 5J94-13, Juneau.

Gray, P. L., Koerner, J. F., and R. A. Marriott. 1984. The use of minnow traps for evaluating rearing coho salmon (*Oncorynchus kisutch*), populations and habitat in southeastern Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries. Informational Leaflet. 70 p.

Hartman, J. L. and J. Richardson. 1993. Applying cost-benefit analysis to salmon restoration projects studies in the "Restoration Survey" of the EVOS Restoration program. *In:* survey and evaluation of instream habitat and stock restoration techniques for wild pink and chum salmon. Exxon Valdez oil spill Restoration Project 93063 final report, Alaska Department of Fish and Game, Habitat and Restoration Division, Anchorage.

Heard, W. R. 1978. Probable case of streambed overseeding: 1967 pink salmon (*Oncorhynchus gorbuscha*) spawners and survival of their progeny in Sashin Creek, southeastern Alaska. Fish Bull. 76:569-582.

Honnold, S. G. 1994. Survey and evaluation of instream habitat and stock restoration techniques for wild pink, chum, coho and sockeye salmon Oil Spill Restoration Study 105 - Kodiak Island Component. *In*: : survey and evaluation of instream habitat and stock restoration techniques for wild pink and chum salmon. Exxon Valdez oil spill Restoration Project 93063 final report, Alaska Department of Fish and Game, Habitat and Restoration Division, Anchorage.

Honnold, S. G. 1995. Salmon instream habitat and stock restoration - Little Waterfall barrier bypass improvement Detailed Project Description (FY 96) to *Exxon Valdez* oil spill trustee council, 11 p.

Honnold, S. G. 1991 Assessment and evaluation of the performance of fishpasses located on Afognak Island. Unpublished report. Alaska Department of Fish and Game, Kodiak.

Honnold, S. G. and J. A. Edmundson. 1993. Limnological and fisheries assessment of sockeye salmon (*Oncorhynchus nerka*) production in the Laura Lake system. Alaska Department of Fish and Game, FRED Division Report Series 130:55 p.

Kyle, G. B. 1990. Aspects of the food habits and rearing behavior of underyearling coho salmon (*Oncorhynchus kisutch*) in Bear Lake, Kenai Peninsula, Alaska. Alaska Department of Fish and Game, FRED Division Report Series 105:36 p.

McDaniel, T. R. 1981. Evaluation of pink salmon (*Oncorhynchus gorbuscha*) fry plants at Seal Bay creek, Afognak Island, Alaska. Alaska Department of Fish and Game Informational Leaflet No. 193, 9 p.

McNeil, W. J. 1964. A method of measuring mortality of pink salmon eggs and larvea. U.S. Fish and Wildl. Serv., Fish. Bull. 63: 575-588.

Prince William Sound Aquaculture Association. 1991. Production planning recommendations to the Board. Prince William Sound Aquaculture Association, Cordova, Alaska.

Olsen, R. A. and M. Wenger. 1991. Cooper Landing Cooperative Project, Stream Habitat Monitoring. USFS Internal Report.

Schmidt, D. C., K.E. Tarbox, B. M. Barrett, L.K. Brannian, S. R. Carlson, J. A. Edmundson, J.M. Edmundson, S. G. Honnold, B.E. King, G. B. Kyle, P. A. Roche, P. Shields, and C. O. Swanton. 1993. Sockeye salmon overescapement, *Exxon Valdez* Oil Spill State/Federal Natural Resource Damage Assessment Final Report (Fish/Shellfish Study Number 27), Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Soldotna, Alaska.

Sharr, S. , T. M. Willette, C. J. Peckham, D. G. Sharp, J. L. Smith, D.G. Evans, and B. G. Bue. 1993. Coded wire tag studies on PWS salmon. Natural Resource Damage Assessment Fish/Shellfish Study Number 3, Alaska Department of Fish and Game, Cordova.

Sheng, M.D. , M. Foy, and A. Y. Fedorenko. 1990. Coho salmon enhancement in British Columbiea using improvced grouindwater-fed side channels. Can. Man. Rep. Fish. and Aquat. Sci. no. 2071.

Swanton, C. O., T. J. Dalton, B. M. Barrett, D. Pengilly, K. R. Brennan, and P. A. Nelson. 1993. Effects of pink samon (*Oncorhynchus gorbuscha*) escapement level on egg retention, preemergent fry, and adult returns to the Kodiak and Chignik management areas caused by the *Exxon Valdez* Oil Spill State/Federal Natural Resource Damage Assessment Final Report (Fish/Shellfish Study Numbers 7b and 8B), Alaska Department fofFish and Game, Commeciala Fisheries Management and Development Division, Kodiak, Alaska.

White, L. E. 1980. Evaluation of a new planting device for salmon eggs. Prog. Fish. Cult. 42:177-180.

White, L. E. 1986. Successful rehabilitation of a sockeye stock utilizing an egg planting device. Proceedings of the Northwest Fish Culture Conference. Eugene, Oregon.

White, L. E. 1988. Karluk Lake sockeye salmon investigations: successful rehabilitation of Upper Thumb river sockeye salmon stock. Alaska Department of Fish and Game, FRED Division, Federal Aid in Anadromous Fish Conservation annual report. 27 p.

Willette, M. T., N. Dudiak, and S. G. Honnold. 1994. Survey and evaluation of instream habitat and stock restoration techniques for wild pink and chum salmon. *Exxon Valdez* oil spill Restoration Project 93063 final report, Alaska Department of Fish and Game, Habitat and Restoration Division, Anchorage. 173 p.

Appendix 1. Response to peer review of FY 96 Detailed Project Description for Little Waterfall Barrier Bypass Improvement.


# STATE OF ALASKA

**DEPARTMENT OF FISH AND GAME**

*DIVISION OF COMMERCIAL FISHERIES*
*MANAGEMENT AND DEVELOPMENT*

*TONY KNOWLES, GOVERNOR*

*211 Mission Road*
*KODIAK, AK 99615*
*PHONE: (907) 486-1873*
*FAX: (907) 486-1841*


June 14, 1995

Ms. Molly McCammon
Executive Director
Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G. Street, Suite 401
Anchorage, Alaska 99501-3451

Dear Ms. McCammon:

I am writing you in response to your memorandum of April 10, 1995 to Joe Sullivan regarding Project 95139A/Salmon Instream Habitat and Stock Restoration - Little Waterfall Creek Barrier Bypass. I apologize for the delay in my response. I interpreted your letter as approval of the DPD and FY95 budget with the response to peer review comments due prior to field work. Apparently, this was a misinterpretation on my part, and funds are now on hold until comments are provided. Thus, this letter includes my response to Dr. Spies comments on the DPD as follows:

**1) "The discussion nor the objectives mention evaluation of effects of enhancement on fish and other associated species which may be resident in the affected areas. Are there resident species, and if so, what would be the impact of salmon enhancement on them?"**

Yes, there are resident species in Little Waterfall Creek. These include Dolly Varden char (*Salvelinus malma*), rainbow or steelhead trout (*Onchorynchus mykiss*), three spine stickleback (*Gasterosteus aculeatus*), freshwater sculpin (*Cottus aleuticus*), and a small number of sockeye salmon (*O. nerka*). The abundance of Dolly varden has not been documented in recent years, however, I have not observed more than fifty in my stream walks on the system. The steelhead trout population is minimal, with usually less than a dozen observed from May through October. The target species of this project, pink (*O. gorbuscha*) and coho salmon (*O. kisutch*) have also occurred in the system historically. Pink salmon escapements of a few thousand occurred prior to the construction of the three fishpasses in the 1970's and early 1980's. Coho salmon numbers were minimal (not a lot of documentation) prior to the project. The initial enhancement work, targeting pink salmon, occurred after interagency review (ADF&G and the USFS) of the proposed project. Although I have not taken the time to locate and review comments by the agencies, I assume that the necessary habitat permit requirements were adhered to, allowing construction and operation of the fishpasses. Habitat permitting requirements, in most cases, address non-target species habitat requirements. Thus, I believe this question has been addressed appropriately in the past. In addition, the habitat permits for modification to the third fishpass have been approved and

plans have been made to adhere to permitting requirements. The increased production of pink salmon fry will provide additional forage for both steelhead and Dolly varden. In addition, spawning habitat availability for both species will be increased by the project.

