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# SOUTH SPRUCE STREET BEACH PARKING

| BEACH PARKING   | Receiven  |
|---|---|
| 99387   | APR 1 4 1998  |
| City of Kenai   | EXXON VALDEZ ON SEAL  |
|   | TRUSTEE COUNCIL   |
|   |   |
| No  |   |
| FY99 1 <sup>st</sup> year, 1-year project                                   |   |
| \$155,000   |   |
| 0   |   |
| 0   |   |
| 0   |   |
| Kenai Peninsula   |   |
| Lost or reduced services: recreation<br>fishing and other recreational uses | n and tourism including sport<br>subsistence  |
|   | 99387<br>City of Kenai<br>No<br>FY99 1 <sup>st</sup> year, 1-year project<br>\$155,000<br>0<br>0<br>Kenai Peninsula<br>Lost or reduced services: recreation<br>fishing and other recreational uses. |

#### ABSTRACT

The State of Alaska Department of Fish and Game has opened a seasonal dip net fishery at the mouth of the Kenai River that thousands of "dip netters" from all over the State take advantage of. This project is to provide proper access in a way that will not damage the area or cause user problems to the dip net fishery at the mouth of the Kenai River and will relieve the heavy fishing pressure upstream. The new proposed project could be considered Phase II of the Kenai Beach Dunes Protection Project. This project will provide additional parking and reroute an existing trail to this parking area. Adjacent damaged wetlands will be repaired and barriers placed to help protect the wetlands in the future.

#### **INTRODUCTION**

In 1997 the City received a grant from the Exxon Valdez Oil Spill Restoration office through the Alaska Department of Fish and Game, Habitat and Restoration Division, for a project to help protect the dunes. The project placed concrete barriers to keep people off the dunes and provide access to the beach at designated points. The road was opened for vehicles to transport passengers and gear to the mouth of the Kenai River. The barriers prevented vehicle damage to the dunes, which also blocked any off-road parking. This project was very successful in protecting the dunes, and they are recovering nicely.

The new proposed project could be considered Phase II of the Kenai Beach Dunes Protection Project. At the present time, the only place to park, for the north-side Kenai River mouth dip netting, is a small parking lot at the end of South Spruce. This project will be to enlarge this parking lot.

This project will provide additional parking and reroute an existing trail to this parking area. Vehicles have damaged wetlands and a drainage way next to this area. This project will restore the damaged wetlands and help protect them.

#### **NEED FOR THE PROJECT**

#### A. Statement of Problem

This project is designed to address lost or reduced services of recreation and tourism including sport fishing and other recreational uses and subsistence. The State of Alaska has opened a seasonal dip net fishery at the mouth of the Kenai River. Over 15,000 dip net permits for households were issued for Kenai, Kasilof, and Fish Creek in 1997. Alaska Department of Fish and Game estimated 103,000 fish were caught in the 1996 Kenai dip net fishery. This was almost three-fourths of all fish caught by dip netters. Thousands of "dip netters" from all over the State take advantage of this very productive method of obtaining salmon on the Kenai River.

There are more people using the Kenai River than any other river in the State of Alaska. Providing access to the dip net fishery at the mouth of the River will relieve the heavy fishing pressure upstream. The goal is to provide <u>proper</u> access in a way that will not damage the area or cause user problems.

#### B. Rationale/Link to Restoration

This project should be done as a general restoration project. It will improve the rate of natural recovery by directly manipulating the environment. The existing small parking lot can only handle a very small fraction of the vehicles used in the subsistence and/or personal use dip net fishery at the north side mouth of the Kenai River.

This project will provide parking for vehicles that are presently damaging wetlands and drainages in this area. The new larger parking area will be outlined in large concrete pile barriers that will restrict access to wetlands.

#### C. Location

This project is located at the South Terminal of South Spruce Street at the Cook Inlet Beach. This project will benefit all Alaskans that participate in the dip net fishery. (Estimate of 15,000 households.)

#### COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

The community will be informed by public hearings that are advertised in the local newspaper and on the radio. Contractors will be informed of the preference for local hire. The project will be reviewed by the Kenai City Council, the Harbor Commission, and the Planning and Zoning Commission.

#### **PROJECT DESIGN**

#### A. Objectives

- 1. Provide additional parking for dip net fishery.
- 2. Prevent damage to surrounding wetlands and drainage area.
- 3. Help educate the public about how to prevent environmental damage in the area.
- 4. Provide informative, educational, regulatory, and directional signs to the public.

#### B. Methods

The City of Kenai Public Works Administration would be responsible for this project. The construction project would be awarded to the lowest responsible bidder.

Approximately half of the 65,000 square foot area would be excavated to remove the frost susceptible material (FSM). Half of the excavation would be hauled off site with the other half being used to reshape the remaining area and relocate the existing trails. Filter Fabric would be used in areas still containing FSM.

A temporary silt fence would be placed at the toe of the new slope during construction. The existing fence along the Wastewater Treatment Plant would be relocated after the new fill is in place. Concrete piles will be used as barriers to detour vehicles away from wetlands and sensitive areas. The existing vehicle ruts and damage to the low land areas next to the parking lot will be repaired. The areas off the gravel parking lot will be seeded.

Public informational and educational signs will be placed in the area. Regulatory and directional signs will also be installed.

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

Trustee agencies have not been assigned to this project as yet. Most of this project will be contracted out to a construction company. The administration and bidding services will be performed by the City and will not be charged to the project.

## SCHEDULE

# A. Measurable Project Tasks for FY99 (October 1, 1998 – September 30, 1999)

| October 1, 1998  | Design Work Begins      |
|------------------|-------------------------|
| February 1, 1999 | <b>Bid Construction</b> |
| May 1, 1999      | Start Construction      |
| June 1, 1999     | Project Complete        |

#### **B.** Project Milestones and Endpoints

All project objectives will be met by June 1, 1999.

## **PUBLICATIONS AND REPORTS**

A project final report and as-built drawings will be submitted. An annual report on the project and how the objectives were met will be submitted on April 15, 2000.

#### **PROFESSIONAL CONFERENCES**

The City is prepared to present the project results at any conference in Alaska at the City's expense.

# NORMAL AGENCY MANAGEMENT

The Alaska Department of Fish and Game manages the salmon resource and its recovery for Cook Inlet and the Kenai River. The dip net fishery on the Kenai River is part of this salmon management program. The local government of the City of Kenai is trying to provide proper access to the fishery with minimal damage to the environment.

# **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

The City of Kenai worked through the Alaska Department of Fish and Game on the Kenai Dunes Project. This project could be considered Phase II of the earlier project. All appropriate Federal and State agencies reviewed this project prior to the Corps of Engineers issuing the City permit No. M-810010 for the project.

# **KEY PERSONNEL**

Keith Kornelis will be managing this project for the City of Kenai.

Keith Kornelis, Public Works Director 210 Fidalgo Avenue, Suite 200 Kenai, AK 99611 1(907) 283-7535 1(907) 283-3014 <u>pwdept@alaska.net</u>

| Budget Category:           | / tatilon Loa | Proposed |  |   |              |            |                               | a sa |
|----------------------------|---------------|----------|--|---|--------------|------------|-------------------------------|--|
|                            | FY 1998       | FY 1999  |  |   |              |            |                               |  |
|                            |               |          |  |   |              |            |                               |  |
| ersonnel                   |               | \$0.0    |  |   |              |            |                               |  |
| ravel                      |               | \$0.0    |  |   |              |            |                               |  |
| ontractual                 |               | \$155.0  |  |   |              |            |                               |  |
| ommodities                 |               | \$0.0    | an a   | n de la companya de<br>La companya de la comp |              |            |                               | nia na la manda la mana sa ana           |
| quipment                   |               | \$0.0    |  | LONG R/   | ANGE FUNDI   | NG REQUIRE | MENTS                         |  |
| Subtotal                   | \$0.0         | \$155.0  |  | Estimated   | Estimated    | Estimated  |                               |  |
| direct                     |               | \$0.0    |  | FY 2000   | FY 2001      | FY 2002    |                               |  |
| Project Total              | \$0.0         | \$155.0  | and the second | \$0.0   | \$0.0        | \$0.0      |                               |  |
| ull-time Equivalents (FTE) |               | 0.0      |  |   |              |            |                               |  |
|                            |               | 0.0      | Dollar amounts   | s are shown in  | thousands of | dollars.   | and Contract Play a comparate |  |
| ther Resources             |               | \$0.0    | -  | ſ   |              |            |                               |  |
|                            |               |          |  |   |              |            |                               |  |
|                            |               |          |  |   |              |            |                               |  |

FY 99 EXXON VALDEZ TRUS JOUNCIL PROJECT BUDGET

| Personnel Costs:  |                         |             |                                    | Months   | Monthly |               | Proposed      |
|-------------------|-------------------------|-------------|------------------------------------|----------|---------|---------------|---------------|
| Name              | Position Description    |             |                                    | Budgeted | Costs   | Overtime      | FY 1999       |
|                   |                         |             | nan na kanjal manana na manali a k |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         | :             | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
| жис               |                         | Subtotal    |                                    | 0.0      | 0.0     | 0.0           |               |
|                   |                         |             | *                                  |          | Pei     | rsonnel Total | \$0.0         |
| ravel Costs:      |                         |             | Ticket                             | Round    | Total   | Daily         | Proposed      |
| Description       |                         |             | Price                              | Trips    | Days    | Per Diem      | FY 1999       |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         | Ĩ           |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    |          |         |               | 0.0           |
|                   |                         |             |                                    | <b>I</b> |         | Travel Total  | 0.0           |
|                   |                         |             |                                    |          |         | Traver Total  | ΦΟ.Ο          |
|                   |                         |             |                                    |          |         | F             | ORM 4B        |
|                   | Project Number:         |             |                                    |          |         |               | Personnel     |
| FY 99             | Project Title: South Sn | ruce Street | Beach Park                         | ina      |         |               |               |
|                   | Name: City of Kensi     |             |                                    | 3        |         |               | & I ravel     |
|                   |                         |             |                                    |          |         |               | DETAIL        |
| Prepared: 4/10/98 |                         |             |                                    |          | ]       | L             | 4/10/98, 2 of |

FY 99 EXXON VALDEZ TRUS OUNCIL PROJECT BUDGET

| Contractual Cos | sts:   | Proposed  |
|-----------------|--|-----------|
| Description     | Construction Contractors Bid Estimate            | FY 1999   |
| Excavation,     | usable and unusable                              | 6.3       |
| Backfill - bor  | row, aggregate, filter fabric, silt fence        | 108.1     |
| Relocate tra    | il, fence, concrete piles                        | 5.4       |
| Public inform   | nation and educational signs                     | 2.4       |
| Seeding, wa     | tering, topsoil                                  | 3.8       |
| Mobilization    | and demobilization                               | 5.0       |
| Administratio   | on and contract engineering/inspection           | 12.0      |
| Contingency     |  | 12.0      |
|                 |  |           |
|                 |  |           |
|                 |  |           |
|                 |  |           |
|                 |  |           |
|                 | Contractual Total                                | \$155.0   |
| Commodities Co  | osts:  | Proposed  |
| Description     |  | FY 1999   |
|                 |  |           |
|                 |  |           |
|                 |  |           |
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|                 |  |           |
|                 |  |           |
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|                 |  |           |
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|                 |  |           |
|                 | Commoditios Total                                |           |
| L               | Commodities rotar                                | φ0.0      |
|                 |  |           |
|                 | Project Number:                                  |           |
| FY 99           | Droject Title: South Spruce Street Reach Parking |           |
|                 | Col  | mmodities |
|                 | Name: City of Kenai                              | DETAIL    |
|                 |  |           |

| New Equipment Purchases:      |   | Number   | Unit         | Proposed   |
|-------------------------------|---|----------|--------------|--|
| Description                   |   | of Units | Price        | FY 1999  |
|                               |   |          |              | 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 wi | th replacement equipment should be indicated by placement of an R | New Eau  | ipment Total | \$0.0  |
| Existing Equipment Usage:     |   |          | Number       |  |
| Description                   |   |          | of Units     |  |
|                               |   |          |              | na sun ser a s |
|                               |   |          |              |  |
|                               |   |          |              |  |
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| L                             |   |          |              | Line and the second |
|                               |   |          |              |  |
|                               | Project Number:   |          |              | quinment   |
| FY 99                         | Project Title: South Spruce Street Beach Parking                  |          |              |  |
|                               | Name: City of Kenai   |          |              |  |
|                               |   |          | L            |  |
| Prepared: 4/10/98             |   |          |              | 4/10/98, 4   |



# KENAI RIVER MOUTH SOUTH SIDE ACCESS AND PARKING

| Project Number:           | 99388                                     |                             |
|---------------------------|---|-----------------------------|
| Restoration Category:     |   | DECEMBE                     |
| Proposer:                 | City of Kenai                             |                             |
| Lead Trustee Agency:      |   |                             |
| Cooperating Agencies:     |   | APR 1 4 1998                |
| Alaska SeaLife Center:    | No  |                             |
| Duration:                 | FY99 1 <sup>st</sup> year, 1-year project | EXXON VALDEZ OIL SPILL      |
| Cost FY99:                | \$800,000                                 | TRUSTEE COUNCIL             |
| Cost FY00:                | 0   |                             |
| Cost FY01                 | 0   |                             |
| Cost FY02                 | 0   |                             |
| Geographic Area:          | Kenai Peninsula                           |                             |
| Injured Resource/Service: | Lost or reduced services: recreation      | and tourism including sport |
|                           | fishing and other recreational uses, s    | ubsistence                  |

#### ABSTRACT

The State of Alaska Department of Fish and Game has opened a seasonal dip net fishery at the mouth of the Kenai River that thousands of "dip netters" from all over the State take advantage of. This project is to provide proper access in a way that will not damage the area or cause user problems to the dip net fishery at the mouth on the south side of the Kenai River. It will relieve the heavy fishing pressure upstream. This project is to build a road with a parking lot at the end near the south side of the Kenai River Mouth. "Dip netters" are presently accessing the area with  $4 \times 4$  vehicles along the beach damaging the environment and often crossing private property.

#### INTRODUCTION

The State of Alaska has opened a "dip net" fishery at the mouth of the Kenai River. This fishery is very popular and is growing extremely fast. Access to the dip net fishery on the Kenai River is very limited. Areas that do have road access near the river are usually surrounded by private property. Also, much of the northern shore has a high, steep, eroding bluff.

The City of Kenai is doing its best to accommodate this fishery. The City, in cooperation with the Alaska Department of Fish and Game (and the Exxon Valdez Oil Spill Restoration funds) has improved the access to the north side of the Kenai River mouth. The north shore is over utilized, and fishermen are shoulder to shoulder during the fish runs.

The City suggests building the road at the highest elevation along the coastline with parking at the end of the road near the South Kenai River Mouth. The City is open to suggestions and requests agency input as to where to build the road and parking area.

#### NEED FOR THE PROJECT

#### A. Statement of Problem

This project is designed to address lost or reduced services of recreation and tourism including sport fishing and other recreational uses and subsistence. The State of Alaska has opened a seasonal dip net fishery at the mouth of the Kenai River. Over 15,000 dip net permits for households were issued for Kenai, Kasilof, and Fish Creek in 1997. Alaska Department of Fish and Game estimated 103,000 fish were caught in the 1996 Kenai dip net fishery. This was almost three-fourths of all fish caught by dip netters. Thousands of "dip netters" from all over the State take advantage of this very productive method of obtaining salmon on the Kenai River.

There are more people using the Kenai River than any other river in the State of Alaska. Providing access to the dip net fishery at the mouth of the River will relieve the heavy fishing pressure upstream. The goal is to provide <u>proper</u> access in a way that will not damage the area or cause user problems.

Dip net fishermen with 4 x 4 vehicles have found access to the south shore at the mouth of the Kenai River by going down a section line easement to the beach and following the shoreline north to the mouth. Unfortunately, once you are on the beach traveling north you have to cross private property during the higher tides (above 19.13). 4 x 4 vehicles have damaged much of this shoreline (both private and public lands).

The City of Kenai is open to suggestions on how to best provide access to the south shore of the Kenai River Mouth. We feel that a road needs to be built with an elevation above the high tides so people will not get trapped at the mouth with a vehicle and then cause damage to the wetlands and dunes in getting out. It would be cost prohibitive to build a road on the beach since it would take a large quantity of fill material to get the road above the high tides.

Presently the City of Kenai has no way to provide emergency help to the dip net fishermen on the south shore of the mouth of the Kenai River. In 1997 a fisherman's pickup burned to a skeleton on this beach. Fortunately, no one was injured as neither fire nor ambulance vehicles could get to the scene. Clean up also proved to be difficult for the insurance company.

This new road is badly needed to provide access to monitor and provide environmental cleanup from the users. It is needed to provide the users with trash receptacles and restrooms.

#### **B.** Rationale/Link to Restoration

This project should be done as a general restoration project. It will improve the rate of natural recovery by directly manipulating the environment. The existing access for the subsistence and/or personal use dip net fishery at the south side mouth of the Kenai River is by  $4 \times 4$  vehicles only.

This project will provide access and parking for the 4 x 4 vehicles that are presently damaging wetlands and drainages in this area. It will also provide access for the overwhelming majority of dip net fishermen that have two-wheel drive vehicles. The project will also provide access for City services such as emergency fire, ambulance, and police along with refuse and sanitary service.

#### C. Location

This project is North on Cannery Road off Kalifornsky Beach Road and continuing on Bowpicker Lane to the start of the project at its intersection with Sea Catch Drive. The new road would start at the end of Bowpicker Lane and go northwest to the higher elevation and north parallel to the coastline. The road would end at a parking lot near the mouth of the Kenai River. The City is open for suggestions from the Federal and State agencies as to the best location for the road. This project will benefit all Alaskans that participate in the dip net fishery. (Estimate of 15,000 households.)

#### COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

The community will be informed by public hearings that are advertised in the local newspaper and on the radio. Contractors will be informed of the preference for local hire. The project will be reviewed by the Kenai City Council, the Harbor Commission, and the Planning and Zoning Commission.

#### **PROJECT DESIGN**

#### A. Objectives

- 1. Provide access to the south side of the mouth of the Kenai River and parking for dip net fishery.
- 2. Prevent damage to surrounding wetlands and drainage area.
- 3. Help educate the public about how to prevent environmental damage in the area.
- 4. Provide informative, educational, regulatory, and directional signs to the public.

Prepared 4/98

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Project 99\_\_\_

#### **B.** Methods

The City of Kenai Public Works Administration would be responsible for this project. The construction project would be awarded to the lowest responsible bidder.

This project would be to build approximately 5,200 linear feet of roadway 28-feet wide with a one-acre parking lot at the end. Part of the roadway and parking lot would be constructed on wetlands thus requiring many agency approvals, coordination, review, and permits. The parking lot, estimated to hold 50 to 75 vehicles, would be near the mouth of the Kenai River on the south side.

The project would include appropriate signs about the project including the Kenai River's ecology and proper use of its resources. Warning signs about the tides, damage to wetlands and the dunes, and informative signs about the fish and wildlife would be placed in the parking area and possible along the roadway.

Once this project is completed it will be the City of Kenai's responsibility to operate and maintain this facility. The operation would include restrooms or Port-a-potties and garbage dumpsters or trash containers.

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

Trustee agencies have not been assigned to this project as yet. Most of this project will be contracted out to a construction company. The administration and bidding services will be performed by the City and will not be charged to the project.

#### SCHEDULE

#### A. Measurable Project Tasks for FY99 (October 1, 1998 – September 30, 1999)

| October 1, 1998  | Design Work Begins |
|------------------|--------------------|
| February 1, 1999 | Bid Construction   |
| May 1, 1999      | Start Construction |
| July 1, 1999     | Project Complete   |

#### **B.** Project Milestones and Endpoints

All project objectives will be met by July 1, 1999.

## PUBLICATIONS AND REPORTS

A project final report and as-built drawings will be submitted. An annual report on the project and how the objectives were met will be submitted on April 15, 2000.

## **PROFESSIONAL CONFERENCES**

The City is prepared to present the project results at any conference in Alaska at the City's expense.

# NORMAL AGENCY MANAGEMENT

The Alaska Department of Fish and Game manages the salmon resource and its recovery for Cook Inlet and the Kenai River. The dip net fishery on the Kenai River is part of this salmon management program. The local government of the City of Kenai is trying to provide proper access to the fishery with minimal damage to the environment.

# COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The City of Kenai worked through the Alaska Department of Fish and Game on the Kenai Dunes Project. This project could be considered another phase of the earlier project. All appropriate Federal and State agencies will have to review this project prior to the Corps of Engineers and others issuing a permit to the City for the project.

# **KEY PERSONNEL**

Keith Kornelis will be managing this project for the City of Kenai.

Keith Kornelis, Public Works Director 210 Fidalgo Avenue, Suite 200 Kenai, AK 99611 1(907) 283-7535 1(907) 283-3014 pwdept@alaska.net

| Budget Category:           | Authorized | Proposed | and the second | ter e en the holes and the strength a second | AND         |            | in and an interaction of the |                           |
|----------------------------|------------|----------|--|--|---|------------|------------------------------|---------------------------|
|                            | FY 1998    | FY 1999  |  |  | <b>转来的。</b> 在19                                 |            |                              |                           |
|                            |            |          |  |  | n kasaka sa |            |                              |                           |
| Personnel                  |            | \$0.0    |  |  |   |            |                              |                           |
| Travel                     |            | \$0.0    |  |  |   |            |                              |                           |
| Contractual                |            | \$800.0  |  |  |   |            |                              |                           |
| Commodities                |            | \$0.0    |  |  |   |            |                              |                           |
| Equipment                  |            | \$0.0    |  | LONG R                                       | ANGE FUNDI                                      | NG REQUIRE | MENTS                        |                           |
| Subtotal                   | \$0.0      | \$800.0  |  | Estimated                                    | Estimated                                       | Estimated  |                              |                           |
| ndirect                    |            | \$0.0    |  | FY 2000                                      | FY 2001   | FY 2002    |                              |                           |
| Project Total              | \$0.0      | \$800.0  |  | \$0.0  | \$0.0   | \$0.0      |                              |                           |
|                            |            |          | and the second |  |   |            |                              | A CONTRACTOR OF THE OWNER |
| ull-time Equivalents (FTE) |            | 0.0      | an a   |  |   |            |                              |                           |
|                            |            |          | Dollar amounts   | are shown in                                 | n thousands of                                  | dollars.   |                              |                           |
| Other Resources            |            | \$0.0    |  |  |   |            |                              |                           |
|                            |            |          |  |  |   |            |                              |                           |
|                            |            |          |  |  |   |            |                              |                           |

October 1, 1998 - September 30, 1999

| Dar       | annal Castar  |                                     | 1            |              |         |              |              |
|-----------|---------------|-------------------------------------|--------------|--------------|---------|--------------|--------------|
| Pers      |               |                                     |              | Months       | Monthly |              | Proposed     |
|           | Name          | Position Description                |              | Budgeted     | Costs   | Overtime     | FY 1999      |
| NATE:     |               |                                     |              |              |         |              | 0.0          |
| AND THE A |               |                                     |              |              |         |              | 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          |              |
|           |               |                                     |              |              | Per     | sonnel Total | \$0.0        |
| Trav      | el Costs:     |                                     | Ticket       | Round        | Total   | Daily        | Proposed     |
|           | Description   |                                     | Price        | Trips        | Days    | Per Diem     | FY 1999      |
|           |               |                                     |              |              |         |              | 0.0          |
|           |               |                                     |              |              |         |              | 0.0          |
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|           |               |                                     |              |              |         |              | 0.0          |
|           |               |                                     |              |              |         |              | 0.0          |
|           |               |                                     |              |              |         | Travel Total | \$0.0        |
|           |               | [                                   |              |              |         |              |              |
|           |               | Drain at Number                     |              |              |         | F            | ORM 4B       |
| F         | FY 99         |                                     |              | . –          |         | P            | ersonnel     |
|           |               | Project Title: Kenai River Mouth So | outh Side Ac | ccess and Pa | arking  |              | & Travel     |
|           |               | Name: City of Kenai                 |              |              |         |              |              |
|           |               | -                                   |              |              |         | L            |              |
| Prep      | ared: 4/10/98 |                                     |              |              |         |              | 4/13/98, 2 c |

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| Contractual Costs:  | Proposed   |
|---|------------|
| Description Construction Contractors Bid Estimate                           | FY 1999    |
| Road  | 454.0      |
| Parking Lot   | 100.0      |
| CMP   | 60.0       |
| Public information and educational signs                                    | 9.0        |
| Seeding, watering, topsoil  | 17.0       |
| Administration and contract engineering/inspection                          | 96.0       |
| Contingency   | 64.0       |
|   |            |
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|   | <u> </u>   |
| Contractual Total   | \$800.0    |
| Commodities Costs:  | FV 1000    |
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| Commodities Total   | \$0.0      |
|   |            |
|   | ORM 4B     |
| Project Number:   | tractual & |
| <b>FY 99</b> Project Title: Kenai River Mouth South Side Access and Parking | nmodities  |
| Name: City of Kenai   |            |
|   |            |

#### FY 99 EXXON VALDEZ TRUS JOUNCIL PROJECT BUDGET

| New Caulman and Dunet        |   |          |              |  |
|------------------------------|---|----------|--------------|--|
| Rew Equipment Purchases:     |   | Number   | Unit         | Proposed   |
|                              |   | of Units | Price        | FY 1999  |
|                              |   |          |              | 0.0  |
|                              |   |          |              | 0.0  |
|                              |   |          |              | 0.0  |
|                              |   |          |              | 0.0  |
|                              |   |          |              | 0.0  |
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|                              |   |          |              | 0.0  |
|                              |   |          |              | 0.0  |
|                              |   |          |              | 0.0  |
|                              |   |          |              | 0.0  |
| Those purchases associated w | ith replacement equipment should be indicated by placement of an R. | New Equ  | ipment Total | \$0.0  |
| Existing Equipment Usage:    |   |          | Number       |  |
| Description                  |   |          | of Units     |  |
|                              |   |          |              |  |
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|                              |   | ·        |              |  |
|                              |   |          | F            |  |
|                              | Project Number:   |          |              |  |
| FY 99                        | Project Title: Kenai River Mouth South Side Access and F            | Parking  |              | quipment   |
|                              | Name <sup>-</sup> City of Kenai                                     | 2        |              | DETAIL   |
|                              |   |          |              |  |
| Prepared: 4/10/98            |   |          |              | 4/13/98, 4 d   |

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99391

# Cook Inlet/Prince William Sound Information Management/Monitoring System

| Project Number:           | <del>99xxx</del> 99391                  |                        |
|---------------------------|---|------------------------|
| Restoration Category      | Monitoring                              |                        |
| Proposer:                 | ADEC/ADNR                               | RECEIVED               |
| Lead Trustee Agency       | ADEC/ADNR                               | APR 1 3 1998           |
| Cooperating Agencies      | USEPA, USGS, USFS                       | FXXON VALDEZ OIL SPILL |
| Alaska SeaLife Center     | N/A                                     | TRUSTEE COUNCIL        |
| Duration:                 | 2 Years                                 |                        |
| Cost FY 99:               | \$675.5                                 |                        |
| Cost FY 00:               | \$315.0                                 |                        |
| Geographic Area           | Cook Inlet, Kenai / Prince William Sour | nd                     |
| Injured Resource/Service: | All                                     |                        |

# ABSTRACT

This project will develop an integrated data base containing digital environmental and spatial data for the Cook Inlet and Prince William Sound watersheds. The proposed system will facilitate access to significant amounts of disparate data from a wide variety of sources about the resources and services injured by the Exxon Valdez Oil Spill as well as base data sets important to understanding the environment of the watersheds. This database and its associated retrieval system will support monitoring, management and restoration of resources and services injured by the Exxon Valdez Oil Spill. The system will provide access to data, graphics, images, text and documents for users in both the public and private sectors. It will relate current, historical and future data sets thereby improving data availability, access and integration. The system will enable syntheses, environmental analyses, planning and natural resources management. Water quality data sets derived from the two watersheds will provide the cornerstone of this system thereby facilitating monitoring of both baseline parameters and chronic sources of marine pollution that may be affecting recovery of injured resources and services. From both public policy and natural resources management perspectives, this project will protect the governments' investment in restoration by making information derived from restoration activities and water quality monitoring programs available for management of the watersheds in a manner that will promote the recovery of the injured resources and services.

#### INTRODUCTION

Monitoring populations of injured resources/services and effective management of their habitats that will facilitate their recovery requires a watershed-based management approach that encompasses entire ecosystems. This approach requires managers and scientists to "distinguish between natural and human-induced changes in the marine ecosystem" (Spies 1997). Pollution-caused water quality degradation, for example, could impact sensitive species or their habitats thereby exacerbating the injury and adversely affecting recovery. Toxic levels of contaminants can make fish and shellfish unfit for human consumption. Even the presence of pollutants below toxic levels can affect the public's perception of quality and safety, thereby affecting their purchasing habits for fish and shellfish. "Toxic materials can damage or stop the biological processes occurring in the aquatic ecosystems, including long-term inhibition of growth, reproduction, and migration of organisms, and have adverse effects on the rate of degradation of biodegradable contaminants" (Novotny and Olem 1994).

Although watershed-based management can be an effective strategy, implementation includes the review, integration and multivariate analysis of large volumes of data. Moreover, management and planning for development within these large areas calls for participation by federal, state and local governments as well as the public. Multiple stakeholders and scientists from many disciplines may be involved and need access to relevant data used in management and policy decisions.

This project proposes creation of an information management and monitoring system that will provide easy access to significant amounts of disparate data from a wide variety of sources about the resources and services injured by the *Exxon Valdez* oil spill as well as base data sets important to understanding the environment of the CI/PWS watersheds. The system will be a useful tool for monitoring species populations, ecological processes and predicting changes that may affect recovery of injured resources. This tool will contribute to the EPA Cook Inlet Watershed Clearinghouse and could serve as a template for other watersheds within Alaska.

Data management encompasses a broad spectrum of activities including database design and implementation, establishment of data standards, data entry, quality assurance/quality control (QA/QC), data processing, data documentation (metadata), archiving and access. The proposed project will facilitate recovery monitoring of *Exxon Valdez* oil spill injured resources/services, monitoring of water quality, tracking of pollution, and management and planning in the Cook Inlet and PWS watersheds. The system will be designed around a hardware/software mix that contains a relational database and a geographic information system (GIS). It will allow users to access and review large amounts of data, assess current conditions, analyze trends, and model hypothetical scenarios. The system will contain or be linked to data sets that provide information needed to monitor:

- recovery of injured resources/services,
- baseline physical and biological parameters,
- chronic pollution sources.

The system, which will be designed to be "user-friendly," will allow information about injured resources to be considered during resource agency permitting and regulatory functions and planning for petroleum and petrochemical development, mining, timber harvest and urban development. In addition, monitoring and data collection partnerships with *Exxon Valdez* oil spill project principle investigators, agency, industry and public stakeholders will be established through project team participation in the Cook Inlet Watershed Clearinghouse, PWS Copper River Delta Ecosystem Initiative, Kachemak Bay National Estuarine Research Reserve, USGS Cook Inlet Watershed Study, meetings with EVOS project principle investigators, and other initiatives. This collaborative effort will result in the identification and prioritization of data needs, development of consistent reporting formats, adherence to metadata standards, formalization of

QA/QC protocols, and the development of a user-friendly graphical user interface that will facilitate the ability of different users to learn about and access each other's data.

Potential users of the system include Federal, State, borough, and municipal government agencies, industry, scientists, the environmental community, and public oversight groups with an interest or mandate to manage these watersheds. Many of these entities have already generated data sets relevant to management of these watersheds that would be considered for inclusion in the system. The Biological Resources Division of the USGS has cataloged 192 resource spatial data sets specific to the PWS-Copper River region. The Alaska Natural Heritage Program has cataloged 461 data sets relevant to Alaska watersheds. In addition, the Alaska Geospatial Data Clearinghouse has compiled a suite of GIS coverages and is currently embarked on a project to catalog existing spatial data within Alaska in cooperation with ADNR. This project will establish a National Geospatial Data Clearing-house node at the Alaska Department of Natural Resources for state data. Other examples include: studies funded by the Trustee Council, e.g., Research & Restoration Information database, Petroleum Hydrocarbon database, Sound Ecosystem Assessment Project (SEA); ADEC's Contaminated Site Remediation Program database that contains information from more than 2,300 contaminated sites; Federal agency databases including EPA's Storage and Retrieval System for Water and Biological Monitoring Data (STORET); USGS stream flow gauging database; and Cook Inlet RCAC Environmental Monitoring Results. In addition, considerable amounts of relevant monitoring data have been and are currently being collected by various government and private sector entities for compliance with National Pollution Discharge Elimination System (NPDES) regulations and ADEC's water quality program.

Currently, there is no mechanism in place that relates these diverse data sets in a manner that gives managers a comprehensive picture of marine and upland pollution issues in Cook Inlet/PWS.

#### NEED FOR THE PROJECT

#### **Statement of Problem**

The Cook Inlet and Prince William Sound watersheds are large and complex ecosystems containing a diverse and abundant biota that are subject to intense physical forces as well as increasing human influences. A majority of Alaska's population lives, works, and recreates in and adjacent to these watersheds. Cook Inlet is an area where leasing, exploration, development, and production of oil and gas resources are on-going and important activities. In 1996 the Minerals Management Service offered about 1.98 million acres for leasing (MMS 1996). In the same year, the State of Alaska, Dept. of Natural Resources, offered for lease approximately 1,063,423 acres of State-owned onshore and offshore land for petroleum exploration and development (ADNR 1996). Timber harvest, mining, commercial, sport, personal-use and subsistence fishing and urban development are also taking place within this watershed. Some of these activities are also occurring in PWS. Large volumes of North Slope crude oil are transported across the Sound from Valdez by tanker almost every day. Both of these areas are exceptionally important to both Alaska residents and tourists for recreation.

Communities and industry operating in these watersheds generate waste streams that may be entering, degrading, and affecting the recovery of resources/services. Examples of these waste streams include used oil from vessels and other sources, bilge discharges, petroleum spills, surface runoff, sewage discharges, household hazardous wastes, and windblown garbage and/or leachate from community landfills. While some of these activities may be individually permitted, there is no system for the regional assessment of their cumulative impacts, These sources of pollution not only potentially hinder full recovery of the marine environment but could also impact the quality of the recreational experience in these areas.

Each year, industry, government, the scientific community and citizen watchdog groups generate and use large quantities of information about these areas and its resources. Typically this

information is used to focus on a single resource, issue, or problem and data management techniques are used that are specific to that need. Watershed management, on the other hand, has a scope that requires evaluation of a much broader spectrum of factors within a defined geographic area. In most large, intensively used and managed watersheds, such as Cook Inlet, some stakeholders collect and analyze samples and generate data, while others rely on data to monitor resources, conduct research, or make management and policy decisions. The flow of information between these groups is often non-existent or hindered by incompatible information transfer software and hardware.

For example, information used to evaluate impacts to water quality is derived and analyzed in a fragmentary fashion that does not assure a comprehensive assessment of actions affecting water quality resources in Cook Inlet. Projects and required individual project permits are evaluated independently of other projects or permitted actions. As a result, the cumulative risk to Cook Inlet's water quality is assessed with incomplete information. Permit decisions are based upon incomplete and disparate data sets that reside in various formats that are not conducive to integrated analysis.

Information and data management problems are not unique to CI/PWS; similar issues have been recognized for other watersheds across the nation. For example, information management concerns identified as part of the Chesapeake Bay Program (SAIC 1996) include:

- Users or potential users find it difficult or impossible to access needed data. Many participants obtain and manage data for different purposes, in different formats, and on different platforms making transfer of text and data files difficult. There are no defined procedures for obtaining information.
- Documentation of data (metadata) is often insufficient or lacking entirely. There is no documentation of collection or analytical methods thereby diminishing confidence in the quality of data.
- Desired data types are not available and/or up-to-date. Data requests are not coordinated leading to duplicative data acquisition efforts.
- Available data are often too geographically broad. Information is not available at local and sub-watershed levels.
- Environmental indicators are difficult and inefficient to produce.
- There is an important unmet need for integration of different types of data in order to undertake complex analyses.

Projects that are characterized by complex data relationships, such as recovery monitoring of species populations and ecological processes, need efficient data access, integration and analysis. This is also true of ecosystem-level research projects, watershed management and monitoring, and planning and regulation of development activities conducted over large geographic areas. These activities become more efficient when relevant data is related and integrated. Managers are more likely to make decisions which benefit injured resources and services and their associated habitats if they can access and visualize the relationships between variables and proposed development. Data management increases in importance for long-term and broad-scale comparative studies in which scientists from numerous disciplines may be involved for long periods of time in addressing a complex series of questions or hypotheses, requiring increased attention to metadata, QA/QC, archiving, and methods standardization (Michener 1997).

# B. Rationale/Link to Restoration

"Realistic ecological assessment" of the recovery of resources/services injured by the *Exxon Valdez* oil spill "requires long-term monitoring of salient patterns and processes at appropriate spatial and temporal scales using sound sampling design and statistical analyses" (Michener 1997). This

strategy was echoed by the Chief Scientist (Spies 1997) in his description of a "...permanent, adaptive, interdisciplinary monitoring and research program that would track, and eventually help predict ecosystem changes and provide a basis and mechanism for long-term restoration, enhancement, and wise management of marine resources in the northern Gulf of Alaska."

This plan is supported by the Trustee Council's increased emphasis on "integration and synthesis of what has been and is being learned from various restoration projects and the earlier work conducted during the damage assessment phase." As Stated in the Ecosystem Synthesis section of the 1999 RFP (Trustee Council 1999): "The integration and synthesis of project results will enable the Council, the scientific community, and the public to view the effects of the oil spill and the long-term restoration and management of injured resources/services from broad, multi-project and ecosystem-level perspectives. This will provide an improved framework for development of long-term restoration, research, monitoring, and management plans."

In general, the proposed system would help achieve this strategy by:

- Tracking recovery and minimizing additional injury,
- Improving data integration and enabling complex analyses which address the need to look at cumulative impacts,
- Depicting information in GIS formats to provide clear presentation of complex issues and alternatives,
- Providing more complete information to decision-makers and the public.

The proposed information management/monitoring system will help recovery of the injured resources/services by facilitating monitoring efforts as follows:

- 1. Define and track baseline parameters and eventually help predict changes that would be used to manage injured resources/services and their habitats, i.e., modeling.
- 2. Identify and track pollution that might have adverse impacts upon injured resources/services. Most of the communities and development projects in the CI/PWS watersheds are located in coastal areas. Consequently, many of the wastes generated have the potential to enter the nearshore marine environment and affect recovery of injured resources/services.
- 3. Provide data for oil and gas leasing to limit impacts on injured resources/services.
- 4. Help to distinguish between natural and human-induced changes in the CI/PWS watersheds.
- 5. Provide data to researchers who are studying ecological processes and who are modeling physical and biological factors to improve management of fishery resources in the CI/PWS watersheds.
- 6. Provide maps of injured species' habitats, movement corridors and environmentally sensitive areas.
- 7. Provide EVOS researchers and agency resource managers the ability to view and analyze multiple data sets, i.e., data layers, simultaneously through the GIS capability.
- 8. Provide information to regulators to help them review permit applications with recovery of injured resources/services in mind.

#### C. Location

Design and development components of the project will take place in Juneau and Anchorage. Project benefits will be realized throughout the CI/PWS watersheds. Communities that may be affected by the project include: Anchorage, Chenega, Cordova, Homer, Kenai, Nanwalek, Nikiski, Ninilchik, Port Graham, Seldovia, Soldotna, Tatitlek, Tyonek, Whittier, and Valdez.

#### COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Despite the wealth of information from studies following the *Exxon Valdez* oil spill and other research efforts, most of the information used to plan developments and to evaluate impacts to water quality and other resources in Cook Inlet and Prince William Sound is derived and analyzed in a fragmentary fashion. Permit decisions for development projects are based upon incomplete and disparate data sets that reside in formats not conducive to integrated analyses or public understanding of the issues.

To ensure that the proposed system will deliver the appropriate information in a format useful to stakeholders in the watershed, participation of municipal, environmental and private industry stakeholders will be solicited and welcomed. Stakeholders in both watersheds have previously been identified by various agency processes.

Although this project does not specifically address traditional ecological knowledge (TEK), TEK products that have a geo-referenced, digital database could be incorporated into the system. Data standards and QA/QC protocols will be made available to the TEK coordinator. The TEK coordinator could work with TEK projects collecting data to make researchers aware of the requirements for system compliance.

#### **PROJECT DESIGN**

#### A. Objectives

- 1. Create an information management/monitoring system.
- 2. Populate or link the system with data relevant to recovery monitoring of injured resources/services, water quality monitoring, management and planning of the Cook Inlet watershed.
- 3. Provide access, integration and analysis of information that will allow regulatory agencies to identify, track and regulate, and reduce sources of pollution that might adversely affect recovery of injured resources/services and their habitats.
- 4. Create access to the system for watershed stakeholders.

#### B. Methods

The proposed approach for creating and implementing an information management/ monitoring system includes the following steps:

- Step 1: Establish Project Management Team
- Step 2. Identify user needs and functional requirements.
- Step 3: Identify and prioritize data needed to support watershed management including that related to injured resources and services and reduction of marine pollution.

- Step 4: Evaluate existing computing infrastructure.
- Step 5: Design database, GIS, and network access.
- Step 6: Develop data standards, data transfer, & QA/QC protocols.
- Step 7: Integrate existing databases and metadata.
- Step 8: Develop a long range implementation, training, and maintenance plan.

Project implementation will initially focus on Cook Inlet with implementation of the Prince William Sound watershed to follow.

#### Step 1. Establish Project Management Team

ADNR and ADEC staff and a technical consultant will be selected to assist the Project Management Team (The Project Team). The project team will have demonstrated expertise in database management technology and GIS. Agency participants will be familiar with the *Exxon Valdez* restoration program, the CI/PWS watersheds, and agency responsibilities therein. Team members will review data sets, develop data standards, QA/QC protocols, and ensure that users of the system are involved in evaluating functionality of the system as it is being developed. The project team will interact with stakeholders and represent the project on the Cook Inlet watershed clearinghouse work group.