**2) "the proposal appears to assume that seeding of the affected spawning grounds should occur by means of colonization from salmon populations that now exist in no-affected areas" - not stated in the proposal.**

The seeding of habitat not presently at full production will be by natural colonization.

**3) "since juvenile coho salmon eat pink salmon, some discussion of the potential for interspecific competition to reduce the actual benefits of the enhancement project should occur."**

The majority of salmon producing systems on Kodiak Island produce both pink and coho salmon. I agree that some pink salmon fry will be eaten by juvenile coho salmon. Temporal and spatial separation contributes to the coexistence and success of both species. Pink salmon fry emerge from mid March to late May at L. Waterfall and immediately move out of the freshwater to the estuary. Since spawning habitat requirements between the species vary at L. Waterfall, juvenile coho are often found in areas that pink salmon fry are not, thus, possibly, limiting some interspecific competition. There is, however, definitely overlap, as with all other Kodiak salmon systems. If spawning habitat access is improved, then both species should have equal opportunity to utilize it and produce juveniles. Interspecific competition would remain at a similar level as occurring now if the rate of increased escapement is similar for each species. The improved habitat access will, potentially, be more beneficial to pink salmon, since rearing habitat is the limiting factor for coho salmon, thus indigenous species should benefit or be unaffected by the project.

**4) " how will harvest regulations be designed to take advantage of the increased salmon production, and is there any potential for mixed stock harvest management dilemmas to be created by the increased production?"**

All salmon systems in Alaska are managed for optimum escapement. Salmon fisheries in the Kodiak Management Area (Area K) are managed to provide for potential maximum production of future returns, to provide for orderly fisheries on high quality salmon, and to meet allocative requirements of the Board of Fish. The harvest strategy for pink salmon produced at L. Waterfall is part of the overall Area K pink salmon harvest strategy and includes a fixed opening date of July 6, a forecasting program (based on preemergent fry sampling indices and ambient temperature) to set the length of the initial fishing periods, and coordination of multiple fisheries when possible to disperse the fleet. The fishing periods are based on the forecast and, generally, occur 3.5 days weekly from July 6 - August 25, but may extend to seven days a week during peak harvest periods (late July through mid August). This harvest strategy is not expected to change with increased pink salmon production from this project. More fishing time and closed water boundaries can be adjusted in the event of extremely large runs. Coho harvest strategy in Area K is based on reaching the optimum escapements. This harvest strategy is expected to provide for adequate management of coho returns generated by this project.

**5) "there are no calculations shown, nor is any literature cited, which would allow the reader to evaluate the reasonableness of either the annual production potential attributed to the affected areas or the annual spawning capacities attributed to the affected areas."**

The following spawner density, fecundity, survivals and exploitation rates were used as planning assumptions to forecast pink and coho salmon production benefits for this project:

Pink Salmon

| parameter | Mean | Source (Area) |
|---|---|---|
| Optimum female density (#/sq.m) | 0.7 | Heard (1978) |
| Average fecundity | 1858 | Prince William Sound |
| Egg-fry survival (%) | 6.4 | SE Alaska |
| Marine survival rate (%) | 3.1 | Alaska |
| Exploitation rate (%) | 54 | Kodiak |

Coho Salmon

| parameter | Mean | Source (Area) |
|---|---|---|
| Optimum female density (#/sq.m) | 0.08 | Shang et al (1990) |
| Average fecundity | 4835 | Alaska |
| Egg-fry survival (%) | 7.4 | Kodiak |
| Marine survival rate (%) | 4.1 | Washington, California |
| Exploitation rate (%) | 75 | Chapman (1986) |

Spawning habitat evaluation parameters are described in the final report for Restoration Project 93063, Survey and Evaluation of Instream Habitat and Stock Restoration Techniques for Wild Pink and Chum Salmon. This report was authored by Willette, Dudiak, and Honnold and submitted in 1995.

6) "Literature citation are too few."

The attached pages from the final report for Restoration Project 93063, as described above, provide citations. Please refer to this report for additional information if needed.

This completes my response to Dr.Spies comments. If additional information is needed I will be happy to provide it at your convenience. Thank you for the opportunity to comment.

Sincerely,

Steven G. Honnold
Fishery Biologist

Attachment:

cc: Bob Spies
Traci Cramer
Bill Hauser
Joe Sullivan
Bruce McCurtain
Pete Probasco
Wayne Donaldson

# 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1996 | Proposed FFY 1997 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Personnel | | $20.6 | | | | | | |
| Travel | | $1.0 | | | | | | |
| Contractual | | $1.2 | | | | | | |
| Commodities | | $0.4 | | | | | | |
| Equipment | | $0.0 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
| Subtotal | $0.0 | $23.2 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| General Administration | | $3.2 | | | | | | |
| Project Total | $0.0 | $26.4 | $23.0 | $9.0 | | | | |
| Full-time Equivalents (FTE) | | 0.5 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

Comments:

**1997**

Prepared: 12 Apr 96
Received Apr 96



Project Number: 97139A1
Project Title: Salmon Instream Habitat and Stock Restoration
Sub Project: Little Waterfall Creek Barrier Bypass Improvement
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

5/7/96

1997 EXXON VALDEZ TRUS[illegible] COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

| Personnel Costs: | | GS/Range/ | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|
| Name | Position Description | Step | Budgeted | Costs | Overtime | FFY 1997 |
| S.Schrof PCN 5270 | Fishery Biologist I | 14C | 3.0 | 4.6 | 0.0 | 13.8 |
| G. Watchers PCN 5297 | FW Tech III | 11F | 1.0 | 4.0 | 0.0 | 4.0 |
| S. Honnold PCN 7045 | FB III | 18B | 0.5 | 5.5 | | 2.8 |
| S. Honnold PCN 7045 | FB III | 18B | 1.0 | in kind | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | Subtotal | | 5.5 | 14.1 | 0.0 | |
| | | | | | Personnel Total | $20.6 |

| Travel Costs: | Ticket | Round | Total | Daily | Proposed |
|---|---|---|---|---|---|
| Description | Price | Trips | Days | Per Diem | FFY 1997 |
| Travel to workshop - Kodiak-Anchorage round trip | 0.4 | 1 | 3 | 0.2 | 1.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | Travel Total | $1.0 |

1997

Prepared:

Project Number: 97139A1
Project Title: Salmon Instream Habitat and Stock Restoration
Sub Project: Little Waterfall Creek Barrier Bypass Improvement
Agency: ADFG