#### Step 2. Identify User Needs And Functional Requirements

Project team members will survey watershed partners and stakeholders (User Needs Analysis). The survey will target existing and potential watershed partners and stakeholders who will use or contribute data in order to determine specific user needs, functional requirements, and responsibilities. This approach will provide better communication with users and lay the groundwork necessary for development of a user-oriented design.

#### Step 3. Identify And Prioritize Data Needed To Support Watershed Management Including That Related To Injured Resources And Services And Reduction Of Marine Pollution.

There is a hierarchy of data needs in any ecosystem scale or watershed-based program. Many of these data sets will be identified in the User Needs Analysis (Step 2). Certain kinds of analytical and base data coverages are needed more frequently than others. For example, certain data sets may be accessed often to integrate living resources and water quality monitoring data so that watershed health can be monitored on a regular basis. Land use, human population and other demographic information may be accessed less frequently in order to conduct development trends analysis. Once this hierarchy is established, the project team will acquire and review the most essential data sets, write or update the accompanying metadata files, and prioritize them for incorporation or linkage to the system. This process will also be used to identify incomplete data sets and those that need to be converted to GIS coverages. The most applicable base map coverages and analytical data sets appropriate to effective watershed management in the Cook Inlet watershed include smaller scale geographic management unit coverages and larger scale, analytical coverages.

#### Step 4. Evaluate Existing Computing Infrastructure

Hardware, software and network configurations used in the system will be chosen on the basis of capability and compatibility with existing systems. Much of the data accessible through the system

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will be referenced geographically. A geographic information system (GIS) will be used to visualize these data and discover new relationships, especially as they relate to detection of cumulative impacts, conduct spatial analyses using analytical algorithms, and generate maps that are easily understood by decision makers and the general public. Various database and GIS options will be considered that embody needed capacity, compatibility, technical support and user-friendliness.

Most State and Federal agencies are using either Arc/Info or ArcView or both to view and manage geographic information. It is expected that ArcView will be used as a prototyping tool.

## Step 5. Design Database, GIS and Network Access

Once hardware and software requirements are identified, an object based design effort will document the essential system components. A prototype will then be developed based upon specifications delineated in the User Needs Analysis, prioritized list of data sets, the system design, and the recommended hardware software, and network configurations.

The prototype will contain a transaction based system designed to accommodate tabular data associated with permitting and regulatory activities. This component of the project will be developed in close coordination with ADEC regulatory staff in order to capture all pertinent water quality information. The transaction based system will be related to a decision making tool utilizing base map information to depict relationships between physical, biological, and cultural features of the watershed. The initial prototype will be populated with a subset of readily available datasets from the prioritized list of data sets. Information sources referencing available data are identified in the References section.

The Project Team will introduce the prototype to partners and stakeholders to solicit additional input from potential users. The Project Team will observe use patterns and query potential users on potential training needs. Initial review of the prototype will result in a preliminary analysis of training and access needs for various user groups.

The final product, which will be based on the prototype and its evaluation, will enable users to access data, browse, select, integrate, and analyze different types of data from disparate sources including geo-referenced spatial data. Part of the design and development process will be the creation of a user-friendly, menu driven, graphical user interface.

#### Step 6. Develop Data Standards, Data Transfer & QA/QC Protocols

Common data definitions, standardized data entry, data transfer, metadata standards, and reporting procedures will be developed and adopted for this specific project for both spatial and non-spatial data. Current standards will be used when they already exist. For example, FGDC standards for metadata will be utilized. Data standards will apply to specific data elements, and will address how and what types of information will be recorded. Data standards affect data collection and reporting at fundamental levels. Metadata describes the content, context, quality, structure, availability, and spatial/temporal span of the data. Metadata minimally should include all information sufficient and necessary to enable analysis and data reuse by the original scientist(s) (Michener 1997).

The Design Team will evaluate data sources for ease of use and relevance to the project. Data gaps will be identified with suggestions for filling these gaps. A revised, prioritized list will be developed which takes into account:

- status of data,
- importance of data to success of the project,
- accuracy,

- scale,
- currency,
- QA/QC,
- format,
- organization of the data,
- integrity of the data,
- adherence to data standards,
- duplication and redundancy,
- resources needed to acquire the data,
- effort required to incorporate data into system, and
- update requirements.

#### Step 7. Integrate Existing Databases and Metadata Files

Primary and high priority data sets that are in compliance with documentation and process standards will be loaded into the system. Other compatible data sets, accompanied by metadata files, will be linked to the system. Updates to existing data sets and new data sets will be evaluated for compliance with standards and brought into the system over time.

#### Step 8. Develop a Long-Range Implementation Plan

A plan will be developed for maintaining the system and transferring, relating, integrating and updating data over the long run. The plan will include staffing, hardware and software, application and networking recommendations. Deliverables associated with Step 8 include Project Design Document, Training Manual, and User's Guide. The Department of Natural Resources is committed to maintaining the GIS coverages supporting this application as part of their on-going role in maintaining a National GeoSpatial Data Clearinghouse node at ADNR.

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

The Alaska Department of Environmental Conservation and the Alaska Department of Natural Resources will be jointly responsible for project implementation, drawing upon the expertise within each agency. Both agencies will work cooperatively with technical consultants in the areas of hardware and software upgrade requirements, data acquisition and translation support, application development, and staff training. ADEC will focus primarily on water quality issues and database design while ADNR will lend assistance in the areas of geo-referenced data issues, application development, and resource management issues.

ADEC will conduct an in-house review of other agencies' water quality data inventories in addition to ADEC's Data Repository Analysis (Resource Data, Inc., 1997). ADEC will develop QA/QC protocols and data collection standards associated with water quality data. ADEC will assist in the design and development of the tabular database engine. ADEC will conduct workshops with stakeholders to determine their data needs, review sampling protocols and provide system training.

In keeping with its objective, to develop a State wide watershed approach, ADEC will operate and maintain the information-monitoring system subsequent to completion of this project. This long term committment will allow the Trustee Council, the scientific community, resource managers and the public to access information on the recovery of injured resources and services.

ADNR is currently implementing an "Alaska State Geospatial Clearinghouse" funded with a grant from USGS. The Clearinghouse project will establish a National Geospatial Data Clearinghouse node at the Alaska Department of Natural Resources which will allow for the development of an electronic pathway to meet public and inter-agency demands for geospatial data. Data will be documented according to the FGDC requirements to ensure consistency and discovery on line. The ADNR Clearinghouse project focuses on state and local data and will complement the Alaska Geographic Data Clearinghouse site developed and maintained by USGS.

As a result of the clearinghouse project ADNR will be able to facilitate the identification of available data, encourage the efficient use of State and Federal resources in order to avoid duplication of effort, and ensure that data, as it is incorporated into this project, is both useful to and consistent with other Statewide efforts. ADNR will be responsible for evaluating and determining usefulness of related GIS data, and will take the lead in making data usable to the GIS application developed as a result of this project. ADNR will ensure that the GIS interface is compatible with other State GIS projects, software and data collection efforts. ADNR will develop data and data transfer standards for this project, and evaluate existing hardware and software configurations in terms of capability, capacity, and compatibility. ADNR will have primary responsibility for the GIS component of this project.

As a collaborator on the project, EPA will provide technical assistance in system design as well as access to the EPA Contractor responsible for designing similar systems in other States. As part of the overall EPA and ADEC objective of a State wide watershed approach, emphasis will be placed on assuring that the project is complementary to the concept of a State-wide "Environmental Information Clearinghouse." EPA will also serve as the facilitator for involvement in the project of other Federal natural resource agencies. EPA has also agreed to make all of its Water Quality and Permits data bases available to the Cook Inlet/Prince William Sound Management/monitoring System.

A consultant will be utilized to facilitate creation of a database structural framework and integration of water quality data, EVOS related data, environmental data, cultural and physical features into a GIS-based decision making tool with the potential for Internet access.

It is expected that some level of data review and QA/QC procedures may be accomplished through the use of student interns working through the University of Alaska, Co-op Program.

#### **SCHEDULE**

#### Measurable Project Tasks for FY 99 (October 1, 1998 -September 30, 1999)

| Phase | I |
|-------|---|
|-------|---|

| October 1998   | Create Information Management Design and Implementation Tea  | m.    |
|----------------|--|-------|
| October 1998   | Initiate multi-agency data inventory.<br>Initiate User Needs Assessment.<br>Initiate development of data standards protocol.   |       |
| January 1999   | Prioritized list of data sources and strategy for data acquisition.<br>User Needs Analysis.<br>Systems evaluation of hardware and software.<br>Build database model. |       |
| January - June | Establishment of data standards.<br>Initiate data acquisition, manipulation, QA/QC.<br>Compile metadata.   |       |
| 4/10/98        | 10   | 99xxx |

|               | Rapid Prototype development for Cook Inlet.  |
|---------------|--|
| Ongoing       | Data acquisition, manipulation, QA/QC.   |
| July -October | Prototype evaluation.<br>Complete equipment augmentation & software upgrade.<br>Initiate agency staff training as a prototype evaluation tool.   |
| Phase II      |  |
| October 1999  | Initiate integration of prioritized databases and associated metadata.<br>Continue agency staff training as a prototype evaluation tool.<br>Initiation of Prince William Sound System. |
| June 2000     | Integration of databases completed. Data documentation/metadata completed.   |
| August        | Complete user's manual and database documentation.   |
| September     | Staff Training and public outreach.  |

# **Project Milestones and Endpoints**

Phase I

| October 1998    | Create Information Management Design and Implementation Team.   |
|-----------------|---|
| January 1999    | Prioritized list of data sources and strategy for data acquisition.<br>User Needs Analysis.<br>Systems evaluation of hardware and software. |
| March           | Entity relationship data model (database diagram/model).  |
| June            | Establishment of data standards.<br>Rapid Prototype for Cook Inlet.   |
| July<br>October | Complete equipment augmentation and software upgrade.<br>Beta Version of Database System.   |
| Phase II        |   |
| June 2000       | Integration of databases and metadata.  |
| August          | User's manual and database documentation.   |
| September       | Staff Training and public outreach.   |
|                 |   |

# Completion Date September 30, 2000.

#### NORMAL AGENCY MANAGEMENT

Resource agency management mandates in the CI/PWS watersheds do not specifically address recovery monitoring or management of injured resources/services or their habitats. Only projects that have been funded by the *Exxon Valdez* Oil Spill Trustee Council have focused on injured resources and services as an objective.

Agency regulatory actions are generally focused on single resource management strategies or individual project implementation. These actions generally lack a coordinated, comprehensive ecosystems approach. Ecosystem or watershed-level management requires access and integration of a diverse array of data from disparate sources. In order for agencies to consider the cumulative impact of management and regulatory actions on injured resources and services and their associated habitats, the agencies must be able to integrate and utilize the data and information collected about these resources. Agencies do not normally consider, or have the capability to consider, the impact of management and permitting decisions on injured resources and services.

The lack of a coordinated, comprehensive watershed-level approach precludes effective management. It also precludes the implementation of cost-effective solutions that are beyond the capability and capacity of the individual agencies and communities. As a result, there is increased environmental stress and further degradation of existing services, resulting in injury to local resources important to the livelihood of these communities. A cooperative effort between the agencies and communities is needed to improve the management of water resources and facilitate recovery of injured resources.

#### COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project will be integrated with the Restoration Effort through the User Needs Analysis. Key Principal Investigators will be surveyed and asked to evaluate and test the system for usefulness and the ability to accommodate results of their research. It is extremely important that key information derived from EVOS studies be included in this system if end users are to be able to include information relative to injured resources and services in their decision making processes. In addition, extensive coordination with the PWS Human Use Model, SEA, APEX and NVP, will avoid duplication of effort and ensure that pertinent data and information from those projects is incorporated into this system.

#### PRINCIPAL INVESTIGATORS

#### Jeff Hock

Jeff Hock has a Bachelor's degree in Environmental Sciences from the University of Virginia with significant coursework in civil engineering. He has been employed in various capacities with the State of Alaska since 1975 in both the Alaska Department of Fish & Game and the Department of Environmental Conservation. As an Ecologist with the ADEC Division of Environmental Quality he has been involved in the design and implementation of a variety of monitoring projects and has extensive experience in quality assurance, project plan development and review, and sampling methodology. He has been instrumental in exploring and implementing new technologies within the Division of Environmental Quality including, modeling software, rapid bioassessment protocols, satellite telemetry, global positioning technology, geographic information systems, and automated water quality data acquisitions and telemetry systems. Mr. Hock's responsibilities also

include developing and implementing ADEC's watershed framework by working with local stakeholders, and participating on various statewide water quality planning committees.

#### **Russell Kunibe**

Russell Kunibe has an MS and BS in Physiology from UC Davis and has 9 years of experience with the Department of Environmental Conservation both as an Environmental Specialist and as an Analyst Programmer. He is currently responsible for the DEC Web site and is the department GIS expert. He has seved as the department representative to the Statewide GIS committee and Webmasters committee. He has managed the Spill Prevention and Response Division's data management tasks.

In addition Mr. Kunibe has a working knowledge of the Cook Inlet and Prince William Sound areas. He successfully owned and operated his own commercial fishing, boat charter, and dive shop businesses in Homer prior to the Exxon Valdez Spill. During the response to the Exxon Valdez Spill, Mr. Kunibe managed the DEC Field Office in Homer.

#### **Dorothy Mortenson**

Dorothy Mortenson has fourteen years of cartographic and geographic information system experience. She is currently the GIS Project Manager and a senior member of the Technical Iinformation Services staff at the Alaska Department of Natural Resources, and is responsible for all aspects of GIS services for the Exxon Valdez oil spill mapping and analysis. Ms. Mortenson has piloted projects to improve data quality, efficiency, and accessibility. Ms. Mortenson received the "Director's Technical Contribution Award" from the Environmental Protection Agency, 1989 and has a Bachelor of Science degree in Geography with an emphasis on Cartography and Remote Sensing, Oregon State University, 1986.

Ms. Mortenson has been instrumental in creating an ADNR GIS User's Group and has actively participated in statewide State Federal Data Clearinghouse efforts and projects. She is currently involved in the implementation of the Alaska State Geospatial Clearinghouse, an NSDI Competitive Cooperative Agreement with USGS. This project will establish a National Geospatial Data Clearing-house node at the Alaska Department of Natural Resources. This project will allow for the development of an electronic pathway to meet public and inter-agency demands for geospatial data. Data will be documented per the requirements of the FGDC "GEO" content standards to assure discovery. This node will complement the NSDI clearinghouse site established at the Alaska Field Office of the US Geological Survey by focusing on state and local data. Ms. Mortenson's experience in this project will prove invaluable as the team seeks to identify existing data sets, avoid duplication of effort, and leverage ongoing data acquisition, and manipulation efforts.

#### **Kelly Zeiner**

Kelly Zeiner has a Master of Science in Spatial Information Science and Engineering from the University of Maine, Orono, and a Bachelor's Degree in Management Information Systems from Northeastern University, Boston, MA. She has extensive experience with Arc/Info, ArcView, and a variety of programming languages (AML, DIBOL, COBOL, BASIC) and computer operating systems (UNIX, Windows, Macintosh). As part of her graduate program she designed and taught a series of 3 day ArcView/Avenue course exercises and lectures at the University of Maine. This experience is invaluable in communicating with potential system users, managers, and scientists and interpreting and understanding their information and analytical needs.

Ms. Zeiner has been employed at DNR since 1992 and has extensive experience with *Exxon Valdez* Oil Spill data and project demands. Final products of her work on EVOS related projects include applications ("EVOS Oil Spill Research & Restoration Information Project"), maps, slides, and reports on analyses performed. Ms. Zeiner has also designed and built a prototype application using ArcView 3.0 for viewing and querying ADNR's statewide parcel-level database, including an SQL connection to a massive land records database. In addition, Ms. Zeiner has designed a prototype application based on the State of Florida's Oil Spill Contingency Planning tool using ArcView 3.0 adapted for use in the State of Alaska. The contingency planning prototype has focused on the Kodiak region.

#### **KEY PERSONNEL**

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October 1, 1998 - September 30, 1999

|                             | Authorized | Proposed | PROPOSED FY 1999 TRUSTEE AGENCIES TOTALS |                  |                    |                                   |                   |                            |
|-----------------------------|------------|----------|--|------------------|--------------------|-----------------------------------|-------------------|----------------------------|
| Budget Category:            | FY 1998    | FY 1999  | ADEC                                     | ADF&G            | ADNR               | USFS                              | DOI               | NOAA                       |
|                             |            |          | \$220.6                                  |                  | \$430.1            |                                   |                   |                            |
| Personnel                   | \$0.0      | \$277.8  |  |                  | None State         | an series and                     | Statillers Hollow | and the state of the state |
| Travel                      | \$0.0      | \$15.7   |  |                  |                    |                                   |                   |                            |
| Contractual                 | \$0.0      | \$270.5  |  |                  |                    |                                   |                   |                            |
| Commodities                 | \$0.0      | \$3.2    |  |                  |                    |                                   |                   |                            |
| Equipment                   | \$0.0      | \$48.2   |  | LONG F           | RANGE FUNDI        | NG REQUIREN                       | IENTS             |                            |
| Subtotal                    | \$0.0      | \$615.4  |  | Estimated        | Estimated          | Estimated                         |                   | ]                          |
| General Administration      | \$0.0      | \$60.1   |  | FY 2000          | FY 2001            | FY 2002                           |                   |                            |
| Project Total               | \$0.0      | \$675.5  |  | \$315.0          | \$0.0              | \$0.0                             |                   |                            |
|                             |            |          | The second states                        | STATISTICS STATE | HERE WEIGHT        | state all sources and sources and | with the second   |                            |
| Full-time Equivalents (FTE) | 0.0        | 5.0      |  |                  | Line constants and |                                   | Nutrie Flores and | an at a to                 |
|                             |            |          | Dollar amoun                             | ts are shown ir  | thousands of c     | follars.                          |                   | <                          |
| Other Resources             | \$0.0      | \$0.0    |  | \$0.0            | \$0.0              | \$0.0                             |                   |                            |

Comments: This project will develop an integrated data base containing digital environmental and spatial data for the Cook Inlet and Prince William Sound watersheds. The proposed system will facilitate access to significant amounts of disparate data from a wide variety of sources about the resources and services injured by the Exxon Valdez Oil Spill as well as base data sets important to understanding the environment of the watersheds. This database and its associated retrieval system will support monitoring, management and restoration of resources and services injured by the Exxon Valdez Oil Spill. The system will provide access to data, graphics, images, text and documents for users in both the public and private sectors. It will relate current, historical and future data sets thereby improving data availability, access and integration. The system will enable syntheses, environmental analyses, planning and natural resources management. Water quality data sets derived from the two watersheds will provide the cornerstone of this system thereby facilitating monitoring of both baseline parameters and chronic sources of marine pollution that may be affecting recovery of injured resources and services. From both public policy and natural resources management perspectives, this project will protect the governments' investment in restoration by making information derived from restoration activities and water quality monitoring programs available for management of the watersheds in a manner that will promote the recovery of the injured resources and services.

1999

Project Number: Project Title: CI/PWS Information Management/Monitoring System Lead Agency: AK Dept. of Environmental Conservation and Natural Resources FORM 2A MULTI-TRUSTEE AGENCY SUMMARY

1998 EXXON VALDEZ TRUS

ON VALDEZ TRUS COUNCIL PROJECT BUDGET October 1, 1998 - September 30, 1999

|                        |            | Authorized     | Proposed     |                                 |                  |                |               |  |                  |
|------------------------|------------|----------------|--------------|---------------------------------|------------------|----------------|---------------|--|------------------|
| Budget Category:       |            | FY 1998        | FY 1999      |                                 |                  |                |               |  |                  |
| Demonst                |            |                |              |                                 |                  |                |               |  |                  |
| Personnel              |            |                | \$155.0      |                                 |                  |                |               |  |                  |
| Contractual            |            |                | \$12.7       |                                 |                  |                |               |  |                  |
| Commodition            |            |                | \$10.5       |                                 |                  |                |               |  |                  |
| Commodities            |            |                | \$1.5        |                                 |                  |                |               |  |                  |
|                        |            |                | \$40.2       |                                 | LONG R           | ANGE FUNDIN    |               | ENIS   | 1                |
| Subtotal               | ~ -        | \$0.0          | \$219.9      |                                 | Estimated        | Estimated      | Estimated     |  |                  |
| General Administrati   | on         | <b>*</b>       | \$24.0       |                                 | FY 2000          | FY 2001        | FY 2002       |  |                  |
| Project I otal         |            | \$0.0          | \$243.9      | Ministeries Constant Statements | \$140.0          |                |               | Service and the service of the second service of the |                  |
|                        | / <b>-</b> |                |              |                                 |                  |                | <b>动物的 网络</b> | a far far her start at the start                     | Lis and some set |
| IFull-time Equivalents | s (FIE)    | <u>_</u>       | 2.3          |                                 |                  | 1.04 VA 1.     |               |  |                  |
|                        |            |                |              | Dollar amour                    | nts are shown ir | thousands of   | dollars.      |  | T                |
| Other Resources        |            |                |              |                                 |                  |                |               | <u> </u>   |                  |
| Comments:              |            |                |              |                                 |                  |                |               |  |                  |
|                        |            |                |              |                                 |                  |                |               |  |                  |
|                        |            |                |              |                                 |                  |                |               |  |                  |
|                        |            |                |              |                                 |                  |                |               |  |                  |
|                        |            |                |              |                                 |                  |                |               |  |                  |
|                        |            |                |              |                                 |                  |                |               |  |                  |
|                        |            |                |              |                                 |                  |                |               |  |                  |
|                        |            |                |              |                                 |                  |                |               |  |                  |
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|                        |            |                |              |                                 |                  |                |               |  |                  |
|                        |            |                |              |                                 |                  |                |               |  |                  |
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|                        |            |                |              |                                 |                  |                |               |  |                  |
|                        |            |                |              | <u></u>                         |                  |                |               |  |                  |
|                        |            |                |              |                                 |                  |                |               | r  |                  |
|                        |            |                |              |                                 |                  |                |               |  | FORM 3A          |
| 1000                   |            | Project Numb   | ber:         |                                 | - /8 /           |                |               |  | TRUSTEE          |
| 1999                   |            | Project Title: | CI/PWS Info  | rmation Man                     | agement/Mor      | nitoring Syste | em 👘          |  | AGENCY           |
|                        |            | Lead Agency    | : AK Dept. c | of Environme                    | ntal Conserva    | ation          |               | 9  | SUMMARY          |
|                        |            |                |              |                                 |                  |                |               |  |                  |
| Prepared: 2            | of 14      |                |              |                                 |                  |                |               |  | 4/10/98          |

October 1, 1998 - September 30, 1999

| Personnel Costs:                         |   | GS/Range/ | Months                                 | Monthly |              | Proposed        |
|--|---|-----------|--|---------|--------------|-----------------|
| Name                                     | Position Description                      | Step      | Budgeted                               | Costs   | Overtime     | FY 1999         |
| TBD                                      | Analyst Programmer III                    | 17        | 12.0                                   | 6.7     |              | 80.4            |
| Jeff Hock                                | Environmental Specialist IV               | 20        | 6.0                                    | 7.2     |              | 43.2            |
| Russell Kunibe                           | Analyst Programmer IV                     | 19        | 2.0                                    | 6.9     |              | 13.8            |
|  | Student Intern                            |           | 8.0                                    | 2.2     |              | 17.6            |
|  |   |           |  |         |              | 0.0             |
|  |   |           |  |         |              | 0.0             |
|  |   |           |  |         |              | 0.0             |
|  |   |           |  |         |              | 0.0             |
|  |   |           |  |         |              | 0.0             |
|  |   |           |  |         |              | 0.0             |
|  |   |           |  |         |              | 0.0             |
| · · · · · · · · · · · · · · · · · · ·    |   |           |  |         |              | 0.0             |
|  | Subtotal                                  |           | 28.0                                   | 23.0    | 0.0          | <b><i>Ф</i></b> |
|  |   |           |  |         | \$155.0      |                 |
| Travel Costs:                            | ······································    | licket    | Round                                  | Iotal   | Daily        | Proposed        |
| Description                              |   | Price     | l rips                                 | Days    | Per Diem     | FY 1999         |
| Travalto Anchorana to mant.              |   | 0.45      | 10                                     | 00      | 0.15         | 0.0             |
| Travel to Anchorage to meet v            | with cooperators.                         | 0.45      | 10                                     | 30      | 0.15         | 9.0             |
| Troval to Kanai to most with S           | takahaldara municipal cay, and public     | 0.11      | 4                                      | 10      | 0.15         | 0.0             |
| Traver to Kenar to meet with S           | takenoluers, municipal gov. and public    | 0.11      | 4                                      | 12      | 0.15         | 2.2             |
| Travel to Valdez to most with            | Stakeholdere, municipal day, and public   | 0.19      | 0                                      | 1       | 0.15         | 1.0             |
| maver to valuez to meet with             | Stakeholders, municipal gov. and public   | 0.10      | 2                                      | 4       | 0.15         | 1.0             |
| Travel to Cordova to most with           | a Stakeholders, municipal dov, and public | 0.20      | 4                                      | 2       | 0.15         | 0.0             |
|  | T Stakeholders, municipal gov. and public | 0.20      | 1                                      | 2       | 0.10         | 0.0             |
|  |   |           |  |         |              | 0.0             |
|  |   |           |  |         | l            | 0.0             |
|  |   |           |  |         |              | 0.0             |
| an a |   |           | ······································ |         | Travel Total | \$12.7          |

| 1999     |         | Project Number:<br>Project Title: CI/PWS Information Management/Monitoring System<br>Lead Agency: AK Dept. of Environmental Conservation |     | FORM 3B<br>Personnel<br>& Travel<br>DETAIL |
|----------|---------|--|-----|--|
| repared: | 3 of 14 |  | ] — | 4/10/98                                    |

1998 EXXON VALDEZ TRUS

COUNCIL PROJECT BUDGET October 1, 1998 - September 30, 1999

se.

| Contractual Cost         | S:  |                   | Proposed  |
|--------------------------|---|-------------------|---|
| Description              |   |                   | FY 1999   |
| Air Charter ar           | nd Boat Charters needed to access local communities for project input.<br>Boat Charters (Cook Inlet), 20 hours @ \$70 hour.<br>Air Charters, 20 hours @ \$250 hour.<br>Boat Charters (PWS), 4 days @ \$400/day. |                   | 1.4<br>7.5<br>1.6                                       |
| When a non-truste        | e organization is used, the form 4A is required   | Contractual Total | \$10.5  |
| Commodition Co           |   |                   | Proposed  |
| Deparintion              | 515,  |                   |   |
| Office Cupplic           | · · · · ·   |                   | 05  |
| Computer sup             | pport materials (storage media, plotter cartridges, plotter paper, cabling, routers).   |                   | 1.0   |
| L                        |   | Commodities Total | \$1.5   |
| <b>1999</b><br>Prepared: | Project Number:<br>Project Title: CI/PWS Information Management/Monitoring Syst<br>Lead Agency: AK Dept. of Environmental Conservation  | em F<br>Cor<br>Co | ORM 3B<br>ntractual &<br>mmodities<br>DETAIL<br>4/10/98 |

October 1, 1998 - September 30, 1999

| New Equipment   | Purchases:     |   | Number   | Unit          | Proposed  |
|-----------------|----------------|---|----------|---------------|-----------|
| Description     |                |   | of Units | Price         | FY 1999   |
| Arc View Lic    | ense           |   | 4        | 1.3           | 5.2       |
| Relational DI   | B License      |   | 1        | 15.0          | 15.0      |
| Server          |                |   | 1        | 20.0          | 20.0      |
|                 |                |   |          |               | 0.0       |
|                 |                |   |          |               | 0.0       |
|                 |                |   |          |               | 0.0       |
|                 |                |   |          |               | 0.0       |
|                 |                |   |          |               | 0.0       |
|                 |                |   |          |               | 0.0       |
|                 |                |   |          |               | 0.0       |
|                 |                |   |          |               | 0.0       |
|                 |                |   |          |               | 0.0       |
|                 |                |   |          |               | 0.0       |
| Those purchases | associated wit | h replacement equipment should be indicated by placement of an R. | New Eq   | uipment Total | \$40.2    |
| Existing Equipm | ent Usage:     |   |          | Number        | Inventory |
| Description     |                |   |          | of Units      | Agency    |
|                 |                |   |          |               |           |
|                 |                |   |          |               |           |
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| r               | -1             |   |          | Γ             | )         |
|                 |                |   |          | F             | ORM 3B    |
| 1000            |                | Project Number:   |          | E             | auipment  |
| 1999            |                | Project Title: CI/PWS Information Management/Monitoring Syste     | em       |               | DETAIL    |
|                 |                | Lead Agency: AK Dept. of Environmental Conservation               |          |               |           |
| L               | _]             |   |          | L             |           |
| Prepared:       | 5 of 14        |   |          |               | 4/10/98   |

October 1, 1998 - September 30, 1999

|                                    | Authorized                                     | Proposed                               | · Charles Male               | NAMES OF STREET          | en en sit ette                              | ugir i gaardin |  | dinesis en services                      |
|------------------------------------|--|--|------------------------------|--------------------------|---|----------------|--|--|
| Budget Category:                   | FY 1998  | FY 1999                                |                              |                          |   |                | Strephene State  |  |
| Dereennel                          |  |  |                              |                          | uting streets                               |                | e service and  |  |
| Travel                             |  | \$122.8                                |                              |                          |   |                |  |  |
| Contractual                        |  | \$3.0                                  |                              |                          |   |                |  |  |
| Commodities                        |  | <u></u>                                |                              |                          |   |                |  |  |
| Equipmont                          |  | <u>φ1.7</u>                            |                              |                          |   |                | ENTO   |  |
| Subtotal                           |  | \$8.0                                  |                              |                          |   |                | ENIS   | -  |
| Subioial<br>Conorol Administration | \$0.0  | \$395.5                                |                              | Estimated                | Estimated                                   | Estimated      |  |  |
| Broject Total                      | <b>#0.0</b>                                    | \$30.1                                 |                              | FY 2000                  | FY 2001                                     | FY 2002        |  |  |
|                                    | \$0.0  | \$431.5                                | ·                            | \$175.0                  | Charles of Franks, Springer, Martin, et al. |                | en de la compañía de compañía de la |  |
| Full time Equivalente (ETE)        |  |  |                              |                          | a star strand th                            |                | 2 Carte State  | an a |
| Full-time Equivalents (FTE)        |  | 2.1                                    | Dalla                        |                          |   | 1-0            |  |  |
| Other Resources                    |  | •••••••••••••••••••••••••••••••••••••• | Dollar amou                  | nts are snown ir         | thousands of                                | dollars.<br>T  | T  |  |
|                                    |  |  |                              |                          |   | <u> </u>       | L  |  |
|                                    |  |  |                              |                          |   |                |  |  |
| 1999<br>Prepared: 6 of 14          | Project Numb<br>Project Title:<br>Agency: AK I | er:<br>CI/PWS Info<br>Department       | ormation Mar<br>of Natural R | nagement/Mor<br>esources | nitoring Syste                              | əm             |  | FORM 3A<br>TRUSTEE<br>AGENCY<br>SUMMARY  |

October 1, 1998 - September 30, 1999

| Personnel Costs:                                      | GS/Range/                             | Months   | Monthly |                | Proposed |
|---|---------------------------------------|----------|---------|----------------|----------|
| Name Position Description                             | Step                                  | Budgeted | Costs   | Overtime       | FY 1999  |
| Kelly Zeiner / TBD Analyst Programmer IV              | 19                                    | 12.0     | 5.8     |                | 69.6     |
| TBD Student Intern, 1 part time annually              |                                       | 12.0     | 1.1     |                | 13.2     |
| TBD Student Intern, Full time summer                  |                                       | 3.0      | 2.2     |                | 6.6      |
| Dorothy Mortenson Analyst Programmer IV               | 19                                    | 2.0      | 6.2     |                | 12.4     |
| TBD Natural Resource Manager                          | 20                                    | 3.0      | 7.0     |                | 21.0     |
|   |                                       |          |         |                | 0.0      |
|   |                                       |          |         |                | 0.0      |
|   |                                       |          |         |                | 0.0      |
|   |                                       |          |         |                | 0.0      |
|   |                                       |          |         |                | 0.0      |
|   |                                       |          |         |                | 0.0      |
|   |                                       |          |         |                | 0.0      |
| Subtota   |                                       | 32.0     | 22.3    | 0.0            |          |
|   | · · · · · · · · · · · · · · · · · · · |          | Pe      | ersonnel Total | \$122.8  |
| Travel Costs:   | Ticket                                | Round    | Total   | Daily          | Proposed |
| Description   | Price                                 | Trips    | Days    | Per Diem       | FY 1999  |
|   |                                       |          |         |                | 0.0      |
| Travel to local communities                           | 0.2                                   | 6        | 12      | 0.15           | 3.0      |
| (Includes primarily, Kenai area, Valdez, and Cordova) |                                       |          |         |                | 0.0      |
|   |                                       |          |         |                | 0.0      |
|   |                                       | ]        |         |                | 0.0      |
|   |                                       |          |         |                | 0.0      |
|   |                                       |          |         |                | 0.0      |
|   |                                       |          |         |                | 0.0      |
|   |                                       |          |         |                | 0.0      |
|   |                                       |          |         |                | 0.0      |
|   |                                       |          |         |                | 0.0      |
|   |                                       |          |         |                | 0.0      |
|   |                                       |          |         | Travel Total   | \$3.0    |
|   |                                       |          |         |                |          |
|   |                                       |          |         |                | ORM 3B   |

Project Number: Personnel 1999 Project Title: CI/PWS Information Management/Monitoring System Agency: AK Department of Natural Resources & Travel DETAIL Prepared: 7 of 14

October 1, 1998 - September 30, 1999

| Contractual Costs:   |   | Proposed                                     |
|--|---|--|
| Description  |   | FY 1999                                      |
| Data Conversion<br>Consulting Servi<br>E<br>F<br>D<br>P<br>U | n, Data Cleanup, Data Documentation<br>ces for development and implementation of:<br>atabase Model<br>apid Prototype<br>ata Integration<br>rototype Evaluation, Refinement<br>sers Manual, Training, DB Documentation                                     | 60.0<br>200.0                                |
| (<br>a<br>lı<br>s  | Contractual support for project implementation is expected to be<br>pproximately \$150,000 for system development focusing on Cook Inlet.<br>nplementation in Prince William Sound following development of Cook Inlet<br>ystem is estimated at \$50,000. |  |
| When a non-trustee o   | rganization is used, the form 4A is required. Contractual Total   | \$260.0                                      |
| Commodities Costs:<br>Description                            |   | Proposed<br>FY 1999                          |
| Plotter Paper<br>Storage Media<br>Software upgrad            | es<br>Commodities Total   | 0.3<br>1.0<br>0.4                            |
| l  | Commodities Total   | \$1.7  |
| 1999   | Project Number:<br>Project Title: CI/PWS Information Management/Monitoring System<br>Agency: AK Department of Natural Resources   | ORM 3B<br>ntractual &<br>mmodities<br>DETAIL |

Prepared: 8 of 14

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October 1, 1998 - September 30, 1999

| New  | Equipment Purchases:        |  | Number   | Unit          | Proposed  |
|------|-----------------------------|--|----------|---------------|-----------|
| Des  | cription                    |  | of Units | Price         | FY 1999   |
|      |                             |  |          |               | 0.0       |
|      | Desktop PC, Pentium Proce   | essor  | 1        | 5.0           | 5.0       |
|      | ArcView License w spatial a | analyst  | 1        | 3.0           | 3.0       |
|      |                             |  |          |               | 0.0       |
|      |                             |  |          |               | 0.0       |
|      |                             |  |          |               | 0.0       |
|      |                             |  |          |               | 0.0       |
|      |                             |  |          |               | 0.0       |
|      |                             |  |          |               | 0.0       |
|      |                             |  |          |               | 0.0       |
|      |                             |  |          |               | 0.0       |
|      |                             |  |          |               | 0.0       |
| Thos | e purchases associated with | h replacement equipment should be indicated by placement of an R.                  | New Eq   | uipment Total | \$8.0     |
| Exis | ting Equipment Usage:       |  |          | Number        | Inventory |
| Desc | cription                    |  |          | of Units      | Agency    |
|      |                             |  |          |               |           |
|      |                             |  |          |               |           |
|      |                             |  |          |               |           |
|      |                             |  |          |               |           |
|      |                             |  |          |               |           |
|      |                             |  |          |               |           |
|      |                             |  |          |               |           |
| L    |                             |  |          |               |           |
|      |                             | Broiget Number:  |          | F             | ORM 3B    |
|      | 1999                        | Project Number.<br>Project Title: CI/PWS Information Management/Monitoring Systems | tem      | E             | quipment  |
|      |                             | Agency: AK Department of Natural Resources   |          |               |           |
| Prep | ared: 9 of 14               |  |          |               | 4/10/98   |



# PrinceWilliamSoundFoodWebs:StructureandChange,Submitted UndertheBAA

Research

Project Number:

99393-BAA

APR 1 3 1998

EXXON VALDEZ OIL SPILL

TRUSTEE COUNCIL

Restoration Category:

Proposer:

Prince William Sound Science Center Cordova, Alaska

Lead Trustee Agency: Cooperating Agencies: NOAA

Alaska SeaLife Center:

Duration:

Cost FY 99: Cost FY 00: Cost FY 01: Cost FY 02:

Geographic Area:

InjuredResource/Service:

Year 1, 4-year project

\$ 207.2K \$ 250K \$ 175K \$ 150K

Prince William Sound

Fishes and their Injured Consumers, Fisheries: Commercial, Recreational, and Subsistence

#### ABSTRACT

Recent research has shown that the advective regime connecting the northern Gulf of Alaska (GOA) with Prince William Sound (PWS) may affect recruitment and nutritional processes in Fishes (Kline 1998b). Accordingly, food webs are subject to changes in carbon flow occurring between GOA and PWS. This project seeks to: (1) conduct retrospective analysis of GOA production shifts since EVOS, (2) address Ecopath model validation data gaps, (3) find evidence of biophysical coupling from the 1997-8 ENSO event, (4) address a benthos data gap, and (5) expand the isotopic database domain in space and time.

#### **INTRODUCTION**

Stable isotope ratios of carbon and nitrogen have been shown to serve as effective tracers of energy supply in the Prince William Sound study area (Kline 1997a, 1997b, 1998a, 1998b) This is due to (1) the conservative transfer of carbon isotope ratios between the lower tropic levels (phytoplankton to zooplankton to forage fishes, etc.) of Prince William Sound (PWS) and adjacent Gulf of Alaska (GOA) waters up to the top consumers and (2) the naturally occurring gradient in  $^{13}C/^{12}C$  productivity generated in the Gulf compared with the Sound. Organisms acquire these isotope ratios in response to the importance of the food in bulk body tissues. Isotope ratio analysis of tissues thus provide insight into both habitat usage and assist in quantifying amounts derived from various areas. Nitrogen isotope ratios, in turn, provide excellent definition of relative trophic level. The heavy isotope of nitrogen is enriched by about 0.3 % with each trophic level and thus can accurately indicate the relative trophic status of species within an ecosystem (Minagawa and Wada 1984, Fry 1988) and is useful for food web model validation (Kline and Pauly 1998, Kline 1998b).

#### **RESULTS FROM PRIOR WORK**

Juvenile herring and pollock are the dominant pelagic fishes in PWS and both consume zooplankton. Juvenile herring and pollock from PWS shifted in  ${}^{13}C/{}^{12}C$  content between 1994 and 1995 from which a change in carbon source dependency was inferred (Fig. 1). Although both species shifted in concert to greater GOA dependency in 1995 than 1994, pollock were consistently less dependent on GOA carbon. Juvenile pollock and herring occupy different levels in the water column, have different schooling behavior, and recruit from the larval stage at different times, effecting access to a different forage-base as confirmed by the data. This difference may not be reflected in the species composition of diet but instead the where and when of the production cycle as integrated into the isotopic signature which reflects the assimilated carbon pool of the fish. The greater reliance on GOA-derived carbon in herring may `reflect their dependence on carbon generated later in the season during the time when advection of GOA production was nearly the sole carbon source in 1995 as suggested by the data (Fig. 1). The concordant shift to greater GOA dependency by both species in 1995, Sound-wide, implied that system-wide bottom-up effects permeated the whole ecosystem due oceanographic processes.

The isotopic gradient between PWS and GOA had a consistent relationship in the 1994-1996 period except for May 1996 when the gradient reversed owing to a large magnitude change in the GOA signature (Fig. 2). Whereas PWS mean <sup>13</sup>C/<sup>12</sup>C values ranged within 1 delta unit, and the difference between PWS and GOA averaged 3 delta units, the GOA mean value shifted in spring 1996 by 5 delta units. This large shift reflected a change in phytoplankon fractionation during uptake of CO<sub>2</sub> which varies as a function of growth

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rate (Laws et al. 1995, Bridigare et al. 1997). Thus productivity during the spring bloom of 1996 was markedly different from other times. Large fluctuations in productivity in the GOA suggests large inconsistencies in food availability for consumers from year to year if these fluctuations are typical.



Figure 1. Shift in <sup>13</sup>C/<sup>12</sup>C and inferred change in Gulf of Alaska (GOA) vs. Prince William Sound (PWS) carbon dependency (see Kline 1998b, for explanation of delta notation and method of data interpretation) of juvenile herring and pollock in 1994 - 6 (from Kline 1998a). The distribution of values are shown as box and whisker plots that denote the 10th, 25th, 50th, 75th, and 90th percentiles; ouliers are shown as symbols. There was a large shift to greater GOA carbon dependency in 1995 for both species as indicated by the large change between the Fall of 1994 and the Fall of 1995.

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Figure 2. Time series of <sup>13</sup>C/<sup>12</sup>C measured in feeding *Neocalanus cristatus* from Prince William Sound (PWS) and the Gulf of Alaska (GOA). Points reflect mean values, standard deviations were 0.5 to 1 delta units. PWS and GOA values were consistently statistically different (Kline 1998a, 1998b).