FORM 3B
Personnel
& Travel
DETAIL



5/7/96

# 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Contractual Costs: | Proposed |
|---|---|
| Description | FFY 1997 |
| aircraft charters: 4 hr of C206@295/hr | 1.2 |
| helecopter charter: 2 hr of B206 @ 650/hr; 4 hr of standby at 325/hr - in kind | 0.0 |
| When a non-trustee organization is used, the form 4A is required. **Contractual Total** | $1.2 |

| Commodities Costs: | Proposed |
|---|---|
| Description | FFY 1997 |
| film and photo processing | 0.1 |
| groceries: 20 mandays@ $15/day | 0.3 |
| field supplies: hip boots, polorized glasses, field notebooks, minnow traps, buckets, etc - in kind | 0.0 |
| **Commodities Total** | $0.4 |

**1997**

Prepared:

Project Number: 97139A1
Project Title: Salmon Instream Habitat and Stock Restoration
Sub Project: Little Waterfall Creek Barrier Bypass Improvement
Agency: ADFG

FORM 3B
Contractual & Commodities DETAIL



5/7/96

## 1997 EXXON VALDEZ TRUS[illegible] COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| New Equipment Purchases: Description | Number of Units | Unit Price | Proposed FFY 1997 |
|---|---|---|---|
| | | | 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 |
|---|---|---|
| pre-emergent pumps | 2 | ADFG |
| flow meter | 1 | ADFG |

**1997**

Prepared:

4 of 4

Project Number: 97139A1
Project Title: Salmon Instream Habitat and Stock Restoration
Sub Project: Little Waterfall Creek Barrier Bypass Improvement
Agency: ADFG

FORM 3B
Equipment
DETAIL

5/7/96

**Salmon Instream Habitat and Stock Restoration - L. Waterfall Barrier Bypass Improvement**

**FY 97 DETAILED PROJECT DESCRIPTION**
**( incomplete submission: to be finalized and submitted with FY 95 annual report - see explanation below)**

| | |
|---|---|
| **Project ID number:** | 97139A1 |
| **Restoration Category:** | General Restoration |
| **Proposer:** | Alaska Department of Fish and Game |
| **Lead Trustee Agency:** | Alaska Department of Fish and Game |
| **Cooperating Agencies:** | None |
| **Duration:** | October 1, 1996 through September 30, 1997<br>3rd year, 4- year project |
| **Cost FY97:** | $26,400 |
| **Cost FY 98:** | $23,000 |
| **Cost FY 99:** | $9,000 |
| **Geographic Area:** | Afognak Island (Kodiak Island) |
| **Injured Resource/Service:** | The project is intended to mitigate for and restore pink and coho salmon resources on Afognak Island. |



## ABSTRACT

This proposal will provide for continuation of Project 96139A1 and will focus on evaluation of barrier bypass improvement at Little Waterfall Creek, as indicated by pink (*Onchorynchus gorbuscha*) and coho salmon (*Onchorynchus kisutch*) use of the bypass. The renovation of the bypass (decreased grades and addition resting pools) was completed in FY96 and is expected to facilitate increased spawning habitat use by pink and coho salmon, thus will increase salmon production to optimum levels in ensuing years. Studies in FY 97 will include bypass inspections to document salmon passage, spawner enumeration, and juvenile salmon abundance monitoring.

## INTRODUCTION

The proposed project is a continuation of restoration efforts initiated in 1994 (Project 94139A1) which began as result of surveys (Restoration Study 93063) conducted on Kodiak Island which evaluated instream habitat and stock restoration techniques for wild salmon stocks (Willette et al. 1994). The emphasis of this evaluation was to improve or develop spawning habitat at systems with barriers to salmon passage which have historically prevented access. Surveys focused on systems which were directly impacted or were located in proximity to areas impacted by the *Exxon Valdez* oil spill (EVOS) with the intent of mitigating for injured spawning habitat (Figure 1). Data collected from these surveys were analyzed, including a cost to benefit analysis, to determine the most effective mitigation techniques for Kodiak Island salmon systems. As result of these surveys, The **Exxon Valdez Oil Spill Trustee Council** selected L. Waterfall Creek as a site for spawning habitat mitigation.

In FY95, pre-construction production parameters were assessed (coho salmon escapement), final engineering surveys completed, and design for bypass improvements finalized. In addition, engineering documents were completed for the contract bidding process, and the contract was awarded to SeaCoast Construction. Construction , however, scheduled to begin in July, and be completed near the end of the fiscal year, was delayed due to poor work conditions as result of high water events. Thus, construction did not begin until FY 96, and was completed in November. The delay in construction prevented evaluation of bypass use since salmon were not present in L. Waterfall Creek at that time. However, the evaluation of pre- project production continued with salmon escapement and juvenile rearing abundance surveys, and egg to fry abundance estimates conducted. For the remainder of FY 96, upon inspection of the renovated bypass, any additional work required to complete bypass improvements will be conducted with contingency funds previously allocated. In addition, juvenile rearing abundance surveys, bypass use evaluation and spawner distribution surveys will be conducted.

## EXPLANATION OF PARTIAL SUBMISSION

Upon peer review of the FY 96 Detailed Project Description for Little Waterfall Barrier Bypass Improvement several questions were raised by the reviewer. These questions were addressed in a letter to Ms. Molly McCammon (June 14, 1995) which satisfied the reviewers concerns, thus resulted in approval of the FY 96 DPD and requested budget (see attachment 1). To alleviate similar questions that could arise upon review of the FY 97 DPD, pertinent information will be included in the final DPD.

Also, some confusion arose as result of the annual reporting requirement and the DPD requirement. The 3 April "Reminders" memo from Ms. McCammon clarified the need for improved formatting and inclusion of more thorough data summary. As result, a

request for extension for two weeks was submitted and approved (Attachment 2). However, confusion persisted in regard to the combination of the annual report and the DPD. It was assumed that combining these two documents would be efficient since much of the same data and information was required. Since this was not an accurate assumption, and the DPD and budget request is due April 15, this document represents partial submission of requirement for the FY 97 DPD. The complete DPD will be submitted in conjunction with the annual report by April 30, 1996.

The proposed work for FY 97 will include continued evaluation of the bypass for salmon usage, juvenile salmon abundance indexing and adult salmon spawner distribution estimates. A man-month of Fishery Biologist salary for report writing has been added for FY 97, with other costs associated with the evaluation work, remaining similar to FY 96 (Attachment 3). Previous reporting requirements have been funded by ADFG general fund.

**PROPOSED PRINCIPAL INVESTIGATOR**

Steve Honnold
ADF&G - CFMD
211 Mission Road
Kodiak, AK 99615-6399

ph 907-486-1873
fax 907-486-1841
Email steveh@fishgame.ak.us.state

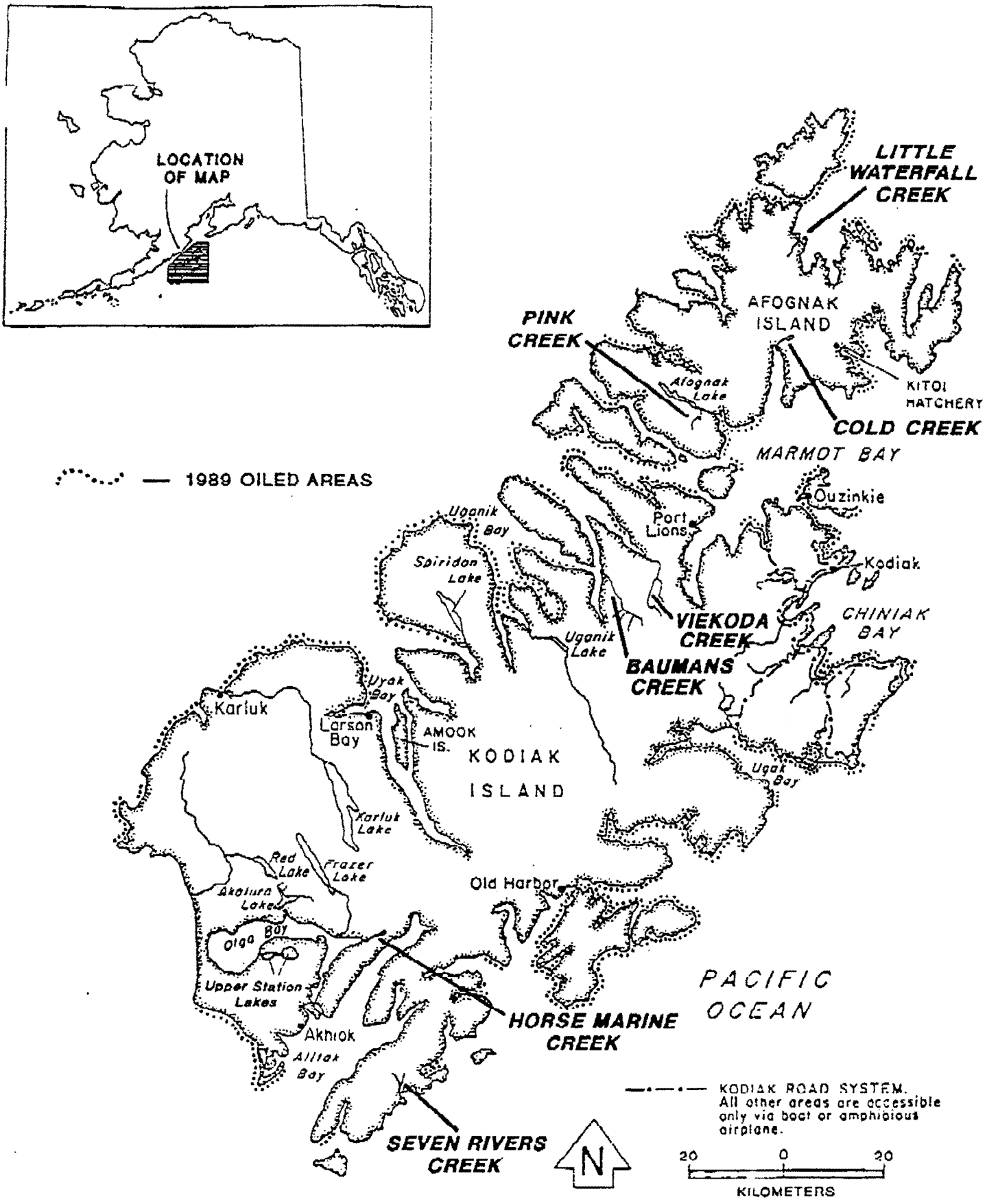


Figure 1. Location of 1989 oiled areas and salmon restoration/mitigation systems.

**ATTACHMENTS:**

1. Letter of Response from Steve Honnold (dated 14 June 1995) to a Memorandum from Molly McCammon (dated 10 April 1995).

2. Memorandum from Molly McCammon to Steve Honnold (dated 11 April 1996) to extend the due date for the FY 1995 Annual Report for the Little Waterfall Project (No. 95139A1).

3. FY 1996 Detailed Project Description for the Little Waterfall Project (No. 95139A1).

# STATE OF ALASKA

**DEPARTMENT OF FISH AND GAME**

*DIVISION OF COMMERCIAL FISHERIES*
*MANAGEMENT AND DEVELOPMENT*

*TONY KNOWLES, GOVERNOR*

*211 Mission Road*
*KODIAK, AK 99615*
*PHONE: (907) 486-1825*
*FAX: (907) 486-1841*


June 14, 1995

Ms. Molly McCammon
Executive Director
Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G. Street, Suite 401
Anchorage, Alaska 99501-3451

Dear Ms. McCammon:

I am writing you in response to your memorandum of April 10, 1995 to Joe Sullivan regarding Project 95139A/Salmon Instream Habitat and Stock Restoration - Little Waterfall Creek Barrier Bypass. I apologize for the delay in my response. I interpreted your letter as approval of the DPD and FY95 budget with the response to peer review comments due prior to field work. Apparently, this was a misinterpretation on my part, and funds are now on hold until comments are provided. Thus, this letter includes my response to Dr. Spies comments on the DPD as follows:

**1) "The discussion nor the objectives mention evaluation of effects of enhancement on fish and other associated species which may be resident in the affected areas. Are there resident species, and if so, what would be the impact of salmon enhancement on them?"**

Yes, there are resident species in Little Waterfall Creek. These include Dolly Varden char (*Salvelinus malma*), rainbow or steelhead trout (Onchorynchus mykiss), three spine stickleback (Gasterosteus aculeatus), freshwater sculpin (Cottus aleuticus), and a small number of sockeye salmon (O. nerka). The abundance of Dolly varden has not been documented in recent years, however, I have not observed more than fifty in my stream walks on the system. The steelhead trout population is minimal, with usually less than a dozen observed from May through October. The target species of this project, pink (O. gorbuscha) and coho salmon (O. kisutch) have also occurred in the system historically. Pink salmon escapements of a few thousand occurred prior to the construction of the three fishpasses in the 1970's and early 1980's. Coho salmon numbers were minimal (not a lot of documentation) prior to the project. The initial enhancement work, targeting pink salmon, occurred after interagency review (ADF&G and the USFS) of the proposed project. Although I have not taken the time to locate and review comments by the agencies, I assume that the necessary habitat permit requirements were adhered to, allowing construction and operation of the fishpasses. Habitat permitting requirements, in most cases, address non-target species habitat

requirements. Thus, I believe this question has been addressed appropriately in the past. In addition, the habitat permits for modification to the third fishpass have been approved and plans have been made to adhere to permitting requirements. The increased production of pink salmon fry will provide additional forage for both steelhead and Dolly varden. In addition, spawning habitat availability for both species will be increased by the project.

**2) "the proposal appears to assume that seeding of the affected spawning grounds should occur by means of colonization from salmon populations that now exist in no-affected areas" - not stated in the proposal.**

The seeding of habitat not presently at full production will be by natural colonization.

**3) "since juvenile coho salmon eat pink salmon, some discussion of the potential for interspecific competition to reduce the actual benefits of the enhancement project should occur."**

The majority of salmon producing systems on Kodiak Island produce both pink and coho salmon. I agree that some pink salmon fry will undoubtably be eaten by juvenile coho salmon. Temporal and spatial separation contributes to the coexistence and success of both species. Pink salmon fry emerge from mid March to late May at L.Waterfall and immediately move out of the freshwater to the estuary. Since spawning habitat requirements between the species vary at L.Waterfall, juvenile coho are often found in areas that pink salmon fry are not, thus, possibly, limiting some interspecific competition. There is, however, definitely overlap, as with all other Kodiak salmon systems. If spawning habitat access is improved, then both species should have equal opportunity to utilize it and produce juveniles. Interspecific competition would remain at a similar level as occurring now if the rate of increased escapement is similar for each species. The improved habitat access will, potentially, be more beneficial to pink salmon, since rearing habitat is the limiting factor for coho salmon, thus indigenous species should benefit or be unaffected by the project.