#### NEED FOR THE PROJECT

#### A. Statement of Problem

The Problem: Recovery of EVOS damaged species is uncertain in light of regime shifts

Decadal-scale changes in production cycles in the subarctic Pacific Ocean have been conjectured to effect population changes in fishes and their zooplankton forage base (Brodeur and Ware 1992, Francis and Hare 1994). A "ring of zooplankton" occurring near the Gulf of Alaska continental shelf break appears to undergo dramatic oscillations over decadal time scales (Brodeur and Ware 1992). This "ring of zooplankton" is driven onto the shelf providing the ecosystem with an important forage base (Cooney 1988, 1993). The transport of zooplankton from the continental shelf into Prince William Sound was suggested to provide significant quantities of forage for food webs there based on natural stable isotope (NSI) evidence (Kline 1998b). Kline 1998b conjectured that NSI data may be a good method for detecting changes in biophysical coupling in the PWS region. Several questions may be resolved using NSI data in the next four years:

#### Need #1: Gulf of Alaska productivity fluctuations - retrospective analysis since EVOS

There is a discontinuity between the start of PWS ecosystem studies in 1994 and the timing of EVOS in 1979. Ecosystem shifts occurring in the GOA since 1989 were thus

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not incorporated in present studies. To overcome this perspective, retrospective NSI analyses may enable a reconstruction systematic ecological changes occurring since 1989. A retrospective approach is being used by GLOBEC in several projects in the N.E. Pacific as a means of overcoming temporal limitations in our database (U.S. GLOBEC 1996). Fixed tissues such as the protein layer on the exterior of mussels provide a recent record of changes in the isotopic composition of their phytoplankton diet. An opportunistic collection of *Mytilus californianus* from Middleton Island made in September 1997 provides an inexpensive approach to retrospective analysis. Middleton Island's location in the Alaska Current provides an "upstream perspective" on the EVOS area since samples from there will reflect changes in plankton upstream before interaction with PWS-origin carbon is possible.

#### Need #2: Mass-balance modeling validation data gaps

Kline and Pauly (1998) established the utility of using NSI data to validate the Ecopath mass-balance model (Project 330). This was done with a small number of highly aggregated functional groups. The final model will likely have about 40-50 functional groups (Table 1). Of the functional groups listed good isotopic representation is currently available for about 7 (Table 1). Thus confident model validation could only be performed for a limited selection of the functional groups. Additional samples for 17 functional groups are available as archived or stored samples (underlined <u>yes</u> in the column labeled "sample accessibility") while another 14 functional groups (underlined <u>yes</u> in the column labeled "sample accessibility") could be easily sampled. A total of ~ 40 functional groups providing a good model validation could be made available by augmenting the existing database by analysis of existing samples and additional sampling (Table 1).

Table 1. Ecopath model functional groups as of April 1998 and potential isotopic model validation data (groups 25, 26, and 27 are likely to be dropped from the model. Uncertain functional group size break criteria at time of this writing reflected by question marks. Data courtesy of T. Oakey, Univ. British Columbia.

| Functional<br>group | Species           | Data availability | Sample<br>availability | Sample<br>accessibility | Final data avail<br>probability |
|---------------------|-------------------|-------------------|------------------------|-------------------------|---------------------------------|
|                     |                   |                   |                        |                         |                                 |
| 1 Resident Orcas    | orca              | none              | no                     | no                      | poor                            |
| 2 Sm cetaceans      | porpoise          | none              | no                     | no                      | poor                            |
| 3 Adult Herring     | herring >?        | good              | yes                    | yes                     | good                            |
| 4 Juv. Herring      | herring < ?       | good              | yes                    | yes                     | good                            |
| 5 Baleen Whales     | humpback          | none              | no                     | no                      | poor                            |
| 6 NearshorePelagics | Juv tom and p cod | fair              | no                     | yes                     | good                            |

| 7 Offsh Sm Pelagics        | other osmerids,<br>lanternfish, smoothtongue  | fair | <u>yes</u> | yes        | good |
|----------------------------|---|------|------------|------------|------|
| 8 Offsh Lg Pelagics        | sharks, pel RFs, gadids   | fair | yes        | yes        | good |
| 9 Capelin                  | capelin   | fair | yes        | yes        | good |
| 10 Sandlance               | sandlance   | fair | no         | ves        | good |
| 11 Squid                   | squid   | fair | yes        | yes        | good |
| 12 Sea otter               | sea otter   | none | no         | no         | poor |
| 13 Arrowtooth Adult        | arrowtooth fldr >?  | poor | yes        | yes        | good |
| 14 Arrowtooth juv          | arrowtooth fldr </td <td>none</td> <td>no</td> <td>yes</td> <td>good</td>           | none | no         | yes        | good |
| 15 Pollock 3+ age          | 3+age pollock   | good | yes        | yes        | good |
| 16 Pollock 0 age           | 0 age pollock   | good | yes        | yes        | good |
| 17 Pollock 1-3 age         | 1-3 age pollock   | fair | <u>yes</u> | yes        | good |
| 18 Nearshore<br>Demersal   | greenlings, sculpins,<br>gunnels, shanny, ronquils                                  | fair | <u>yes</u> | yes        | good |
| 19 Shallow Lg              | seastars, crabs   | none | <u>ves</u> | yes        | good |
| 20 Shallow Sm<br>Epibenth. | mussels, periwinkles,<br>barnacles, limpets,<br>chitons, amphipods, other<br>snails | none | no         | <u>yes</u> | good |
| 21 Shallow Lg              | polychaetes   | none | no         | <u>yes</u> | good |
| 22 Shallow Sm              | clams   | none | no         | <u>yes</u> | good |
| 23 Mid. Sm Epibenth        | . ophioroids  | none | no         | <u>yes</u> | good |
| 24 Mid Lg Epibenth.        | sea pens, crabs   | none | <u>yes</u> | yes        | good |
| 25 Mid Lg Infauna          |   |      |            |            |      |
| 26 Mid Sm. infauna         |   |      |            |            |      |
| 27 Deep Sm Infauna         |   |      |            |            |      |
| 28 Omniv<br>zooplankton    | euphausiids, amphipods,<br>larval Fishes,<br>chaetognaths, decapods                 | fair | <u>yes</u> | yes        | good |
| 29 Herbzooplankton         | copepods,<br>larvaceans,<br>pteropods   | good | yes        | yes        | good |
| 30 Diatoms                 | diatoms (See McRoy)   | fair | yes        | yes        | good |
| 31 Flagellates             | flagellates (See McRoy)   | fair | yes        | yes        | good |
| 32 Macroalgae              | kelps, eelgrass   | none | yes        | ves        | good |
| 33 Fish-eating birds       | kittiwakes (See Suryam)   | fair | yes        | yes        | good |
| 34 Inverteating Bird       | (See Bishop)  | poor | no         | no         | good |
| 35 Avian Raptors           | eagles  | none | no         | no         | poor |
| 36 Transient Orcas         | orca  | none | no         | no         | poor |
| 37 Adult Salmon            | salmonidae adult  | fair | no         | yes        | good |

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| 38 Pinnipeds                 | seals, sealions (See Schell)    | good | yes        | yes        | good |
|------------------------------|---------------------------------|------|------------|------------|------|
| 39 Salmon Fry 0-6 cm         | n 5 <i>Oncorhynchus</i> sp <6cm | fair | <u>yes</u> | yes        | good |
| 40 Salmon fry 6-12<br>cm     | 5 Oncorhynchus sp >6cm          | fair | <u>ves</u> | yes        | good |
| 41 Meiofauna                 | infauna < 1mm                   | none | no         | yes        | good |
| 42 InshoreDetritus           | <20 m(macro alg)                | none | no         | yes        | good |
| 43 Offshr Detritus           | >20m (plankton)                 | none | no         | yes        | good |
| 44 Rockfishes                | Sebastes spp.                   | fair | yes        | yes        | good |
| 45 Sablefish                 | sablefish                       | none | <u>yes</u> | yes        | good |
| 46 Lingcod                   | lingcod                         | none | yes        | yes        | good |
| 47 Halibut                   | halibut                         | poor | yes        | yes        | good |
| 48 Herring eggs              | herring eggs                    | none | no         | <u>ves</u> | good |
| 49 River otters and<br>minks | (seeBen-David)                  | good | yes        | yes        | good |
| 50 Carnivorous jellies       | ctenophores, cnidarians         | none | <u>yes</u> | yes        | good |

#### Need #3. 1997-8 ENSO event

At the time of the writing, the strongest El Niño - Southern Oscillation (ENSO) event in history is occurring. Although the anomalous temperatures experienced in Alaska may reflect an atmospheric teleconnection with this event, the primary oceanographic response in Alaskan waters is expected to be delayed 6 to 9 months from the peak event (Royer 1985). Therefore, there is a potential for highly anomalous conditions during 1998 arising from the ENSO event. This imposes a great uncertainty for species recovering from EVOS. NSI analysis of biota comparable with those collected previously could reveal anomalous changes.

# Need #4. Benthos-oceanographic relationships knowledge gap

NSI research in PWS up to now has not included the benthos. The importance of this habitat is suggested by the large number of benthic functional groups identified in the Ecopath model (Table 1). Furthermore, the benthic response to changing oceanographic which is largely unknown could be highly significant since many species have planktonic life stages. Addressing our data gap in this area would also be useful for fulfilling need #2, above.

# Need #5. Expanded domain needed to assess impacts of regime shifts

The use of NSI data to link biological and physical processes as been focused on PWS with only very limited sampling in the adjacent Gulf of Alaska. The results suggest that the Gulf is very important providing the major source of carbon in certain years (Kline 1998b). Furthermore, while the isotopic signature of PWS carbon has fluctuated very little, GOA carbon underwent a dramatic shift (Fig. 2). The shifts suggests that larger

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fluctuations are more likely in the GOA than PWS as isotopic signature reflects changes in the growth rate of phytoplankton (Laws et al. 1995, Bridigare et al. 1997). Thus an effort needs to me made in expanding the domain being studied, both in space and time. The latter will be served by long-term time-series analysis (long enough to encompass multiple regime shifts) while the former by expanding the scope of the study outside PWS (sufficient to provide a representation of changes in the GOA carbon pool). Furthermore, in the FY99 Invitation (*Exxon Valdez* Trustee Council 1998), the need for more complete interpretation of Pacific herring ecology outside PWS was articulated. It is probable that systematic shifts to greater or lesser dependency on GOA carbon occurs systematically over the region as a function of physical forcing. Therefore it follows that analysis of herring should be made systematically over the area with the expectation of concordant isotopic shifts among sites in relation to shifts also observed in zooplankton (Kline 1998b).

#### Urgency in need

Scheduling of analysis in relation to delivery of Ecopath model: There will be a significant time lag from date when funding begins to when data will be available for model validation. First, samples will need to be prepared in the laboratory, converting them into a finely-powdered form. Second, samples will be sent out for mass spectrometry at the University of Alaska Stable Isotope Facility. It takes 6 to 9 months to get data back. Therefore, data are not likely to be available until about a year from start date. Therefore it is imperative that this project commence in the forthcoming fiscal year.

Time-sensitive sampling: The on-going ENSO may have a devastating effect on the EVOS recovery suggesting an urgent need to collect appropriate data. The later will depend on samples collected during the ENSO as isotopic shifts occurring afterwards will mask ENSO changes. Therefore, samples need to be collected in 1998.

#### Need for continuity

Previous results suggest that shifts occur on an annual basis. Additionally, given that strong cohorts evolve from specific year classes, sampling must be conducted on a yearly basis. Furthermore, isotopic signatures for a given cohort can change from one year to the next. Thus to resolve these processes, data need to taken continuously from year to year. Resolving if and how regime shifts are related to fisheries production cycles will require a long-term commitment.

# **B.** Rationale/Link to Restoration

Shifts in carbon flow occurring as a result in variations in the physical environment represent fundamental changes in the way the PWS ecosystem supports commercially important species. The availability of macrozooplankton forage for fishes varies in space and time because of changes in physical processes in PWS. The NSI approach is unique in its ability to integrate time and spatial scales at mesoscale levels. No other technique

currently available can generate such results. The natural tracer aspects of the approach emulates artificial tracer experiments without the burden of needing to generate signals or experimental artifacts. Tracking the effect of Gulf carbon inflow on pelagic production that appears to vary between years will be used to resolve the question of how oceanographic process affect fisheries recruitment. Of particular concern in the immediate future is the ENSO event and how it might affect recovery from EVOS. Additionally relating the benthic portion of the PWS ecosystem to shifts observed in the pelagic might explain the poor recovery of those species. Finally, the value of the Ecopath modeling effort funded as restoration tool would be greatly enhanced through a incorporation of a proven model validation concept.

C. Location

Prince William Sound

# COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Community involvement and traditional ecological knowledge was incorporated into the sampling. For example, local fishermen provide the P.I. with the knowledge and opportunity to acquire the *Mytilus californianus* samples.

# **PROJECT DESIGN**

Natural stable isotope abundances reflect (1) trophic level and (2) source of assimilated matter and are thus a proxy for the change in diet. Stable isotope ratios will thus be used as a indicator of production and shifts in predation as tests of hypotheses which are stated below in relation to the stated needs.

# A. Hypothesis-based Objectives

The needs described above suggest several hypotheses, listed below, that form the basis for the project objectives.

For Need and thus Objective #1

Ho<sub>1,1</sub>: The isotopic shift seen in 1995 was a singular anomaly, therefore the GOA  $^{13}C/^{12}C$  values in earlier years will be consistent.

Ha<sub>1.1</sub>: If they are different, what is the pattern (if there is one)?

Ho<sub>1.2</sub>: The <sup>13</sup>C/<sup>12</sup>C of *Mytilus californianus* = <sup>13</sup>C/<sup>12</sup>C of *Neocalanus*. This is expected since both are hebivores.

Ha<sub>1.2</sub>: If they are not equal is the there a systematic difference?

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#### For Need and thus Objective #2

Ho<sub>2.1</sub>: Trophic level of each functional group predicted by Ecopath = the trophic level of each functional group predicted by their mean  ${}^{15}N/{}^{14}N$ .

 $Ho_{2,2}$ : Omnivory index of each functional group predicted by Ecopath = the standard deviation of trophic level of each functional group predicted by individual  $^{15}N/^{14}N$  values.

See Kline and Pauly 1998 (embedded within Kline 1998b) for a description of the validation method.

#### For Need and thus Objective #3

 $Ho_3$ : Isotopic signatures of organisms following the onset of the ENSO = isotopic signatures of organisms prior to the onset of the ENSO, specifically the isotopic signatures of herbivorous copepods feeding and in diapause and juvenile fishes.

It is unknown how ENSO will affect circulation; previous events have resulted in large salinity and temperature anomalies at depth (Royer 1985). Of concern is the role of deepwater in PWS renewal, which is linked to increased in salinity on the adjacent continental slope during summer; and conjectured to have affected the transport of diapausing copepods and other zooplankters into PWS (Kline 1998b). A change in this transport mechanism could impact food PWS pelagic food webs by changing zooplankton forage abundance.

# For Need and thus Objective #4

Ho<sub>4</sub>: The benthos will undergo isotopic fluctuations in concordance with those observed in pelagic organisms, especially benthic filter feeders.

That is, the benthos, like the pelagic system, is coupled to and dependent on physical forcing.

#### For Need and thus Objective #5

Ho<sub>5</sub>: Isotopic shifts will occur systematically over the greater GOA in all species.

If isotopic changes are due to physical forcing, there should be concordance in these changes among taxa in systems that are physically linked (share the same aquatic environment).

# Data Gaps

The proposed study will build upon the existing data base; adding new data will fill data gaps and further the construction and tests of conceptual food webs supporting productivity in the greater Prince William Sound area. The goal is to determine the trophic positions and to define the natural history parameters accessible from NSI data in

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light of the observed declines in their populations. These include changes in trophic level over the lives of pelagic organisms, habitat dependencies, seasonal energetics and trophic dynamics relative to other community organisms. As part of this goal, we will integrate our analytical work with the field and laboratory studies of other investigators looking at food web structure, productivity of lower trophic levels, and provide validation data for assessment of conceptual and quantitative models.

Sampling objectives are listed in relation to needs and their hypotheses. The emphasis will shift among the objectives by fiscal year (these are given proceeding each objective) according to the urgency in need.

#### **B.** Objective-based Methods

# For Objective 1, Retrospective Analysis Of GOA Production Shifts Since EVOS

FY99-00: Stable isotopic analysis of the outer protein layer (periostracum) on the shells and body tissues of Sea-mussels (Mytilus californianus) of varying ages collected at Middleton Island (N= 50 mussels) in September 1997. The periostracum will be analyzed by cutting sections (of 2.0 mg for each analysis) along annular growth rings. Mussels of different age will be used to extract data from various years (as annuli are wider and more distinct at earlier ages) to reconstruct an isotopic time series retracing conditions from 1997 backwards in time to EVOS and earlier. For example a 5 to 10 - year old mussel will resolve well recent years whereas a 10 to-20 year old will resolve years when the mussel was younger. Overlapping years (of periostracum samples) of good age resolution will be used to inter-calibrate mussels while younger mussels will be calibrated against our zooplankton database (Fig. 2). An estimated 500 isotopic analyses ( $\sim n = 10$ / mussel) will be required for this task in FY99. The expected results would consist of an isotopic characterization in GOA isotopic signature from 1989 (possibly earlier) to 1997. The following question will be asked: Did changes of the magnitude seen in 1996 occur in other years? If so, how often. If not, then the 1996 will be considered an anomaly rather than a common occurrence. Objective #5 will address occurrences over longer time scales but will be limited to future sampling.

# For Objective 2, Addressing Ecopath Model Validation Data Gaps

FY 99-00: A) Analysis of available samples from the P.I.'s archives and samples from other P.I.'s.

The purpose of this objective is to acquire data most cost-effectively - without additional field sampling. Functional groups identified for additional analyses are noted by the underlined <u>yes</u> in Table 1. Those underlined in the column "sample availability" are planned for analysis in FY99-00. Since the Ecopath model is centered on data collected

from 1994-6 and for which years these samples are from, they are optimal for this purpose. An estimated 750 isotopic analyses will be required for this task in FY99.

FY00-01 B) Collection and analysis of additional samples as needed. Once sample archive sources are exhausted, additional selective sampling will be made. The degree of need for additional sampling is presently unknown thus increasing uncertainty in the need for the FY00 budget. Those functional groups with <u>yes</u> underlined in Table 1 under the column "sample accessibility" are expected to require this supplemental sampling in FY00-01. An estimated 500 isotopic analyses will be required for this task in FY00.

The methods for calculating trophic level and omnivory index are given in Kline and Pauly 1998 (embedded within Kline 1998b). The data generated will used in a similar way.

#### For Objective 3, Evidencing Biophysical Coupling from the 1997-8 ENSO Event

FY99-00: We will be asking for samples from existing EVOS projects with field plans for FY98-9. Additional samples will be made available from government (e.g., ADFG) and private agencies (e.g., North Pacific Processors, Cordova) since they routinely have access to samples and have provided us with them in the past. An estimated 750 isotopic analyses will be required for this task in FY99.

Additional support may come from funding requested from NSF and OSRI for both sampling and analysis. The NSF has been requested to provide support for analysis of GOA samples as part of the GLOBEC effort. At present these projects are still pending.

#### For Objective 4, Addressing the Benthos Data Gap

FY00-02: Sampling for this objective planned for FY00 (the field operations costs is reflected in the budget prognostication). The potential of using NSI to elucidate biophysical coupling in the benthos may serve to explain the poor recovery of species since EVOS. Additionally, this sampling will be used to fill a number of Ecopath gap needs as benthic functional groups are presently not represented in the isotopic validation data. An estimated 500 isotopic analyses/ FY will be required for this task in FY00, FY01 and FY02.

A benthos NSI project has been submitted to OSRI, if it gets funded this project would serve to augment planned dive-sampling. The combined sample and datasets would be greater than if only one project is funded thus there is the potential for more than double the number of data suggested here. This would improve the model validation as well as fill in the data gaps. The OSRI project funding is limited to filter feeding invertebrates. Thus other functional groups would require EVOS funding. At present this OSRI project is still pending.

Prepared 4/10/98

#### For Objective 5, Expanded Domain in Space and Time

FY99-02: Samples would be acquired from colleagues (M. Willette, A. Paul, K. Stokesbury) and by collaborating with industry and P.I.'s providing vessels of opportunity.

Sampling will included juvenile fishes from selected sites in PWS and fishes from the North Gulf Coast region from which colleagues would be measuring other parameters, zooplankton during the bloom at representative sites in PWS and the North Gulf Coast region, and copepods undergoing diapause in the deep waters of PWS.

A time-series isotopic analysis project has been submitted to OSRI, if it gets funded this project would serve to augment sampling planned in it. The combined sample and datasets would be greater than if only one project is funded thus there is the potential for more than double the number of data than suggested here. At present this OSRI project is still pending.

Additional support in terms of access to commercially valuable species is available through collaboration with industry - we are establishing a port sampling plan with North Pacific processors that would enable us to systematically collect a representational sample of important species during commercial fisheries in the Cordova fishing district. We anticipate collecting ~ 100 of each major species. In additional to tissue samples we would collect metadata on each fish. The objective would be to seek out relationships (if any) in isotopic composition with other body parameters - such as length and weight (at age). For example, systematic changes in salmon size at return from the North Pacific are suggested to reflect density-dependence in the GOA (Bigler et al. 1996). If these changes reflect food web structural change, then systematic isotopic changes are expected too.

It is estimated that 2000- 3000 samples per year would be required for a comprehensive long-term study combining funding from several sources.

An estimated 500 - 1000 isotopic analyses/ FY will be required for this task in FY00, FY01 and FY02 from the EVOS Trustee Council.

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

N/A

Prepared 4/10/98

#### SCHEDULE

# A. MEASURABLE PROJECT TASKS for FY99 (October 1, 1998 - September 30, 1999)

| Oct. 1998 - Apr. 99: | Preparation of archived samples for mass spectrometry          |
|----------------------|--|
| Jan - Oct 1999:      | Mass spectrometry at UAF (~ month processing time)             |
| Jun - Oct 1999:      | Process new isotope data (bulk of data expected in early FY00) |

#### **B.** Project Milestones and Endpoints

| Preparation of archived samples for mass spectrometry                   |
|---|
| Preparation of new samples for mass spectrometry                        |
| Attend Annual Restoration Workshop                                      |
| Process new isotope data  |
| Data, receipt (from mass spect lab), integration and synthesis          |
| Preparation for and dissemination of results at EVOS and other Symposia |
| Preparation of Annual Report (completion of objectives 1 and 2)         |
| Preparation of Annual Report (completion of objectives 3 and 4)         |
| Draft final report preparation  |
| Final Report  |
|   |

FY-specific goals stated under objectives

# C. Completion Date

September 2003 (Final Report)

# PUBLICATIONS AND REPORTS

Kline and Pauly - a greatly augmented sequel to Kline and Pauly (1998) incorporating validation of the model developed in project 330) but is planned for 00. A paper based on the retrospective analysis is also planned for 00. These and other papers will be produced on an ad hoc basis as waranted by results.

#### **PROFESSIONAL CONFERENCES**

Travel is requested for the P.I. to present results at a national (or when appropriate, international) meeting such as ASLO or AGU and to attend workshops with collaborators. Travel to present project results at national meetings and to participate in collaborative workshops are essential to the project's success.

#### NORMAL AGENCY MANAGEMENT

N/A

# COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Collaboration with other EVOS investigators will continue and facilitate relating carbonsource dependency with e.g., somatic energy content (A.J. Paul) and trophic level (D. Pauly and S. Pimm). Other P.I.'s in possession of NSI data for certain functional groups, noted in Table 1 (their names proceeded by "see") will be asked to provide appropriate portions of pertinent data for incorporation into objective #2. Results of analyses will be exchanged at workshops and by telecommunications. Preliminary analysis from the integrated effort will be used to direct retrospective analysis of archived samples. Sampling will be coordinated with other P.I.'s and within the auspices of other biota sampling programs. Pertinent data of each sample (ie. data on each individual fish will be shared among components). Coordination in relation to specific objectives listed in project design section.

#### PROPOSED PRINCIPAL INVESTIGATOR

Thomas C. Kline Jr., Ph.D. Prince William Sound Science Center P. O. Box 705 Cordova, AK 99574 907-424-5800 (t) 907-424-5820 (f) tkline@grizzly.pwssc.gen.ak.us

Prepared 4/10/98

#### PRINCIPALINVESTIGATOR

T. Kline has been actively involved in stable isotope research since 1985. His use of stable isotopes has been in fish ecology with emphasis on salmonid fishes in northern, western, south central and southeast Alaska. His innovative use of the techniques has allowed him to quantify the effect of salmon carcass nutrient input to juvenile sockeye salmon production. This research has been the first to provide direct evidence for the importance of salmon carcasses for juvenile salmon production. He has generated stable isotope models that enable the quantification of different sources of production important in salmon ecosystems. Dr. Kline also led an investigation relating feeding strategies to growth forms in North Slope salmonids. His on-going efforts include collaborations with ADF&G, the North Slope Borough, and BPX. The results of these projects have been presented in numerous scientific papers as well as in public forums (speaking to local groups and classes). T. Kline initiated project 320I which has been the first comprehensive project using natural stable isotopes in Prince William Sound. Through this project he has developed new models and application of natural stable isotope abundance methods. He was the first to provide direct evidence of the importance of carbon from the Gulf of Alaska in Prince William Sound.

#### **OTHER KEY PERSONNEL**

Fish Biologist: J. Williams. PWSSC. J. Williams received his Masters degree in Fisheries from Texas A&M University in 1995. While earning his degree, he spent one year conducting field research in a remote are of Venezuela, successfully incorporating native fishermen in his survey of reservoir fish populations. His research has been presented in a variety of forums and is currently under review for journal publication. J. Williams is a certified Rescue Diver, Divemaster and has eleven years of diving experience. He is currently fulfilling a diver-in-training program for cold water research diving to expand his knowledge of diving further. J. Williams is tasked with sample and data processing and data management for this project and will actively contribute to data synthesis.

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October 1, 1998 - September 30, 1999

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|-------------------------------------|--|---|--|------------------------|------------------|--------------|-------------|---|
| Budget Category:                    | FY 1998  | FY 1999   |  |                        |                  |              |             |   |
| Personnel                           |  | <u></u>   |  |                        |                  |              |             | 1. Traiscore                            |
| Travel                              |  | <u>۵.0 گر</u>   |  |                        |                  |              |             |   |
| Contractual                         | · · · · ·  | \$20.0<br>\$ 702  |  |                        |                  |              |             | The second second                       |
| Commodities                         |  | <u>\$0.0</u>  |  |                        |                  | ALCHARD A    |             |   |
| Fauinment                           |  | \$0.0   | and a state of the | LONG B                 | ANGE FUNDIN      | IG BEOLIIBEM | ENTS        |   |
| Subtotal                            | \$0.0  | \$207.2   |  | Estimated              | Estimated        | Estimated    |             |   |
| General Administration              |  | \$14.5  |  | EY 2000                | EY 2001          | FY 2002      |             |   |
| Project Total                       | \$0.0  | \$221.7   |  | \$250.0                | \$175.0          | \$150.0      |             |   |
|                                     | <b>\$0.0</b>   | +   |  |                        |                  |              | UNIX2 SECON |   |
| Full-time Equivalents (FTE)         |  | 18.0  | AREAS AND IN   |                        |                  |              |             |   |
|                                     | I  |   | Dollar amour   | nts are shown ir       | n thousands of o | dollars.     |             |   |
| Other Resources                     |  |   |  |                        |                  |              |             |   |
| Admin Costs not reflected in long r | ange estimates   |   | -008   |                        |                  |              |             |   |
| FY 99                               | Project Numl<br>Project Title:<br>Submiited Ur<br>Name: Prince<br>Agency: NO | oer:99 <u>39</u><br>Prince Willia<br>nder the BAA<br>e William So<br>AA | - BA A<br>am Sound Fo<br>A<br>und Science  | od Webs: Str<br>Center | ucture and C     | hange,       | 5           | FORM 3A<br>TRUSTEE<br>AGENCY<br>SUMMARY |

FY 99 EXXON VALDEZ TRUST JUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

|                                   | Authorized        | Proposed       |                | V and the set of the set | e e af the start has | . State Constraints | a to the second |  |
|-----------------------------------|-------------------|----------------|----------------|--------------------------|----------------------|---------------------|-----------------|--|
| Budget Category:                  | FY 1998           | FY 1999        |                |                          |                      |                     |                 |  |
|                                   |                   |                |                |                          |                      |                     |                 | 日本中国法律学  |
| Personnel                         |                   | \$101.4        |                |                          |                      |                     |                 |  |
| Travel                            |                   | \$5.5          |                |                          |                      |                     |                 |  |
| Contractual                       |                   | \$58.1         |                |                          |                      |                     |                 |  |
| Commodities                       |                   | \$4.7          |                |                          |                      |                     |                 | and the second |
| Equipment                         |                   | \$3.0          |                | LONG F                   | RANGE FUNDI          | NG REQUIREN         | IENTS           |  |
| Subtotal                          | \$0.0             | \$172.7        |                | Estimated                | Estimated            | Estimated           |                 |  |
| Indirect                          |                   | \$34.5         |                | FY 2000                  | FY 2001              | FY 2002             |                 |  |
| Project Total                     | \$0.0             | \$207.2        |                | \$250.0                  | \$175.0              | \$150.0             |                 |  |
|                                   |                   |                | <b>大学会社</b> 主义 |                          | 5.号由公共省。5            |                     |                 |  |
| Full-time Equivalents (FTE)       |                   | 18.0           |                |                          |                      |                     | 的人们必须通知的        |  |
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| Other Resources                   |                   |                |                | <u> </u>                 |                      |                     | I               |  |
| Comments:                         |                   |                |                |                          |                      |                     |                 |  |
| Admin Costs not reflected in long | g range estimates |                |                |                          |                      |                     |                 |  |
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|                                   | Project Num       | ber:99         |                |                          |                      |                     | Г               |  |
|                                   | Project Title     | · Prince Willi | am Sound Fo    | ood Webs: St             | tructure and (       | Change.             |                 | FORM 4A  |
|                                   | Submitted U       | Inder the BA   | Δ              |                          |                      | <b>J</b> ,          |                 | Non-Trustee  |
| 1133                              | Nomo: Princ       | No William Sc  | ound Science   | Contor                   |                      |                     |                 | SUMMARY  |
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| Propared:                         | Agency: NC        | JAA            |                |                          |                      |                     | ]               |  |
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| October | 1, | 1998 | - | September | 30, | 1999 |
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| Dore   | onnel Coste:  |                                    |                           | Monthal       | Monthlul | 1              | Proposed  |
|--|---|------------------------------------|---------------------------|---------------|----------|----------------|-----------|
|  | Name  | Position Description               |                           | Budgeted      | Costs    | Overtimo       | EV 1000   |
| dera; g  | T. Kline  | PI                                 | Not an and an and         | 6 N           | 7 9      | Overtime       | 47 4      |
|  | J. Williams   | Biologist                          |                           | 8.0           | 5.0      |                | 40.0      |
| 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 -<br>1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - 1998 - | TBN   | Technician                         |                           | 4.0           | 3.5      |                | 14.0      |
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| 22.33  |   |                                    |                           |               |          |                | 0.0       |
|  |   |                                    |                           |               |          |                | 0.0       |
|  |   |                                    |                           |               |          |                | 0.0       |
|  |   | Subtotal                           | a de la com               | 18.0          | 16.4     | 0.0            |           |
|  |   |                                    |                           |               | Pe       | ersonnel Total | \$101.4   |
| Trav   | el Costs:   |                                    | Ticket                    | Round         | Total    | Daily          | Proposed  |
|  | Description   |                                    | Price                     | Trips         | Days     | Per Diem       | FY 1999   |
| CARL.  | 1 national meeting  |                                    | 0.8                       | 1             | 7        | 0.1            | 1.5       |
|  | 4 workshops   |                                    | 0.2                       | 4             | 12       | 0.1            | 2.0       |
|  | meeting registraion   |                                    | 0.3                       | 1             |          |                | 0.3       |
|  | car rentals (total all travel)  |                                    | 0.1                       | 17            |          |                | 1.7       |
|  |   |                                    |                           |               |          |                | 0.0       |
|  |   |                                    |                           |               |          |                | 0.0       |
|  |   |                                    |                           |               |          |                | 0.0       |
|  |   |                                    |                           |               |          |                | 0.0       |
| P.C.   |   |                                    |                           |               |          |                | 0.0       |
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| and Line   |   |                                    |                           |               |          |                | 0.0       |
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|  |   | Project Nulliber.33                | od Moher St               | ruoturo and ( | bango    |                | -ORM 4B   |
|  | EV 00 Project Title: Prince William Sound Food Webs: Structure and Change, Pe |                                    |                           |               |          |                | Personnel |
|  |   |                                    |                           |               |          | & Travel       |           |
|  |   | Name: Prince William Sound Science | Center                    |               |          |                | DETAIL    |
| L  |   | Agency: NOAA                       |                           |               |          | L              |           |

October 1, 1998 - September 30, 1999

| Contractual Costs:          |  | Prop               | osec         |
|-----------------------------|--|--------------------|--------------|
| Description                 |  | FY                 | 1999         |
| Stable isotope analyses (2  | 2000)  |                    | 50.0         |
| Laboratory equipment use    | e fee (2000)   |                    | 6.0          |
| Photocopying                |  |                    | 0.3          |
| Shipping                    |  |                    | 0.3          |
| Communications              |  |                    | 0.!          |
| PWSSC network charge        |  |                    | 1.(          |
|                             |  |                    |              |
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|                             | Co   | ntractual Total \$ | 58.1         |
| Commodities Costs:          |  | Prop               | osec         |
| Description                 |  | <u>FY</u>          | 1999         |
| Lab supplies miscl          |  |                    | 0.5          |
| Vials, chemicals, grinder b | olades, scalpels   |                    | 2.0          |
| Office supplies miscl.      |  |                    | 0.5          |
| Computer supplies and up    | ogrades  |                    | 1.5          |
| Dyesub material             |  |                    | 0.2          |
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|                             | Com  | nodities Total     | <u>\$4.7</u> |
|                             |  | ]                  |              |
|                             | Project Number:99  | FORM 4             | 3            |
|                             | Project Title: Prince William Sound Food Webs: Structure and Change, | Contractua         | 18           |
| FY 99                       | Submitted Under the BAA  | Commodit           | inc          |
|                             | Name: Prince William Sound Science Center                            |                    | 63           |
|                             |  | DETAIL             |              |
| Dua na ana ala              | Agency. NOAA   |                    |              |

October 1, 1998 - September 30, 1999

| New Equipment Purchases:            |  | Number   | Unit          | Proposed                              |
|-------------------------------------|--|----------|---------------|---------------------------------------|
| Description                         |  | of Units | Price         | FY 1999                               |
| 0.1 mg prec. elec. lab. balance     |  | 1        | 3.0           | 3.0                                   |
|                                     |  |          |               | 0.0                                   |
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|                                     |  |          |               | 0.0                                   |
|                                     |  |          |               | 0.0                                   |
|                                     |  |          |               | 0.0                                   |
|                                     |  |          |               | 0.0                                   |
|                                     |  |          |               | 0.0                                   |
| Those purchases associated with rer | placement equipment should be indicated by placement of an B   | Now Ea   | uinment Total | 0.0                                   |
| Existing Equipment Usage:           | placement equipment should be indicated by placement of an n.  |          | Number        | φ0.0                                  |
| Description                         |  |          | of Units      |                                       |
|                                     |  |          | 01 01110      |                                       |
|                                     |  |          |               |                                       |
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| [] [F                               | Project Number:99  |          | _             |                                       |
|                                     | Project Title: Prince William Sound Food Webs: Structure and ( | Change.  |               | ORM 4B                                |
| <b>FY 99</b>                        | Submitted Under the BAA  |          | E             | quipment                              |
|                                     | Name: Prince William Sound Science Center                      |          |               | DETAIL                                |
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# DEVELOPMENT OF MAPS DEPICTING ENVIRONMENTALLY SENSITIVE AREAS IN PRINCE WILLIAM SOUND

Project Number: Restoration Category: Proposer: Lead Trustee Agency: Cooperating Agencies: Alaska SeaLife Center: Duration: Cost FY 99: Cost FY 00: Cost FY 01: Cost FY 02: Geographic Area: Injured Resource/Service:

99394

Julie Michaelson, Keith Boggs, University of Alaska Anchorage

No 1st year, 1-year project \$109.1 0 0 0 No field work



#### ABSTRACT

This project is to develop a database that identifies areas environmentally sensitive to potential oil spills within Prince William Sound. The project's products would provide a tool specifically for use by oil response teams and planners who need detailed information in regard to species rarity and seasonal use of critical habitat areas. Species rarity would be evaluated using The Nature Conservancy's national rarity ranking methods, and seasonal usage would be presented as detailed as the current information allows. The spatial database would be constructed using Arc/Info software and contain approximately 66 data layers. Access to this information would be made available to a broad-based user audience through its distribution over the Internet on the *Exxon Valdez* Oil Spill homepage. A series of four seasonal maps (winter, spring, summer and fall) would be developed, each presenting a broad, regional overview of environmentally sensitive resources. These would be primarily for display purposes and oriented to the general user, similar to seasonal maps produced by the National Oceanic and Atmospheric Administration in 1988.

# **INTRODUCTION**

Since the 1989 *Exxon Valdez* oil spill a variety of studies have been conducted by federal, state and private researchers to assess species response to oiling and their habitat distribution within Prince William Sound. Multiple data sets have been assembled as a result of these studies, many of which are ongoing. As a result of the oil spill, response planning has become more refined and now demands a broader view of ecosystem function and species distribution. Thus, spill response planners and environmental regulators now require a wider spectrum of environmental data to make good response decisions. In order for this research to be applied in the decision making process, data must be integrated into a usable format and made easily accessible to a wide variety of users. The widespread use of Geographic Information Systems (GIS) across federal, state and private agencies as well as the ever growing use of internet technologies has made more accurate and detailed data available to decision makers.

The following products would be developed for this project:

- 1. A detailed GIS database depicting species, critical habitats and areas sensitive to oil spillage within Prince William Sound would be developed. These spatial data layers would contain polygons depicting critical habits and locations that would be made searchable by species rarity ranking and by seasonal use. These detailed maps would enable response teams to make rapid and appropriate decisions as a function of spill size, location and date. It would be scalable to allow response teams and planners the ability to zoom in on a specific area. Date specific information would be included to enable users to query areas sensitive to oiling using a specific week, month or season. Use of marine habitats by different organisms varies greatly by time of year, and these temporal variations are important considerations in spill response and planning. For example, the time of arrival and departure for different bird species would be included for most bird colonies. Consequently, the status of the bird colony could be queried by a specific date, the results of which would influence a response team's efforts. To allow greatest flexibility to the user, this database would be available in Arc/Info and Arcview.
- 2 Four seasonal maps (summer, fall, winter and spring) depicting species distribution for the Prince William Sound area would be mapped according to the standards of the 1988 National Oceanic and Atmospheric Administration (NOAA) Environmental Sensitivity Index (Gibeaut 1990). An Arc/Info plot file would be used to produce multiple hardcopies of these maps.
- 3 Metadata files for each of the GIS layers would be generated according to Federal Geographic Data Standards, 1995.
- 4 An internet webpage to be placed on the *Exxon Valdez* Oil Spill (EVOS) homepage would be developed for distribution of these products. This page would include map graphics, textual descriptions, downloadable data files, and metadata layers for each of the 66+ data layers.

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Initial steps have already been taken by the EVOS Trustee Council in the automation, integration and distribution of this post spill research with the creation of the EVOS home page and CD ROM. The products from the proposed project would further this effort by automating and integrating additional data layers. The means of distributing the final products to the general public, agencies, and other groups would be through the webpage, and hardcopies of the seasonal maps. The webpage would display (JPEG) the seasonal and detailed maps, and associated descriptions would be provided. In order to show the viewer what level of detail the GIS maps provide we would also display two progressively finer scale maps (1:25,000 and 1:5,000). These images would be for quick view purposes, and are not considered a substitute for the interactive Arc/Info and Arcview files. The Arc/Info and Arcview files of both the detailed and seasonal maps would be downloadable, as would the associated Metadata.

To ensure that this project is accurate and thorough we would contact other EVOS projects and past studies. This project would be linked to nearly all EVOS studies in that their project leaders would be contacted, each study would be reviewed, and the appropriate ecosystem components incorporated into the final products. These steps are essential to the development of an accurate map depicting areas sensitive to oil spillage. Please see Table 2 for the groups that would be contacted.

# **NEED FOR THE PROJECT**

## A. Statement of Problem

Access to information describing areas that are susceptible to oiling is a critical factor when responding to a spill. Spill response resources are often limited from a time and materials viewpoint, and identifying areas most sensitive to oiling allows response teams to concentrate their efforts. A series of seasonal maps depicting sensitive areas was developed by NOAA in 1988 to address this need. Due to a tremendous increase in available information these NOAA maps need to be updated. In addition, employing the latest technologies such as GIS is also critical.

Most of the new information has been collected primarily as a result of oil spill damage assessment and restoration programs funded by the Exxon Valdez Oil Spill Trustee Council. Much of this information has greatly improved the ability to identify and support the delineation of areas sensitive to oiling. Some studies are species specific and others include ecosystem level work such as the Sound Ecosystem Assessment project and the Alaska Predator Ecosystem Experiment. These studies not only identify areas important to specific species, but also define regions important for the continued functioning of healthy ecosystems. Many of these studies are mature and ready to be synthesized within and among projects.

# B. Rationale/Link to Restoration

The proposed maps would provide a far more useful tool than the NOAA (1988) maps for oil response teams, oil spill planners, and groups concerned with environmental issues in PWS. The chief advantage is that it would provide response teams rapid and accurate information critical to

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responding to oil spills of different types, size and location. For example, a small oil spill may allow response teams to focus all their resources on one fjord to protect all areas sensitive to oiling. Whereas, a large oil spill may dictate that the response team concentrate on only the highest priority resources on a coarser scale. Our maps would allow this flexibility because they would be scalable and with the ability to query by date, sensitivity rating, and species.

In addition, these products would be useful for integrating information collected in Prince William Sound with more regional groups and databases concerned with wildlife or conservation issues. For example, the Alaska Department of Fish and Game maintains a watchable wildlife computer database that could incorporate much of the sensitive area information. The Environmental Protection Agency is initiating a statewide internet based information clearinghouse (beginning with Cook Inlet watershed) that could incorporate all of this information, as would the worldwide Biological Conservation Database maintained by The Nature Conservancy. When combined with these other efforts these sensitive area maps take on a broader role than strictly oil spill response.