**4) " how will harvest regulations be designed to take advantage of the increased salmon production, and is there any potential for mixed stock harvest management dilemmas to be created by the increased production?"**

All salmon systems in Alaska are managed for optimum escapement. Harvest regulations are currently in place to harvest pink salmon produced at L.Waterfall. No change to these regulations is expected with increased pink salmon production from this project. More fishing time and closed water boundaries can be adjusted in the event of extremely large runs. Coho harvest regulations are also currently in place in Perenosa Bay and will allow adequate management of the fishery. Thus, mixed stock harvest management problems are not anticipated.

**5) "there are no calculations shown, nor is any literature cited, which would allow the reader to evaluate the reasonableness of either the annual production potential attributed to the affected areas or the annual spawning capacities attributed to the affected areas."**

The following spawner density, fecundity, survivals and exploitation rates were used as planning assumptions to forecast pink and coho salmon production benefits for this project:

Pink Salmon

| parameter | Mean | Source (Area) |
|---|---|---|
| Optimum female density (#/sq.m) | 0.7 | Heard (1978) |
| Average fecundity | 1858 | Prince William Sound |
| Egg-fry survival (%) | 6.4 | SE Alaska |
| Marine survival rate (%) | 3.1 | Alaska |
| Exploitation rate (%) | 54 | Kodiak |

Coho Salmon

| parameter | Mean | Source (Area) |
|---|---|---|
| Optimum female density (#/sq.m) | 0.08 | Shang et al (1990) |
| Average fecundity | 4835 | Alaska |
| Egg-fry survival (%) | 7.4 | Kodiak |
| Marine survival rate (%) | 4.1 | Washington, California |
| Exploitation rate (%) | 75 | Chapman (1986) |

Spawning habitat evaluation parameters are described in the final report for Restoration Project 93063, Survey and Evaluation of Instream Habitat and Stock Restoration Techniques for Wild Pink and Chum Salmon. This report was authored by Willette, Dudiak, and Honnold and submitted in 1995.

**6) "Literature citation are too few."**

I agree that more citations should have been included in the 1995 DPD. Future submissions will be more thorough in this regard. For this questions on literature citations on this project please refer to the final report for Restoration Project 93063 as described above.

This completes my response to Dr.Spies comments. If additional information is needed I will be happy to provide it at your convenience. Thank you for the opportunity to comment.

Sincerely,

Steven G. Honnold
Fishery Biologist

cc: Bob Spies
Traci Cramer
Bill Hauser
Joe Sullivan
Bruce McCurtain
Pete Probasco
Wayne Donaldson

**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**

**MEMORANDUM**

TO: Steve Honnold/ ADF&G
FAX (907) 486-1841

FROM: Molly McCammon
Executive Director

RE: Annual Report for Project 95139A1/Salmon Instream Habitat and Stock Restoration – Little Waterfall Creek Barrier Bypass

DATE: April 11, 1996

The purpose of this memorandum is to confirm an extended due date of April 30, 1996 for your annual report on Project 95139A1/Salmon Instream Habitat and Stock Restoration – Little Waterfall Creek Barrier Bypass. I understand that this extension will allow you to include more detail and analysis in the report.

cc: Bob Spies
Bill Hauser

Salmon Instream Habitat and Stock Restoration - L. Waterfall Barrier Bypass Improvement

FY 96 DETAILED PROJECT DESCRIPTION

**Project ID number:** 96139A1

**Restoration Category:** General Restoration

**Proposer:** Alaska Department of Fish and Game

**Lead Trustee Agency:** Alaska Department of Fish and Game

**Cooperating Agencies:** None

**Duration:** October 1, 1995 through Sepetember 30, 1996

**Cost FY96:** $49.7

**Geographic Area:** Afognak Island (Kodiak Island)

**Injured Resource/Service:** The project is intended to mitigate for and restore pink salmon resources on Afognak Island.

## ABSTRACT

This proposal will provide for continuation of Project 95139A including contingency funding to assure completion of barrier bypass improvement at Little Waterfall Creek. It will also provide for evaluation of the improvements as indicated by pink (*Onchorynchus gorbuscha*) and coho salmon (*Onchorynchus kisutch*) use of the the bypass once construction is complete. The project will facilitate increased spawning habitat use by pink and coho salmon by decreasing grades on an existing bypass structure, thus will increase salmon production to optimum levels in ensueing years.

## INTRODUCTION

The proposed project is a continuation of restoration efforts initiated in 1994 (Project 94139A1) which began as result of surveys (Restoration Study 105) conducted on Kodiak Island which evaluated instream habitat and stock restoration techniques for wild salmon stocks (Honnold 1994). The emphasis of this evaluation was to improve or develop spawning habitat at systems with barriers to salmon passage which have historically prevented access. Surveys focused on systems which were directly impacted or were located in proximity to areas impacted by the *Exxon Valdez* oil spill with the intent of mitigating for injured spawning habitat (Figure 1). Data collected from these surveys was analyzed, including a cost to benefit analysis, to determine the

most effective mitigation techniques for Kodiak Island salmon systems. As result of these surveys, The **Exxon Valdez Oil Spill Trustee Council** selected L. Waterfall Creek as a site for spawning habitat mitigation.

In FY95, pre-construction production parameters were assessed (coho salmon escapement), final engineering surveys completed, and design for bypass improvements finalized. Presently, project specifications are being completed for the contract bidding process. Construction is expected to begin in July, and be completed near the end of the fiscal year (September 30, 1995). In FY96, evaluation of the project will begin with salmon escapement and juvenile rearing abundance surveys, and egg to fry abundance estimates. Prior to evaluation of the project, any additional work required to complete bypass improvements as result of delays in the FY95 construction schedule (high flows or logistical problems could potentially occur to delay construction) will be conducted with contingency funds.

## NEED FOR THE PROJECT

### A. Statement of Problem

Several beaches on Afognak Island were heavily oiled in 1989, and remained oiled in 1990 (Barnhart personal communication). Little Waterfall Bay (Little Waterfall Creek drainage) was directly impacted by oil. Similar impacts in Prince William Sound (PWS) damaged salmon stocks.

Three barriers in Little Waterfall Creek have been bypassed with structures allowing increased pink and coho salmon passage to previously unused spawning habitat (Figure 2). The largest barrier bypass structure, however, has not operated efficiently and has impeded salmon passage into the largest portion of spawning habitat. This habitat (~17,000 $m^2$) comprises approximately 80% of the total stream habitat and can support 24,000 and 2,700 pink and coho salmon, respectively. The result of an evaluation of the present design and operation or the largest bypass structure determined several deficiencies, impacting salmon passage. The grade of the bypass is 27%, which is considered too steep (Bruce McCurtain, ADF&G, personal communication). For example, a slope of 22% or less is recommended for sockeye salmon when resting pools (similar to those at Little Waterfall) are employed (Blackett 1987). Pink salmon, a less vigorous fish, may require even less slope. Thus, the gradient of this bypass must be reduced. Initial engineering data indicates that the existing concrete resting tanks will need to be removed, the lower portion of the bypass extended, and two new resting tanks added (Figure 3).

### B. Rationale

Pink and coho salmon production will increase as result of these improvements. The potential harvest, from each years additional production, will be approximately 24,000 and 15,000 pink and coho salmon, respectively (Honnold 1994). Cost to benefit data indicates that this project would have benefits greater than costs of production (Hartman and Richardson 1993).

This project will assist in acheiving the objective, stated in the *Exxon Valdez Oil Spill Restoration Plan*, of accelerating the rate of recovery of damaged pink salmon resources on Afognak Island, and will also mitigate for injured spawning habitat in other areas of Kodiak Island.

**C. Summary of Major Hypotheses and Objectives**

The project objectives for FY96 are to supervise the completion of construction to improve the bypass (if not completed on schedule in FY95), and evaluate the success of the project by determining salmon spawning numbers and juvenile salmon relative abundance in habitat upstream of the improved bypass. Lastly, to provide necessary documentation of project progress and results.

The primary hypothesis for the proposed project is that decreased accessibility to upstream habitat due to the deficiencies of the present barrier bypass, has limited increased spawning activity and salmon production.

**D. Completion Date**

The project is scheduled to be completed by the end of FY96 (September 30, 1996). If construction is not completed on schedule by the end of FY95 (September 30, 1995), then the project may extend into FY97 to complete evaluation tasks.

**COMMUNITY INVOLVEMENT**

The residents of Kodiak and Afognak Islands will continue to be involved in this project through the EVOS Trustee Council planning process. Information is provided to the communities through restoration work sessions, project planning documents, and media coverage. In addition, members of the Kodiak Regional Aquaculture Association (KRAA), composed of area fishers, are informed of project proposals and status of ongoing projects at board meeting open to the public. The Kodiak Regional Planning Team, composed of KRAA, ADF&G and U.S. Fish and Wildlife Service participants assists with development of project proposals.

**FY 96 BUDGET**

| | |
|---|---|
| Personnel | 13.6 |
| Travel | 0.9 |
| Contractual | 26.1 |
| Commodities | 0.3 |
| Equipment | 0.0 |
| Subtotal | 40.9 |
| Gen. Admin. | 8.8 |
| Total | 49.7 |

This budget provides for evalutation of the project for one field season and includes contigency funding if construction is not completed on schedule in FY 95.

## PROJECT DESIGN

### A. Objectives:

The project objectives for FY96 are:

1. to supervise the completion of construction to improve the bypass (if not completed on schedule in FY95).

2. evaluate the success of the project by:
   a) estimating the salmon spawning numbers in habitat upstream of the improved bypass.

   b) determining the juvenile salmon relative abundance in habitat upstream of the improved bypass.

3. Document project progress and results.

### B. Methods:

If scheduled construction is extended into FY 96, compliance with the contract will be supervised by the Project Leader. Barrier bypass improvements at Little Waterfall Creek will focus on construction and modification of the present bypass structure at the third upstream barrier (Figure 3). The bypass grade will be reduced by removing the existing concrete resting tanks and extending the bypass to lower the gradient. This will require extending the bypass, adding two resting tanks, and an entrance tank.

Salmon spawning habitat usage will be determined upon completion of the improvement to the bypass. This will be accomplished by conducting foot surveys of L.Waterfall Creek from 15 August through 30 September. Live and dead salmon will enumerated during each survey in each section of the creek. Peak live counts will be used to determine indexed escapement of pink and coho salmon to upstream habitat.

Prior to fry emergence, spawning redds downstream and upstream of the barrier will be sampled for a relative index of egg-to-fry survival. Ten redds, in both locations, will be pumped to capture eggs and fry which will be enumerated by species. The relative abundance (catch-per-unit-effort) of juvenile coho salmon rearing downstream and upstream of the barrier will also be determined. Minnow traps will be set for two 24 hour periods at permanent sampling locations. All juvenile fish captured will enumerated by species and released.

The necessary documentation of project progress and results will be accomplished on schedule as outlined by the Trustee Council.

### C. Contracts and Other Agency Assistance:

The scheduled barrier bypass improvement will be accomplished by formal contract. The awarding of the contract in FY 95 and will be based on technical experience, previous work quality, and cost estimates. Previous barrier bypass construction projects by the State of Alaska, U.S. Forest Service and other state and federal agencies have been completed by construction contractors. This project is expected to require similar expertise. The present Project Design will require construction to be completed by October 31, 1995 (FY 96). Encumberance of funds, however, will occur in FY 95. Project maintenance and evaluation will be conducted by ADF&G personnel.

### D. Location

The project will be located at Little Waterfall Creek (stream number 251-822) on Afognak Island (Figure 1). Little Waterfall Creek drains into Little Waterfall Bay on northern Afognak Island. The benefits of this project will be realized by increasing pink and coho salmon returns to this system, providing more than 24,000 and 15,000 pink and coho salmon for harvest, respectively. The residents of the city of Kodiak, northern Afognak Island will benefit economically from this project through direct commercial fishery receipts and all associated business enhancement. In addition, sport fishers, guides, and lodge owners as well as subsistence fishers, will benefit directly and provide direct economic return to the associated communities.

## SCHEDULE

### A. Measurable Project Tasks for FY 96

This project will oversee completion of construction to improve the bypass structure and include a period of evaluation to determine the effectiveness of barrier bypass improvement and subsequent use of upstream spawning habitat. The FY 96 work plan is outlined in Table 1.

Table 1. Proposed schedule for Little Waterfall instream habitat improvement project.

| Task | Dates |
|---|---|
| Project construction and oversight | Start up - October 31 |
| Report writing, planning, administration | November 1 - March 10 |
| Egg-to-fry survival sampling | March 15 - March 30 |
| Juvenile coho abundance sampling | May 15 - June 15 |
| Spawner abundance and distribution surveys | August 10 - September 30 |
| Submit FY96 annual report | April 1997? |

**B. Project Milestones and Endpoints**

The following objectives will be accomplished in FY 96 and future years if necessary:

1. to supervise the completion of construction to improve the bypass (if not completed on schedule in FY95).

   Completion: October 31, 1995

2. evaluate the success of the project by:

   a) estimating the salmon spawning numbers in habitat upstream of the improved bypass.

   Completion: September 30, 1996

   b) determining the juvenile salmon relative abundance in habitat upstream of the improved bypass.

   Completion: June 30, 1997

3. Document project progress and results.

   Completion: September 30, 1997

**C. Project Reports**

A project report will be submitted for peer review March 30, 1996. Once peer review is complete the report will be submitted to the Cheif Scientist by April 15, 1996. A final report will be completed by January 1, 1998.

## COORDINATION OF INTEGRATED RESEARCH EFFORT

This project will be coordinated with existing ADF&G restoration studies in the northern Afognak area. Ongoing restoration and development programs at Little Waterfall Creek will assist this project by providing technical and logistical support. Previous methodology employed by ADF&G staff such as barrier bypass construction and maintenance, spawner enumeration, and egg-to-fry survival estimates, will be utilized on this project. This project will build on a program at Little Waterfall that was initiated in the 1970's, as well as other similar programs on Afognak Island, initiated as early as 1952. Project planning, permitting, operation, data analysis and reporting, will be coordinated through the Kodiak CFMD Division staff and Regional Director of KRAA.