# C. Location

This project would be conducted at the office of the Alaska Natural Heritage Program, University of Alaska Anchorage. Those companies, organizations and individuals interested in oil spill planning and response, and those that need rapid and accurate information concerning areas sensitive to oiling would realize benefits from this project.

# COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Because there would be no field component to this proposed project, community involvement would be through the use of the end products. The hardcopy maps are specifically oriented to transfer this project's information to communities, groups and individuals. These maps would be mailed to each end user such as the various communities in Prince William Sound, and would also be available through ARLIS.

Letters would be sent to communities in Prince William Sound describing what information is available, and how to access it via the Internet. The Internet is rapidly becoming a common means of distributing information, and most communities have access for downloading these and other files. Each community could potentially have access to the electronic files, via Arcview or Arc/Info, in order to familiarize themselves with areas that are sensitive to oiling. The Arcview format would facilitate use of the data, thus increasing electronic usage of the results.

Because this project does not entail new field work, incorporation of traditional and local knowledge would depend on existing data layers. Identified existing layers that are oriented towards Native Alaskans includes six GIS subsistence harvest layers (seals, land use, Valdez, Whittier-Hope-Cooper Landing, Copper River, Exxon Valdez Oil Spill Food sites).

## **PROJECT DESIGN**

# A. Objectives

- 1 Develop detailed GIS database containing 66+ layers depicting species, critical habitats and areas sensitive to oil spillage within Prince William Sound. These spatial data layers would contain polygons depicting critical habits and locations that would be made searchable by species rarity ranking and by seasonal use.
- 2 Develop four seasonal maps from the database depicting summer, fall, winter and spring usage by species for the Prince William Sound area to the mapping standards of the 1988 NOAA ESI.
- 3 Develop an internet interface for the EVOS homepage for distribution of this database over the World Wide Web. This page would include map graphics, textual descriptions, downloadable data files, and metadata layers for each of the 66+ database layers to Federal Geographic Data Standards for spatial data.

## **B.** Methods

General methodological steps for this project would be to: 1) refine the list of species habitats to be mapped, 2) gather information needed to assemble GIS layers, 3) assemble the GIS layers, 4) develop seasonal maps, and 5) develop the webpage.

## 1) Refine list of species habitats to be mapped

Table 1 contains a list of all species distribution areas and habitats mapped in the 1988 NOAA map series of Environmentally Sensitive Areas, plus additional species that the Alaska Natural Heritage Program considers to be of concern in the Prince William Sound Area. To provide consensus on this list before database construction it would be put out for review to Prince William Sound researchers and to those researchers currently working in the Alaska Marine environment and inter-tidal systems. Table 2 shows the groups that would be used to evaluate the final list of environmental components to be included for this project.

| Table 1. | Environmental | components that a | are sensitive to c | oil spills in | Prince | William | Sound |
|----------|---------------|-------------------|--------------------|---------------|--------|---------|-------|
|----------|---------------|-------------------|--------------------|---------------|--------|---------|-------|

| DATA LAYER  |
|---|
| <br>Sheltered tidal flats   |
| Rare or sensitive plants in tidal marshes   |
| Tidal marshes   |
| Subsistence harvest areas (GIS layers include seals, land use, Valdez, Whittier-Hope-Cooper |
| Landing, Copper River, Exxon Valdez Oil Spill Food sites)                                   |
|   |
| BIRDS (additional bird data sets are included in marine mammal section)                     |
| Seabird nesting sites   |
| Marine bird concentration areas   |
| Bald eagle nesting sites/feeding areas  |
| Canada geese  |
| Marbled murrelet  |

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**BIRDS** (continued) Kittzlitz's murrelet Ancient murrelet Harlequin duck Black oystercatcher Black-legged kittiwake Common murre Thick billed murre Tufted puffin Horned puffin Pigeon guillemot Arctic tern Aleutian tern Glaucous-winged gull Bonaparte's gull Mew gull Red-faced cormorant Double-crested cormorant Pelagic cormorant Parakeet Auklet Cassin's Auklet Leach's storm-petrel Fork-tailed storm-petrel Black turnstone Surfbird Surf scoter Black scoter White-winged scoter Yellow-billed loon Steller's eider Peregrine falcon

## MARINE MAMMALS

Harbor seal haulouts/rookeries Steller sea lion haulouts/rookeries Sea otter concentrations Sea otter, boat survey design, bathymetry Sea otter (Nearshore Vertebrate Predator Study-EVOS) Sea otter and pelagic seabird transects Marine mammals Seabird and marine mammal counts in Prince William Sound Haul-out sites Killer whale feeding areas Porpoise feeding areas TERRESTRIAL MAMMALS Sitka black-tailed deer

FISH Herring study sites Pacific herring spawning areas Hatcheries Anadramous streams Hydrography/*Anadramous* streams Prince William Sound Fish Escapement Fish species (*anadramous* fish streams and lakes)

MOLLUSCS Razor clam beds Mussel bed restoration and monitoring Coastal habitat, inter-tidal studies

Table 2. Data from the following groups would be used to evaluate the final list of environmental components to be included for this project.

AGENCY OR GROUP NAME Alaska Department of Fish and Game Alaska Department of Natural Resources ARLIS Chugach Native Association Consulting firms (Alaska Biological Research) Environmental groups such as The Nature Conservancy, Audubon Society, and Cook Inlet Keeper **Environmental Protection Agency** Exxon Valdez Oil Spill Exxon Valdez Oil Spill project leaders NOAA National Marine Fisheries Service North Gulf Coast Oceanic Society Prince William Sound Aquaculture Association Prince William Sound Science Center, Cordova, Alaska **Private Researchers** University of Alaska Fairbanks, Institute of Marine Science USDA Forest Service, Chugach National Forest USDA Forest Service, Pacific Northwest Research Station, Copper River Delta Institute USGS Biological Resources Division, Alaska Biological Science Center USDI Fish and Wildlife Service

2) Gather information needed to assemble GIS layers

The next step would be to gather the preexisting GIS layers or raw information needed to develop GIS layers for each environmental component. This would entail gathering and reviewing species, area and ecosystem information from a variety of federal, state and private

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sources (Table 2). A tentative list of environmental components to be included is given in Table 1.

# 3) Assemble the GIS layers

Hardcopy maps and data would be reviewed and digitized using Arc/Info GIS software. To provide consistency and the ability to process between maps we would integrate all the existing and new GIS maps into a common format and projection. Attributes would include a seasonal use designation and species rarity ranking. Additionally, any associated data such as number of animals seen, or use type would be recorded as an attribute. For those data that are automated but do not reside as a GIS layer formatting would be performed to import the data with associated coordinate and attribute information. GIS layers would be directly imported and attributes added to standardize all the attribute files. A project containing all the above layers would be developed in Arcview.

## 4) Develop seasonal maps

The four seasonal maps (winter = December-February, spring = March-May, summer = June-August, fall = September-November) would be generated from a query of the seasonal use attribute. These four database layers would be used to produce a plot file that depicts all information to the same mapping standards as those of the 1988 Environmental Sensitivity Index NOAA maps. These plot files would be used in the production of hardcopy map products.

Metadata documentation for all GIS layers would conform to the Federal Geographic Spatial Metadata Standards. The information would be compiled using the program Metalite.

## 5) Develop the Webpage

A webpage would be developed and placed on the EVOS home page. The first step would be to design the overall site (Interface Design) for the project, emphasizing a user friendly environment with easy downloading capabilities. Next AKNHP would design the EVOS home page entry point in cooperation with the EVOS webmaster. Page templates would be created for a minimum of 29 web pages; these web pages would contain text describing the product, display examples (JPEG) of all the map products at three progressively finer scales (1:250000, 1:25000 and 1:5000), and contain downloadable files. E00, Arcview .apr, and Arc/Info\_view downloadable files would include those making up the detailed map (60+ layers), and the four seasonal maps (4 layers). Metadata of each layer would also be downloadable.

The interactivity of the web site would then be tested. The final step would be to transfer the web site to the EVOS server and test the page to insure that the dynamics of the site and its links continue to function on the World Wide Web.

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

The Alaska Natural Heritage Program would conduct all aspects of the proposed project in cooperation with groups that contribute data. Interaction with the EVOS homepage webmaster and data administrator would be necessary to fully deliver and make accessible all internet products.

## **SCHEDULE**

## A. Measurable Project Tasks for FY 99 (October 1, 1998-September 30, 1999)

December 1: Determine what environmental components are sensitive to oiling

- January 1: Gather the preexisting or raw information needed to develop GIS layers
- June 1: Automate, using Arc/Info, all data layers
- June 15: Complete metadata for all data layers
- August 1: Develop the maps in Arcview
- August 15: Produce hardcopies of the four broad level maps
- September 1: Finish the web page, and incorporate into the EVOS home page

September 30: Distribute the results to all interested parties via webpage and hardcopy

## **B.** Project Milestones and Endpoints

The project's objectives would be addressed and met by the following dates.

August 1, 1999: Develop detailed GIS map of areas sensitive to oil spillage within Prince William Sound. Oil response teams and planners would use the maps.

August 15, 1999: Develop four seasonal maps (both GIS and hardcopy) depicting only areas with the highest sensitivity to oil spillage, or areas with a special management status.

September 1, 1999: Make this information easily accessed and used through mailings and the development of a webpage on the Internet.

## C. Completion Date

September 30, 1999.

## **PUBLICATIONS AND REPORTS**

The results of this project would not be published in a peer-reviewed journal, but rather via the Internet on the EVOS webpage.

## **PROFESSIONAL CONFERENCES**

The results would be presented at 2 conferences. The annual Exxon Valdez Restoration Wordship in Anchorage, Alaska, and the Pacific Seabird Group Annual Meeting, 24-26 January 2000, in Blaine, Washington.

## NORMAL AGENCY MANAGEMENT

AKNHP, University of Alaska Anchorage, is not a government agency.

## **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

Coordination and integration of other restoration efforts would be by incorporating their results into this proposed project (Table 2). We have not made efforts to obtain funds from non-Trustee Council sources.

# PROPOSED PRINCIPAL INVESTIGATOR

Julie Michaelson Alaska Natural Heritage Program University of Alaska Anchorage 707 A Street Anchorage AK 99501 Tel: 907-746-0959 Fax: 257-2789 E-mail: anjam1@uaa.alaska.edu

Keith Boggs Alaska Natural Heritage Program University of Alaska Anchorage 707 A Street Anchorage AK 99501 Tel: 907-257-2783 Fax: 257-2789 E-mail: ankwb@uaa.alaska.edu

## PRINCIPAL INVESTIGATOR

## Qualifications of the Alaska Natural Heritage Program

The Alaska Natural Heritage Program, University of Alaska Anchorage is ideally suited for conducting this project. The goals of AKNHP are to document the distribution and abundance of Alaska's ecologically significant plant and animal species, and ecological communities, and to identify areas of conservation concern. In order to pursue this goal we have developed a GIS

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Project 99\_\_\_\_

database that is composed of information similar, and at times identical to the information needed for this proposed project.

Consequently, AKNHP would be a cost effective organization for developing this project because much of the needed information is already in house. For example, AKNHP has 23 of the approximately 66 GIS layers we are suggesting be gathered.

The eclectic nature of this project dictates that we include a variety of skills to complete the project accurately and efficiently. AKNHP has the necessary skills for this project, including staff with expertise in GIS, sea birds, marine mammals, marine and anadramous fish, and tidal marshes. AKNHP also has the computer resources to efficiently conduct the project. This includes a Sun Unix Ultra with ARC/INFO software, HP series E color plotter, HP color LaserJet 5M, ARCVIEW/Spatial Analyst, Pentium PC's with EXCEL, WORD, and ACCESS databases. AKNHP also has Macintosh Internet software and a scanner.

## Principal Investigators

The principal investigators would be Julie Michaelson and Keith Boggs, who would coordinate the project and work on their assigned project components (GIS and tidal marshes, respectively).

Julie Michaelson's most outstanding qualification in relation to this project is her expertise in summarizing Alaskan biological information into a GIS format that is useful for end users. Her current position is as data manger for AKNHP, and has extensive experience as a principal investigator. She has currently been responsible for the creation of the zoological database layers that reside in the Arc/Info GIS system running on the SUN UNIX work station. Previously she has completed a metadata generation project utilizing metalite software. She has constructed all export files that have been used to create the internet graphics and has had extensive experience in the transfer of data into a variety of textual and graphic formats across platforms.

The qualifications of Keith Boggs in relation to this project are in two areas. He has experience as principal investigator coordinating several projects at the University of Alaska Anchorage, and is currently PI on three projects, two with the EPA and one through the USDI National Park Service. Past projects ranged from describing tidal marshes, to conducting representativeness assessments using GIS (Boggs 1998, Boggs, Libbey and Michaelson 1997, Boggs, Davis and Milner 1997, Boggs and DeVelice 1997, Boggs and Duffy 1996). His experience with Alaskan tidal marshes include a current \$50,000 EPA grant to list and describe all wetlands, including tidal marshes, in the southern half of Alaska. He was PI for a 3 year on a cooperative study with the USDA National Forest Service to describe the vegetation, landscapes and environmental processes on the Copper River Delta, Alaska (Boggs and Shephard 1998, Boggs 1998). Consequently, he is familiar with tidal marshes specific to Prince William Sound. He is also coordinating the development of a vegetation based classification of tidal marshes in Southeast and Southcentral Alaska through AKHNP.

## **OTHER KEY PERSONNEL**

Scott Wilbor would coordinate the avian component. His address is: Alaska Natural Heritage Program University of Alaska Anchorage 707 A Street Anchorage AK 99501 Tel: 907-257-2782 E-mail: anslw1@uaa.alaska.edu

Tracey Gotthardt would gather and incorporate information concerning marine mammals, and marine and anadramous fish. She worked on an APEX funded harbor seal project for her Masters thesis. Her address is: Alaska Natural Heritage Program University of Alaska Anchorage 707 A Street Anchorage AK 99501 Tel: 907-783-3337

Gerald Tande would develop the webpage. His address is: Alaska Natural Heritage Program University of Alaska Anchorage 707 A Street Anchorage AK 99501 Tel: 907-257-2787 E-mail: angft@uaa.alaska.edu

# LITERATURE CITED

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October 1, 1998 - September 30, 1999

|                             | Authorized | Proposed |               |  |                      |            |                |  |
|-----------------------------|------------|----------|---------------|--|----------------------|------------|----------------|--|
| Budget Category:            | FY 1998    | FY 1999  |               |  |                      |            |                |  |
| Personnel                   |            | \$80.9   |               |  | an estar estar de la |            | And a the real |  |
| Travel                      |            | \$0.8    |               |  |                      |            |                |  |
| Contractual                 |            | \$1.9    |               |  |                      |            |                |  |
| Commodities                 |            | \$0.0    |               |  |                      |            |                |  |
| Equipment                   |            | \$3.7    |               | LONG R   | ANGE FUNDI           | NG REQUIRE | MENTS          |  |
| Subtotal                    | \$0.0      | \$87.3   |               | Estimated  | Estimated            | Estimated  |                |  |
| Indirect                    |            | \$21.8   |               | FY 2000  | FY 2001              | FY 2002    |                |  |
| Project Total               | \$0.0      | \$109.1  |               |  |                      |            |                |  |
|                             |            |          |               | and the second |                      |            |                |  |
| Full-time Equivalents (FTE) |            | 1.6      |               |  |                      |            |                |  |
|                             |            |          | Dollar amount | s are shown ir   | thousands of         | dollars.   |                |  |
| Other Resources             |            |          |               |  |                      |            |                |  |
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# FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

| Per        | sonnel Costs:              |   |        | Months   | Monthly |              | Proposed |
|------------|----------------------------|---|--------|----------|---------|--------------|----------|
|            | Name                       | Position Description                      |        | Budgeted | Costs   | Overtime     | FY 1999  |
|            | K. Boggs                   | Wetlands Ecologist                        |        | 1.0      | 6.0     |              | 6.0      |
|            | J. Michaelson              | GIS specialist                            |        | 6.0      | 6.0     |              | 36.0     |
|            | T. Gotthardt               | Arcview Specialist/Marine Ecologist       |        | 6.0      | 4.5     |              | 27.0     |
|            | S. Wilbor                  | Ornithologist                             |        | 1.0      | 4.5     |              | 4.5      |
|            | J. Tande                   | Webpage Master                            |        | 1.6      | 4.6     |              | 7.4      |
|            |                            |   |        |          |         |              | 0.0      |
| 1000       |                            |   |        |          |         |              | 0.0      |
|            |                            |   |        |          |         |              | 0.0      |
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|            |                            |   |        |          |         |              | 0.0      |
|            |                            |   |        |          |         |              | 0.0      |
|            |                            | Subtotal                                  |        | 15.6     | 25.6    | 0.0          | <u> </u> |
| <u> </u>   |                            |   |        |          | Per     | sonnel lotal | \$80.9   |
| Tra        | vel Costs:                 |   | licket | Round    | lotal   | Daily        | Proposed |
| A036555    | Description                |   | Price  | Irips    | Days    | Per Diem     | <u> </u> |
| 100.00     | Blaine, Washington; presen | t results at Pacific Sebird Group Meeting | 0.3    | 1        | 5       | 0.0          | 0.3      |
|            | Meal per diem              |   |        |          | 5       | 0.0          | 0.0      |
|            |                            |   |        |          | 5       | 0.1          | 0.5      |
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| 100002915  | 1                          |   |        |          |         | Travel Total | \$0.8    |

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|---------|-----------|--|----|-----------|
|         |           | Project Number:  |    | FORM 4B   |
| FV 99   |           | Project Title: Development of maps depicting environmentally |    | Personnel |
| 1100    |           | sensitive areas in Prince William Sound                      |    | & Travel  |
|         |           | Name: University of Alaska Anchorage                         |    | DETAIL    |
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| Contractual Costs:   |  | Proposed    |
|--|--|-------------|
| Description  |  | FY 1999     |
| Set of 4 composite negatives (cmyk) of the seasonal maps to be used for printing |  | 0.7         |
| Print 100 copies of each seasonal map (total of 400 copies)                      |  | 1.2         |
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|  | Contractual Total                      | \$1 9       |
| Commodities Costs:   |  | Proposed    |
| Description  | ······································ | FY 1999     |
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|  |  |             |
|  | Commodities Total                      | \$0.0       |
|  |  |             |
| Project Number   | F                                      | ORM 4B      |
| Broject Title: Development of mans depicting environme                           |  | ntractual & |
| <b>FY 99 Froject File.</b> Development of maps depicting environme               |  | mmodities   |
| sensitive areas in Prince william Sound  |  |             |
| Name: University of Alaska Anchorage   |  | DETAIL      |
| Prepared: 11-Apr-98  |  |             |

# FY 99 EXXON VALDEZ TRU

October 1, 1998 - September 30, 1999

| New Equipment Purchases:                           |   | Number   | Unit         | Proposed |
|--|---|----------|--------------|----------|
| Description  |   | of Units | Price        | FY 1999  |
| PC Pentium: cost estimate obtained from the Gat    | eway 2000 webpage                             | 1        | 3.7          | 3.7      |
|  |   |          |              | 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 equipm | nent should be indicated by placement of an B | New Fau  | ipment Total | \$3.7    |
| Existing Equipment Usage:                          |   |          | Number       |          |
| Description  |   |          | of Units     |          |
| Sun Unix Ultra                                     | ***************************************       |          | 1            |          |
| HP series E color plotter                          |   |          | 1            |          |
| HP color LaserJet 5M                               |   |          | 1            |          |
| Pentium PC   |   |          | 2            |          |
|  |   |          |              |          |
|  |   |          |              |          |
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| L  |   |          |              |          |
| Project Number                                     |   |          | r            |          |
| Project Number.                                    | velopment of mans denicting onvironmentally   |          |              |          |
| <b>FY 99</b>                                       | Prince William Sound                          |          |              |          |
| sensitive areas in                                 |   |          |              | DETAIL   |
| Name: Universit                                    | y of Alaska Anchorage                         |          | L            |          |
|  |   |          |              |          |

Prepared:



# Eastern Prince William Sound Human Use and Wildlife Disturbance Model

| Project Number:            | 99399                                 |   |
|----------------------------|---------------------------------------|---|
| Restoration Category:      | General Restoration & Habitat Protect | tion                                      |
| Proposer:                  | Chugach National Forest               |   |
| Lead Trustee Agency:       | USFS                                  |   |
| Cooperating Agencies:      | ADNR                                  | RECEIVED                                  |
| Alaska SeaLife Center:     | No                                    | APR 1 5 1998                              |
| Duration:                  | 1st year; 3 year project              | EXXON VALDEZ OIL SPILL<br>TRUSTEE COUNCIL |
| Cost FY99:                 | \$ 38.6                               |   |
| Cost FY00:                 | \$ 105.0                              |   |
| Cost FY01:                 | \$ 70.0                               |   |
| Geographic Area:           | Eastern Prince William Sound          | × .                                       |
| Injured Resources/Service: | ALL                                   |   |

## ABSTRACT

This project is an expansion of the human-use and wildlife disturbance model developed for the western Prince William Sound (PWS). The project will use geographic information system (GIS) techniques to describe current human-use patterns in eastern PWS and to model potential changes in those use patterns as a result of additional development (e.g., increased access). GIS generated maps of present and projected human-use patterns will be incorporated with GIS maps of the distribution of resources injured as a result of the Exxon Valdez oil spill. This will. provide a basis to identify areas where there may be existing and potential conflicts between human use and wildlife concentrations resulting in disturbance. Disturbance of injured wildlife may result in decreased productivity exacerbating the effects of the oil spill and prolonging the time to recovery. Identification of potential areas of disturbance will allow development of recommended management practices that may eliminate or minimize the negative effects of increasing human use. All injured resources and subsistence species will be addressed in a general approach but specific management recommendations will be developed for harbor seal, pigeon guillemot and cutthroat trout. The model of projected human-use patterns and resulting management recommendations are expected to be useful to Federal, State, and private land managers in their land management planning efforts.

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## INTRODUCTION

This project is an expansion of the pilot project (98339) to model human use and wildlife disturbance in Western Prince William Sound (PWS). By developing the model for activities in the Eastern PWS a model of the entire sound would be available as a management tool. This proposal is essentially a duplicate of the original pilot project proposal because the same techniques to develop the model would be applied for the rest of PWS. There are two exceptions. First, the original proposal included a literature review of human disturbance on wildlife. This review would not need to be repeated. Secondly, the pilot project included an emphasis on three of the injured resources. If the Trustee Council funds updating the NOAA environmentally sensitive index maps for PWS, these data layers would be applied to the model and more of the injured resources would be covered.

The Prince William Sound (PWS) ecosystem has experienced many changes in the last decade. The most notable of these are related to the Exxon Valdez oil spill (EVOS) of 1989. The EVOS caused direct and indirect effects on many resources throughout the oil spill area (EVOS Restoration Plan). Some of the oil spill effects have resulted in changes in human use patterns in PWS and other areas. For example, subsistence harvest patterns changed after EVOS (Seitz and Fall 1995), and commercial harvest of herring was closed in PWS for several years due to pathological problems believed to be caused by the spill. Land acquisition through the EVOS restoration program has made more land available for public use and habitat protection.

In addition to changes which are directly linked to EVOS, other changes in human use of PWS are occurring. Tourism patterns in PWS have changed as cruise ships altered their routes and new glacier tour cruises have been added. While the extensive commercial salmon fishery is expected to remain at about the same level, recreational boating and kayaking has increased dramatically in the last decade and is expected to continue to increase (ADOT 1995). Development in Chenega Bay and Tatitlek have made these communities more accessible. Additional changes in human use are expected as projects such as the Whittier access road or the proposed Bering River road are completed. The Whittier access road will make western PWS much more accessible to Alaska's largest population base. This improved access is expected to result in increased human use in PWS (ADOT 1995).

Increased human activity in PWS may affect the recovery of species injured by EVOS. Humancaused disturbance has been shown to have negative effects on a wide variety of species (e.g. York 1994; Boyle and Samson 1983). Some types of boat-based disturbance have been shown to reduce productivity in many species of birds (e.g. Sowls and Bartonek 1974) and in some seal species (e.g. Richardson et al. 1988). The potential effect of human disturbance varies with species, frequency and type of disturbance, season, and other factors (Knight and Cole 1991). As human use increases in PWS the potential for disturbance-related effects on resources also increases. Human disturbance to marine mammals, seabirds, and shorebirds often occurs as people approach for viewing or photos or when beach activities such as camping and hiking disturb nesting birds.

Managing human use in large geographic areas is often very complex; management of PWS is the responsibility of numerous State and Federal Agencies, and private land owners. Presently,

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there is no single source of information on human use in PWS. This may create difficulties in resource management if human use increases as predicted and populations of injured resources are affected by human disturbance.

This project provides a foundation for displaying and understanding existing and future human use patterns in PWS, the potential disturbances on injured resources, and would make recommendations for management actions to minimize adverse effects of increased human use on injured resources. This proposal would expand the on-going pilot project in western PWS to include the entire PWS. The project consists of two components:

- 1. Develop and evaluate a spatial computer model of existing human use patterns in PWS,
- 2. Use the model to project changes in human use patterns as a result of development and management actions in western PWS, and

The final product of this pilot project would be a report with management recommendations for State and Federal agencies and a geographic computer database. The report and computer model would be available to all agencies and to PWS communities to assist land owners and managers to better understand the potential human use of an area and make appropriate management decisions.

This project would provide a useful tool in many aspects of the EVOS restoration program. The model would help in the identification of appropriate research and monitoring sites to understand the effects of human disturbance on specific injured resources or services. It would help in identifying areas where subsistence harvests may be affected by increased recreation and other uses. In addition to benefiting restoration activities, the model and recommendations would benefit State and Federal agencies, and the various Alaskan Native Corporations, in land management planning and in the protection of resources.

#### **NEED FOR PROJECT**

#### A. Statement of Problem

Human activity in PWS is expected to increase significantly in the next decade (ADOT 1995). This project provides a management tool that would increase the effectiveness of management of resources and human use in PWS. The project has direct application under Habitat Protection and General Restoration as described in the EVOS restoration plan (EVOS Trustee Council 1994), and has the potential to aid in the restoration of most of the identified injured resources and services. The pilot phase of this project placed an emphasis on describing potential disturbance effects and developing management recommendations for harbor seals, pigeon guillemots and cutthroat trout on public lands in PWS. This project would incorporate all injured species if the NOAA maps of PWS environmentally sensitive areas are updated. By expanding the modeling effort to the eastern PWS, areas in the sound that receive use from Valdez, Cordova as well as Whittier would be more accurately represented than in the pilot project which only addressed Whittier and Chenega Bay as access points.

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## B. Rationale/Link to Restoration

The Trustee Council has made significant progress in understanding the effects of the EVOS and in restoring and protecting the resources and services injured by the spill. However, the recovery of these resources and services may be affected by a dramatic increase in human use in PWS. The ADOT has predicted that the Whittier access road will result in an increase of over 600% in recreational and tourism boat traffic in parts of western PWS by the year 2015 (ADOT 1995). However, the Whittier road is one of several changes that will affect human use in PWS. For example, new cruise lines have incorporated Cordova onto their schedules and permits for float house businesses are increasing in eastern PWS. As more people recreate and work in PWS, there will be higher levels of interactions between people and injured resources. Research has shown that human disturbance can cause a wide range of problems for wildlife and fish populations. At its most severe levels, disturbance can cause mortality or reduced productivity (Knight and Cole 1991). As human use increases in PWS, the potential for problems related to human disturbance to delay recovery of injured species also increases. By identifying existing and potential human use patterns in PWS, the Trustee Council would be providing a tool that would assist in habitat protection, general restoration, and would also provide valuable information for research and monitoring projects.

## C. Location

By expanding the pilot project to include the eastern PWS, the entire PWS would be modeled. The project would benefit all State and Federal agencies with management responsibilities in PWS. The project would also benefit other land owners, especially the Chenega Corporation and the community of Chenega Bay.

## COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Involvement from PWS communities is an important component of this project. In order to fully understand human-use patterns in western PWS, the human use patterns to and from each village must also be incorporated into the model. The communities would be asked to participate in describing human-use patterns around their communities.

#### **PROJECT DESIGN**

#### A. Objectives

There are two objectives associated with this pilot project:

- 1. Describe existing and potential human-use patterns in eastern PWS
- 2. Identify areas where human disturbance has a high potential to affect injured resources.

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#### **B.** Methods

These methods are identical to those described in the original proposal for project 98339, except for discussion on a literature review of wildlife disturbance.

#### Model Construction

Only water-based transportation will be considered in the description of human-use patterns in PWS. Vessel classes will be established to more accurately describe use patterns. Classes will be based primarily on size and function (e.g., personal pleasure craft, charter, tour, commercial fishing). Current number, locations, and trips of vessels by class in western PWS will be determined through registration records, fuel records, and harbor master information on slip rental, moorage and launches. Additional information will be provided through a user survey.

The extent of human use in PWS will be described through an analysis of accessibility of the area by water craft in association with preferred destinations (e.g., recreational and commercial fishing areas, mooring buoys, camping sites, recreation cabins). Accessibility will be defined as a function of the travel range of each vessel class. Average travel ranges will be assigned to vessel classes based primarily on fuel capacity. "Preferred" destinations will be described from existing information such as recreation sites maintained by land management agencies (e.g., U.S. Forest Service, Alaska Department of Natural Resources), commercial fishing areas (e.g., Alaska Department of Fish and Game, Prince William Sound Aquaculture Association), sport fishing areas (e.g., Alaska Department of Fish and Game), tour destinations (e.g., tour operators associations). Potential use levels of these sites will be determined from a mail survey of the patrons of the Cordova and Valdez harbors. The survey will be distributed to individuals and groups known to work and recreate in PWS. This survey will help to refine model parameters on frequency and duration of trips associated with different vessel classes.

Cell-based modeling using the GRID feature of the ARC/INFO geographic information system (GIS) will form the basis of our approach to evaluate human-use patterns in western PWS (Environmental Systems Research Institute, Inc. 1994). Weighted distance functions will be used to describe areas that are available to and may be used by vessel operators. Separate grids of the water portion of PWS will be created for the analysis of dispersion of vessels in each class. For each vessel class a source grid will be created which will represent trip initiation points (e.g., marinas, launch sites). The PATHDISTANCE function will be used to determine the minimum accumulative-travel cost from the source to each cell location on the grid. This function allows for the control of factors that influence dispersion. First source cells will be identified. Then the cost to travel to each neighbor that adjoins a source cell will be determined. Next, each of the neighbor cells will be ordered from least costly to most costly. The cell location with the least cost will be removed. Finally, the least-accumulative cost to each of the neighbors of the cell just removed will be determined. This process will be repeated until all cells on the grid have been assigned an accumulative cost.

Corresponding cost grids will also be established for each vessel class. A cost grid will assign an impedance value to each cell that depicts the cost involved in moving through any particular cell. The value of each cell in the cost grid will represent the cost-per-unit distance of passing through the cell, where a unit distance corresponds to the cell width (Environmental Systems Research Institute, Inc. 1994:253). Each cell location will be given a weight proportional to the relative

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cost incurred by a vessel passing through a cell. The cost units will be established on a relative scale of energy units expended. Variations of the horizontal and vertical factor features of the PATHDISTANCE function will be used in the cost grids to represent attraction zones associated with preferred destinations (e.g., recreational and commercial fishing areas, mooring buoys, camping sites, recreation cabins).

ARC/INFO GRID functions will be used to create additional grids in which each cell is assigned the accumulative cost to the nearest source cell. Additional functions will be used to combine the accumulative cost grids and the attraction zone grids to develop grids that represent dispersion of water craft by vessel class in western PWS. These dispersion grids will be combined through map algebra to describe areas of western PWS by use class (e.g., low, medium, high vessel densities). The dispersion and density grids will be combined with grids of sensitive areas for injured species to identify those areas where conflict may occur.

#### Model Evaluation

The model will provide predictions of movements and concentrations of water vessels in the pilot study area. This information will be used to characterize areas of PWS as having high, medium, and low densities of vessels by vessel class and total vessels on a monthly basis. Separate runs of the model will be made for each month from May through September. Actual vessel densities in representative areas will be determined, by month, through field surveys.

Three areas of PWS within each of the high, medium, and low density classes (as predicted by the model) will be randomly selected. Counts of vessels present in each of the sample areas will be made each month from May through September during high-use (e.g., weekends) and low-use (e.g., mid-week) periods. Counts will be conducted from fixed-wing aircraft along line transects using the approach described by Anderson et al. (1979) and applied by Gasaway et al. (1986). Transects will be located 0.4 km apart and will traverse the sample areas. All vessels observed from transects during flights within the sample areas will be recorded by vessel class. Most vessels within sample areas are anticipated to have high sightability. However, small, nonmotorized vessels (e.g., kayaks) may not be obvious to the observers, especially if they are near the shoreline. A Sightability Correction Factor will be calculated for all vessel classes by conducting one intensive survey (e.g., following shorelines) each month in each density class while a standard survey is being conducted. The Sightability Correction Factors will be applied to the results of all transect surveys to provide an estimate of total number of vessels, by class, in the sample areas. The survey technique may be modified as experience in its application is gained.

Results of the field surveys will be used to determine if ranges of actual vessel densities in the sample areas correspond to the vessel density classes predicted by the model under current conditions. If model predictions are not corroborated by the results of the field counts, model parameters will be examined and modified to bring the model into compliance with field counts.

#### Model Application

Upon completion of the evaluation, the model will be used to estimate future use of PWS under potential management changes (e.g., improved Whittier access, additional fuel sources provided). Analyses will be completed which will incorporate projections of increased use of western PWS to demonstrate expected temporal and spatial changes in use patterns. ARC/INFO

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grids of potential human-use patterns will be combined with existing GIS maps of the distribution and areas of essential habitat for injured wildlife and fish resources. Areas of potential conflict (e.g., high density human-use areas coinciding with essential habitat) will be identified.

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

Forest Service personnel will be responsible for the development and evaluation of the human use dispersion model and its attributes. Evaluation of the model will be based on the results of aerial surveys. The Forest Service will conduct the literature search on human disturbance effects on injured resources, and develop management recommendations in cooperation with the State. Forest Service personnel will incorporate the model with known information for three injured species. Coordination with other agencies will be the responsibility of the Forest Service.

The State of Alaska, Department of Natural Resources (ADNR) is a partner on this project. The Chugach National Forest, ADNR, and Chenega Corporation are responsible for most land management within the study area. An ADNR Natural Resources Manager will provide input and coordination with the Division of State Parks and Outdoor Recreation, and the Division of Lands. This partnership would ensure that relevant State activities are included in the model, and that the management recommendations are compatible with State management responsibilities. ADNR will also provide information on other activities related to State Marine Parks, Alaska Marine Highway System, and commercial fishing industry. The State will also conduct the user survey, and incorporate results of previous surveys, to refine the information about existing use patterns.

Contracts for this proposal include airplane costs associated with conducting the aerial surveys. Tatitlek, Eyak and Koncor Corporations would be asked to collaborate on this project by working with the principal investigators to ensure that the human use model accurately displays existing activities on Corporation lands and activities associated with the different communities.

#### **SCHEDULE**

#### A. Measurable Project Tasks for FY99

March. 1 - April 30: Design and distribute user surveys, begin data collection May 1 – Sept. 30: Collect human-use activity data, begin existing use model

#### **B.** Project Milestones and Endpoints

All three of the objectives described in this proposal will be fully completed at the end of the pilot project in April 1999. Project milestones are described in the following schedule.

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<u>FY99</u>

March. 1 - April 30: Design and distribute user surveys, begin data collection

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May 1 – Sept. 30:

Collect human-use activity data, begin existing use model, analyze survey data

<u>FY00</u>

| Oct. 1 – March 1:<br>Jan. 1 – 30: | Apply model with future projections of use<br>Prepare preliminary results for presentation at the annual EVOS |
|-----------------------------------|---|
|                                   | symposium.  |
| March 15 – April 15:              | Prepare annual report   |
| May 1 - Sept. 30:                 | Conduct aerial surveys and user surveys   |
| June 1 - Aug. 30:                 | Preliminary test of model based on initial aerial survey results  |
| Sept. 15 - Sept. 30:              | Begin analysis of survey results and evaluation of model  |
| FY01                              |   |

Oct. 1 – Jan. 15: Finalize model; prepare final report

## C. Completion Date

This pilot project will be completed by April 15th, 2001. This includes a final computer model. This does not include development of a user-based version of the dispersion model for direct use by land managers.

## **PUBLICATIONS AND REPORTS**

The first, and final, report for this project will be submitted in April 1999. There are no plans for publication during FY98; however, opportunities will be explored for FY99.

## **PROFESSIONAL CONFERENCES**

The principal investigators will request support to present the model at annual GIS and The Wildlife Society conferences in FY00 or FY01.

## NORMAL AGENCY MANAGEMENT

This project is outside the scope of normal management for the Chugach National Forest. Development of human dispersion models similar to the proposed project has not been done previously in the context of National Forest management. The Forest Service has conducted public use surveys in 1992 and 1995 on the Chugach National Forest to provide information for the Forest Plan Revision process. Additional surveys are not planned for PWS. This project is also outside of normal agency management because of the combination of species being addressed. Populations of species injured by the EVOS are potentially some of the most vulnerable to disturbance associated with increased human use. Many of these species, such as

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harbor seals, rarely occur on National Forest land; however, activities and management associated with National Forest land can affect these marine species.

Ultimately, managing human use in PWS will be an interagency responsibility which will require coordination between multiple agencies. This project will provide useful information for all of these agencies.

#### **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

Opportunity exists to integrate this project with many of the other restoration projects. If the NOAA Environmentally Sensitive Area maps for PWS are updated in FY99, those GIS layers would be merged with the complete human use model for PWS. This combination would be important information in the management of these sensitive areas for the recovery of injured resources and services.

The project would also be integrated into State and Federal agency management and would provide useful information to the Chenega Corporation and Chenega Bay in their ecotourism development plans for PWS. The Chugach National Forest will be continuing the revision of the 10 year Forest Plan during FY98. The information gathered for this project would be incorporated into the Forest planning process. Although the Forest Plan revision effort is anticipated to be completed before this project would be finalized, the principal investigators would work with the planning team to provide relevant information as it becomes available. The model and recommendations would also benefit biologists and recreation specialists who make project-level decisions for the Chugach National Forest. Many of these individuals would be involved in the development of this project and would have the opportunity to apply the information to other aspects of forest management. It is anticipated that other Federal agencies, such as National Marine Fisheries Service, would benefit from this project in their management activities.

The Alaska Department of Natural Resources is a partner on this project. This partnership will ensure that activities undertaken by State agencies are incorporated into the model and that the product would be beneficial to the State of Alaska.

## PROPOSED PRINCIPAL INVESTIGATORS

Karen A. Murphy Chugach National Forest Glacier Ranger District P.O. Box 129 Girdwood, AK 99587 (907) 783-3242 (907) 783-2094 Lowell H. Suring Chugach National Forest 3301 C Street Ste 300 Anchorage, AK 99503 (907) 271-2836 (907) 271-3992 (FAX)

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## PRINCIPAL INVESTIGATORS

## Lowell H. Suring

Lowell H. Suring received his M.S. in wildlife science from Oregon State University in 1974. His thesis involved assessing habitat use and activity patterns of the endangered Columbian white-tailed deer. This work lead to co-authorship of two major scientific publications. Lowell was leader of the Endangered Species and Wildlife Biometrics units in New York State from 1974 through 1977. In 1977 and 1978 he conducted research on secondary succession patterns in pinyon-juniper woodlands in northwest Colorado. From 1978 to 1984 Lowell held biologist positions with the Fish and Wildlife Service and Forest Service in New Mexico and Minnesota where he was involved with determining wildlife habitat relationships and the assessment of effects of management actions on wildlife habitats and populations. Since 1984, Lowell has been a primary participant in the development of GIS-based wildlife habitat relationships and cumulative effects models in the Alaska Region of the Forest Service. Lowell's professional expertise and interests focus on analyzing habitat-use patterns of wildlife and the development and application of computer-based habitat assessment techniques. He has authored or coauthored more than 30 technical and semi-technical articles describing accomplishments in these areas. Currently, Lowell is employed by the Chugach National Forest where he is implementing analytic techniques and tools that may be used to evaluate the capability of habitats to support wildlife and the effects of land management activities on habitat capability. To support these efforts he has had extensive training and experience in the application of ESRI's ARC/INFO geographic information system. Lowell will have primary responsibility in development of the human use dispersion model.

## Karen A. Murphy

Karen Murphy received a Masters in Environmental Management from Duke University in 1995. Her thesis emphasis was on applying decision theory and risk assessment to wildlife management. Karen has extensive experience with fish and wildlife management on the Chugach National Forest. She began working in Alaska in 1984 as a biological technician responsible for conducting field surveys and monitoring in PWS, Copper River Delta and other areas of the Chugach National Forest. In 1991, she began working with the EVOS Restoration Planning Work Group. She participated in the development of the EVOS Restoration Plan and companion EIS. Since 1996, Karen has been the wildlife biologist for the Glacier Ranger District which covers western PWS and Turnagain Arm. Her current position, combined with her EVOS experience will enhance the opportunity to integrate this project with other EVOS projects and to apply the results to wildlife management on the Chugach National Forest. Karen will have primary responsibility for administering and coordinating this project and for the development of management recommendations.

## **OTHER KEY PERSONNEL**

Ali Iliff, Natural Resource Manager with ADNR will represent the State Marine Parks and State Lands on this project. She will also work with ADF&G and other state agencies to incorporate appropriate data into the model.

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Dan Logan, Wildlife Biologist, with the Cordova Ranger District (USFS) will assist in acquiring information for this project. He is a long-time resident of Cordova and has the local knowledge and network needed to expand this model to the eastern PWS.

## LITERATURE CITED

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1999 EXXON VALDEZ TRUS

October 1, 1998 - September 30, 1999

|                             | Authorized    | Proposed     |               | PROPOSED F     | Y 1999 TRUS     | TEE AGENCII | ES TOTALS |        |
|-----------------------------|---------------|--------------|---------------|----------------|-----------------|-------------|-----------|--------|
| Budget Category:            | FY 1998       | FY 1999      | ADEC          | ADF&G          | ADNR            | USFS        | DOI       | NOAA   |
|                             |               |              |               |                | \$17.5          | \$21.1      |           | ·      |
| Personnel                   | \$0.0         | \$28.5       |               |                |                 |             |           |        |
| Travel                      | \$0.0         | \$4.8        |               |                |                 |             |           |        |
| Contractual                 | \$0.0         | \$0.0        |               |                |                 |             |           |        |
| Commodities                 | \$0.0         | \$1.0        |               |                |                 |             |           |        |
| Equipment                   | \$0.0         | \$0.0        |               | LONG R         | ANGE FUNDI      | NG REQUIRE  | MENTS     |        |
| Subtotal                    |               | \$34.3       |               | Estimated      | Estimated       | Estimated   |           |        |
| General Administration      |               | \$4.3        |               | FY 2000        | FY 2001         | FY 2002     |           |        |
| Project Total               |               | \$38.6       |               | \$104.9        | \$70.0          | \$0.0       |           |        |
|                             |               |              |               |                |                 |             |           |        |
| Full-time Equivalents (FTE) | 0.0           | 0.5          |               |                |                 |             |           |        |
|                             |               |              | Dollar amount | s are shown ir | thousands of    | dollars.    |           |        |
| Other Resources             | \$0.0         | \$0.0        |               | \$0.0          | \$0.0           | \$0.0       |           |        |
| Comments:                   |               |              |               |                |                 |             |           |        |
|                             |               |              |               |                |                 |             |           |        |
|                             |               |              |               |                |                 |             |           |        |
|                             |               |              |               |                |                 |             |           |        |
|                             |               |              |               |                |                 |             |           |        |
|                             |               |              |               |                |                 |             |           |        |
|                             |               |              |               |                |                 |             |           |        |
|                             |               |              |               |                |                 |             |           |        |
|                             |               |              |               | ·              |                 |             |           |        |
|                             |               |              |               |                |                 |             |           |        |
|                             |               |              |               |                |                 |             |           |        |
|                             |               |              |               |                |                 |             |           |        |
|                             |               |              |               |                |                 |             | `         |        |
|                             |               |              |               |                |                 |             |           |        |
| · ·                         |               |              |               |                |                 |             |           |        |
| L                           |               |              |               |                |                 |             |           |        |
| LJ                          | Ducie of Ner  | aham 0020    | n             |                |                 |             | EOF       |        |
|                             | Project Nun   | nber: 9939   | 9             |                |                 |             |           |        |
| 1999                        | Project Title | e: Eastern F | 2005 Human    | Use and W      | /ildlife Distur | bance       | MULII-1   | RUSIEE |
| 1333                        | Model         |              |               |                |                 |             | AGE       | ENCY   |
|                             | Lead Agend    | v: US Fore   | est Service   |                |                 |             | SUM       | MARY   |
| LJ                          |               |              |               |                |                 | 1           |           |        |

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4/15/98

1999 EXXON VALDEZ TRU

October 1, 1998 - September 30, 1999

| ſ <u></u>                   | Authorized    | Proposed     |               |  |                |             |       |         |
|-----------------------------|---------------|--------------|---------------|--|----------------|-------------|-------|---------|
| Budget Category:            | FY 1998       | FY 1999      |               | a an |                |             |       |         |
| Budget Sutegory:            |               |              |               |  |                |             |       |         |
| Personnel                   |               | \$15.5       |               |  |                | 4           |       |         |
| Travel                      |               | \$3.3        |               |  | landa and      |             |       |         |
| Contractual                 | ······        | \$0.0        |               |  |                |             |       |         |
| Commodities                 |               | \$0.0        |               |  |                |             |       |         |
| Equipment                   |               | \$0.0        |               | LONG RA                                  | NGE FUNDIN     | IG REQUIREN | MENTS |         |
| Subtotal                    |               | \$18.8       |               | Estimated                                | Estimated      | Estimated   |       |         |
| General Administration      |               | \$2.3        |               | FY 2000                                  | FY 2001        | FY 2002     |       |         |
| Project Total               |               | \$21.1       |               | \$93.4                                   | \$42.6         |             |       |         |
| -                           |               |              |               |  | <b>-</b>       |             | 1     |         |
| Full-time Equivalents (FTE) |               | 0.3          |               |  |                |             |       |         |
|                             |               | L            | Dollar amount | ts are shown ir                          | n thousands of | dollars.    |       |         |
| Other Resources             |               |              |               |  |                |             |       |         |
| Comments:                   |               |              |               |  |                |             |       |         |
|                             |               |              |               |  |                |             |       |         |
|                             |               |              |               |  |                |             |       |         |
|                             |               |              |               |  |                |             |       |         |
|                             |               |              |               |  |                |             |       |         |
|                             |               |              |               |  |                |             |       |         |
|                             |               |              |               |  |                |             |       |         |
|                             |               |              |               |  |                |             |       |         |
|                             |               |              |               |  |                |             |       |         |
|                             |               |              |               |  |                |             |       |         |
|                             |               |              |               |  |                |             |       |         |
|                             |               |              |               |  |                |             |       |         |
|                             |               |              |               |  |                |             |       |         |
|                             |               |              |               |  |                |             |       |         |
|                             |               |              |               |  |                |             |       |         |
|                             |               |              |               |  |                |             |       |         |
| []                          | Project Nur   | nhor: 0020   | o             |  |                |             |       | FORM 3A |
|                             |               |              |               |  | ildlife Distur | hanaa       |       | TRUSTEE |
| 1999                        | Project litle | e: ⊨astern P | ws Human      | Use and W                                | nume Distur    | Dance       |       |         |
|                             | Model         |              |               |  |                |             |       | AGENUY  |
|                             | Agency: U     | S Forest Se  | rvice         |  |                |             |       | SUMMARY |
|                             | 1 .           |              |               |  |                |             |       |         |

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1999 EXXON VALDEZ TRU

October 1, 1998 - September 30, 1999

| Personnel Costs:       |                                  | GS/Range/   | Months         | Monthly |              | Proposed  |
|------------------------|----------------------------------|-------------|----------------|---------|--------------|-----------|
| Name                   | Position Description             | Step        | Budgeted       | Costs   | Overtime     | FY 1999   |
| K.Murphy               | Project Co-leader                | GS-9        | 1.0            | 4.5     |              | 4.5       |
| L.Suring               | Project Co-leader                | GS-12       | 1.0            | 6.2     |              | 6.2       |
| D.Logan                | Wildlife Biologist               | GS-11       | 1.0            | 4.8     |              | 4.8       |
|                        |                                  |             |                |         |              | 0.0       |
|                        |                                  |             |                |         |              | 0.0       |
|                        |                                  |             |                |         |              | 0.0       |
|                        |                                  |             |                |         |              | 0.0       |
|                        |                                  |             |                |         |              | 0.0       |
|                        |                                  |             |                |         |              | 0.0       |
|                        |                                  |             |                |         |              | 0.0       |
|                        |                                  |             |                |         | ·            | 0.0       |
|                        |                                  |             |                |         |              | 0.0       |
|                        | Subtotal                         |             | 3.0            | 15.5    | 0.0          |           |
|                        |                                  |             |                | Per     | sonnel Total | \$15.5    |
| Travel Costs:          |                                  | Ticket      | Round          | Total   | Daily        | Proposed  |
| Description            |                                  | Price       | Trips          | Days    | Per Diem     | FY 1999   |
| RT Cordova - Valdez    |                                  | 0.5         | 1              | 5       | 0.2          | 1.5       |
| RT Anchorage - Cordova |                                  | 0.3         | 2              | 6       | 0.2          | 1.8       |
|                        |                                  |             |                |         |              | 0.0       |
|                        |                                  |             |                |         |              | 0.0       |
|                        |                                  |             |                |         |              | 0.0       |
|                        |                                  |             |                |         |              | 0.0       |
|                        |                                  |             |                |         |              | 0.0       |
|                        |                                  |             |                |         |              | 0.0       |
|                        |                                  |             |                |         |              | 0.0       |
|                        |                                  |             |                |         |              | 0.0       |
|                        |                                  |             |                |         |              | 0.0       |
|                        |                                  |             |                |         |              | 0.0       |
|                        |                                  |             |                |         | Travel Total | \$3.3     |
|                        |                                  |             |                |         |              |           |
|                        | Project Number: 99399            |             |                |         | F            | ORM 3B    |
| 1000                   | Project Title: Eastern PWS Human | h Use and W | ildlife Distur | bance   | F            | Personnel |

| 1 | 999 |  |
|---|-----|--|
|   |     |  |

| Project Number: 99399   |  |
|---|--|
| Project Title: Eastern PWS Human Use and Wildlife Disturbance |  |
| Model   |  |
| Agency: US Forest Service                                     |  |

& Travel

DETAIL

1999 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET

| Contractual Costs:      |  | Proposed         |
|-------------------------|--|------------------|
| Description             |  | FY 1999          |
|                         |  |                  |
|                         |  |                  |
|                         |  |                  |
|                         |  |                  |
|                         |  |                  |
|                         |  |                  |
|                         |  |                  |
|                         |  |                  |
|                         |  |                  |
|                         |  |                  |
| hen a non-trustee orgar | nization is used, the form 4A is required. Contract            | tual Total \$0.0 |
| ommodities Costs:       |  | Proposed         |
| escription              |  | FY 1999          |
|                         |  |                  |
|                         |  |                  |
|                         |  |                  |
|                         |  |                  |
|                         |  |                  |
|                         |  |                  |
|                         |  |                  |
|                         |  |                  |
|                         |  |                  |
|                         |  |                  |
|                         | Commodi  | ties Total \$0.0 |
|                         |  | FORM 3R          |
|                         | Project Number: 99399  | Contractual &    |
| 1999                    | Project Litle: Eastern PVVS Human Use and Wildlife Disturbance | Commodifies      |
|                         |  |                  |
|                         | Agency: US Forest Service                                      | DETAIL           |
| repared: 4 of 13        |  | 4/15             |

# 1999 EXXON VALDEZ TRUSSE COUNCIL PROJECT BUDGET

| New Equipment Purchases:           |   | Number   | Unit         | Proposed                     |
|------------------------------------|---|----------|--------------|------------------------------|
| Description                        |   | of Units | Price        | FY 1999                      |
|                                    |   |          |              | 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 re | placement equipment should be indicated by placement of an R.   | New Equ  | ipment Total | \$0.0                        |
| Existing Equipment Usage:          |   |          | Number       | Inventory                    |
| Description                        | ander gener i fonder de service de la fonder de service de la fonder en service de la fonder en service de la f   |          | of Units     | Agency                       |
|                                    |   |          |              |                              |
| 1999<br>Mc<br>Ag                   | oject Number: 99399<br>oject Title: Eastern PWS Human Use and Wildlife Distur<br>odel<br>jency: US Forest Service | bance    | F<br>Ed      | ORM 3B<br>quipment<br>DETAIL |

1999 EXXON VALDEZ TRUCE COUNCIL PROJECT BUDGET

|                        | Authorized   | Proposed |              | and the second second |                |                 |         |             |
|------------------------|--|----------|--------------|-----------------------|----------------|-----------------|---------|-------------|
| Budget Category:       | FY 1998  | FY 1999  |              |                       |                |                 |         |             |
|                        |  | <u> </u> |              |                       |                |                 |         |             |
| Personnel              |  | \$13.0   |              |                       |                |                 |         |             |
|                        |  | \$1.5    |              |                       |                |                 |         |             |
|                        |  | \$0.0    |              |                       |                |                 |         |             |
|                        | ·····  | \$1.0    |              |                       |                |                 |         |             |
|                        |  | \$0.0    |              |                       |                |                 |         |             |
|                        |  | \$15.5   |              | Estimated             | Estimated      | Estimated       |         |             |
| General Administration |  | \$2.0    |              | FY 2000               | FY 2001        | FY 2002         |         |             |
|                        |  | \$17.5   |              | \$11.5                | \$11.5         |                 |         |             |
|                        |  |          |              |                       |                |                 |         |             |
|                        |  | 0.2      |              |                       |                | al al la un     |         |             |
| Other Decourses        |  |          | Dollar amoun | ts are snown ir       | n thousands of | r dollars.<br>T | T       |             |
|                        |  | [        | L            | <u> </u>              |                |                 |         |             |
| Comments.              |  |          |              |                       |                |                 |         |             |
|                        |  |          |              |                       | ,              |                 |         | Į.          |
|                        |  |          |              |                       |                |                 |         |             |
|                        |  |          |              |                       |                |                 |         |             |
|                        |  |          |              |                       |                |                 |         |             |
|                        |  |          |              |                       |                |                 |         |             |
|                        |  |          |              |                       |                |                 |         |             |
|                        |  |          |              |                       |                |                 |         |             |
|                        |  |          |              |                       |                |                 |         |             |
|                        |  |          |              |                       |                |                 |         |             |
|                        |  |          |              |                       |                |                 |         |             |
|                        |  |          |              | •                     |                |                 |         | l l         |
|                        |  |          |              |                       |                |                 |         |             |
|                        |  |          |              |                       |                |                 |         |             |
|                        |  |          |              |                       |                |                 |         |             |
|                        |  |          |              |                       |                |                 |         |             |
|                        |  |          |              |                       |                |                 | Г       |             |
|                        | Project Number: 99399  |          |              |                       |                |                 | FORM 3A |             |
| 4000                   | Project Title Eastern PWS Human Use and Wildlife Disturbance |          |              |                       |                |                 |         | TRUSTEE     |
| 1999                   | Model  |          |              |                       |                |                 |         | AGENCY      |
|                        |  |          |              |                       |                |                 |         | SUMMADV     |
|                        | Agency: Al   | JNK      |              |                       |                |                 |         | SUIVIIVIARY |
| Prepared: 6 of 13      |  |          |              |                       |                |                 |         | 4/15/9      |

# 1999 EXXON VALDEZ TRU

October 1, 1998 - September 30, 1999

| Personnel Costs:       |   | GS/Range/I | Months         | Monthly |                    | Proposed                        |
|------------------------|---|------------|----------------|---------|--------------------|---------------------------------|
| Name Positio           | on Description                                    | Step       | Budgeted       | Costs   | Overtime           | FY 1999                         |
| A.Iliff Natura         | al Resource Manager                               | 16         | 2.0            | 6.5     |                    | 13.0                            |
|                        |   |            |                |         |                    | 0.0                             |
|                        |   |            |                |         |                    | 0.0                             |
|                        |   |            |                |         |                    | 0.0                             |
|                        |   |            |                |         |                    | 0.0                             |
|                        |   |            |                |         |                    | 0.0                             |
|                        |   |            |                |         |                    | 0.0                             |
|                        |   |            |                |         |                    | 0.0                             |
|                        |   |            |                |         |                    | 0.0                             |
|                        |   |            |                |         |                    | 0.0                             |
|                        |   |            |                |         |                    | 0.0                             |
|                        |   |            |                |         |                    | 0.0                             |
|                        | Subtotal  |            | 2.0            | 6.5     | 0.0                | <u> </u>                        |
| Turnel Ocates          |   |            |                | Per     | sonnei i otai      | \$13.0                          |
| l ravel Costs:         |   |            | Round          | Total   | Daily<br>Der Diere | Proposed                        |
|                        |   | Plice      | The            | Days    | Per Diem           | FT 1999                         |
| RT Anchorage - Cordova |   | 0.3        | 1              | 3       | 0.2                | 0.0                             |
| RT Anchorage - Valdez  |   | 0.0        | 1              | 3       | 0.2                | 0.9                             |
|                        |   | 0.0        | '              | Ű       | 0.1                | 0.0                             |
|                        |   |            |                |         |                    | 0.0                             |
|                        |   |            |                |         |                    | 0.0                             |
|                        |   |            |                |         |                    | 0.0                             |
|                        |   |            |                |         |                    | 0.0                             |
|                        |   |            |                |         |                    | 0.0                             |
|                        |   |            |                |         |                    | 0.0                             |
|                        |   |            |                |         |                    | 0.0                             |
|                        |   |            | 4              |         |                    |                                 |
|                        |   |            |                |         |                    | 0.0                             |
|                        |   | <u> </u>   |                |         | Travel Total       | 0.0<br>\$1.5                    |
|                        |   |            |                |         | Travel Total       | 0.0<br>\$1.5                    |
| Proje                  | ct Number: 99399                                  |            |                |         | Travel Total       | 0.0<br>\$1.5                    |
| Proje                  | ct Number: 99399<br>ct Title: Eastern PWS Human U | Jse and Wi | ildlife Distur | bance   | Travel Total       | ORM 3B<br>Personnel             |
| 1999 Proje             | ct Number: 99399<br>ct Title: Eastern PWS Human U | Jse and Wi | ildlife Distur | bance   | Travel Total       | ORM 3B<br>Personnel<br>& Travel |

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1999 EXXON VALDEZ TRUS

| Contractual Costs:      |   | Proposed    |
|-------------------------|---|-------------|
| Description             |   | FY 1999     |
|                         |   |             |
|                         |   |             |
|                         |   |             |
|                         |   |             |
|                         |   |             |
|                         |   |             |
|                         |   |             |
|                         |   |             |
|                         |   |             |
|                         |   |             |
|                         |   |             |
| When a non-trustee ora: | prization is used the form 1A is required                     |             |
| commodition Costs:      | Contractual   | Proposod    |
| escription              |   | FY 1999     |
| <u></u>                 |   |             |
| Postage and supplies fo | r mailing user surveys  | 1.0         |
|                         |   |             |
|                         |   |             |
|                         |   |             |
|                         |   |             |
|                         |   |             |
|                         |   |             |
|                         |   |             |
|                         |   |             |
| -                       |   |             |
| _                       | Commodities I   | otal \$1.0  |
|                         |   | EODM 2D     |
|                         | Project Number: 99399   |             |
| 1999                    | Project Title: Eastern PWS Human Use and Wildlife Disturbance |             |
|                         | Model   | Commodities |
|                         | Agency: ADNR  | DETAIL      |
| repared: 8 of 13        |   | 4/15        |

# 1999 EXXON VALDEZ TRU

| New Equipment Purchases:  | Number                              | Unit         | Proposed |
|---|-------------------------------------|--------------|----------|
| Description   | of Units                            | Price        | FY 1999  |
|   |                                     |              | 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 ind | icated by placement of an R New Equ | ipment Total | <u> </u> |
| Existing Equipment Usage:   |                                     | Number       |          |
| Description   |                                     | of Units     | Agency   |
|   |                                     |              |          |
|   |                                     |              |          |
|   |                                     |              |          |
|   |                                     |              |          |
|   |                                     |              |          |
|   |                                     |              |          |
|   |                                     |              |          |
|   |                                     |              |          |
|   |                                     |              |          |
|   |                                     |              |          |
|   |                                     |              |          |
|   |                                     |              |          |
|   |                                     |              |          |
| Project Number: 00300   |                                     |              |          |
| Droject Nulliber. 33033   | an Lleo and Wildlife Disturbance    |              |          |
| 1999  |                                     | E            | quipment |
| IVIOdel   |                                     |              | DETAIL   |
| Agency: ADNR  |                                     | L            |          |
| Prepared: 9 of 13   |                                     |              | 4/15     |
1999 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

|                             | Authorized    | Proposed    |               |                |                |             |       |         |
|-----------------------------|---------------|-------------|---------------|----------------|----------------|-------------|-------|---------|
| Budget Category:            | FY 1998       | FY 1999     |               |                |                |             |       |         |
|                             |               |             |               |                |                |             |       |         |
| Personnel                   |               | \$0.0       |               |                |                |             |       |         |
| Travel                      |               | \$0.0       |               |                |                |             |       |         |
| Contractual                 |               | \$0.0       |               |                |                |             |       |         |
| Commodities                 |               | \$0.0       |               |                |                |             |       |         |
| Equipment                   |               | \$0.0       |               | LONG RA        | NGE FUNDIN     | IG REQUIREN | MENTS |         |
| Subtotal                    | \$0.0         | \$0.0       |               | Estimated      | Estimated      | Estimated   |       |         |
| General Administration      |               | \$0.0       |               | FY 2000        | FY 2001        | FY 2002     |       |         |
| Project Total               | \$0.0         | \$0.0       |               |                |                |             |       |         |
|                             |               |             |               |                |                |             |       |         |
| Full-time Equivalents (FTE) |               | 0.0         |               |                |                |             |       |         |
|                             |               |             | Dollar amount | s are shown ir | n thousands of | dollars.    |       |         |
| Other Resources             |               | . <u> </u>  |               |                |                |             |       |         |
| Comments:                   | A             |             |               |                |                |             |       |         |
|                             |               |             |               |                |                |             |       |         |
|                             |               |             |               |                |                |             |       |         |
|                             |               |             |               |                |                |             |       |         |
|                             |               |             |               |                |                |             |       |         |
|                             |               |             |               |                |                |             |       |         |
|                             |               |             |               |                |                |             |       |         |
|                             |               |             |               |                |                |             |       |         |
|                             |               |             |               |                |                |             |       |         |
|                             |               |             |               |                |                |             |       |         |
|                             |               |             |               |                |                |             |       |         |
|                             |               |             |               |                |                |             |       |         |
|                             |               |             |               |                |                |             |       |         |
|                             |               |             |               |                |                |             |       |         |
|                             |               |             |               |                |                |             |       |         |
|                             |               |             |               |                |                |             |       |         |
| <b></b>                     | ſ             |             |               |                |                |             |       |         |
| []                          |               |             | -             |                |                |             |       | FORM 3A |
|                             | Project Nun   | nber: 99399 | 9             |                |                |             |       | TRUSTEE |
| 1999                        | Project Title | : PWS Hur   | man Use an    | d Wildlife Di  | sturbance N    | /lodel      |       | AGENCY  |
|                             | Agency: Al    | ONR         |               |                |                |             |       |         |
|                             |               |             |               |                |                |             |       | SUMMARY |
| Prepared: 10 of 13          |               |             |               |                |                |             |       | 4/15    |

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# 1999 EXXON VALDEZ TRU

October 1, 1998 - September 30, 1999

| Personnel Costs: |                             | GS/Range/   | Months | Monthly     |           | Proposed            |          |
|------------------|-----------------------------|-------------|--------|-------------|-----------|---------------------|----------|
| Name             | Position Description        |             | Step   | Budgeted    | Costs     | Overtime            | FY 1999  |
|                  |                             | -           |        |             |           |                     | 0.0      |
|                  |                             | · ]         |        |             |           |                     | 0.0      |
|                  |                             |             |        |             |           |                     | 0.0      |
|                  |                             |             |        |             |           |                     | 0.0      |
|                  |                             |             |        |             |           |                     | 0.0      |
|                  |                             | ļ           |        |             |           |                     | 0.0      |
|                  |                             |             |        |             |           |                     | 0.0      |
|                  |                             |             |        |             |           |                     | 0.0      |
|                  |                             |             |        |             |           |                     | 0.0      |
|                  |                             |             |        |             |           |                     | 0.0      |
|                  |                             |             |        |             |           |                     | 0.0      |
|                  |                             | ubtotal     |        | 0.0         | 0.0       |                     | 0.0      |
|                  |                             | ubiotal     |        | 0.0         | 0.0<br>Po | 0.0<br>sonnel Total | 0.02     |
| Travel Costs:    |                             | Ī           | Ticket | Round       | Total     | Daily               | Proposed |
| Description      |                             | [           | Price  | Trins       | Davs      | Per Diem            | FY 1999  |
|                  |                             |             |        |             |           |                     | 0.0      |
|                  |                             |             |        |             |           |                     | 0.0      |
|                  |                             |             |        |             |           |                     | 0.0      |
|                  |                             |             |        |             |           |                     | 0.0      |
|                  |                             |             |        |             |           |                     | 0.0      |
|                  |                             |             |        |             |           |                     | 0.0      |
|                  |                             | 1           |        |             |           |                     | 0.0      |
|                  |                             |             |        |             |           |                     | 0.0      |
|                  |                             |             |        |             |           |                     | 0.0      |
|                  |                             | :           |        |             |           |                     | 0.0      |
|                  |                             |             |        |             |           |                     | 0.0      |
|                  |                             |             |        |             |           |                     | 0.0      |
|                  |                             |             |        |             | -         | Travel Total        | \$0.0    |
|                  |                             |             |        |             |           |                     |          |
|                  | Project Number: 00300       |             |        |             |           | F                   | ORM 3B   |
| 1000             |                             | aturbanca M |        | F           | Personnel |                     |          |
| 1999             | Project Litle: PVVS Human U | se and      |        | sturbance M |           |                     | & Travel |
|                  | Agency: ADNR                |             |        |             |           |                     | DETAIL   |
|                  |                             |             |        |             |           | L                   |          |

Prepared: 11 of 13

4/15/98

1999 EXXON VALDEZ TRUSSE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

| Contractual Costs:  | Proposed                                     |
|---|--|
| Description   | FY 1999                                      |
|   |  |
| When a non-trustee organization is used, the form 4A is required. Contractual Total                                 | \$0.0  |
| Commodities Costs:  | Proposed                                     |
| Description   | FY 1999                                      |
| Commodifies Total   | \$0.0  |
|   |  |
| <b>1999</b><br>Project Number: 99399<br>Project Title: PWS Human Use and Wildlife Disturbance Model<br>Agency: ADNR | ORM 3B<br>Itractual &<br>nmodities<br>DETAIL |

5/98

# 1999 EXXON VALDEZ TRUS

| New Equipment Purchase    | PS:  | Number   | Unit         | Proposed                     |
|---------------------------|--|----------|--------------|------------------------------|
| Description               |  | of Units | Price        | FY 1999                      |
|                           |  |          |              | 0.0                          |
|                           |  |          |              | 0.0                          |
|                           |  |          |              | 0.0                          |
|                           |  |          |              | 0.0                          |
|                           |  |          |              | 0.0                          |
|                           |  |          |              | 0.0                          |
|                           |  |          |              | 0.0                          |
|                           |  |          |              | 0.0                          |
|                           |  |          |              | 0.0                          |
|                           |  |          |              | 0.0                          |
|                           |  |          |              | 0.0                          |
|                           |  |          |              | 0.0                          |
|                           |  |          |              | 0.0                          |
| Those purchases associate | d with replacement equipment should be indicated by placement of an R.                           | New Equ  | ipment Total | \$0.0                        |
| Existing Equipment Usag   | e:   |          | Number       | Inventory                    |
| Description               |  |          | of Units     | Agency                       |
|                           |  |          |              |                              |
| 1999                      | Project Number: 99399<br>Project Title: PWS Human Use and Wildlife Disturbance M<br>Agency: ADNR | lodel    | F<br>Ec      | ORM 3B<br>quipment<br>DETAIL |
| Prepared: 13 of 13        |  |          |              | 4/1                          |

\$

# SPOT SHRIMP - A POPULATION DYNAMICS STUDY Pandulus Platycerus

8

| Project Number:                               | 99401  | RECEIVED       |
|---|--|----------------|
| Restoration Category:                         | General Restoration                              | APR 1 5 1998   |
| Proposer:                                     | Valdez Native Tribe/Charlie Hughey               | MUSTLE COUNCIL |
| Lead Trustee Agency:<br>Cooperating Agencies: | ADF&G<br>Prince William Sound Economic Developme | ent Council    |
| Alaska Sea Life Center:                       | no   |                |
| Duration:                                     | 2 year project                                   |                |
| Cost FY 99:                                   | \$70,100 (preliminary cost estimate)             |                |
| Cost FY 00:                                   | \$72,000   |                |
| Cost FY 01:                                   | \$5,000  |                |
| Cost FY 02:                                   | \$0  |                |
| Geographic Area:                              | Prince William Sound                             |                |
| Injured Resource/Service:                     | Spot Shrimp/Subsistence                          |                |

# ABSTRACT

The project will study population abundance and distribution in various areas of Prince William Sound to determine whether or not the spot shrimp population has sufficiently reestablished itself since the 1989 oil spill. The study will provide data needed to determine if the spot shrimp populations can sustain seasonal openings for subsistence, personal use and commercial fishing in Prince William Sound.

# A. INTRODUCTION

Since the Exxon Valdez Oil Spill of 1989 many changes have occurred in Prince William Sound. The area has been affected directly and indirectly in several important ways. Although the spill itself was damaging, the aftermath has had many beneficial effects if you consider the many scientific studies, programs promoting public awareness of environmental issues, and long range planning for the future of the Sound's sensitive coastal areas. These studies have provided benefits world-wide.

Few studies have taken place specifically for spot shrimp prior to the EVOS. Therefore, it's difficult to establish the population statistics or how commercial fishing and human impact has effected spot shrimp over the years. A scientific study at this time would prove beneficial to implement long range plans for the future.

The new access road connecting Portage and Whittier will bring more visitors to Prince William Sound. More cruise ships and recreational visitors now seek outdoor experiences in Alaska's waterways. How will this human impact affect the habitat for spot shrimp? Is it feasible to harvest the shrimp as subsistence or commercial fishing? These are questions we hope to answer with this study.

# **NEED FOR PROJECT**

# A. Statement of Problem

Historically, the shrimp season (pots) has been open in March. Over the past nine years, this brief opening has diminished from restrictive closure to absolute closure of the spot shrimp season. A once abundant resource apparently has been depleted. Before any new harvest or other alternative solution is attempted, it's of the utmost importance to discern spot shrimp populations in Prince William Sound.

How is tourism impacting spot shrimp habitat within the Sound? Will increased tourism and harvest pressure from the new Whittier access road affect these habitats? When will it again be feasible to harvest spot shrimp commercially or for subsistence users.

# B. Rational/Link to Restoration

Since 1989, several spot shrimp studies have been made for population information, using a grid system. However, these studies were rather limited to a few select locations in the Sound. Our intent is to broaden these sites to include a more diversified area which will give a more concise view of the shrimp population in Prince William Sound. By studying

larvae and mature spot shrimp, the impact of EVOS on this resource should be evident if it is indeed a factor.

# C. Location

The proposed project would focus on various sites in Prince William Sound, new sites as well as areas surveyed earlier.

# COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Charles Hughey of Valdez NativeTribe will act as community facilitator for the project and will act as facilitator with villages in Prince William Sound.

# **PROJECT DESIGN**

Survey for Spot Shrimp population abundance and distribution in PWS - Conceptual Design

The purpose for this survey will be to assess the abundance and distribution of spot shrimp in Prince William Sound using standard resource assessment survey methods to determine if the stocks are healthy enough to sustain a fisher, or, if additional protective measures should be taken.

# A. Objectives

The goal of this project will be to determine the abundance and distribution of spot shrimp compared to pre-spill conditions. Objectives include:

- 1. Abundance (CPUE): weight, number and number per weight
- 2. Compare size and age distribution by sex.
- 3. Determine fecundity eggs per female and number of females with eggs (must verify if this is critical for management applications).
- 4. Distribution of Spot Shrimp in Prince William Sound
- 5. Compare with historical information to determine if the population abundance has changed and to evaluate new areas of distribution.

# **B.** Methods

1. Abundance

Standard historical survey methods (Trowbridge, C. 1992, Injury to Prince William Sound Spot Shrimp. Exxon Valdez Oil Spill NRDA Final Report, Subtidal Study Number 5:142pp.)

Apply methods to determine abundance and distribution of spot shrimp, (i.e., no survey for evidence of hydrocarbon). Timing and schedule must be determined. If fecundity data are critical, surveys must be accomplished between November and March.

2. Distribution

Historical sampling locations.

Two sampling locations in "deeper" water (specific sites - to be determined). Additional sampling locations in other parts of Prince William Sound (specific sites - to be determined).

Compare with historical information.
 Apply same calculating methodology.
 Tabulate and graph historical and new information.

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

This project will be in partnership with Alaska Fish and Game, Valdez Native Tribe facilitator Charlie Hughey and Prince William Sound Economic Development Council.

#### **SCHEDULE**

A. Measurable Project Tasks for FY99 (October 1, 1998-September 30, 1999) Assemble field sampling team and mobilize sampling equipment Complete field surveys

Process samples and analyze field survey results Complete Annual Report

#### **B.** Project Milestones and Endpoints

Abundance and distribution of Spot Shrimp in Prince William Sound Compare with historical information to determine if the population has recovered April, 2000 - Complete Annual Report -

April, 2001 - Final, Sept. 2001 Complete Final Report

#### C. Completion Date

30 September 2001

# **PUBLICATIONS AND REPORTS**

The final report will be submitted September, 2001. Additional publications and reports will be submitted as information is available.

# **PROFESSIONAL CONFERENCES**

Prepared 4/4/98

No conferences are scheduled at this time, but may be scheduled as project progresses.

# **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

Valdez Native Tribe Facilitator Charles Hughey and Prince William Sound Economic Development Council will work with Alaska Fish and Game scientists to successfully complete this Spot Shrimp population study.

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

# PROPOSED PRINCIPAL INVESTIGATORS

| Charles Hughey, Valdez Native Tribe | Sue Cogswell, Executive Director |
|-------------------------------------|----------------------------------|
| P. O. Box 1108                      | Prince William Sound EDC         |
| Valdez, AK 99686                    | P. O. Box 2353                   |
| (907) 835-4951                      | Valdez, AK 99686                 |
| (907) 835-5589                      | (907) 835-3775                   |
|                                     | FX (907) 835-5770                |
|                                     | E-mail pwsedc@alaska.net         |

# PRINCIPAL INVESTIGATORS

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

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

# **KEY PERSONNEL**

Alaska Department of Fish and Game Fishery Biologist (FBII) and a ADF&G Biometrician will be key personnel, as yet to be determined.

FY 99 EXXON VALDEZ TRUE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

|  | Authorized          | Proposed        |                |                 |                  |   |     |  |
|--|---------------------|-----------------|----------------|-----------------|------------------|---|-----|--|
| Budget Category:   | FY 1998             | FY 1999         |                |                 |                  |   |     |  |
|  |                     |                 |                |                 | The second       |   |     |  |
|  |                     | \$19.5          |                |                 |                  |   |     |  |
|  |                     | \$1.2           |                |                 |                  |   |     |  |
| Contractual  |                     | \$36.0          |                |                 |                  |   |     |  |
|  |                     | \$8.0           |                |                 |                  |   |     |  |
| Equipment  |                     | \$0.0           |                | LONG F          | RANGE FUNDIN     | IG REQUIREME                            | NTS |  |
| Subtotal   | \$0.0               | \$64.7          |                | Estimated       | Estimated        | Estimated                               |     |  |
| General Administration   |                     | \$5.4           |                | FY 2000         | FY 2001          | FY 2002                                 |     |  |
| Project Total  | \$0.0               | \$70.1          |                | \$72.0          | \$5.0            |   |     |  |
|  |                     |                 |                |                 |                  |   |     |  |
| Full-time Equivalents (FTE)  |                     | 0.3             |                |                 |                  |   |     |  |
|  |                     |                 | Dollar amoun   | ts are shown in | thousands of a   | dollars.                                |     |  |
| Other Resources  |                     |                 |                |                 |                  |   |     |  |
| Comments:  |                     |                 |                |                 |                  |   |     |  |
| within Prince William Sound.<br>This budget assumes that crab po   | ots will be availal | ole at no cost; | either from AD | F&G or included | d as part of the | boat charter.                           |     |  |
| FY 99       Project Number: 99401         Project Title: Spot Shrimp - A Population Dynamics Study         Name: Charles Hughey, Valdez Native Tribe         Agency: ADF&G |                     |                 |                |                 | 4/1              | FORM 3A<br>TRUSTEE<br>AGENCY<br>SUMMARY |     |  |

14 Ap 98 with assistance by wjh

# FY 99 EXXON VALDEZ TRUE & COUNCIL PROJECT BUDGET

| Personnel Costs:     |  | GS/Range/           | Months   | Monthly |                 | Proposed  |
|----------------------|--|---------------------|----------|---------|-----------------|-----------|
| Name                 | Position Description   | Step                | Budgeted | Costs   | Overtime        | FY 1999   |
|                      |  |                     |          |         |                 | 0.0       |
| To be Named          | Fishery Biologist II   | 16E                 | 3.0      | 5.0     |                 | 15.0      |
|                      |  |                     |          |         |                 | 0.0       |
| To be Named          | Biometrician II  | 19E                 | 1.0      | 4.5     |                 | 4.5       |
|                      |  |                     |          |         |                 | 0.0       |
|                      |  |                     |          |         |                 | 0.0       |
|                      |  |                     |          |         |                 | 0.0       |
|                      |  |                     |          |         |                 | 0.0       |
|                      |  |                     |          |         |                 | 0.0       |
|                      |  |                     |          |         |                 | 0.0       |
|                      |  |                     |          |         |                 | 0.0       |
|                      |  |                     |          |         |                 | 0.0       |
| -                    |  | Subtotal            | 4.0      | 9.5     | 0.0             |           |
|                      |  |                     |          | F       | Personnel Total | \$19.5    |
| Travel Costs:        |  | Ticket              | Round    | Total   | Daily           | Proposed  |
| Description          |  | Price               | Trips    | Days    | Per Diem        | FY 1999   |
|                      |  |                     |          |         |                 | 0.0       |
| Cordova to Anchorage |  | 0.2                 | 2        | 8       | 0.1             | 1.2       |
|                      |  |                     |          |         |                 | 0.0       |
|                      |  |                     |          |         |                 | 0.0       |
|                      |  |                     |          |         |                 | 0.0       |
|                      |  |                     |          |         |                 | 0.0       |
|                      |  |                     |          |         |                 | 0.0       |
|                      |  |                     |          |         |                 | 0.0       |
|                      |  |                     |          |         |                 | 0.0       |
|                      |  |                     |          |         |                 | 0.0       |
|                      |  |                     |          |         |                 | 0.0       |
|                      |  |                     |          |         |                 | 0.0       |
| L                    |  |                     |          |         | Travel Total    | \$1.2     |
| <b></b>              |  |                     |          |         | · · · · ·       |           |
|                      | Project Number: 99401  |                     |          |         |                 | FORM 3B   |
|                      | Project Title: Spot Shrimp - A   | A Population Dynami | cs Study |         |                 | Personnel |
| FY 99                | , include the second se |                     | ,        |         |                 | 9. Trouch |

FY 99 EXXON VALDEZ TRUE & COUNCIL PROJECT BUDGET

| Contractual Costs:         |  |                   |             |
|----------------------------|--|-------------------|-------------|
| Description                |  |                   | Proposed    |
|                            |  |                   | FY 1995     |
| 4A Linkage                 |  |                   | 33.0        |
| Equipment repairs          |  |                   | 3.0         |
|                            |  |                   |             |
|                            |  |                   |             |
|                            |  |                   |             |
|                            |  |                   |             |
|                            |  |                   |             |
|                            |  |                   |             |
| When a non-truston organiz | ation is used the form 4A is required                    | Contractual Tota  | <u> </u>    |
| Commodities Costs:         |  | Contractual Total |             |
| Description                |  | •                 | FY 1999     |
|                            |  |                   | 111000      |
| Laboratory Supplies        |  |                   | 3.0         |
| Field Supplies             |  |                   | 4.0         |
|                            |  |                   |             |
| Bait                       |  |                   | 1.0         |
|                            |  |                   |             |
|                            |  |                   |             |
|                            |  |                   |             |
|                            |  |                   |             |
|                            |  | Commodities Total | \$8.0       |
|                            |  |                   |             |
|                            | Project Number: 99401                                    | F                 | FORM 3B     |
|                            | Project Title: Spot Shrimp - A Population Dynamics Study | Co                | ntractual & |
| רושש                       | Name: Charles Hughey, Valdez Native Tribe                | Cc                | mmodities   |
|                            | Agency: ADE&G  |                   | DETAIL      |
| Prepared:                  |  |                   |             |

# FY 99 EXXON VALDEZ TRUE COUNCIL PROJECT BUDGET

| New Equipment Purchases:                |  | Number   | Unit          | Proposed  |
|---|--|----------|---------------|-----------|
| Description                             |  | of Units | Price         | FY 1999   |
|   |  |          |               | 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 replace | ment equipment should be indicated by placement of an R. | New E    | uipment Total | \$0.0     |
| Existing Equipment Usage:               |  |          | Number        | Inventory |
| Description                             |  |          | of Units      | Agency    |
|   |  |          |               |           |
|   |  |          |               |           |
|   |  |          |               |           |
|   |  |          |               |           |
|   |  |          |               |           |
|   |  |          |               |           |
|   |  |          |               |           |
|   |  |          |               |           |
|   |  |          |               |           |
|   |  |          |               |           |
|   |  |          |               |           |
|   |  |          |               |           |
|   |  | ]        |               |           |
| Proje                                   | ect Number: 99401  |          | F             | ORM 3B    |
| FV OO Proie                             | ect Title: Spot Shrimp - A Population Dynamics Study     |          | F             | auinment  |
|   | e: Charles Hughey, Valdez Native Tribe                   |          |               |           |
|   |  |          |               |           |
|   |  |          | L             |           |

FY 99 EXXON VALDEZ TRUE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

| r  | Authoritand      | D               |   |   |
|--|------------------|-----------------|---|---|
| Budget Cotegowy  | Authorized       | Proposed        |   |   |
|  | FY 1998          | FY 1999         |   |   |
| Personnel  |                  |                 |   |   |
| Travel   |                  | <u> </u>        |   |   |
| Contractual  |                  | \$0.0           |   |   |
| Commodities  |                  | \$30.0          |   |   |
| Equipment  |                  | ÷0.0            |   |   |
| Subtotal   | \$0.0            |                 |   | 1 |
|  | \$0.0            |                 | Estimated Estimated Estimated                   |   |
| Project Total  | \$0.0            | \$3.0<br>\$32.0 | FY 2000 FY 2001 FY 2002                         |   |
|  | \$0.0            | \$33.0          |   |   |
| Full time Faulture ante (FTF)  |                  |                 |   |   |
| Full-time Equivalents (FTE)  |                  | 0.0             |   |   |
| Other Descures   | T                |                 | liar amounts are shown in thousands of dollars. |   |
| Other Resources  |                  |                 |   |   |
| Comments:  |                  |                 |   |   |
| including fuel, Captain, deck har  | nd and human foo | d.              |   |   |
| FY 99       Project Number: 99401         Project Title: Spot Shrimp - A Population Dynamics Study         Name: Charles Hughey, Valdez Native Tribe         Prepared: |                  |                 |   |   |

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# FY 99 EXXON VALDEZ TRUE É COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

| Perso                                    | nnel Costs: |                                       |              | Months   | Monthly |                | Proposed  |
|--|-------------|---------------------------------------|--------------|----------|---------|----------------|-----------|
|  | Name        | Position Description                  |              | Budgeted | Costs   | Overtime       | FY 1999   |
|  |             |                                       |              |          |         |                | 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          | 0.0       |
|  |             |                                       |              |          | P       | ersonnel Total | \$0.0     |
| Trave                                    | I Costs:    |                                       | Ticket       | Round    | Total   | Daily          | Proposed  |
|  | Description |                                       | Price        | Trips    | Days    | Per Diem       | FY 1999   |
|  |             |                                       |              |          |         |                | 0.0       |
|  |             |                                       |              |          |         |                | 0.0       |
|  |             |                                       |              |          |         |                | 0.0       |
|  |             |                                       |              |          |         |                | 0.0       |
|  |             |                                       |              |          |         |                | 0.0       |
|  |             |                                       |              |          |         |                | 0.0       |
|  |             |                                       |              |          |         |                | 0.0       |
|  |             |                                       |              |          |         |                | 0.0       |
| an a |             |                                       |              |          |         |                | 0.0       |
|  |             |                                       |              |          |         |                | 0.0       |
|  |             |                                       |              |          |         |                | 0.0       |
|  |             |                                       | <b>L</b>     |          |         | Travel Total   | \$0.0     |
|  |             |                                       |              |          |         |                |           |
|  |             |                                       |              |          |         |                | FORM 4B   |
| _  |             | Project Number: 99401                 |              |          |         |                | Personnel |
|  | Y 99        | Project Title: Spot Shrimp - A Popula | ation Dynami | cs Study |         |                | & Travel  |
|  |             | Name: Charles Hughey, Valdez Nativ    |              |          |         |                |           |

4/15/98, 6 of 8

DETAIL

# FY 99 EXXON VALDEZ TRUE COUNCIL PROJECT BUDGET

| Contractual Costs:      |               | · · · · · · · · · · · · · · · · · · ·                                       |                               |                         |              |                 |                | Proposed                                     |
|-------------------------|---------------|---|-------------------------------|-------------------------|--------------|-----------------|----------------|--|
| Description             |               |   |                               |                         |              |                 |                | FY 1999                                      |
| Charter rate            | \$500- \$1500 | per day<br>depending on<br>size of boat                                     | includes capt.<br>one crewman | \$1500 /day             | 10day survey | 2 surveys /year |                | 30.0   |
| pwsedc                  | 10%           | OF Non-Trustee project costs  |                               |                         |              |                 |                |  |
|                         |               |   |                               |                         |              |                 |                |  |
|                         |               |   |                               |                         |              | Contractu       | ıal Total      | \$30.0                                       |
| <b>Commodities Cost</b> | s:            |   |                               |                         |              |                 |                | Proposed                                     |
| Description             |               |   |                               |                         |              |                 |                | FY 1999                                      |
|                         |               |   |                               |                         |              | Commoditie      | s Total        | \$0.0  |
|                         |               |   |                               |                         |              | Commoditie      | s iotai        | \$0.0  |
| FY 99                   |               | Project Number: 99401<br>Project Title: Spot Shrim<br>Name: Charles Hughey, | p - A Popula<br>Valdez Nati   | ation Dynam<br>ve Tribe | ics Study    |                 | F<br>Cor<br>Co | ORM 4B<br>ntractual &<br>mmodities<br>DETAIL |

# FY 99 EXXON VALDEZ TRUE COUNCIL PROJECT BUDGET

| New Equipment Purchases:        |   | Number   | Unit           | Proposed |
|---------------------------------|---|----------|----------------|----------|
| Description                     |   | of Units | Price          | FY 1999  |
|                                 |   |          |                | 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 E    | quipment Total | \$0.0    |
| Existing Equipment Usage:       |   |          | Number         |          |
| Description                     |   |          | of Units       |          |
|                                 |   |          |                |          |
|                                 |   |          |                |          |
|                                 |   |          |                |          |
|                                 |   |          |                |          |
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|                                 |   |          |                |          |
|                                 |   |          |                |          |
|                                 |   |          |                |          |
|                                 |   |          |                |          |
|                                 |   |          |                |          |
|                                 |   |          |                |          |
| ·                               |   |          |                |          |
|                                 | Project Number: 99401   |          | F              | ORM 4B   |
|                                 | Designed Titles Const Chairman A Description Dynamics Study     |          | E              | quipment |
| רושש                            | Project little: Spot Snrimp - A Population Dynamics Study       |          |                | DETAIL   |
|                                 | Name: Charles Hughey, Valdez Native Tribe                       |          |                |          |
|                                 |   | ]        |                |          |



#### WEATHERED OIL EFFECTS ON SEDIMENT MICROORGANISMS

Project Number: None 99402

Restoration Category:

Proposer: Richard D. Ewing Biotech Research and Consulting, Inc.