This project compliments ADF&G management programs, as well as KRAA enhancement activities by providing data on escapements, and juvenile salmon survivals that are not normal agency duties. Likewise, staffing, equipment, and baseline data that have been and are currently part of the ADF&G and KRAA programs at L. Waterfall and nearby areas assist with this project.

## ENVIRONMENTAL COMPLIANCE

Little Waterfall Creek drainage is located on Afognak Native Corporation (ANC) land. The present program for fishery development has an existing lease with ANC to operate on this land. The construction and maintenance portions of this project are categorically excluded from the National Environmental Policy Act (NEPA). Other evaluation and monitoring activities fall within the existing fishery collection (and related scientific sampling) permits issued to ADF&G. General Waterway/Waterbody and Coastal Zone Consistency application/questionnaires will be submitted to ADF&G, Habitat and Restoration (H&R) Division as required to conduct project construction. No other permits or other coordination activities are required for this project.

## PERSONNEL

Steven G. Honnold
Commercial Fisheries Management and Development Division
211 Mission Road
Kodiak, Alaska 99615
(907)486-1873

March, 1989 to present. Fisheries Biologist - Assistant Area Biologist, Fisheries Enhancement Rehabilitation and Development Division (FRED), Alaska Department of Fish and Game (ADF&G), Kodiak, Alaska. The recent merger of FRED and Commercial Fisheries Divisions of ADF&G upgraded this position to Area Development Biologist.

Responsibilities include: planning, implementation, data analysis, and report writing for all Kodiak FRED/OSIAR (H&R) Division damage assessment studies and restoration programs, as result of EVOS. Studies included early marine life history damage assessment (this study was in the late planning phase when canceled), juvenile sockeye damage assessment via hydroacoustic surveys and limnological assessment of Red and Akalura Lakes, Red Lake restoration planning and NEPA reporting, and instream habitat and stock restoration feasibility - barrier bypass technique evaluation. Additional responsibilities include all Kodiak and Afognak Island rehabilitation, enhancement or development projects conducted by the Development Section of CFMD Division. Projects include Spiridon Lake sockeye salmon development, Kitoi Hatchery evaluation, Kodiak lake limnology, Perenosa Rehab./Enhance., Malina and Afognak Lakes Rehabilitation, Ugak Development and Hidden Lake Development. Duties associated with these projects include: barrier bypass construction, maintenance and evaluation, sockeye stocking and subsequent smolt and fingerling monitoring and evaluation, lake limnology studies, and all associated planning, personnel supervision, data quality control and analysis, budget development, report writing, and

presentation of results at professional and public forums. Lastly, he is responsible for a program on the Alaska Peninsula to assess the feasibility of coho and sockeye salmon development.

## LITERATURE CITED

Blackett, R. F. 1987. Development and performance of an Alaska steeppass fishway for sockeye salmon (*Oncorhynchus nerka*). Canadian Journal of Fisheries and Aquatic Sciences. Vol. 44, No. 1. p. 66-76.

Hartman, J. L. and J. Richardson. 1993. Applying cost-benefit analysis to salmon restoration projects studies in the "Restoration Survey" of the EVOS Restoration program. In review.

Honnold, S. G. 1994. Survey and evaluation of instream habitat and stock restoration techniques for wild pink, chum, coho and sockeye salmon Oil Spill Restoration Study 105 - Kodiak Island Component. In review.

## Appendix A. Additional Information

### Resources and/or Associated Services:

This project is located on northern Afognak Island, part of the Kodiak Island archipelago (Figure 1). The heaviest oiling of beaches and salmon systems occurred on northern Afognak Island, potentially damaging fisheries resources. In addition, commercial, subsistence and sport fisheries were closed as result of the 1989 EVOS, seriously impacting the economies of all fishing communities in the region.

The Little Waterfall system is the largest producer of non-hatchery pink salmon on Afognak Island. Pink salmon production from the Little Waterfall system, since enhancement activity began in the late 1970's, early 1980's, has provided a significant portion of the commercial catch in the area. Production, however, has not reached optimum levels. The pink salmon escapement to the upper-most optimum spawning habitat has averaged only 8,600, while the optimum number of spawners for this area is ~ 24,000. Thus, production of pink salmon, and the potential commercial harvest, will be increased by implementation of the project and the consequent enhanced use of the aforementioned barrier bypass structure.

Coho production has been minimal at Little Waterfall Creek. There are few major producers of coho on Afognak Island, with the majority of fishing effort concentrated at two systems (Paul's and Portage). This project, at Little Waterfall Creek, will increase production of coho in the northern Afognak area, thus provide increased benefits to users of the resource.

### Relation to Other Damage Assessment/Restoration Work:

Restoration study R105, sponsored by the Trustee Council, was the predecessor to this project and concluded in 1993. This study determined the methodology and feasibility of barrier bypass improvement necessary to enhance pink and coho production by increasing spawning habitat at Little Waterfall Creek. The intent of the study was to mitigate for oil spill damage occurring at nearby systems or restore production that may have been negatively impacted at Little Waterfall Creek.

**Technical Support:**

General administrative support is provided by the Administrative, Habitat and Restoration Division, and Commercial Management and Development Divisions (CFMD) of the Alaska Department of Fish and Game (ADF&G). The project leader of this project is primarily funded by general funds and program receipts (Kodiak Regional Aquaculture Association - KRAA - cooperative funding) from the State of Alaska. Engineering support is provided by CFMD of the ADF&G, funded by general funds from the State of Alaska. This study is directly associated with ongoing rehabilitation and enhancement projects funded by program receipts provided by KRAA. The KRAA project at Little Waterfall will provide logistical support and personnel during portions of this project. Lastly, the CFMD Division of ADF&G will provide logistical and personnel support for a portion of the evaluation of this project.

The Project Leader (Steven G. Honnold - PCN 11-7045) and associated support personnel contribute significant time to the project with funding provided by existing agency programs as described below.

**EXISTING AGENCY PROGRAM**

The ADF&G, CFMD Division, Development Section operates a sockeye and pink salmon development project at Little Waterfall Creek. Little Waterfall Creek has three existing barrier bypass structures which currently enhance pink salmon production. Little Waterfall Lake is stocked with sockeye salmon from Pillar Creek Hatchery which is operated by KRAA. The Department conducts all maintenance, monitoring and evaluation activities associated with this fisheries development program with funding provide by KRAA through program receipts. This includes lake enrichment, smolt sampling, limnological sampling, and weir operation. In addition, the Finfish Management Section of CFMD Division conducts fisheries management operations in the area which includes egg-to-fry survival indexing at Little Waterfall Creek.

Other programs that are operated in the northern Afognak area by the ADF&G include: Paul's Lake adult salmon weir, Paul's, Laura and Gretchen Creek barrier bypass operation; lake assessment and smolt studies at Laura, Paul's, Portage, and Hidden Lakes; lake enrichment at Portage, Little Waterfall, and Laura Lakes; and egg-to-fry survival indexing at various streams. With the exception of egg-to-fry survival indexing, all portions of these programs are funded through KRAA program receipts. Also, KRAA operates a sockeye stocking program facilitated through Pillar Creek Hatchery, at Hidden Lake. In addition, KRAA operates Kitoi Bay Hatchery on northern Afognak Island, producing pink, coho, chum and sockeye salmon for commercial

harvest. All evaluation associated with Pillar Creek and Kitoi Bay hatcheries is conducted by ADF&G with funds provided by KRAA program receipts. Lastly, the Alaska Department of Natural Resources, Kodiak State Parks operates several coho escapement weirs on Shuyak Island, located just north of Afognak Island. The ADF&G provides equipment and logistical support, as well as conducting aerial salmon escapement surveys in the area.