Cooperating Agencies: None

Alaska SeaLife Center: No

Duration: 1st year, 3-year Project

Cost FY 99: \$99,400

Cost FY 00: \$126,200

Cost FY 01: \$33,700

Cost FY 02:

Geographic Area: Prince William Sound

Injured Resource: Subtidal and Intertidal Communities

# RECEIVED

# APR 0 8 1998 EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL

#### ABSTRACT

This project proposes to examine the biomass and composition of microorganisms in beach sediments polluted with weathered oil and compare these results with control areas with similar sediments but with no residual oil. Biomass and composition will be determined with a series of microbiological, biochemical and chemical measurements, including most probable number analysis of bacteria, oxygen consumption, chlorophyll content, ATP determinations, adenylate charge measurements, and electron transport system measurements of sediments. Analyses will correlated with the amount of oil present, water temperature, substrate type, and season.

1

#### **INTRODUCTION**

Micro-organisms that inhabit the ocean's intertidal sediments contribute heavily to the base of the food chain. It has been estimated that between 30% to 50% of primary productivity in marine environments is contributed by bacteria (Austin 1988). These micro-organisms play a major role in the recycling of dead animals and plants that wash ashore and become buried in sediment at the waters edge.

The shoreline is also the area where the weathered oil from oil spills collects and is buried. Conditions in the sediments contribute to the longevity of the oil deposits. Salt marsh and sheltered bay sediments result in anaerobic conditions a few centimeters below the surface of the substrate (Sorenson et al. 1979; Revsbech et al. 1980; Ward et al. 1982). Under anaerobic conditions and cold water temperatures, oil is metabolized very slowly (National Research Council 1985) so that substantial deposits may still be expected decades after the spill. On sandy or rocky beaches, the oil works its way through the interstices of the gravel down to the subsurface. The aerobic zone extends much deeper into the substrate. Oil is degraded more quickly in these sediments, although deeply buried oil or tars are degraded much more slowly (National Research Council 1985).

The effects of this burial and retention of tar layers on the micro-organisms of the sediments of the shoreline are largely unknown. Hydrocarbons from the tars may inhibit the growth of algae and bacteria in the sediments (Atlas and Bartha 1972; Larsen et al. 1979). However, under proper conditions, oil stimulates the growth of oil-metabolizing bacteria with the capacity to utilize the hydrocarbons as an energy source. These microbes effectively cause bioremediation of the area. These species may increase to the exclusion of all others (Atlas 1981).

#### **NEED FOR THE PROJECT**

#### A. Statement of the Problem

The effects of oil spills are most readily seen in the birds and mammals which forage for food at the interface between sea and sky. These animals represent the highest trophic levels and their numbers rely on the food provided animals and plants of lower trophic levels. Members of the lowest trophic levels, the microscopic algae and microorganisms, are easy to ignore because their size is microscopic, their biology is not easily observed or appreciated, and their numbers are huge. These remain the basis for all the higher trophic levels.

Micro-organisms are especially numerous in fine benthic sediments found in sheltered bays and salt marshes. These are the areas where weathered oil from oil spills is most likely to deposit in extensive layer and remain for long periods of time. The effects of burial and retention of tar layers on the micro-organisms of the benthic sediments are unknown. Hydrocarbons from the tars may either inhibit or stimulate the growth of algae and bacteria in the sediments (Atlas and Bartha 1972; Larsen et al. 1979). Because these organisms form the lowest trophic levels for the ecosystem, it is important for assessment of the ecological damage by oil spills to determine changes in the biomass related to the oil deposits. Sediments which appear normal on the surface may be profoundly damaged by subsurface oil deposits. This damage may persist for much longer than is presently appreciated.

The effects of buried tar deposits from oil spills on the benthic organisms in these rich environments needs further study. At present, most of our knowledge of these effects has been derived from studies performed shortly after the oil spills have occurred. Little is known of the effects of oil and tar deposits on benthic micro-organisms after the ecosystem has apparently returned to its pre-spill condition.

#### B. Rationale/Link to Restoration

Natural restoration of the environment in the years following an oil spill depends in part upon sedimentation of heavy tars. These tars are formed from evaporation of volatile elements. This weathered oil is then dispersed and biodegraded by oil-consuming micro-organisms (Doerffler 1992). Numerous laboratory studies have examined the role of bacteria in consuming oil and oil products. Various strains have been developed specifically for bioremediation. Much less effort has been applied to the study of natural biodegradation of oil. In particular, little is known of the changes in bacterial populations in sediments in the vicinity of oil spills.

The hypothesis to be tested is that oil residues in sediments cause alterations of the micro-organisms in the sediment for many years after the external signs of the oil spill have disappeared. While the environment appears normal, the base of the food chain in salt marshes and areas of fine sediments is profoundly altered and this alteration may have repercussions at higher trophic levels.

We propose to examine the biomass and composition of micro-organisms in beach sediments polluted with weathered oil and compare these results with control areas with similar sediments but with no residual oil. Biomass and composition will be determined with a series of microbiological, biochemical and chemical measurements, including heterotrophic plate counts of bacteria, oxygen consumption, chlorophyll content, ATP determinations, adenylate charge determinations, and electron transport system measurements of micro-organisms in selected sediments.

#### C. Location

Samples of sediments will be taken at the western end of Prince William Sound, in the vicinity of Knight Island and Evans Island where the oil spill was particularly dense and the Hydrocarbon Database study has a number of sampling sites. Control locations will be located south of oil spill, probably around the town of Cordova. Control sampling locations will be chosen to duplicate the oil-contaminated sampling sites as closely as possible.

#### **PROJECT DESIGN**

#### A. Objectives

1. Using multiple assays, estimate the biomass and activity of aerobic and anaerobic micro-organisms in sediments in areas of oil spill.

2. Compare the total and fractional biomass from oil polluted areas with that of control areas.

3. Correlate oil present in the samples with the biomass in the sediments.

4. Determine the changes in microbiological biomass and activity with substrate size, temperature, and season.

#### **B.** Methods

The hypothesis to be tested is that oil residues in sediments profoundly affect the micro-organisms in the sediment and that these effects persevere for extended periods of time, even though the environment appears normal. The extent to which microbial activity is changed is influenced by the extent of contamination, the nature of the substrate, temperature, and season. Quantitative estimates of microorganisms in the presence and absence of buried oil will be determined by five processes: heterotrophic plate counts, oxygen consumption, ATP concentration and adenylate energy charge, total chlorophyll concentration, and reduction of nitroblue tetrazolium by sonicated sediments.

Sampling Sites and Procedures

Sampling sites for the project will be coordinated with personnel from the State/Federal Trustee Council Hydrocarbon Database maintained at the Auke Bay Laboratory. These researchers have information on the extent of oil refuse located at the different sites in Prince William Sound. A preliminary scan of their database indicates that Herring Bay, Snug Harbor, Knight Island, Smith Island, McClure Bay, and Northwest Bay all had substantial deposits of oil as late as 1994. Residents of Chenega Bay on Evans Island have repeatedly complained about the presence of oil on the beach. Bay of Isles on Knight Island has some of the fine sediments that tend to accumulate long-lasting oils. Each site selected would be paired with a control site south of the oil spill that has similar beach/sediment characteristics.

Beach characteristics will also determine the locations of sampling sites. Three specific beach characteristics will be targeted: coarse beach sand, fine beach sand or silt, and salt marsh. Emphasis will be placed on locating finer sediments, which tend to retain oil residues for longer periods of time. Finer sediments located at the base of large boulders have trapped residual pockets of oil.

For each site selected, test sediment cores will be extracted to look for the presence of oil residues. Once these are found, five cores will be taken: at the site, to the sides and above and below the residue to determine microbial densities. The distance to the sides will be standardized at six inches. The distance above and below the residue will depend on the gradient of the beach and will be related to Mean Lower Low Water to correspond to similar measurements by the Hydrocarbon Database. The measurements to the sides will determine the reproducibility of the assays, while the cores taken above (shoreward) and below (seaward) the deposits will determine if the microbial populations are affected by seaward leaching of the deposits.

To ensure that measurements representative of a substrate type are reproducible, five sites from the area will be chosen, each with an attempt to be as representative of the area as possible. For any particular area, 25 samples of substrate will be taken. Samples will be stored in ice chests for transport to the laboratory. Under optimal circumstances, assays should be performed within 24 hours. However, most samples may be stored at 0-4 C for periods less than a week without substantial loss in activity (Clesceri et al. 1989).

Because microbial populations change with season, two sampling times will be established: May and August. Sampling will occur at the same sites and in the same manner for each sampling time. A method will have to be devised to determine the level of the oil deposits, because seasonal weather and wave conditions may either bury or expose the oil. Two years of sampling are planned. Results from the first year will served to strengthen the sampling plan of the second year. Results from the second year will confirm the results and conclusions from the first year. Assays for measurement of microorganism biomass

The measurement of microorganisms in sediments is an inexact science (Austin 1988). Microbiological methods differ widely in their estimates of total numbers present. There are large discrepancies in numbers estimated between direct microscopical counts and total viable counts (Staley and Konopka 1985). Microscopical counts often overlook the presence of very small bacteria that represent the dormant stage when nutrients are minimal for growth (Torrella and Morita 1981). Transmission electron microscopy has also been used but the numbers varied from microscopical counts. Watson et al. (1977) suggested that light microscopical counts tend to confuse nonbacterial objects for bacteria. Viable counts also have their problems (Simidu et al. 1983). Highest counts were obtained with the heterotrophic plate count technique, presumably because many of the cold adapted bacteria were killed by the warm agar in pour-plate technique. Even with their difficulties, heterotrophic plate counts (HPCs) are perhaps the most desirable of the conventional microbiological assays for determining populations of bacteria because of their familiarity and ease of interpretation. All assays have difficulty with the particulate nature of the sediments. Subsampling of diluted sediments is difficult, because microorganisms tend to cluster about the sediment particles. This clustering causes the serial dilutions used for the HPC to inaccurately represent the total number of organisms present. The numbers derived from the HPC technique should be used for comparisons between sites rather than accurate representations of numbers or biomass of microorganisms present.

Oxygen consumption will be used to estimate roughly the aerobic respiration that takes place in a given amount of sediment. This method has the advantage of simplicity in determining the aerobic micro-organisms of the sample. Most of the microbiological activity of fine sediments is anaerobic and measurements of oxygen consumption will not assess this activity. Comparisons of the total biomass by ETS and adenylate charge to the oxygen consumption rates will provide a rough idea of the mass of aerobes compared to the total number of microorganisms present. However, there are difficulties associated with this technique that require special care for reproducible results. Oxygen consumption can result from oxidation of either carbon or nitrogen. In the present case, we will measure total oxygen consumption and not differentiate between sources unless further investigation shows this desirable.

Because algae and chlorophyll-containing micro-organsims may occur in substantial numbers, especially in the coarser substrates, samples will be sonicated and extracted with acetone. The acetone extracts will then be examined fluorimetrically for chlorophyll, using an excitation wavelength of 430 nm and an emission wavelength of 663 nm. Emission will be compared to a standard curve of chlorophyll in acetone. While this method has advantages of simplicity and a long history of use in limnology, it has a possible disadvantage in the presence of oil. It is expected that a fraction of the oil may dissolve in the acetone and interfere with the determinations. Preliminary experimentation before the samples are taken should provide methods for avoiding this problem. If necessary, chlorophyll measurement may require concentration by solid phase extraction techniques or separation by thin layer chromatography before assay.

Measurement of ATP concentrations after lysis of sediment microorganisms has been used extensively as a biomass indicator (Holm-Hansen 1973; Ferguson and Murdock 1973; Karl and LaRock 1975; Bulleid 1978; Tobin et al. 1978). ATP concentration provides a good indicator of bacterial biomass during active growth, but loses its precision during periods of dormancy or stress. In addition, materials in the sediment extracts can inhibit the luciferase reaction used to measure the ATP. ATP may also be bound to sediment particles or organic macromolecules such as fulvic acid (Cunningham and Wetzel 1978), removing it from the reaction. Spikes of known amounts of ATP are required to determine the extent of inhibition of the luciferase reaction.

A better indicator of biomass is provided by adenylate charge, the ratio between ATP concentrations and total adenine nucleotide concentrations (Atkinson and Walton 1967). Fewer studies of adenylate charge have been reported because the problem of extraction efficiency is compounded by the additional adenine nucleotides (Wiebe and Bancroft 1975). These difficulties have been overcome to some degree by the use of internal standards that correct for the absorbtion of nucleotides and the inhibition of the enzymatic reactions (Tobin et al. 1978). The use of phosphoric acid and the detergent Triton X-100 to cold sulfuric acid extracts of sediments also increased extraction efficiency and sensitivity (Christensen and Devol 1980). Using these techniques, Christensen and Devol (1980) were able to show lower adenylate charge values in continental shelf sediments, suggesting depressed physiological activity in these microorganisms. The strength of this method is that it is able, to some extent, to distinguish between active and dormant micro-organisms.

Adenylate charge is measured in multiple tube assays in which ATP is measured by the production of light in the luciferin-luciferase reaction (Christensen and Devol 1980). ADP is measured as the difference between readings from tubes with and without the presence of pyruvate kinase (PK) and phosphoenolpyruvate (PEP). The presence of PK and PEP drives ADP to the formation of ATP and pyruvate. AMP is determined in conjunction with these measurements by the addition of adenylate kinase which forms 2 ADPs from the presence of AMP and ATP. ADP formed is then converted to ATP by PK and measured by light production in a luminometer. Conversions of the enzymes may be checked routinely by addition of known amounts of ATP, ADP, and AMP to the reaction mixtures. These internal standards will also account for any absorption of the nucleotides to material in the samples or quenching of the light production by compounds in the samples. Subtraction of ATP concentrations measured in various tubes permits the determination of concentrations of AMP, ADP, and ATP corrected for absorbtion and quenching by the sediments.

Prepared 4/3/98

Reduction of nitroblue tetrazolium to formazan dye by the electron transport system (ETS) provides an additional test for determining biomass of micro-organisms. Sediment samples are diluted in extraction buffer containing Triton X-100, sonicated, and further diluted to remove competing reactions for the reduction. This method has been used extensively for sediments because it measures not only aerobic organisms but anaerobic organisms as well (Broberg 1985; Songster-Alpin and Klotz 1995). Because the reaction relies only on the ETS and is performed <u>in vitro</u> under maximized conditions, it does not rely as heavily on the physiological state of the microorganisms. Although cyanide is not required under some conditions (Jones and Simon 1979), we have found that, in freshwater sediments rich in organic material, cyanide addition to the reaction mixture results in a 2-fold stimulation of the reaction. This stimulation is presumably due to inhibition of cytochrome oxidase, which may compete for electrons with the nitroblue tetrazolium. Conditions for ETS measurements in sediments have been optimized in our laboratory for assay in microplates.

The cumulative measurements of total viable colony counts, oxygen consumption, adenylate charge, total chlorophyll, and ETS activity will provide estimates of the nature and activity of the total microbial population in sediments surrounding the buried oil. HPCs, ATP concentration, and ETS activity will serve to estimate total microorganisms in the sediment sample. Oxygen consumption will permit an estimate of the aerobic activity in the sediment sample. Adenylate charge will serve to estimate the physiological condition of both the aerobes and anaerobes in the sample. Total chlorophyll concentration will estimate the number of chlorophyll containing microorganisms in the sediment.

#### Other Assays

A number of physical measurements will be recorded at the time of collection. These include time of day collected, temperature of air, temperature of sediments, depth of core sample and notes about the physical environment. In the laboratory, several other relevant measurements will be made in addition to those determining biomass. Sediment size will be determined by sieving. Total oil present in the samples will be measured gravimetrically by solvent extraction into tared distillation flasks (Clesceri et al. 1989). Total carbon in the sample will be measured gravimetrically with a forced air muffle furnace. Dry weights of sediment samples will be determined and used to standardize assays. Analysis of Results

Results will be tested statistically for each measurement of microbial biomass or activity by hierarchical (nested) analysis of variance. Hypotheses to be tested include:

Are there statistical differences between cores at a particular sampling site?

Are there statistical differences between cores from experimental and control areas?

Are there statistical differences between cores of a particular sediment type?

Are there statistical differences between cores from experimental and control areas at different times?

The power of the statistical analysis at each level will depend upon the magnitude and variance of the measurements. If sample sizes prove too small during the first year for adequate power of the analyses, adjustments for sample size will need to be made during the second year of sampling.

#### **SCHEDULE**

#### A. Measureable Project Tasks for FY 99

- Mar 1-31: Purchase supplies and set up for assays
  Apr 1-8: Conduct initial surveys for sampling sites
  May 1-4: Collect samples for analyses
  May 5-Aug 1: Perform assays on sediment samples
  Aug 1-4: Collect samples for analyses
  Aug 5-Nov 1: Perform assays on sediment samples
  Nov 1-Dec 31: Data analyses and report writing

#### **B.** Project Milestones and Endpoints

- May 5: Samples for analysis collected and shipped to laboratory
- Aug 1: Analysis of samples completed and preliminary data analysis begun
- Aug 5: Samples for analysis collected and shipped to laboratory

Nov 1: Analysis of samples completed and preliminary data analysis begun
Dec 31: Data analysis completed and annual report begun. At this point, all four objectives will have been completed for the first year. After analyses are complete, any necessary changes in the sampling plan would occur and sampling for a second year would be necessary for confirmation of the first year's results.

#### C. Completion Date

Data collection and assays for first year will be completed by November 1, 1999. Annual report on data analysis will be submitted by April 15, 2000. Data collection and assays for second year will be completed by November 1, 2000. Final report and manuscript for publication will be done by April 15, 2001.

#### **PUBLICATIONS AND REPORTS**

No publication is planned after data analyses in FY99. If the study is funded for two years, both years of data and analyses will be combined for publication in a refereed journal. However, if only a single year is funded, data and analyses for the single year will be published in a refereed journal.

An annual report on the results of the data collection and analysis in FY 99 will be submitted by April 15, 2000.

#### **PROFESSIONAL CONFERENCES**

The annual restoration workshop held in FY 99 will be attended, as well as a technical review session.

#### **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

Coordination of the proposed research will be coordinated with the Hydrocarbon Database project (\290) to determine the best locations for sampling sites and which sites are most contaminated with weathered oil. We will attempt to use similar field sites for sampling so that the results from the microbial assays can be used in conjunction with the oil contaminants present.

When the samples are analyzed and data is complete, the information should be coordinated with the project to Develop a Mass-Balance Model (\330). Mass estimates of bacterial populations in the vicinity of oil deposits should help to predict the effects of oil spills on the marine ecosystem.

#### PROPOSED PRINCIPAL INVESTIGATOR

Name: Richard D. Ewing, Ph.D

Affiliation: Biotech Research and Consulting, Inc.
Mailing Address: 2340 SE Ryan Street, Corvallis, OR 97333
Phone Number: 541-752-8259
Fax Number: 541-758-7005
E-Mail Address: none

#### PRINCIPAL INVESTIGATOR

Name: Richard D. Ewing

Education: B. A., Reed College (1962); Ph. D., University of Miami (1968).

Employment: CEO, Biotech Research and Consulting, Inc., Corvallis (1992-present); Supervisory Fisheries Biologist, Oregon Department of Fish and Wildlife, Corvallis (1975-1992); Courtesy Assoc. Prof., Oregon State University, Corvallis (1975-present); Research Associate, Oregon State University, Corvallis (1971-1975); Asst. Prof. (temp), Oregon State University, Corvallis (1972-1973).

Professional Recognition: Award for Excellence in Fisheries, American Fisheries Society, 1987; Editor, Northwest Fish Hatchery Newsletter, 1985-1995; Associate editor, Progressive Fish Culturist, 1990-1993; Member of the technical subcommittee on oxygen standards in Oregon rivers for the Oregon Department of Environmental Quality, 1993; Finalist, AFS Best Paper Award, 1994 and 1995. Over sixty publications in refereed journals; over fifty annual reports in gray literature for Oregon Department of Fish and Wildlife and funding agencies.

Qualifications:

Ph. D. in cell and molecular biology from University of Miami, 1968;

extensive research background from 1966 to present;

publications in numerous biochemical and physiological journals, such as Biochimica Biophysica Acta, Journal of Biological Chemistry, American Journal of Physiology, Archives of Biochemistry and Biophysics, General and Comparative Endocrinology, Comparative Biochemistry and Biophysics;

development of a number of physiological assays for fishes;

certification in microbiological methods provided by Hach Chemical Company, Loveland, CO, 1994;

extensive water quality and physiological assays for clients of Biotech Research and Consulting, Inc., including ETS measurement, ATP measurement, oxygen analysis, chlorophyll analyses, and presence/absence testing for coliform bacteria.

#### Laboratory Technician

A qualified laboratory technician will be hired temporarily to assist with the sample analysis. Biotech Research and Consulting maintains a current list of applicants seeking employment in water quality and biochemical analyses.

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Prepared 4/3/98

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FY 99 EXXON VALDEZ TRUSTLE COUNCIL PROJECT BUDGET October 1, 1998 - September 30, 1999

|                            | Authorized                | Proposed |              | ана на селото на село<br>Селото на селото на се |                |            | s Long Shi |  |
|----------------------------|---------------------------|----------|--------------|---|----------------|------------|------------|--|
| Budget Category:           | FY 1998                   | FY 1999  |              |   |                |            |            |  |
|                            |                           |          |              |   |                |            |            |  |
| Personnel                  | - <u> </u>                | \$62.8   |              |   |                |            |            |  |
| Travel                     |                           | \$7.0    |              |   |                |            |            |  |
| Contractual                |                           | \$4.5    |              | a de la companya de l<br>La companya de la comp |                |            |            |  |
| Commodities                |                           | \$7.2    |              |   |                |            |            |  |
| Equipment                  |                           | \$0.0    |              | LONG R  | ANGE FUNDI     | NG REQUIRE | MENTS      |  |
| Subtotal                   | \$0.0                     | \$81.5   |              | Estimated   | Estimated      | Estimated  |            |  |
| Indirect                   |                           | \$17.9   |              | FY 2000   | FY 2001        | FY 2002    |            |  |
| Project Total              | \$0.0                     | \$99.4   |              | \$126.2   | \$33.7         |            |            |  |
|                            |                           |          |              |   |                |            |            |  |
| Full-time Equivalents (FTI | E)                        | 12.5     |              |   |                |            |            |  |
|                            |                           |          | Dollar amoun | its are shown ir  | n thousands of | dollars.   |            |  |
| Other Resources            |                           |          |              |   |                |            |            |  |
| No other funds for th      | nis project are anticipat | ed.      |              |   |                | _          |            |  |
|                            |                           |          |              |   |                |            |            |  |

FY 99 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

| ·    |                               |                                      |              |              |         |                                       |               |
|------|-------------------------------|--------------------------------------|--------------|--------------|---------|---------------------------------------|---------------|
| Pers | ionnel Costs:                 |                                      |              | Months       | Monthly | · · · · · · · · · · · · · · · · · · · | Proposed      |
|      | Name                          | Position Description                 |              | Budgeted     | Costs   | Overtime                              | FY 1999       |
|      | R. Ewing                      | Principal Investigator               |              | 5.0          | 6.1     |                                       | 30.5          |
|      | Vacant                        | Laboratory Technician                |              | 6.0          | 4.6     |                                       | 27.6          |
|      | Vacant                        | Office Assistant                     |              | 1.5          | 3.1     |                                       | 4.7           |
|      |                               |                                      |              |              |         |                                       | 0.0           |
|      |                               |                                      |              |              |         |                                       | 0.0           |
|      |                               |                                      |              |              |         |                                       | 0.0           |
|      |                               |                                      |              |              |         |                                       | 0.0           |
|      |                               |                                      |              |              |         |                                       | 0.0           |
|      |                               |                                      |              |              |         | :                                     | 0.0           |
|      |                               |                                      |              |              |         |                                       | 0.0           |
| U    |                               |                                      |              |              |         |                                       | 0.0           |
|      |                               |                                      |              |              |         |                                       | 0.0           |
|      |                               | Subtotal                             |              | 12.5         | 13.8    | 0.0                                   | ant states as |
|      |                               |                                      |              |              | Pe      | ersonnel Total                        | \$62.8        |
| Tray | el Costs:                     |                                      | Ticket       | Round        | Total   | Daily                                 | Proposed      |
|      | Description                   |                                      | Price        | Trips        | Days    | Per Diem                              | FY 1999       |
|      | Attend Annual Restoration \   | √orkshop                             | 0.6          | 1            | 5       | 0.2                                   | 1.6           |
|      | Scouting trip to determine sa | ample sites                          | 0.6          | 1            | 7       | 0.2                                   | 2.0           |
|      | Sampling trip in May          |                                      | 0.6          | 1            | 3       | 0.2                                   | 1.2           |
|      | Sampling trip in August       |                                      | 0.6          | 1            | 3       | 0.2                                   | 1.2           |
|      | Technical Review Session      |                                      | 0.6          | 1            | 2       | 0.2                                   | 1.0           |
|      |                               |                                      |              |              |         |                                       | 0.0           |
|      |                               |                                      |              |              |         |                                       | 0.0           |
|      |                               |                                      |              |              |         |                                       | 0.0           |
|      |                               |                                      |              |              |         |                                       | 0.0           |
|      |                               |                                      |              |              |         |                                       | 0.0           |
|      |                               |                                      |              |              |         |                                       | 0.0           |
|      |                               |                                      |              |              |         |                                       | 0.0           |
|      |                               |                                      |              |              |         | Travel Total                          | \$7.0         |
|      |                               |                                      |              |              | ]       | <u>,</u>                              |               |
|      |                               | Project Number:                      |              |              |         | <sup>•</sup> F                        | ORM 4B        |
|      |                               | Project Title: Weathered Oil Effects | s on Sedimer | nt Microorga | nisms   | F                                     | Personnel     |
|      | 33                            |                                      |              |              |         | 1 .                                   |               |

Effects on Sediment Microorganisms Name: Biotech Research and Consulting, Inc.

& Travel DETAIL

Prepared:

FY 99 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

| Contractual Costs   | D.  | Proposed          |  |  |  |  |
|---|---|-------------------|--|--|--|--|
| Description   |   | FY 1999           |  |  |  |  |
| Boat Charter  | 1 scouting trip and 2 sample trips  | 0.5               |  |  |  |  |
| Ferry trips : 1   | scouting trip and 2 sample trips  | 0.5               |  |  |  |  |
| Car Rental: 1 scouting trip, 2 sample trips, and workshop trip, 12 days |   |                   |  |  |  |  |
| Equipment re  | pair  | 1.0               |  |  |  |  |
| Report writin   | ]   | 0.3               |  |  |  |  |
| Plane charter   | : 1 scouting trip and 2 sample trips  | 1.0               |  |  |  |  |
|   |   |                   |  |  |  |  |
|   |   |                   |  |  |  |  |
|   |   |                   |  |  |  |  |
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|   |   |                   |  |  |  |  |
| l<br>Commondition Con   | Contra  | ctual lotal \$4.5 |  |  |  |  |
| Commodities Cos   | 15.   | Proposed          |  |  |  |  |
| Field Supplie   | s: corers chest waders ice chests ice shinning notehooks thermometers             | 20                |  |  |  |  |
| Laboratory S  | upplies: petri dishes filters test tubes separatory funnels cuvettes baggies tags | 2.0               |  |  |  |  |
| Chemicals: o  | rowth media, enzymes, nitroblue tetrazolium, solvents                             | 2.0               |  |  |  |  |
| offerniedio. g  |   |                   |  |  |  |  |
|   |   |                   |  |  |  |  |
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|   |   |                   |  |  |  |  |
|   |   |                   |  |  |  |  |
|   |   |                   |  |  |  |  |
|   | Commod  | ities Total \$7.2 |  |  |  |  |
|   |   |                   |  |  |  |  |
|   |   | FORM 4B           |  |  |  |  |
|   | Project Number:   | Contractual &     |  |  |  |  |
| FY 99   | Project Title: Weathered Oil Effects on Sediment Microorganisms                   | Commodities       |  |  |  |  |
|   | Name: Biotech Research and Consulting, Inc.                                       |                   |  |  |  |  |
|   |   | DETAIL            |  |  |  |  |
| Prepared:   | 4/3/98  |                   |  |  |  |  |
# FY 99 EXXON VALDEZ TRUST COUNCIL PROJECT BUDGET October 1, 1998 - September 30, 1999

| P                     |   |          |                           |          |
|-----------------------|---|----------|---------------------------|----------|
| New Equipment F       | Purchases:  | Number   | Unit                      | Proposed |
| Description           |   | of Units | Price                     | FY 1999  |
| none                  |   |          |                           | 0.0      |
|                       |   |          |                           | 0.0      |
|                       |   |          |                           | 0.0      |
|                       |   |          |                           | 0.0      |
|                       |   |          |                           | 0.0      |
|                       |   |          |                           | 0.0      |
|                       |   |          |                           | 0.0      |
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|                       |   |          |                           | 0.0      |
|                       |   |          | · · · · · · · · · · · · · | 0.0      |
| I nose purchases      | associated with replacement equipment should be indicated by placement of an R. | New Eq   | upment lotal              | \$0.0    |
|                       | nt Usage:   |          | Number                    |          |
| Description           |   |          | of Units                  |          |
|                       |   |          |                           |          |
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| L                     |   |          |                           |          |
|                       |   |          |                           |          |
|                       | Project Number:   |          | F                         | ORM 4B   |
| FYQQ                  | Project Title: Weathered Oil Effects on Sediment Microord                       | anisms   | E                         | quipment |
|                       | Name: Biotech Besearch and Consulting Inc.                                      |          |                           | DETAIL   |
|                       | Invarite. Diolecti nesearch and Consulting, IIC.                                |          |                           |          |
| Prenared <sup>.</sup> | 4/3/98  | ]        |                           |          |
| nopulou.              | 1,0,00  |          |                           | 115102   |



## Project Title: Port Graham Salmon Hatchery Reconstruction

Project Number: **Restoration Category:** Proposer: Lead Trustee Agency: Cooperating Agencies: Alaska SeaLife Center Duration: Cost FY 99 Cost FY 00 Geographic Area: Injured Resource/Service:

994055 **General Restoration** Port Graham Village Council ADF&G Port Graham IRA Council

1 Year Project \$777,500 \$0.0 Port Graham/Nanwalek, southwestern Kenai Peninsula Pink Salmon, Sockeye Salmon, Coho Salmon /Subsistence, Commercial Fishing

**RECEIVE**[[ APR 1 4 1998

EXXON VALDEZ OIL SPILL

TRUSTEE COUN

### ABSTRACT

This project will help rebuild the Port Graham salmon hatchery that was destroyed in a fire on January 13, 1998. The Port Graham hatchery was involved in the rehabilitation and enhancement of local pink salmon, sockeye salmon and coho salmon stocks for the benefit of both the local subsistence and commercial fisheries. These stocks are of major social, cultural and economic importance to the area and sustained injuries resulting from oil spill clean-up efforts. This project will help fund design, engineering, site preparation and construction of a salmon hatchery to replace the one that was destroyed in the fire.

## INTRODUCTION

## A. General

This project will help rebuild the Port Graham hatchery that was destroyed in a fire on January 13, 1998. The hatchery played a major role in rejuvenating the subsistence and commercial fisheries in the Port Graham/Nanwalek area. A new hatchery is needed so that the rejuvenation effort can continue.

The Native villages of Port Graham and Nanwalek on the southwestern tip of the Kenai Peninsula rely heavily on the local salmon runs for subsistence and commercial fishing. There are local runs of sockeye salmon, pink salmon and coho salmon that have varying degrees of importance in the local subsistence and commercial fisheries. The sockeye salmon is sought after in both the subsistence and commercial fisheries. The pink salmon is generally regarded as a commercial species although it has been a major contributor to the subsistence fishery in recent years. Coho salmon are harvested mostly in the subsistence fishery.

All of the local salmon runs to the Port Graham/Nanwalek area have been depressed in recent years. These low returns neither commercial nor subsistence fishing was allowed on the sockeye salmon run, the pink salmon commercial fishery was closed and the coho subsistence harvest was minimal. Although there are probably several reasons for the low returns the *Exxon Valdez* oil spill may be a factor. Boom deployment at the mouths of the Port Graham and English Bay rivers during the early phases of the oil spill clean up effort trapped large numbers of pink salmon fry, sockeye salmon smolt and coho salmon smolt in the boom curtain on the ebbing tides. Most of the fish trapped in this manner were killed.

In addition to losing out-migrating fish, the curtailment of the commercial fishery in lower Cook Inlet during the oil spill resulted in the Port Graham cannery closing down. The cannery was the largest employer of Port Graham and Nanwalek residents. Its closure had a major impact on these villages.

The Port Graham hatchery was set up as part of the effort to rejuvenate the local salmon runs to the point when they could again support subsistence and commercial fisheries. The hatchery first started working with the Port Graham River pink salmon stock. The English Bay River sockeye enhancement project was added in 1992 and the Port Graham River coho project started in 1995.

The hatchery program has made a difference. In 1995 a subsistence fishery was held on the English Bay River sockeye stock for the first time since the oil spill. In 1996 a commercial fishery was held on this stock for the first time in ten years. In 1996 the cannery reopened. In 1997 a commercial fishery was held on the Port Graham River pink salmon stock for the first time since the oil spill. It is too soon to tell how well the coho project will do. The first adult returns aren't expected until 1999.

On January 13, 1998 the Port Graham hatchery was completely destroyed in a fire. The loss of the hatchery program put the entire salmon enhancement and rehabilitation program in jeopardy. Without the hatchery program there won't be enough local salmon to meet the subsistence needs in Port Graham and Nanwalek or support the local commercial fisheries. It is also likely that

without the hatchery program the Port Graham cannery will be forced to close again.

## B. Funding

Approximately 40% of the total funding needed to construct the Port Graham salmon hatchery is being requested from the EVOS Trustee Council. The remaining funds will come from several other sources. The table below lists the various sources of funding that will be used to build and equip the new hatchery. About a third of this funding has been secured to date.

| Funding Source  | Description  | Est.<br>Amount |
|---|--|----------------|
| Fire Insurance  | Insurance collected for loss of equipment and building improvements                      | \$200.0        |
| Lannon Foundation   | Private economic development grant for building construction                             | \$100.0        |
| HUD   | Federal economic development grant for engineering and design and foundation preparation | \$250.0        |
| Bureau of Indian<br>Affairs                               | Federal grant for construction and equipment   | \$180.0        |
| Alaska Department of<br>Community and<br>Regional Affairs | State grant for hatchery equipment   | \$240.0        |
|   | Total  | \$ 970.0       |

## NEED FOR PROJECT

## A. Statement of Problem

The salmon runs to the Port Graham/Nanwalek area were at very low levels, partly as a result of the *Exxon Valdez* oil spill. As a consequence the subsistence needs of these villages was not being met and the once robust local commercial salmon fisheries were a thing of the past. Also, partly as a consequence of the oil spill, the Port Graham cannery was forced to close and with it went the bulk of the employment in the two villages.

A hatchery was set up in Port Graham in 1991 and a program initiated to help restore the local salmon runs. The program was beginning to have some success. It was providing fish for the local subsistence and commercial fisheries and it helped justify reopening the Port Graham cannery. The hatchery was completely destroyed in a fire on January 13, 1998. Without the hatchery, the restoration process will cease and the progress that has been made to date will be lost.

## B. Rationale/Link to Restoration

The importance of subsistence to the Native villages and the commercial fishery in the oil spill area has been recognized by the EVOS Trustee Council in its November 1994, *Exxon Valdez Oil Spill Restoration Plan*. This project will help preserve the subsistence lifestyle in Port Graham and Nanwalek by providing additional salmon for subsistence needs. It will also provide enough salmon to support local commercial fisheries and will play a major role in reestablishing the commercial salmon processing operation at Port Graham.

## C. Location

The project will be conducted at Port Graham with the bulk of the benefits accruing to the Port Graham and Nanwalek villages.

## COMMUNITY INVOLVEMENT

The Port Graham Village Council is submitting this proposal. The Port Graham hatchery is owned and operated by Port Graham Hatchery, Inc., an arm of the Port Graham Village Council. The Port Graham Village Council will manage this project under a contract with ADF&G.

## **PROJECT DESIGN**

## A. Objectives

Provide a portion of the funding required to construct a new salmon hatchery at Port Graham to replace the one lost in the January 13, 1998 fire.

## B. Methods

SUPPLEMENTATION CRITERIA. This is a supplementation project. The following is a brief discussion of how the project fits under each of the supplementation criteria presented in the *Invitation to Submit Restoration Projects for Federal Fiscal Year 1996 and Draft Restoration Program: FY 96 and Beyond*, March 1995, pages 34-35.

<u>Benefits of Supplementation</u>. This project will provide additional pink salmon, sockeye salmon and coho salmon for harvest in the subsistence and commercial fisheries in the Port Graham/ Nanwalek area. By shifting some of the subsistence and commercial harvest to hatchery salmon this project will help Port Graham and Nanwalek wild salmon stocks recover from their present low levels.

<u>Generic Risk.</u> The Port Graham salmon hatchery program was reviewed by the ADF&G, CFMD Genetics Section who determined that the program meets all criteria of the state Genetics Policy for Salmon Enhancement. The program has been awarded the necessary state and federal permits needed for salmon hatchery operations in Alaska.

<u>Mixed-stock Fishery</u>. The potential for the Port Graham pink salmon hatchery program creating or exacerbating a mixed stock fishery program is minimal. The harvest of each species of Port Graham hatchery salmon is spatially and/or temporally separated from other Kachemak Bay salmon stocks as well as other salmon species. There is very little overlap.