The commercial fishery management activities associated with all of the preceding programs are provided by ADF&G, CFMD Division with general fund monies.

Table 2. Agency and non-agency contributions to this project or relating to the resource or service area.

| Program | Funding Source | FY94 Amount |
|---|---|---|
| Perenosa Rehab/Dev.<br>L. Waterfall<br>Portage<br>Paul's | ADF&G-Program Receipts | 46.0 |
| Lake Assess<br>L.Waterfall<br>Portage<br>Laura<br>Hidden<br>L. Kitoi<br>B. Kitoi<br>Sorg<br>Ruth | ADF&G-Program Receipts | 23.0 |
| Kitoi Eval. | ADF&G-Program Receipts | 47.0 |
| Hidden Lake Eval. | ADF&G-Program Receipts | 28.0 |
| Pre-emerg. sample | ADF&G-General Funds | 5.9 |
| Aerial Surveys | ADF&G-General Funds | 1.4 |
| Shuyak Weirs | ADNR-General Funds | 10.2 |
| Shuyak support/Mgmt. | ADF&G-General Funds | 1.1 |
| Lake Enrich.<br>L. Waterfall<br>Portage<br>Laura | KRAA | 69.0 |
| Kitoi Hatchery | KRAA | 1264.0 |
| Pillar Hatchery | KRAA | 97.2 |

## PERFORMANCE MONITORING

Performance monitoring of this project will be conducted through the ADF&G, CMFD, H&R, and Administrative Divisions. All aspects of the project will be overseen by the standard chain of command as required by standard operating procedures and administrative regulations. This includes contractual compliance, personnel hiring, supervisory standards, and all other ADF&G regulations. If personnel replacement is required, or temporary project problems occur, regional ADF&G expertise and support is available. Project objectives and tasks, data summation and analysis, and status reports will be kept on the required timeline through planning and integration of the project activities as required for all programs of the ADF&G, CFMD Division, Development Section.

The Kodiak Development Section of the CFMD Division implements and operates approximately 10 restoration/development projects on Afognak and Kodiak Islands. On Afognak Island there four systems with barrier bypass projects which have successfully developed salmon production through increased spawning habitat availability. The quality control procedures that have been employed for these programs will be applied to this project. All data collected, analyzed, and incorporated into scientific reports will be subject to internal review within CFMD and H&R Divisions. Publications will be integrated by the Principle Investigator for Peer Review before submission to EVOS Board of Trustees and Chief Scientists. Status reports will be generated for Peer Review as well as a final report after completion of the project.

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| Budget Category: | Authorized FFY 1996 | Proposed FFY 1997 | LONG RANGE FUNDING REQUIREMENTS | | | | | |
|---|---|---|---|---|---|---|---|---|
| Personnel | | $20.6 | | | | | | |
| Travel | | $1.0 | | | | | | |
| Contractual | | $1.2 | | | | | | |
| Commodities | | $0.4 | | | | | | |
| Equipment | | $0.0 | | | | | | |
| Subtotal | $0.0 | $23.2 | Estimated FFY 1998 | Estimated FFY 1999 | Estimated FFY 2000 | Estimated FFY 2001 | Estimated FFY 2002 | |
| General Administration | | $3.2 | | | | | | |
| Project Total | $0.0 | $26.4 | $23.0 | $9.0 | | | | |
| | | | | | | | | |
| Full-time Equivalents (FTE) | | 0.5 | | | | | | |
| | Dollar amounts are shown in thousands of dollars. | | | | | | | |
| Other Resources | | | | | | | | |

Comments:

**1997**

Project Number: 97139A1
Project Title: Salmon Instream Habitat and Stock Restoration
Sub Project: Little Waterfall Creek Barrier Bypass Improvement
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY
4/15/96

Prepared: 12 Apr 96
Received : 12 Apr 96

## 1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

| Personnel Costs: | | GS/Range/ | Months | Monthly | | Proposed |
|---|---|---|---|---|---|---|
| Name | Position Description | Step | Budgeted | Costs | Overtime | FFY 1997 |
| S.Schrof PCN 5270 | Fishery Biologist I | 14C | 3.0 | 4.6 | 0.0 | 13.8 |
| G. Watchers PCN 5297 | FW Tech III | 11F | 1.0 | 4.0 | 0.0 | 4.0 |
| S. Honnold PCN 7045 | FB III | 18B | 0.5 | 5.5 | | 2.8 |
| S. Honnold PCN 7045 | FB III | 18B | 1.0 | in kind | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | | | | | | 0.0 |
| | Subtotal | | 5.5 | 14.1 | 0.0 | |
| | | | | | Personnel Total | $20.6 |

| Travel Costs: | Ticket | Round | Total | Daily | Proposed |
|---|---|---|---|---|---|
| Description | Price | Trips | Days | Per Diem | FFY 1997 |
| Travel to workshop - Kodiak-Anchorage round trip | 0.4 | 1 | 3 | 0.2 | 1.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | | 0.0 |
| | | | | Travel Total | $1.0 |

**1997**

Prepared:



Project Number: 97139A1
Project Title: Salmon Instream Habitat and Stock Restoration
Sub Project: Little Waterfall Creek Barrier Bypass Improvement
Agency: ADFG

FORM 3B
Personnel
& Travel
DETAIL

4/15/96

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| **Contractual Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| aircraft charters: 4 hr of C206@295/hr | 1.2 |
| helecopter charter: 2 hr of B206 @ 650/hr; 4 hr of standby at 325/hr - in kind | 0.0 |
| When a non-trustee organization is used, the form 4A is required. **Contractual Total** | $1.2 |

| **Commodities Costs:** | Proposed |
|---|---|
| Description | FFY 1997 |
| film and photo processing | 0.1 |
| groceries: 20 mandays@ $15/day | 0.3 |
| field supplies: hip boots, polorized glasses, field notebooks, minnow traps, buckets, etc - in kind | 0.0 |
| **Commodities Total** | $0.4 |

**1997**

Project Number: 97139A1
Project Title: Salmon Instream Habitat and Stock Restoration
Sub Project: Little Waterfall Creek Barrier Bypass Improvement
Agency: ADFG

FORM 3B
Contractual & Commodities DETAIL

Prepared: 4/15/96

**1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**
October 1, 1996 - September 30, 1997

| New Equipment Purchases: | Number | Unit | Proposed |
|---|---|---|---|
| Description | of Units | Price | FFY 1997 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| | | | 0.0 |
| Those purchases associated with replacement equipment should be indicated by placement of an R. | | **New Equipment Total** | $0.0 |

| Existing Equipment Usage: | Number | Inventory |
|---|---|---|
| Description | of Units | Agency |
| pre-emergent pumps | 2 | ADFG |
| flow meter | 1 | ADFG |

**1997**

Prepared:



Project Number: 97139A1
Project Title: Salmon Instream Habitat and Stock Restoration
Sub Project: Little Waterfall Creek Barrier Bypass Improvement
Agency: ADFG

FORM 3B
Equipment
DETAIL

4/15/96