Monitoring and Evaluation. State approved evaluation programs are in place for each stock produced by the Port Graham hatchery.

Economic Criteria. This project will provide substantial economic and social benefits to the villages of Nanwalek and Port Graham.

<u>Procedural Criteria.</u> All evaluations (Regional Salmon Planning Team, Coastal Project Certification) of the Port Graham hatchery program have been conducted and all necessary permits (hatchery permit, fish transport permit, COE, DNR, CZM) have been obtained. This project has not been evaluated under the NEPA process.

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

The Port Graham IRA Council will operate this project under a contract with ADF&G. The ADF&G CFMD division has responsibility for managing the harvest of returning hatchery fish.

## SCHEDULE

## A. Measurable Project Tasks for FY 99

| October, 1998:   | Engineering and design firm selected.   |
|------------------|---|
| December, 1998:  | Design approved, permits applied for, hatchery construction put out for bid(s). |
| March, 1999:     | Bid(s) awarded.   |
| May, 1999:       | Contractor mobilization – site preparation                                      |
| June – November: | Hatchery construction   |
| December, 1999:  | Contractor demobilization   |
| April, 2000:     | Final report  |

## B. Project Milestones and Endpoints

The project objective will be successfully met if hatchery construction is completed by December, 1999.

## C. Completion Date

This project will end when hatchery construction is complete complete. This is expected to occur in December, 1999.

## **PUBLICATIONS AND REPORTS**

Final report Report chronicling hatchery construction.

## **PROFESSIONAL CONFERENCES**

No travel to professional conferences will be paid for out of this project.

## COORDINATION AND INTEGRATION OF RESTORATION EFFORT

If funded, this project will be integrated into the overall pink salmon enhancement program in Port Graham.

## **EXPLANATION OF CHANGES IN CONTINUING PROJECTS**

NA

## PRINCIPAL INVESTIGATOR

Port Graham Village Council/ Hatchery Board Elenore McMullen, Village Chief P. O. Box 5510 Port Graham, AK 99603 phone (907) 284-2227 fax (907) 284-2222

The Port Graham Hatchery board, an arm of the village council, will select the design and engineering firm and oversee hatchery construction

## **OTHER KEY PERSONNEL**

Ephim Anahonak, Jr. Hatchery Manager Port Graham Hatchery P.O. Box 5543 Port Graham, AK 99603 Phone (907) 284-2233 Fax (907) 284-2238

Mr. Anahonak has been hatchery manager of the Port Graham hatchery for the past four years. He will be integrally involved in hatchery design and construction.

David Daisy, hatchery consultant. Mr. Daisy will advise and consult with the Port Graham hatchery board on hatchery construction protocol and design.

Paul McCollum, hatchery consultant. Mr. McCollum will advise the Port Graham hatchery board and hatchery staff on construction oversight.

FY 99 EXXON VALDEZ TI E COUNCIL PROJECT BUDGET October 1, 1995 - September 30, 1999

| Budget Category:  | Authorized<br>FY 1998 | Proposed<br>FY 1999 |               |                |                |   |     |  |
|---|-----------------------|---------------------|---------------|----------------|----------------|---|-----|--|
| Personnel<br>Travel   |                       | \$0.0<br>\$0.0      |               |                |                |   |     |  |
| Contractual<br>Commodities  |                       | \$750.0             |               |                |                |   |     |  |
| Equipment   |                       | \$0.0               |               | LONG F         | RANGE FUNDIN   | G REQUIREME                             | NTS |  |
| Subtotal  | \$0.0                 | \$750.0             |               | Estimated      | Estimated      | Estimated                               |     |  |
| General Administration  |                       | \$27.5              |               | FY 2000        | FY 2001        | FY 2002                                 |     |  |
| Project Total   | \$0.0                 | \$777.5             |               | \$0.0          | \$0.0          | \$0.0                                   |     |  |
|   |                       |                     |               |                |                |   |     |  |
| Full-time Equivalents (FTE)   |                       | 0.0                 |               |                |                |   |     |  |
| - · · -   |                       |                     | Dollar amount | s are shown in | thousands of c | lollars.                                | •   |  |
| Other Resources   |                       |                     |               |                |                |   |     |  |
|   |                       |                     |               |                |                |   |     |  |
| FY 99<br>Project Number: 99406<br>Project Title: Port Graham Salmon Hatchery Reconstruction<br>Agency: ADFG |                       |                     |               |                |                | FORM 3A<br>TRUSTEE<br>AGENCY<br>SUMMARY |     |  |

Prepared: 4/14/98

4/14/98, 1 of 5

FY 99 EXXON VALDEZ TI

October 1, 1998 - September 30, 1999

E COUNCIL PROJECT BUDGET

|  | Authorized | Proposed |               |                |                |                                   |      |  |
|--|------------|----------|---------------|----------------|----------------|-----------------------------------|------|--|
| Budget Category:   | FY 1998    | FY 1999  |               |                |                |                                   |      |  |
|  |            |          |               |                |                |                                   |      |  |
| Personnel  | \$0.0      | \$0.0    |               |                |                |                                   |      |  |
| Travel   | \$0.0      | \$0.0    |               |                |                |                                   |      |  |
| Contractual  | \$0.0      | \$725.0  |               |                |                |                                   |      |  |
| Commodities  | \$0.0      | \$0.0    |               |                |                |                                   |      |  |
| Equipment  | \$0.0      | \$0.0    |               | LONG           | RANGE FUNDI    | NG REQUIREM                       | ENTS |  |
| Subtotal   | \$0.0      | \$725.0  | Estimated     | Estimated      | Estimated      | Estimated                         |      |  |
| Indirect   | \$0.0      | \$25.0   | FY 2000       | FY 2001        | FY 2002        | FY 2003                           |      |  |
| Project Total  | \$0.0      | \$750.0  | \$0.0         | \$0.0          | \$0.0          | \$0.0                             |      |  |
| ·  |            |          |               |                |                |                                   |      |  |
| Full-time Equivalents (FTE)  |            | 0.0      |               |                |                |                                   |      |  |
|  |            |          | Dollar amount | s are shown in | thousands of c | iollars.                          |      |  |
| Other Resources  |            |          |               |                |                |                                   |      |  |
| Other Resources  |            |          |               |                |                |                                   |      |  |
| FY 99<br>Project Number: 99406<br>Project Title: Port Graham Salmon Hatchery Reconstruction<br>Name: Port Graham Village Council |            |          |               |                |                | FORM 4A<br>Non-Trustee<br>SUMMARY |      |  |

#### FY 99 EXXON VALDEZ TI E COUNCIL PROJECT BUDGET October 1, 1995 - September 30, 1999

| Personnel Costs:  |                                     | Ī            | Months      | Monthly |                | Proposed   |
|-------------------|-------------------------------------|--------------|-------------|---------|----------------|------------|
| Name              | Position Description                | 1            | Budgeted    | Costs   | Overtime       | FY 1999    |
|                   |                                     |              |             |         |                | 0.0        |
|                   |                                     |              |             |         |                | 0.0        |
|                   |                                     |              |             |         |                | 0.0        |
|                   |                                     |              |             |         |                | 0.0        |
|                   |                                     |              |             |         |                | 0.0        |
|                   |                                     |              |             |         |                | 0.0        |
|                   |                                     |              |             |         |                | 0.0        |
|                   |                                     |              |             |         |                | 0.0        |
|                   |                                     |              |             |         |                | 0.0        |
| · · · ·           |                                     |              |             |         |                | 0.0        |
|                   |                                     |              |             |         |                | 0.0        |
|                   |                                     |              |             |         |                | 0.0        |
|                   | Subtotal                            |              | 0.0         | 0.0     | 0.0            |            |
|                   |                                     |              |             | P       | ersonnel Total | \$0.0      |
| Travel Costs:     | *****                               | Ticket       | Round       | Total   | Daily          | Proposed   |
| Description       |                                     | Price        | Trips       | Days    | Per Diem       | FY 1999    |
|                   |                                     |              |             |         |                | 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      |
|                   |                                     |              |             |         |                | /          |
|                   |                                     |              |             |         |                | ORM 4R     |
|                   | Project Number: 99406               |              |             |         |                | Porconnol  |
| FY 99             | Project Title: Port Graham Salmon H | atchery Reco | onstruction |         | I              |            |
|                   | Name: Port Graham Village Council   |              |             |         |                | & Iravel   |
|                   | Iname. For Granam village Council   |              |             |         |                | DETAIL     |
| Prepared: 4/14/98 | L                                   |              |             |         | 4/14/          | 98, 3 of 5 |

FY 99 EXXON VALDEZ TR E COUNCIL PROJECT BUDGET October 1, 1998 - September 30, 1999

| Contractual Costs:                |   | <u> </u>                | Proposed  |
|-----------------------------------|---|-------------------------|---|
| Description                       |   |                         | FY 1999   |
| Hatchery Construction             |   |                         | 725.0<br>0.0  |
|                                   | Contractua  | il Total                | \$725.0   |
| Commodities Costs:                |   |                         | Proposed  |
| Description                       |   |                         | FY 1999   |
|                                   |   |                         |   |
|                                   | Commodities   | Total                   | \$0.0   |
| <b>FY 99</b><br>Prepared: 4/14/98 | Project Number: 99406<br>Project Title: Port Graham Salmon Hatchery Reconstruction<br>Name: Port Graham Village Council | FO<br>Cont<br>Corr<br>D | )RM 4B<br>tractual &<br>tractual & tractual &<br>tractual & tractual & trac |



October 1, 1998 - September 30, 1999

| New Equipment Purc   | hases:   | Number   | Unit          | Proposed |
|----------------------|--|----------|---------------|----------|
| Description          |  | of Units | Price         | FY 1999  |
|                      |  |          |               | 0.0      |
|                      |  |          |               | 0.0      |
|                      |  |          |               | 0.0      |
|                      |  |          |               | 0.0      |
|                      |  |          |               | 0.0      |
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|                      |  |          |               | 0.0      |
|                      | •  |          |               | 0.0      |
|                      |  |          |               | 0.0      |
|                      |  |          |               | 0.0      |
|                      |  |          |               | 0.0      |
| Those purchases ass  | ociated with replacement equipment should be indicated by placement of an R. | New Ec   | uipment Total | \$0.0    |
| Existing Equipment U | sage:  |          | Number        |          |
| Description          |  |          | of Units      |          |
|                      |  |          |               |          |
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| ]                    |  |          |               |          |
|                      | Project Number: 99406  |          | F             | -ORM 4B  |
| EV 99                | Project Title: Port Graham Salmon Hatchery Reconstruction                    |          | E             | quipment |
| 1100                 | Name: Dert Crohom Village Council  |          |               | DETAIL   |
|                      | Ivame: Port Granam Village Council   |          | L             |          |
|                      |  |          |               |          |



## FIELD EXAMINATION OF THE RELATION BETWEEN PHYTOPLANKTON PRODUCTION OF FATTY ACIDS AND UPTAKE IN PACIFIC SANDLANCE (Ammodytes hexapterus)

Project Number:

Restoration Category:

Proposer:



Research Monitoring

Ron A. Heintz, M. Larsen NMFS, Auke Bay Laboratory ABL Project Manager: Dr. Stan Rice NOAA Project Manager: Bruce Wright

Receiv APR 1 4 1998 EXXON VALDEZ OIL SPILL TRUSTEE COUNCII

| Lead Trustee Agency:      | NOAA                                    |
|---------------------------|---|
| Cooperating Agencies:     | None                                    |
| Alaska Sea Life Center:   | No                                      |
| Duration:                 | 1 <sup>st</sup> year, of 2-year project |
| Cost FY 99:               | \$106.2k                                |
| Cost FY 00:               | \$ 41.4k                                |
| Geographic Area:          | Auke Bay, and Kachemak Bay Alaska       |
| Injured Resource/Service: | Various                                 |

## ABSTRACT

This project assesses the basic assumption underlying the use of fatty acid (FA) analysis for examining trophic relationships. The FA composition in a predator is assumed to be similar to the composition of its prey. While laboratory studies suggest this assumption may be true, multivariate analysis of these data has not adequately demonstrated this similarity. This demonstration is important because Trustee research projects based on this assumption are underway. The absence of a clear demonstration of this principle in the laboratory combined with the complexity of marine food webs suggests the practical applications of this method may be limited. We propose demonstrating the propagation of fatty acids (FA) through a simple food web, by sampling phytoplankton, zooplankton and sandlance before and after the spring plankton bloom in Kachemak Bay. This field study is coupled with laboratory study designed to examine

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the fate of FA as they are transferred between trophic levels. Together these experiments examine the plausibility of the central assumption underlying the analysis of FA compositions for identifying diet, by evaluating a system where the potential for demonstrating this principle is maximized.

#### **INTRODUCTION**

The trophic interactions between sandlance (*Ammodytes hexapterus*), copepods and phytoplankton will be examined by measuring the similarity of their fatty acid (FA) compositions. This analysis is proposed as an empirical test of the assumption that FA composition in predators reflects the composition in their prey. While some authors have validated this assumption under controlled conditions (for example: Navarro et al. 1995, Navarro et al. 1993, Fraser et al. 1987) the practical use of this assumption for examining multiple trophic relationships in marine environments is still questionable. For example, Viga and Grahl-Nielsen (1990) reported that Atlantic salmon maintained on different diets for 8 months failed to demonstrate significant differences in their fatty acid compositions even though the same statistical procedure demonstrated significant differences in the diets. Similarly, Grahl-Nielsen and Mjaavatten (1991) concluded negligible influence of diet on the fatty acid composition of seals held in captivity. These data suggest that there may be practical limits to the use of fatty acid analysis for examining trophic relationships.

Focusing on the transfer of essential fatty acids (EFA) between trophic levels may optimize the potential for using fatty acid compositions to examine trophic relationships. EFA are those FA that cannot be synthesized by animals, therefore changes in EFA abundance in zooplankton necessarily reflects increased herbivory. However, EFA are likely to retained because of their importance to membrane function. This suggests EFA acquired by vertebrate zooplanktivores may be difficult to discriminate from EFA acquired in previous years. Thus, the potential for tracing signals of EFA production in phytoplankton as they propagate into primary consumers seem assured but its unknown if propagation of the same signal can be detected in higher levels.

The value of using FA composition analysis to identify trophic interactions on levels near primary production is also indicated by Muje et al. (1989) who suggested metabolic control of FA composition increases with age. This indicates the FA composition of a predator might be expected to most resemble its prey when the predator is in a larval or immature form. Navarro et al. (1995) expanded on this idea by indicating that at a given age, different tissues could possess varying amounts of control over FA composition. These data indicate that the probability of identifying a dietary influence in a predator's FA composition is enhanced when the predators are larval or juvenile forms. This may account for the disparate conclusions drawn in the studies described above. The top predators in those studies that identified a direct relation between diet and FA composition were larval fish, while the studies that reached opposite conclusions examined older animals.

Recently, FA composition analysis has been advanced as a method for discriminating trophic interactions in Prince William Sound. The use of FA composition analysis to

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discriminate the foraging behavior of harbor seals (Frost et al. 1996) has stimulated interest in this procedure for investigators examining forage fish and their avian predators. However, acceptance of the conclusions drawn by Frost et al. (1996) depends on demonstrating that FA are unmodified after transfer from prey to predator, and that there is spatial and temporal structure to the variation in FA composition of seal prey. If it is true that a predator's FA composition is determined by its prey, then spatial and temporal variation in foraging indicate that spatial and temporal structure to the variation in a species's FA composition is expected. While the seal data look promising, the resolving power of this analytical tool needs to be examined more systematically. To this end Restoration Study 98347 is examining the spatial and temporal structure to the variation in FA composition of sandlance and herring.

We propose examining the central assumption underlying this procedure by measuring the similarity between the fatty acid compositions of phytoplankton, zooplankton and sandlance before, during and after the spring plankton bloom, and determining if FA are unmodified when they are transferred between trophic levels. The first part of this study represents a direct demonstration of the practical use of this procedure in the field. This field component, optimizes the potential for demonstrating the trophic interactions on three levels in a naturally occurring system by isolating the primary components of an important foodweb. The second part of our study is a laboratory study designed to explain the results of the first study by examining the fate of isotopically labeled FA as they diffuse through our food web model.

#### **NEED FOR THE PROJECT**

#### A. Statement of the Problem

The diets of most species are difficult to quantify with precision, so a tool that can precisely describe diets is of immense value. Such a tool, requires considerable ground truthing before its interpretive value can be widely accepted. The analysis of FA composition has been advanced as such a tool because the FA composition of a predator is assumed to be determined by its prey. This basic assumption is derived from laboratory feeding studies where the FA compositions of animals fed diets with varying amounts of fat are compared. Generally, the conclusions drawn in these studies are based on pairwise comparisons of individual FA in the predators and their diets and multivariate comparisons are rare. Thus, the conclusions of these studies have failed to actually measure differences between the FA compositions of the animals and their diets, rather they have measured associations between a limited number of FA. Conceivably, the FA compositions of animals fed different diets could be different as a result of metabolic responses to the diets, but those compositions might not resemble the diets. Thus, diet could influence a predator's FA composition, but only in a complicated way that would impede hindcasting the diet. The best demonstration of the utility of FA composition analysis for identifying dietary FA would be to statistically demonstrate that there is no difference in the FA compositions of a predator and its prey with multivariate analysis because these techniques permit direct measurement of the distance between multidimensional observations.

Application of multivariate analysis for examining the similarity of FA compositions in

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predators and their prey have rarely been reported. Grahl-Nielsen and Mjaavatten (1991) attempted such a demonstration by feeding captive harbor and grey seals different diets and compared the FA compositions of the seals and their diets with principle components analysis (PCA), but failed to detect any similarity or influence. Similarly, Viga and Grahl-Nielsen (1990) failed to detect any similarity between the FA compositions of Atlantic salmon and their diet, despite detectable differences in the diets. In another study Navarro et al. (1991) employed discriminate analysis to examine the response of larval sea bass to different diets, and found differences in the FA compositions of larvae fed different diets, but did not directly compare the diets to the larvae. The failure to detect any influence or similarity between the FA compositions of the predators and their diets in the first two cases described above may relate to the ages of the predators. Muje et al. (1989) provides evidence that metabolic control over FA composition increases with age. Thus, the assumption that the FA composition of a predator is determined by its prey would be most properly evaluated by comparing the FA composition of a different developmental stages of the predator to its prey with multivariate techniques.

#### **B.** Rationale/Link to Restoration

Discrimination of energetic pathways that link the productivity of top level predators such as seals, kittiwakes and pigeon guillemots to the quality of their diets is an established aim of the Trustee Restoration Plan. Examination of the diets of these species is difficult, so development of a tool that can hindcast diet composition would improve the precision with which these studies can be undertaken. It is important that the tool be developed systematically because inappropriate use of such a tool could lead to erroneous conclusions. For example, seal FA composition has led to conclusions about their foraging behavior that appear to be consistent with satellite tracking data, but extrapolation of those data to dietary composition might not be appropriate because alternative hypotheses have not been ruled out. For example, differences in FA composition between aggregates of seals in PWS might reflect differences in diet composition or they might reflect similar diets composed of prey with different FA compositions. Thus interpretation of the differences in seal FA composition depend on validation of the assumption that FA compositions of prey are represented in predator FA and understanding of the spatial structure to the variation in the FA composition of seal prey.

Restoration Study 347 is examining the spatial and temporal scales of variation in seal prey, and this proposal seeks to examine the basic assumption that FA compositions reflect diet by examining the assumption under optimal conditions. Sandlance are an important forage species whose biology offers a unique opportunity to evaluate the relation between predator and prey FA compositions in the wild. Sandlance are consumed by most of the top level predators in PWS. Their diets consist primarily of copepods consumed in proportion to their abundance in the water column (Sturdevandt et al. 1998) and their foraging ranges (Hobson 1986) are limited to locations near their beds. Their strict habitat requirements mean juveniles and adults are often found in close proximity. Sandlance remain quiescent through the winter and reach peak energy density between April and June suggesting they efficiently acquire a significant fraction of the FA produced in spring plankton blooms (Piatt et al. 1997). Thus, sandlance represent an ecologically important species with relatively simple trophic relations that is easy to sample.

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Examination of a simple food web with sandlance as the top predator provides a basis for extending the FA composition analysis to injured species such as seals, guillemots and kittiwakes. Laboratory evidence suggests that opportunities for demonstrating the similarity of FA compositions between prey and predator will be maximized by examining interactions at the lowest trophic levels. We propose examining the FA composition of the phytoplankton, zooplankton, sandlance during the spring bloom in Kachemak Bay. We also plan to examine different tissues taken from juvenile and adult sandlance to see if developmental stage influences the degree to which diet can influence FA composition. We believe the relatively short time period, and limited geographic scale for our food web limits the inherent variability and thereby maximizes our potential for identifying similarities under field conditions. Failure to identify these relationships in the field under these conditions suggests the limited utility of analyzing FA composition to identifying diet composition.

Its possible that diet could influence the FA composition of a predator even though the FA compositions are dissimilar. The field examination described above can only evaluate the similarity of the FA compositions for each component in the food web. We also propose a laboratory study that examines the fate of isotopically labeled FA as they are transferred through a food web. In the laboratory study, labeled FA will be fed to zooplankton who will subsequently be fed to sandlance. Modification of the FA will then be examined as it diffuses through the food chain by determining which FA and lipid classes contain the label. In addition, the overall FA compositions can be evaluated with the same statistical procedures as the field data to provide for an independent test of the conclusions drawn from the field experiment.

#### COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

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.

#### **PROJECT DESIGN**

#### A. Objectives

We propose testing the following hypotheses:

- 1. The FA compositions of sandlance and that of the zooplankton during the spring phytoplankton blooms in Kachemak Bay are similar regardless of sandlance age or tissue.
- 2. The FA compositions of zooplankton and that of the phytoplankton during the spring plankton blooms in Kachemak Bay are similar.

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- 3. The FA compositions of sandlance and *Artemia* are similar under laboratory conditions regardless of sandlance age or tissue.
- 4. The FA compositions of *Artemia* and *Spirulina* are similar under laboratory conditions.
- 5. FA are not modified when they are transferred between Artemia and sandlance.
- 6. FA are not modified when they are transferred between Spirulina and Artemia.

To test these hypotheses we propose the following objectives:

- Characterize the FA composition of phytoplankton (water particulates 1 65µ diameter) in Kachemak Bay prior to, during and after the spring plankton bloom in 1999.
- Characterize the FA composition of zooplankton (water particulates >65μ diameter) in Kachemak Bay prior to, during and after the spring plankton bloom in 1999.
- 3. Characterize the FA composition of two tissues taken from juvenile and adult prior to, during and after the spring plankton bloom in 1999.
- 4. Characterize the FA composition of unfortified and Sprirulina fortified with labeled FA under laboratory conditions.
- 5. Characterize the FA composition of *Artemia* fed fortified and unfortified Sprirulina under laboratory conditions.
- 6. Characterize the FA composition of two tissues taken from juvenile and adult sandlance after consuming *Artemia* fed fortified and unfortified Spirulina under laboratory conditions
- 7. Identify the fate of labeled FA as they are transferred from fortified Spirulina to *Artemia* and then to sandlance.

These objectives will examine the assumption that dietary FA are similar to the FA composing predators. The first three objectives demonstrate that FA are transferred to predators when they consume their prey, and that this can be detected under field conditions. By examining aged fish and different tissues we propose evaluating hypotheses that suggest metabolic control of FA compositions increase with age. The next three objectives repeat this demonstration under laboratory conditions. The final objective demonstrates the fate of FA as they are passed along trophic levels. Together these objectives provide an empirical basis for developing models for

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trophic interaction that are based on the transfer of FA between prey and predators. Field samples will be collected by APEX 193M investigators operating in Kachemak Bay.

## **B.** Methods

#### Field Study

This component of the project demonstrates the potential for identifying similarities between predators and their prey under field conditions. We will depend on samples collected by investigators working on APEX Study 163M. The site in Kachemak Bay was chosen over other potential sites because sandlance are available for sampling prior to the spring plankton blooms which in that location are relatively intense and short lived. Apex investigators will sample water particulates, zooplankton and sandlance biweekly between mid May and July 1999.

Seven samples of phytoplankton, zooplankton will be collected on each of 4 sampling dates. Phytoplankton will be collected by making vertical tows from 50 m with a 5  $\mu$ m mesh plankton net, zooplankton will be similarly collected but with a 70  $\mu$ m mesh net. Haul contents will integrate the total amount of FA available in the water column on a given date. Seven adult and juvenile sandlance will be dug up from beaches at low tide, and samples will always be collected from the same location. On the first and final sample dates, a second set of 5 juvenile and adult fish will be divided into 4 tissues: muscle, viscera, skull, and gonad to examine dietary influences on the FA composition of different tissues. All samples will be stored in separate sample vials filled with a mixture of chloroform, methanol and BHT to minimize oxidation during transfer to Auke Bay.

#### Lab Study

Lab work will be done at the Auke Bay Laboratory using locally collected sandlance. The lab study will commence in early spring when sandlance have minimal energy densities. The sandlance will be collected in the field near ABL and transported to the laboratory where they will be cultured on diets of cultured Artemia. The Artemia will be fed a maintenance diet consisting of commercially obtained Sprulina mixed with a nutritional supplement and grown to a size suitable for feeding sandlance. The study will encompass 45 days, during the first 15 d sandlance will be fed Artemia grown on the maintenance diet. For the following 15 d the sandlance will be fed Artemia grown on a maintenance diet that has been further fortified with isotopically labeled FA. For the final 15 days sandlance will be fed Artemia grown on the maintenance diet. Ten juvenile and adult fish will be sampled on the final day of the first and last feeding periods, during the middle period 5 fish will be sampled every 5 days providing a total of 70 fish samples. Artemia samples will be collected following the same schedule. Spirulina samples will be replicated 5 times and collected once during each 15 d period for a total number of 15. On the final day of the middle feeding period the muscle, viscera, skull and gonads of 5 juvenile and adult sandlance will be collected to determine how labeled FA were allocated among tissues. Each of the sandlance and their tissues will be examined for lipid class composition, and both the triacylglycerides (TAG )and phospholipid (PL) fractions will be examined for the presence of labeled FA.

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#### Fatty Acid Analysis

Fatty acids composition will be analyzed using methods outlined in Restoration Study 99347. A total of 28 phytoplankton, 28 zooplankton, 56 sandlance and 80 tissue samples will be processed from the field study. Another 15 phytoplankton, 35 zooplankton, 70 sandlance and 40 tissue samples will be processed from the laboratory study.

#### Statistical Analysis

Field data and laboratory data will be examined the same way. The FA compositions of predators (or their tissues) and prey will be examined by principle components analysis (PCA). The number of FA that can be analyzed by PCA is limited by either the number of specimens used for the analysis, thus we will focus our analysis on EFA. Differences in the FA compositions will be examined by calculating statistical class models following the procedure outlined in Viga and Grahl-Nielsen (1990). This procedure estimates the location of a class of samples in the space defined by the PCA and defines the Type I error probability of assigning a sample to the class when that a sample is located x distance units from the class model. The distance between the class and a samples taken from another class is calculated and compared to the maximum limit identified for the class model. Those samples that fall outside the class limits are considered to not fit the model for that class and are considered different. Hypotheses to be tested are listed in the Objectives section.

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

John Piatt, principle investigator from APEX 163M has agreed to collect the field samples.

## SCHEDULE

#### A Measurable Tasks for FY 99 (October 1, 1998 - September 30, 1999)

| May 1999:      | <ol> <li>Begin collecting samples of sandlance, water particulates and<br/>zooplankton for field portion of the study.</li> </ol>                    |
|----------------|--|
|                | 2) Collect sandlance for lab portion of the study.   |
| July 1999:     | <ol> <li>Complete collections of sandlance, water particulates and zooplankton<br/>for portion of the study.</li> <li>Complete lab study.</li> </ol> |
| July 1999:     | Submit samples for FA analysis.  |
| December 1999: | Complete FA analysis   |
| August 2000:   | Submit final report  |

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## **B.** Project Milestones

July 1999: Complete collecting field and laboratory samples for FA analysis.

Jan. 2000: Complete FA analysis of tissue samples collected in Spring.

August 2000: Submit final report

## **C.** Completion Date

Final Report will be submitted on April 15, 2000 in FY 2000.

## **PUBLICATIONS AND REPORTS**

No reports planned for FY 99 Manuscripts planned for FY 2000:

Heintz, R and M. Larsen. Transfer and fate of labeled essential fatty acids between phytoplankton and Pacific Sandlance (*Ammodytes hexapterus*) in simulated food web. Journal unknown.

Heintz, R and M. Larsen. Can fatty acid composition of Pacific Sandlance (Ammodytes hexapterus) be used to identify its diet? Journal unknown.

## **PROFESSIONAL CONFERENCES**

No conferences are planned in FY 99.

## NORMAL AGENCY MANAGEMENT

This project proposes to test the assumptions underlying two Trustee sponsored studies. In addition this work may provide a model that can be employed as a monitoring tool when the Restoration Process begins long term monitoring under the Restoration Reserve. This same model will have applications to Globec programs for long-term monitoring. While NOAA has stewardship for most living marine resources we would not be involved in this research were it not for the EVOS.

## COORDINATION AND INTEGRATION OF RESTORATION EFFORT

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This project has direct implications to APEX studies as well as Restoration Study 064 and 347. Conclusions drawn under Restoration Study 064 about seal foraging behavior and diets are based on the assumption that fatty acid composition in predators is similar to their prey and therefore require validation of the sort described in this proposal. Their data also suggest FA composition in seal prey varies spatially and ontogentically. Restoration Study 347 is actively engaged in examining those conclusions, but this proposal examines the biologial basis for this variation. Should we successfully validate the assumption that fatty acid composition in predators is similar to then a new tool for examining trophic relations will become available to APEX investigators. As consequence we are working with investigators associated with Restoration 347 and APEX 193M to piggy-back sample designs and interpret results.

## **PROPOSED PRINCIPAL INVESTIGATOR**

Ron Heintz National Marine Fisheries Service 11305 Glacier Hwy. Juneau, AK. 99801 office: 907-789-6058 fax: 907-789-6094 rheintz@abl.afsc.noaa.gov

# PRINCIPAL INVESTIGATOR

Ron Heintz

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

Ron Heintz obtained his BS in Ecology from the University of Illinois in 1979 and his MS Fisheries Science from the University of Alaska in 1986. He has worked for the National Marine Fisheries Service, Auke Bay Laboratory since 1985 and been actively involved with Trustee sponsored research since 1992. He is a co-investigator in two pink salmon studies, the first examines the effects of incubating in oiled gravel on reproductive capacity, and the other examines the effects on homing fidelity. The first of these projects established the plausibility of effects on pink salmon fry observed in the Sound after the EVOS, including the existence of long-term effects on growth, marine survival and reproductive ability. He was also a co-author of the final report for Subtidal 8, which examined all of the Trustee Hydrocarbon data for the presence of EVO. This work is of substantial importance to the trustees, by providing evidence for the presence of oil on the beaches of PWS. His efforts in this project led to a detailed understanding of the utility of multivariate methods for analyzing GC/MS data.

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## **OTHER PERSONNEL**

Stanley D. Rice, GM-14 PhysiologistEducation:BA in biology (1966) from Chico State UniversityMA in biology (1968) from Chico State UniversityPh.D. in comparative physiology (1971) from Kent State University

Experience:

1986 - present: Habitat Program Manager. Managed NOAA/NMFS/Auke Bay Laboratory's *Exxon Valdez* damage assessment and restoration studies. Conducted and managed cooperative projects interactive with other agencies, provided critical reviews and input in agency decisions. 1971 - 1986: Research Physiologist/Task Leader. Researched and managed studies investigating oil effects encompassing a wide variety of organisms and conditions, and has published over 100 papers on these and other topics.

Marie Larsen, GS-11 Research Analytical Chemist Education: BA in chemistry (1983) from The College of St. Benedict

#### Experience:

1990 - present: Senior Analytical Chemist. Managed daily activities and schedules in the hydrocarbon analysis lab at the Auke Bay Laboratory. Primary operator of mass spectrometer. 1983- 1990: Contracted chemist services to the U.S. EPA Environmental Research Laboratory-Duluth as part of the National Dioxin Study. Responsibilities included sample processing and operation/maintenance of mass spectrometry systems.

## LITERATURE CITED

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1999 EXXON VALDEZ TRUSTE UNCIL PROJECT BUDGET October 1, 1998 - September 30, 1999

|   | Proposed                                  | Authorized   |   |                             |  |                |           |   |
|---|---|--|---|-----------------------------|--|----------------|-----------|---|
| Budget Category:  | FFY 1998                                  | FFY 1999   |   |                             | and the life of the second s | and the second |           |   |
|   |   |  |   |                             |  |                |           |   |
| Personnel   |   | \$65.7   |   |                             |  |                |           |   |
| Travel  |   | \$2.1  |   |                             |  |                |           |   |
| Contractual   |   | \$0.0  |   |                             |  |                |           |   |
| Commodities   |   | \$28.5   |   |                             |  |                |           |   |
| Equipment   |   | \$0.0  |   | LONG RA                     | ANGE FUNDIN  | IG REQUIREN    | MENTS     |   |
| Subtotal  | \$0.0                                     | \$96.3   | Estimated                               | Estimated                   | Estimated  | Estimated      | Estimated |   |
| General Administration  | \$0.0                                     | \$9.9  | FFY 2000                                | FFY 2001                    | FFY 2003   | FFY 2004       | FFY 2005  |   |
| Project Total   | \$0.0                                     | \$106.2  | \$41.4                                  | \$0.0                       | \$0.0  | \$0.0          | \$0.0     | )                                       |
|   |   |  |   |                             |  |                |           | Sector Constant                         |
| Full-time Equivalents (FTE)   |   | 1.0  |   | E Contraction of the second |  |                |           |   |
|   |   |  | Dollar amount                           | s are shown ii              | n thousands of   | dollars.       |           |   |
| Other Resources   |   | \$30.1   | l i i i i i i i i i i i i i i i i i i i |                             |  |                |           |   |
| NOAA Contribution:<br>Habitat Investigation Program Manager, S. Rice,0.5 mo = \$5.5, PI R. Heintz 1.5 mo @ 10.0K, Research Chemist L. Holland, 1 mo. @ 6.0K,<br>Fishery Biologist J. Maselko 1 mo @ 4.5K, Senior Research Chemist J. Short, .5 mo. @ 4.1K for a total contribution of \$30.1K |   |  |   |                             |  |                |           |   |
| 1999  | Project Nur<br>Project Title<br>Agency: N | mber: 99_ <del>/</del><br>e: Sandlanc<br>ational Oce | 06<br>e EFA Uptal<br>anic & Atmo        | ke<br>spheric Adr           | ninistration   |                |           | FORM 3A<br>TRUSTEE<br>AGENCY<br>SUMMARY |

1999 EXXON VALDEZ TRUSTE JINCIL PROJECT BUDGET

| 1000 2/0/0/ |           |        |                |        |  |
|-------------|-----------|--------|----------------|--------|--|
|             | October 1 | , 1998 | - September 30 | . 1999 |  |
|             |           | •      | •              | •      |  |
|             |           |        |                |        |  |

| Personnel Costs:                                      |                                   | GS/Range/ | Months   | Monthly |               | Proposed     |
|---|-----------------------------------|-----------|----------|---------|---------------|--------------|
| Name  | Position Description              | Step      | Budgeted | Costs   | Overtime      | FFY 1999     |
| R.Bradshaw  | Fishery Biologist                 | 9/6       | 3.0      | 5.0     |               | 15.0         |
| R Heintz  | Co-PI: Fishery Research Biologist | 12/3      | 2.0      | 6.6     |               | 13.2         |
| M. Larsen   | Co -PI: Research Chemist          | 11/6      | 3.0      | 6.0     |               | 18.0         |
| L. Holland  | Research Chemist                  | 11/6      | 1.0      | .6.0    |               | 6.0          |
|   | Fishery Research Biologist        | 9/2       | 3.0      | 4.5     |               | 13.5         |
|   |                                   |           |          |         |               | 0.0          |
|   |                                   |           |          |         |               | 0.0          |
|   |                                   |           |          |         |               | 0.0          |
|   |                                   |           |          |         |               | 0.0          |
|   |                                   |           |          |         |               | 0.0          |
|   |                                   |           |          |         |               | 0.0          |
|   |                                   |           |          |         |               | 0.0          |
|   | Subtotal                          |           | 12.0     | 28.1    | 0.0           |              |
|   |                                   |           |          | Per     | sonnel Total  | \$65.7       |
| Travel Costs:   |                                   | Ticket    | Round    | Total   | Daily         | Proposed     |
| Description   |                                   | Price     | Trips    | Days    | Per Diem      | FFY 1999     |
|   |                                   |           |          |         |               | 0.0          |
| Cook Inlet to collect samples                         |                                   | 0.8       | 1        | 4       | 0.1           | 1.2          |
|   |                                   |           |          |         |               | 0.0          |
|   |                                   |           |          |         |               | 0.0          |
| APEX Review Anchorage                                 |                                   | 0.5       | 1        | 2       | 0.2           | 0.9          |
| Larsen, Co-Pl   |                                   |           |          |         |               | 0.0          |
|   |                                   |           |          |         |               | 0.0          |
|   |                                   |           |          |         |               | 0.0          |
|   |                                   |           |          |         |               | 0.0          |
|   |                                   |           |          |         |               | 0.0          |
|   |                                   |           |          |         |               | 0.0          |
|   |                                   | L         |          |         | Travel Total  | 0.0<br>\$2.1 |
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| 1000  | Project Number: 99                |           |          |         | F             | ersonnel     |
| Agency: National Oceanic & Atmospheric Administration |                                   |           |          |         |               | & Travel     |
|   |                                   |           |          |         |               | DETAIL       |
| <b>L</b> ]  |                                   |           |          |         | L             |              |

# 1999 EXXON VALDEZ TRUSTE UNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

| <b>Contractual Cost</b>   | S:   | Proposed                                     |
|---|--|--|
| Description   |  | FFY 1999                                     |
|   |  | 0.0<br>0.0<br>0.0<br>0.0<br>0.0<br>0.0       |
| When a non-truste   | ee organization is used, the form 4A is required. Contractual Total  | \$0.0  |
| Commodities Co  | sts:   | Proposed                                     |
| Description   |  | FFY 1999                                     |
| gases, reagents, c<br>Labelled fatty acid<br>fish culture supplie | columns, standards<br>s<br>es  | 17.0<br>8.5<br>3.0                           |
|   | Commodities Total  | \$28.5                                       |
| 1999  | Project Number: 99<br>Project Title: Sandlance EFA Uptake<br>Agency: National Oceanic & Atmospheric Administration | ORM 3B<br>htractual &<br>mmodities<br>DETAIL |

# 1999 EXXON VALDEZ TRUSTE UNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

| New Equipment Purchases:       |   | Number   | Unit         | Proposed  |
|--------------------------------|---|----------|--------------|-----------|
| Description                    |   | of Units | Price        | FFY 1999  |
|                                |   |          |              | 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 wit | th replacement equipment chould be indicated by placement of an P | Now Equ  | inment Total | 0.0       |
| Frieting Equipment League      | inteplacement equipment should be indicated by placement of an R. |          |              |           |
| Existing Equipment Usage.      |   |          | of Unite     | Inventory |
|                                |   |          |              | NOAA      |
| GC/MS                          |   |          | 1            |           |
|                                |   |          | 1            | no/vi     |
|                                |   |          |              |           |
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|                                |   |          |              |           |
|                                | r   |          |              | 1         |
|                                | Project Number: 00  |          | F            | ORM 3B    |
| 1000                           |   |          | F            | quipment  |
| 1999                           | Project Litie: Sandiance EFA Uptake                               |          |              |           |
|                                | Agency: National Oceanic & Atmospheric Administration             |          |              |           |
|                                |   |          | L            |           |



Aspects of Salmon Shark Ecology in Alaska Waters, Submitted Under the BAA.

| Project Number:           | 99408-BAA  |              |  |  |
|---------------------------|--|--------------|--|--|
| Restoration Category:     | Research   |              |  |  |
| Proposer:                 | Dr. John A. Musick, Virginia Institute of Marine<br>Science, VIMS<br>Kenneth J. Goldman, Virginia Institute of Marine<br>Science, VIMS |              |  |  |
| Lead Trustee Agency:      | ADFG   |              |  |  |
| Cooperating Agencies:     | VIMS & ADFG  |              |  |  |
| Alaska SeaLife Center:    | No   |              |  |  |
| Duration:                 | 1st Year , 3-year project  | APR 1 4 1998 |  |  |
| Cost FY 99:               | \$265,500  |              |  |  |
| Cost FY 00:               | \$287,000  |              |  |  |
| Cost FY 01:               | \$190,300  |              |  |  |
| Geographic Area:          | Kodiak Island to, and including, Prince William<br>Sound   |              |  |  |
| Injured Resource/Service: | Recreation and Tourism (sport fishing)   |              |  |  |

## ABSTRACT

Salmon sharks are the apex pelagic fish predator in Gulf of Alaska waters and Prince William Sound, yet their ecological role is largely unknown due to a lack of information on their biology and life history. In an effort to define the ecological role of salmon sharks, a cooperative program between the Virginia Institute of Marine Science (VIMS) and the Alaska Department of Fish and Game (ADFG) was established in 1997. Results from this study will make a substantial contribution towards better understanding ecosystem function in the Gulf of Alaska and Prince William Sound, and will also foster responsible population management.

#### INTRODUCTION

The salmon shark, *Lamna ditropis*, is widespread in the boreal North Pacific (Strasburg 1958, Compagno, 1984). They are the largest apex fish predator in the upper pelagic zone of the Gulf of Alaska and Prince William Sound, yet very little is known of their basic biology and life history. Apex predators are often the "keystone species" in an ecosystem and their role is critical to the overall community ecology as their activities determine community structure (Paine 1974). Understanding the community ecology of the Gulf of Alaska and Prince William Sound ecosystems is not possible without information on the biology and ecology of salmon sharks.

The collection of basic life history information such as an age-length relationship, growth rates, age at maturity, and maximum age achieved are crucial to understanding the ecology of salmon sharks in the Gulf of Alaska and Prince William Sound. The most reasonable method of estimating ages in sharks (without spines) is by the enumeration of growth zones deposited in vertebral centra (Cailliet 1990). We plan to obtain vertebrae from salmon sharks from our fishing efforts, from sharks caught aboard sport fishing vessels as well as the by-catch from cooperating fishermen and research vessels ranging from Alaska through central California. Biological data such as sex and length will also be recorded. Age at sexual maturity will be determined by measuring clasper length and width for males, and through both field and laboratory analysis of reproductive tracts for females. Preliminary scientific study on salmon shark biology and life history parameters undertaken by VIMS and ADFG along with anecdotal information suggests they are relatively abundant in the Gulf of Alaska and Prince William Sound. Sizable aggregations have been seen at the surface (K.J. Goldman pers. obsv.), on underwater video (Haldorson, pers. comm.) and many have been caught aboard sport fishing vessels. Indications are that there is segregation by both size and sex with females dominating the sport catch, and that feeding is taking place on a fairly wide range of fish prey species.

The physiological ecology of any species is instrumental in not only understanding its environmental niche, but providing clues to other life history parameters such as growth rates and longevity. Salmon sharks are unusual in that they possess elevated body temperatures and are very active predators in cold water (Smith & Rhodes 1983, Carey et al. 1985, Anderson & Goldman, in preparation). Elevated body temperature is a highly evolved aspect of salmon shark biology which directly relates to their functioning as the apex fish predator in the Gulf of Alaska and Prince William Sound ecosystems. In the course of this study, we plan to obtain measurements of body core temperature from free-swimming salmon sharks in order to study their physiological ecology and examine possible effects of warmbodiedness on life history parameters such as growth rate. Mako sharks (which are also warm-bodied) have faster growth rates than most other non-thermal sharks of similar size. Faster growth can lead can lead to earlier age at maturity, higher intrinsic rates of increase and greater resilience in the face of high exploitation.

The rate of biological functions are affected by temperature increases (Schmidt-Nielsen 1990). Hence, the warm-bodiedness of salmon sharks may also play a

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significant role in their digestive rate and therefore on their overall impact on prey resources in a given area. Information from our body temperature study may play an important role in accurately assessing the trophic interactions of salmon sharks in the Gulf of Alaska and Prince William Sound. Therefore, along with our collection of vertebral samples we are cooperating with NOAA/NMFS, Juneau, by collecting stomachs for their salmon shark feeding ecology study, and providing them with the results of our thermal data. Stomachs and gut contents will be frozen and sent to Audra Brase and Leland Hulbert at the NOAA/NMFS office in Juneau.

Biogeography is a key ecological component of any population. Individuals within a population are not only dispersed in space, but in time. The geographic range of movements and residency times of salmon sharks within any given area of the Gulf of Alaska and Prince William Sound are unknown. While tracking sharks to obtain body temperatures, we will also be mapping their movements. This will provide insight on short term movements within areas of the Gulf of Alaska and Prince William Sound (including the spill area) and allow inference into short-term residency times. Additionally, salmon sharks will be tagged with pop-off satellite transmitters to gather information on swimming depth and water temperature preferences and long term geographic movements. These transmitters remain on the animal for up to six months before self-releasing and floating to the surface where they download the archival (recorded) data to the ARGOS Satellite Network for our retrieval. The movement data will enable estimates of long-term residency times to be made. The ecological role of salmon sharks in the Gulf of Alaska and Prince William Sound, and the effect of their predation on injured fish resources in the spill area (e.g. herring, salmon, rockfish), will vary with their movements and residency times. Our study will provide important longer term migration information greatly enhancing our understanding of salmon shark ecology.

There is currently more interest in salmon sharks in the Alaska then ever before and sightings by fishermen and tourists within Prince William Sound have increased dramatically. This 'new awareness' of salmon sharks in Alaska has resulted in an increased sport fishing effort, which along with three years of commercial fishing and a lack of biological knowledge on salmon sharks prompted ADFG and the Alaska Board of Fisheries to establish sport fishing limits and close the commercial fishery in February 1998. Sharks generally exhibit a life history strategy characterized by slow growth, late maturity, low fecundity and, therefore, extremely low intrinsic rates of population increase (Holden 1974 and 1977, Hoenig and Gruber 1990). Historically, heavy exploitation rates and a lack of management have led to rapid declines in shark populations and fishery failures worldwide (Compagno 1990, Hoff and Musick 1990). Due to the regulations on salmon shark fishing, it is likely that the impact on the Alaska salmon shark population has been minimal. This means we have the rare opportunity to gather essential demographic data from a near virgin population of sharks to understand the basic biology of the species, model the key ecological parameters, and guide future management to prevent stock collapse.

The focus of this research is to study the ecology of salmon sharks by gathering key biological and biogeographical data and modeling their growth parameters and

population demographics. Our results will allow the ecological role of salmon sharks, the apex fish predator in the Gulf of Alaska and Prince William Sound, to be integrated into the ecosystem model for the status and recovery of the spill area, and foster responsible conservation and management of the species.

# NEED FOR THE PROJECT

## A. Statement of Problem

In order to effectively model and understand ecosystems, knowledge on the basic biology of the major populations within the community must be obtained. The EVOS Trustee Council is interested in understanding the dynamics of Prince William Sound ecosystem to better their restoration efforts in the spill area. The problem exists, however, that knowledge is lacking on the role and impact of the largest apex fish predator in the pelagic zone of the Gulf of Alaska and Prince William Sound. Hence, accurately modeling the system and assessing the recovery of fishes such as herring, rockfish and salmon is not possible without knowledge of salmon shark ecology. Due to concern over the lack of life history and population data for salmon sharks and the increased interest in salmon shark sport fishing, the Alaska Board of Fisheries has closed all commercial fishing and implemented recreational bag limits. While this may provide a more conservative approach, it does not provide any new information to effectively manage this ecologically important species. These factors create an urgency to obtain both behavioral and biological data to assess their life history parameters and population dynamics within the region.

# **B.** Rationale/Link to Restoration

Our goal is collect the necessary data in order to model the ecological parameters of the salmon shark population in the Gulf of Alaska and Prince William Sound. By doing so, we will provide essential ecological information to the state of Alaska and the EVOS Trustee Council on salmon sharks to assist in modeling and understanding the role of salmon sharks in the Prince William Sound ecosystem. Additionally, other fisheries biologists will be able to consider the potential impact of salmon sharks on both healthy and recovering prey populations in the region.

The list of ecosystem restoration goals of the EVOS Trustee Council contains the increase of recreation and tourism. In addition to providing ecological information, our goal is to create a successful sport fishery management plan for salmon sharks in Alaska waters. An effective management strategy would provide for a long term sustainable sport fishery, increasing recreational activities and tourism in the Spill region. Alaskans and tourists will be able to sport fish for salmon sharks and boat captains will be able to earn income through chartered shark fishing trips.
## C. Location

Our fishing effort will take place in waters of and adjacent to the Gulf of Alaska from Prince William Sound to Kodiak Island. However, the geographic range of our sampling effort, and therefore our sample size, is dramatically increased by the cooperating agencies listed in "Project Design, Part C".

Many of Alaska's fishing communities should be able to benefit from the results of this study and a responsible long term management plan for salmon sharks. Fishermen who target prey species of salmon shark should also benefit from information on the sharks' population status, movements and residency times.

# COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Throughout the course of our study we will use any traditional knowledge provided by local fishermen and native villages. The use of local fishermen is already being implemented. To date, catch data along with samples of vertebrae, muscle tissue, gut contents, reproductive tracts, and parasites have been obtained from 29 salmon sharks caught aboard the sport fishing vessel "Legend" (owned and operated by Captain Robert Candopoulos, Seward, AK) by K.J. Goldman and S. Anderson. Other fishermen in other ports will gladly be used if their knowledge of locating and fishing these sharks compares with that of Captain Candopoulos.

Audra Brase and Leland Hulbert, NOAA/NMFS Juneau, are pursuing discussions with native villagers. Successful discussions will result Brase and Hulbert obtaining gut content samples. Diet data, along with biological data and vertebral samples will be transferred to us as part of our cooperative agreement stated in "Coordination and integration of restoration effort".

#### **PROJECT DESIGN**

## A. Objectives

#### **Overall Objective**

The overall objective of this research is to study the ecology of salmon sharks by gathering key biological and behavioral data and modeling their growth parameters and population demographics. Our results will allow the ecological role of salmon sharks, the apex fish predator in the Gulf of Alaska and Prince William Sound, to be integrated into the ecosystem model for the status and recovery of the spill area, and foster responsible conservation and management of the species.

#### Data Objectives

1) Catch data: date, location, gear used, fishing depth, water temperature.

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- 2) Biological data: length measurements, gender, girth (and weight if possible). males: clasper measurements to assess length at maturity. females: field observations and lab analysis of reproductive tract sections.
- 3) Assess length at maturity in females: examine reproductive tissue and tracts.
- 4) Collect vertebrae: A six to 10" section in front of first dorsal fin (above gills).
- 5) Collect body temperature data from free-swimming sharks via acoustic telemetry.
- 6) Collect data on water temperature and swimming depth preferences, and long-term geographic movements via satellite telemetry.

## **Ecological and Modeling Objectives**

- 1) Calculate and/or validate an age-length relationship and age at sexual maturity.
- 2) Calculate maximum length for males and females.
- 3) Calculation of growth rates for males and females.
- 4) Estimate longevity.
- 5) Estimate reproductive rate.
- 6) Examine population structure (demographics).
- 7) Create a successful long term sport fishery management plan.
- 8) Examine the commercial fishing potential of this species.

## Seasonal Objectives

# Fall 1998

- 1) Hire a vessel for a five day period to fish for sharks hook and line for the purposes of tagging (w/ ADFG streamer tags and pop-off satellite transmitters), injecting with \*OTC and releasing.
- 2) Prepare and perform growth zone counts on vertebral samples collected to date.
- 3) Input all data into growth and demographic models for preliminary analysis.

\*OTC = oxytetracyline: see "Project design section, Part B. Methods" for description of OTC use in age and growth studies.

# Spring 1999

- 1) Hire a vessel for a five day period to fish for sharks hook and line for the purposes of tagging (w/ ADFG streamer tags and pop-off satellite transmitters), injecting with OTC and releasing.
- 2) Continue to work up any vertebral samples from sources along the eastern Pacific and update models.
  - Audra Brase and Leland Hulbert (NOAA/NMFS, Juneau, AK) will be longlining.
  - The Pacific Biological Station, Nanaimo, BC conducts juvenile salmon trawls.

- Several are caught and wash up dead along the central California coast each spring.

## Summer 1999

- 1) Use observer spots on Captain Robert Candopoulos' shark fishing trips out of Seward to collect catch data and vertebrae, and tag, injecting with OTC and release sharks.
- 2) Hire a vessel for two, five day periods to fish for sharks hook and line for the purposes of tagging (w/ ADFG streamer tags and pop-off satellite transmitters), injecting with OTC and releasing.
- 3) Hire a vessel for two, 72 hour periods to conduct 48 hour temperature trackings.

- The 72 hour period allows for travel to fishing location, catching and tagging of a shark, tracking time and travel back to port.

## Fall 1999

- 1) Hire a vessel for a five day period to fish for sharks hook and line for the purposes of tagging (w/ ADFG streamer tags and pop-off satellite transmitters), injecting with OTC and releasing.
- 2) Hire a vessel for one, 72 hour period to conduct 48 hour temperature trackings.
- 3) Prepare and perform growth zone counts on all new vertebral samples.
- 4) Update growth and demographic models.
- 5) Examine vertebrae from any tag returned sharks in attempts to validate the age-length relationship (look for the OTC mark in the growth zone).
- 6) Add any tag return data to the models.
- 7) Retrieve and analyze data from pop-off satellite tag returns.

## Spring 2000

- 1) Hire a vessel for a five day period to fish for sharks hook and line for the purposes of tagging (w/ ADFG streamer tags and pop-off satellite transmitters), injecting with OTC and releasing.
- 2) Hire a vessel for one, 72 hour period to conduct 48 hour temperature trackings.
- 3) Continue to work up any vertebral samples from sources along the eastern Pacific and update models.
- 4) Retrieve and analyze data from pop-off satellite tag returns.

## Summer 2000

1) Use observer spots on Captain Robert Candopoulos' shark fishing trips out of Seward to collect catch data and vertebrae, and tag, inject (w/OTC) and release sharks.

- 2) Hire a vessel for two, five day periods to fish for sharks hook and line for the purposes of tagging (w/ ADFG streamer tags and pop-off satellite transmitters), injecting with OTC and releasing.
- 3) Hire a vessel for two, 72 hour periods to conduct 48 hour temperature trackings.

## Fall 2000

- 1) Hire a vessel for a five day period to fish for sharks hook and line for the purposes of tagging (w/ ADFG streamer tags and pop-off satellite transmitters), injecting with OTC and releasing.
- 2) Hire a vessel for one, 72 hour period to conduct 48 hour temperature trackings.
- 3) Prepare and perform growth zone counts on all new vertebral samples.
- 4) Update growth and demographic models.
- 5) Examine vertebrae from any tag returned sharks in attempts to validate the age-length relationship (look for the OTC mark in the growth zone).
- 6) Add any tag return data to the models.
- 7) Retrieve and analyze data from pop-off satellite tag returns.

## Spring and Summer 2001

- 1) Produce final reports on our research for EVOS and the state of Alaska.
- 2) Submit results to scientific journals.
- 3) Provide demographic results and recommendations to the Alaska Board of Fisheries in order to update the sport fishery management strategy.

## Secondary Objectives

 Obtaining stomach samples and gut contents for salmon shark feeding ecology study being conducted by Audra Brase and Leland Hulbert, NOAA/NMFS, Juneau, AK, as part of our cooperative agreement - stated in "Coordination and integration of restoration effort".

## **B.** Methods

## 1. Age, Growth, and Demographics

The enumeration of growth zones deposited in vertebral centra provides the most reasonable method of estimating age at length in sharks (Cailliet 1990), and will therefore be the primary method used. Methods to aid in the enumeration of growth zones, such as X-radiography, will also be employed (Cailliet et al. 1981). Multiple readings will be conducted on all vertebral samples by multiple readers to obtain accurate and precise estimates of ages. Establishing an age-length relationship will allow us to assess such life history parameters as growth rate, age at sexual maturity for each gender, natural mortality and longevity. These data will be applied to several demographic models to examine the population structure of this species. Assistance in collecting additional vertebral samples and related biological data will come from the cooperative efforts of NOAA/NMFS Alaska, and several other state and scientific institutions in Alaska, Canada, Washington, Oregon, and California.

Attempts will be made to validate our age-length relationship estimates. A shark tag and release program is being established by ADFG with support from VIMS. We will be catching salmon sharks on hook and line, tagging with ADFG streamer tags, simultaneously injecting oxytetracycline (OTC), at 25 ml/kg body weight and releasing them. (Salmon shark weight to length estimates have been calculated from sharks collected to date by K.J. Goldman, VIMS). Cooperative fishermen and researchers aiding in the collection of vertebrae will also tag, inject with OTC and release sharks.

Oxytetracycline, OTC, binds to calcium deposited into the current growth zone and is visible in vertebral centra of recaptured sharks when viewed under ultraviolet light (Tanaka 1990). Knowing time-at-large and number of growth zones since injection allows validation of an age-length relationship. Using OTC is only one method of validating the age-length relationship, therefore, all applicable validation methods will be attempted (Cailliet 1990, Hoenig and Goldman in prep.).

## 2. Thermal Biology

Salmon sharks are known to possess elevated body temperatures (Smith & Rhodes 1983, Carey et al. 1985, Anderson & Goldman, in preparation), but body temperatures from a free-swimming salmon shark have yet to be obtained. Stomach temperature has been shown to be a solid indicator of body core temperature in sharks (Carey et al. 1981, Goldman et al. 1996, Goldman 1997).

Sharks will be caught and brought to the side of the vessel where an ultrasonic transmitter will be dropped into the stomach through a small PVC tube. Sharks will be tracked for a 48 hour period. The transmitters and tracking technique will be similar to those used to study the thermal biology of white sharks, *Carcharodon carcharias*, by Goldman (1997). We will use a 72 hours period for each track allowing travel time to the fishing location, fishing time, tracking time, and travel time back to port.

Statistical analyses will be run. comparing stomach temperature data to ambient water temperature to examine the degree of thermoregulation exhibited by this species which is determined by the stability of its elevated body temperature relative to that of ambient water. The effect of elevated body temperatures on life history parameters, such as intrinsic rate of population growth will be elucidated by this study. Temperature data will also be useful to Audra Brase and Leland Hulbert of NOAA/NMFS, Juneau, AK, in their salmon shark feeding ecology as temperature elevations affect digestive rates.

## 3. Satellite Telemetry

As sharks are being transmittered for short-term temperature trackings, they will also be tagged with pop-off satellite transmitters. In addition, some sharks caught for tagging with ADFG streamer tags and OTC injection will also be tagged with popof satellite transmitters. These transmitters record water temperature and swimming depth regimes for a three to six month period before self-releasing and floating to the surface where they download the archival (recorded) data to the ARGOS Satellite Network for our retrieval. Tagging and pop-off locations from these transmitters provide data on geographical movements and range, and allow for estimation of residency times to be made. Water temperature and swimming depth records will indicate whether salmon sharks show preferences towards either of these parameters. This information is important in not only understanding the ecology of salmon sharks, but in understanding the ecology of their prey and the whole Prince William Sound ecosystem.

Satellite telemetry provides the best mechanism to collect these biogeographical data. They have been used successfully with bluefin tuna the Atlantic (G. Skomal pers. comm.), and will be used this summer on other sharks in Australia (J.D. Stevens, pers. comm.). The amount of information obtained relative to additional effort to satellite tag a shark is enormous, particularly since we will be tagging and releasing sharks for another aspect of this study.

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

Groups cooperating with VIMS and ADFG by collecting vertebral samples: NOAA/NMFS, Juneau, AK - Audra Brase and Leland Hulbert. Prince William Sound Science Center, Cordova, AK - Tom Kline. Pacific Biological Station, Nanaimo, B.C. Canada - David Welch and John Morris. Washington Department of Fish and Wildlife, Seattle, WA - Cindy Knudsen Point Defiance Zoo and Aquarium, Tocoma, WA - Dr. John Rupp California Academy of Sciences, San Francisco, CA - Dr. John McCosker University of California, Santa Cruz, CA - Dr. Dave Casper California Department of Fish and Game - John Ugoretz Wildlife Conservation Society, Brooklyn, NY - Dr. Ellen Pikitch

## SCHEDULE

## A. Measurable Project Tasks for FY 99-00 (October 1, 1998 - September 30, 2000)

October 1998 - April 1999 -Preparation and enumeration of vertebral samples. -Results input into preliminary growth and demographic models. -Obtain additional vertebral samples.

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-Tag (w/ ADFG streamer tags and pop-off satellite transmitters), inject with OTC and release as many sharks as possible via our fishing efforts and cooperative ones.

## May 1999 - April 2000

-Tag (w/ ADFG streamer tags and pop-off satellite transmitters), inject with OTC and release as many sharks as possible via our fishing efforts and cooperative ones.

-Obtain catch data and vertebral samples from assisting institutions, agencies and individuals.

-Attempt three temperature trackings.

-Update growth and demographic models. -Examine any tag returned (OTC) vertebrae.

-Retrieve and analyze data from pop-off satellite tag returns.

-Present poster or presentation on research findings to date at the annual meeting of the American Elasmobranch Society, July 1999, Penn State University.

-Present up to date research findings to date at the EVOS annual meeting, January 2000.

-Tag (w/ ADFG streamer tags and pop-off satellite transmitters), injecting with OTC , inject and release as many sharks as possible via our fishing efforts and cooperative ones.

- -Obtain catch data and vertebral samples from assisting institutions, agencies and individuals.
- -Examine any tag returned (OTC) vertebrae.
- -Attempt four temperature trackings.
- -Complete work-up of temperature data.
- -Finalize growth and demographic models.
- -Retrieve and analyze data from pop-off satellite tag returns.

-Present final research findings at the annual meeting of the American Elasmobranch Society, July 2000, La Paz, Mexico.

-Present up to date research findings to date at the EVOS annual meeting, January 2001.

-Ph.D. dissertation of K.J. Goldman completed at VIMS with resulting cooperative publications being prepared and submitted to scientific journals.

-Present final research findings and resulting management plan to the EVOS Trustee Council.

## May 2000 - April 2001

May - August 2001

- -Provide demographic results and recommendations to the Alaska Board of Fisheries in order to update the sport fishery management strategy.
- -Present final research findings at the annual meeting of the American Elasmobranch Society, July 2001.
- -Present final research findings at the annual meeting of the American Fisheries society, August 2001.

## **B.** Project Milestones and Endpoints

- Year 1 (Oct. 98 Sept. 99):
- Milestone: Conduct temperature tracks of free-swimming salmon sharks. Continue to obtain vertebral samples from cooperating agencies. Tag (ADFG streamers and satellite), OTC inject and release sharks.
- Endpoint: Produce preliminary growth and demographic models. Work-up results from initial temperature tracks and satellite transmitters.

Year 2 (Oct. 99 - Sept. 00):

Milestone: Conduct temperature tracks of free-swimming salmon sharks. Continue to tag (ADFG streamers and satellite), OTC inject and release sharks.

Endpoint: Update growth and demographic models. Work-up results from temperature tracks and satellite transmitters.

Year 3 (Oct. 00 - Sept. 01):

- Milestone: Finalize growth and demographic models, analysis of thermal biology and satellite transmitter data.
- Cooperative data sharing. Endpoint: Present final research findings and resulting management plan to the EVOS Trustee Council.
  - Ph.D. dissertation of K.J. Goldman completed at VIMS with resulting cooperative scientific publications being prepared.
  - Provide demographic results and recommendations to the Alaska Board of Fisheries in order to update the sport fishery management strategy.

## C. Completion Date

August 2001

# PUBLICATIONS AND REPORTS

Updated reports will be provided to the EVOS Trustee Council as required. Presentations on findings will be presented at the EVOS annual meetings (January

Prepared 4/8/98

2000 and 2001) and at the American Elasmobranch Society annual meetings (July 2000 and 2001). Research findings and the most effective resulting management strategy will be presented to the Alaska Board of Fisheries along with information on their commercial fishing potential. Results will be submitted for publication in ichthyological and physiological scientific journals.

## PROFESSIONAL CONFERENCES

EVOS annual meetings - January 2000 and 2001. American Elasmobranch Society annual meetings - July 1999, 2000 and 2001. American Fisheries Society annual meetings - August 2001.

## NORMAL AGENCY MANAGEMENT

N/A

## COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Both state and federal agencies within Alaska are interested in obtaining knowledge on salmon sharks not only for management purposes, but to better understand their role in the ecosystem as an apex predator. The effect salmon sharks have on fish populations in the Gulf of Alaska and Prince William Sound is unknown yet is important in understanding the population dynamics of those species. Injured resources in the spill area include salmon, rockfish and herring which are known prey items of salmon sharks (K.J. Goldman pers. obsv.) making it necessary to understand the predator-prey dynamics in the region.

We are providing samples for the feeding ecology study being conducted by Audra Brase and Leland Hulbert at NOAA/NMFS, Juneau, AK and providing them data on salmon shark thermal biology to aid in the assessment of trophic interactions in the Spill region. (Additionally, Ken Goldman [VIMS] is a consultant on that project). They in turn will provide vertebrae to aid in our fisheries study. The complimentary nature of these studies will provide key information to and benefit the EVOS Trustee Council, the state of Alaska, other scientists, educational institutions and the general public about the ecology of salmon sharks.

## EXPLANATION OF CHANGES IN CONTINUING PROJECTS

N/A

#### PROPOSED PRINCIPAL INVESTIGATORS

Dr. John A. Musick Head, Vertebrate Ecology and Systematics Virginia Institute of Marine Science P.O. Box 1346 Gloucester Point, VA 23062 (804) 684-7 Fax: (804) 684-7327 E-mail: jmusick@vims.edu

John A. (Jack) Musick was born in Trenton, New Jersey in 1941. He received his B.A. in Biology from Rutgers University in 1962 and his M.A. and Ph.D. from Harvard University in 1964 and 1969 respectively. He has been on the faculty at the Virginia Institute of Marine Science since 1967 and has successfully mentored 30 M.A. and 31 Ph.D. students. His research has covered many aspects of vertebrate ecology including community structure in coastal and deep sea fishes, shark population dynamics and se turtle ecology. He has been studying shark ecology since 1962 and has used both sonic and satellite technology in his research for more than 15 years. In 1985 he was elected a Fellow by the American Association for the Advancement of Science. He has served as President of both the American Elasmobranch Society and the Annual Sea Turtle Symposium, and has also served on numerous national and international advisory groups for conservation and management; most recently as a member of the National Marine Fisheries Service Shark Evaluation Panel, co-chair of the IUCN Shark Specialist Group and as co-chair of the American Fisheries Society Committee on Endangered Marine Fishes. Dr. Musick has authored or co-authored more than 100 scientific papers, and four books dealing with various aspects of marine ecology, vertebrate ecology and fisheries management.

Kenneth J. Goldman Fisheries Department Virginia Institute of Marine Science P.O. Box 1346 Gloucester Point, VA 23062 (804) 684-7556 Fax: (804) 684-7327 E-mail: keng@vims.edu

Kenneth J. Goldman was born in Denver, Colorado in 1963. From 1990 to 1996, he worked as an aquarist and research associate to Dr. John McCosker at the Steinhart Aquarium, California Academy of Sciences. He received his B.S. in Biology (emphasis in Marine Biology and Limnology) graduating magna cum laude and his M.A. degree in Biology from San Francisco State University in 1993 and 1996 respectively. His research has covered aspects of shark physiology and behavioral ecology, focusing on the thermal physiology and behavioral adaptations of sharks living in temperate and boreal waters. He entered the Ph.D. program at the Virginia Institute of Marine Science to work with Dr. Musick in 1996, where his research is

Prepared 4/8/98

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focusing on the vascular anatomy and thermal physiology of the common thresher shark, the age, growth and demographics of sand tiger sharks in the Atlantic, and the age, growth and demographics of salmon sharks in the north-east Pacific. He received the 1992-93 Academic Achievement award from San Francisco State University, and in 1996 he was awarded the Samuel H. Gruber Best Student Paper Award by the American Elasmobranch Society. In 1996 he served as the chair of the American Elasmobranch Society's nominating committee (a first for a student), and currently serves as the chair of their Student Affairs Committee.

#### **Cooperating Agency Investigators**

Bill Bechtol Alaska Department of Fish and Game 3298 Douglas Pl. Homer, AK 99603 (907) 235-8191 Fax: (907) 235-2448 E-mail: billb@fishgame.state.ak,us

Doug Vincent-Lang Alaska Department of Fish and Game 333 Rasberry Rd. Anchorage, AK 99518 (907) 267-2339 Fax: (907) 267-2424 E-mail: dougvl@fishgame.state.ak,us

## OTHER KEY PERSONNEL

- Audra Brase, NOAA/NMFS, Juneau, AK: Cooperating by collecting catch data and vertebral samples, and tagging, injecting, and releasing some sharks during their feeding ecology study.
- Lee Hulbert, NOAA/NMFS, Juneau, AK: Cooperating by collecting catch data and vertebral samples, and tagging, injecting, and releasing some sharks during their feeding ecology study.
- Scot Anderson, Elasmobranch research conservationist and collaborating scientist: Will fill observer spot on some sport fishing trips (aboard Captain Robert Candopoulos' vessel) to provide catch data and vertebral samples, and tagging, injecting, and releasing some sharks. Will participate in some of the temperature trackings and aid with certain aspects of data analysis.
- Cindy Knudsen, Washington Dept. of Fish and Wiildlife: Will fill observer spot on some sport fishing trips (aboard Captain Robert Candopoulos' vessel) to provide catch data and vertebral samples, and tagging, injecting, and releasing some sharks. Will participate in some of the temperature trackings
- Lew Haldorson, University of Alaska: Will aid in interpreting the salmon shark body temperature data in relation to food consumption (with NOAA/NMFS group, Juneau, AK)

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FY 99 EXXON VALDEZ TRUSTE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

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|  | Authorized       | Proposed      |                  |                 |                 |                 |               |       |
|--|------------------|---------------|------------------|-----------------|-----------------|-----------------|---------------|-------|
| Budget Category:                                 | FY 1998          | FY 1999       |                  |                 |                 |                 |               |       |
|  |                  |               |                  |                 |                 |                 |               |       |
| Personnel  |                  | \$30.7        |                  |                 |                 |                 |               |       |
| Iravel   |                  | \$26.3        |                  |                 |                 |                 |               |       |
| Contractual                                      |                  | \$70.4        |                  |                 |                 |                 |               |       |
|  |                  | \$2.3         |                  |                 |                 |                 | 的人们在之前自己      |       |
| Equipment  |                  | \$78.5        |                  | LONG R          | ANGE FUNDI      | NG REQUIRE      | MENTS         |       |
| Subtotal   | \$0.0            | \$208.2       |                  | Estimated       | Estimated       | Estimated       |               |       |
| Indirect   | <b>*••••</b>     | \$57.3        |                  | FY 2000         | FY 2001         | FY 2002         |               |       |
| Project Total                                    | \$0.0            | \$265.5       |                  | \$287.0         | \$190.3         |                 |               |       |
|  |                  |               |                  |                 |                 |                 |               |       |
| Full-time Equivalents (FIE)                      |                  | 0.6           | and the state is |                 |                 |                 |               |       |
|  |                  |               | Dollar amount    | ts are shown in | thousands of    | dollars.        |               |       |
| Other Resources                                  | Sigma Xi         | \$0.5         | VIMS/GSA         | \$0.4           | Explorers' Club | \$1.2           | Lerner-Gray   | \$0.8 |
| This is a multi-faceted study, i<br>accordingly. | f the EVOS Trus  | ee Council ch | nooses to fund   | less than the t | otal project, w | e will modify t | he scope of w | ork   |
| See attached copy of indire                      | ct cost agreemer | ıt.           |                  |                 |                 |                 |               |       |
|  |                  |               |                  |                 |                 |                 |               |       |
|  |                  |               |                  |                 |                 |                 |               |       |
|  |                  |               |                  |                 |                 |                 |               |       |

## FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

| ,                                      |                             |  |             |              |  |              |           |
|--|-----------------------------|--|-------------|--------------|--|--------------|-----------|
| Pers                                   | sonnel Costs:               |  |             | Months       | Monthly                                |              | Proposed  |
|  | Name                        | Position Description                   |             | Budgeted     | Costs                                  | Overtime     | FY 1999   |
|  | J. Musick                   | Head, Vertebrate Ecology & Systematics |             | 1.0          | 9.1                                    |              | 9.1       |
| 11111                                  | K. Goldman                  | Doctoral Candidate                     |             | 6.0          | 3.6                                    |              | 21.6      |
|  |                             |  |             |              |  |              | 0.0       |
|  |                             |  |             |              |  |              | 0.0       |
|  |                             |  |             |              |  |              | 0.0       |
| S.C.M.                                 |                             |  |             |              |  |              | 0.0       |
|  | 2<br>                       |  |             |              |  |              | 0.0       |
|  |                             |  |             |              |  |              | 0.0       |
|  |                             |  |             |              |  |              | 0.0       |
|  |                             |  |             |              |  |              | 0.0       |
|  |                             |  |             |              |  |              | 0.0       |
|  |                             |  |             |              |  |              | 0.0       |
|  |                             | Subtotal                               |             | 7.0          | 12.7                                   | 0.0          |           |
|  |                             |  |             |              | Per                                    | sonnel Total | \$30.7    |
| Trav                                   | vel Costs:                  |  | Ticket      | Round        | Total                                  | Daily        | Proposed  |
|  | Description                 |  | Price       | Trips        | Days                                   | Per Diem     | FY 1999   |
|  | Transportation from VA to A | Inchorage, AK to Seward, AK            | 1.2         | 6            | 73                                     | 0.176        | 20.0      |
|  | Alaska: vessel days at redu | uced per diem                          |             |              | 9                                      | 0.025        | 0.2       |
|  | AES Conference: Penn Sta    | ate, University Park, PA               | 0.3         | 2            | 14                                     | 0.128        | 2.4       |
|  | EVOS Conference: Anchor     | age, AK                                | 0.8         | 2            | 12                                     | 0.179        | 3.7       |
| 111 111 111 111 111 111 111 111 111 11 |                             |  |             |              |  |              | 0.0       |
|  |                             |  |             |              |  |              | 0.0       |
|  |                             |  |             |              |  |              | 0.0       |
|  |                             |  |             |              |  |              | 0.0       |
|  |                             |  |             |              |  |              | 0.0       |
|  |                             |  |             |              |  |              | 0.0       |
|  |                             |  |             |              |  |              | 0.0       |
|  |                             |  | <u> </u>    |              |  |              | 0.0       |
|  | <b>744</b>                  |  |             |              |  | Travel Total | \$26.3    |
| <b></b>                                |                             | I                                      |             |              |  | r            |           |
|  |                             | Project Number:                        |             |              |  | F            | ORM 4B    |
|  |                             | Project Title: Aspects of Salmon S     | Shark Ecolo | gy in Alaska | Waters,                                | F            | Personnel |
|  |                             | Submitted under the BAA                |             |              |  |              | & Travel  |
|  |                             | Name: Virginia Institute of Marino     | Science     |              |  |              |           |
| Prov                                   | l                           |  | Ocience     |              |  | L            |           |
| - FIEL                                 | Jaieu, 4/10/30              |  |             |              | ······································ |              | 1110100   |

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## FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

| Contractual Costs:  | Proposed                              |
|---|---------------------------------------|
| Description   | FY 1999                               |
| Observer Spots on Sport Fishing Vessel (collection of vertebrae and related biological data, tagging w/ADFG streamer tags and satellite transmitters, injecting with Oxytetracycline and releasing) \$100/day for 10 trips: Capt. Candopoulos will match w/10 |                                       |
| trips at no cost.   | 1.0                                   |
| Charter Vessel (collection of vertebrae and related biological data, tagging w/ADFG streamer tags and satellite transmitters,   |                                       |
| injecting with Oxytetracycline, releasing and tracking with acoustic transmitters) \$2,400/day for 20 days.   | 48.0                                  |
| Charter Vessel for temperature tracks. (Capt. Candopoulos is not charging additional fee for 24 hour use vs. 12 hr. use for day trips   |                                       |
| as a cooperative gesture - normally fee would be higher) \$2,400/day for 6 days.  | 14.4                                  |
| ARGOS, Annual Satellite Network Platform Time   | 7.0                                   |
|   | · · · · · · · · · · · · · · · · · · · |
| Contractual Total   | \$70.4                                |
| Commodities Costs:  | Proposed                              |
|   | FY 1999                               |
| Oxytetracycline (500 ml bottles, 25 @\$55)  | 1.4                                   |
| Locking Noodlos (500 packs @ \$110)   | 0.3                                   |
| Batterios   | 0.1                                   |
| Misc. Field Supplies  | 0.2                                   |
|   | 0.0                                   |
|   |                                       |
|   |                                       |
|   |                                       |
|   |                                       |
|   |                                       |
|   |                                       |
| Commodities Total   | \$2.3                                 |
|   |                                       |
| Project Number:   | ORM 4B                                |
| Project Title: Aspects of Salmon Shark Ecology in Alaska Waters, Co   | ntractual &                           |
| Submitted under the BAA.  | mmodities                             |
| Name: Virginia Institute of Marine Science  | DETAIL                                |
| Prepared: 4/10/98   | ·····                                 |

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## FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

| New Equipment Purchases:  | Number       | Unit         | Proposed              |
|---|--------------|--------------|-----------------------|
| Description   | of Units     | Price        | FY 1999               |
| Acoustic Transmitters   | 7            | 1.10         | 7.7                   |
| Satellite Transmitters  | 25           | 2.80         | 70.0                  |
| Oxytetracycline injection systems   | 10           | 0.08         | 0.8                   |
|   |              |              | 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 Equ      | ipment Total | \$78.5                |
| Existing Equipment Usage:   |              | Number       |                       |
| Description   |              | of Units     |                       |
| Hydrophone  |              | 1            |                       |
| Acoustic recording equipment for hydrophone   |              | 1            |                       |
| Decoding software for data conversion   |              | 1            |                       |
| Tagging poles, 2 injection systems, hook and line fishing gear                                  |              | 1            |                       |
|   |              |              |                       |
|   |              | -            |                       |
|   |              |              |                       |
|   |              |              |                       |
|   |              |              |                       |
|   |              |              |                       |
|   |              |              |                       |
|   |              |              | and the second second |
|   |              |              |                       |
|   |              |              |                       |
| Project Number:   |              |              | ORM 4B                |
| Project Title: Aspects of Salmon Shark Ecology in Alaska  | Waters.      |              | quinment              |
| <b>FY 99</b>  | , indicatory |              |                       |
| Nemer Virginia Institute of Marine Science  |              |              |                       |
| INAME: VIrginia Institute of Marine Science   |              | L            |                       |
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# Investigations of Salmon Shark Diet and Predation on Spill Injured Resources in Prince William Sound

| Project Number:           | 99 <u>409</u>   |                           |
|---------------------------|---|---------------------------|
| Restoration Category:     | Research  |                           |
| Proposer:                 | Audra L. J. Brase and Leland B<br>NMFS, Auke Bay Laboratory<br>ABL Program Manager: Dr. Sta<br>NOAA Program Manager: Brue | an Rice<br>ce Wright      |
| Lead Trustee Agency:      | NOAA  | DECEMER                   |
| Cooperating Agencies:     | none  |                           |
| Alaska Sea Life Center:   | no  | APR 1 4 1998              |
| Duration:                 | Year 1 of 3 year project  | TRUSTEE COUNCIL           |
| Cost FY 99:               | \$91,200  |                           |
| Cost FY 00:               | \$91,200  |                           |
| Cost FY 01:               | \$44,000  |                           |
| Geographic Area:          | Prince William Sound  |                           |
| Injured Resource/Service: | Harbor seals, pink salmon, Paci   | fic herring, marine birds |

#### ABSTRACT

The salmon shark, *Lamna ditropis*, is the predominant large predatory fish species in Prince William Sound (PWS). Anecdotal evidence suggests a dramatic increase in salmon shark biomass within the *Exxon Valdez* oil spill (EVOS) region in recent years. Little is known of the biological and trophic importance of these sharks as apex predators in the PWS ecosystem. In areas of high abundance, salmon sharks have the potential to significantly impact a number of spill injured species in the region. Salmon sharks are known predators of pink salmon, rockfish and Pacific herring; and are potential predators of marine birds and harbor seals. This study of the spatial and temporal variation in the diets of PWS salmon sharks will help fill a void in our understanding of the trophic interactions of these sharks with spill injured resources.

#### **INTRODUCTION**

The salmon shark, *Lamna ditropis*, occurs in Prince William Sound (PWS) and throughout the North Pacific (Strasburg 1958, Compagno 1984). Although this shark has a wide distribution, little is know about its temporal feeding ecology and its significance as an apex predator. In PWS, anecdotal information and observations suggest a significant increase in salmon shark abundance in recent years. Underwater videos from the APEX study (Haldorson, L. J. pers. comm.) observed salmon sharks congregating in large numbers in PWS. Sport fisherman have observed large aggregations of salmon sharks feeding upon returning adult salmon. Observations of group feeding behavior in PWS include: sharks in pursuit of prey (both fish and marine birds) and co-feeding with marine mammals such as sea lions (Borer, L. pers. comm.). Preliminary scientific study of the PWS salmon sharks has been performed by Ken Goldman, Virginia Institute of Marine Science (VIMS). He has documented some of the aforementioned feeding behaviors and also size and sexual segregation within schools of salmon sharks.

These preliminary observations suggest the feasibility of a targeted study in which the predatory role of these large fish might be defined within the bounds of PWS. Salmon sharks may reach 4 m in length and weigh over 400 kg. A predator of this magnitude could prey upon almost any species found within PWS, including several of the marine mammal species, thereby impacting the species composition of the region's upper trophic system.

Although it is known that salmon sharks feed on salmon, their complete prey composition in PWS is not known. This is particularly important for the 10 month period that salmon are not present in the Sound. Salmon shark residency time within PWS is also unknown. It has been suggested that the large numbers recently observed in the Sound are due to increased hatchery production and the sharks are simply responding to an increased food source. If this is true, are the sharks only affecting the Sound for a short period, or have they become residents and therefore have a greater than seasonal effect?

This study proposes two components. The first will be a two year directed field study of temporal and spatial observations of changes in salmon shark diets. We will attempt to study the diets of salmon sharks through the "lean" months of little to no salmon influx. This field component will rely on evidence of salmon sharks within PWS throughout the year and on our ability to capture them.

The third year will consist of the second component, a synthesis which will bring together information from several sources, including ADF&G management, the EVOS ecosystem modelers and shark biologists who are interested in other biological aspects of the sharks. Providing key biological feeding information on this species will help answer the many questions which exist about this species and its role in the PWS ecosystem.

#### NEED FOR THE PROJECT

#### A. Statement of the Problem

Prepared 4/07/98

Anecdotal information and observations in PWS suggest that salmon shark abundance has increased dramatically in the years following the *Exxon Valdez* oil spill. Little is known of the sharks' seasonal residency, abundance, distribution, or feeding ecology in the spill region, leaving a void in our understanding of the biological and trophic importance of these predators.

The interaction of salmon sharks with their prey and other predators has not been studied in PWS. As the predominant large predatory fish species in the PWS ecosystem, salmon sharks potentially consume a variety of fish species that are commercially and ecologically important. Known prey species of the salmon shark include Pacific salmon, Pacific herring, Pacific cod, Pacific tomcod, walleye pollock (cited in Paust 1986) and rockfish (Ken Goldman pers. comm.). In areas of high abundance, predation can be significant (Sano 1959, 1960; cited in Paust 1986). It is unclear whether salmon shark abundance is seasonal, only co-occurring with the large aggregations of adult salmon returning to hatcheries, or if they also reside in the Sound during fall, winter, or spring. If shark numbers and length of residency in PWS persist beyond the short period of adult salmon abundance, they may have a significant predatory impact on a number of fish species, marine birds, and harbor seals. A study of salmon shark temporal residency and feeding ecology is necessary to gain insight into their impact on spill injured resources such as pink salmon, Pacific herring, and harbor seals in the PWS region.

#### B. Rationale

One focus of the EVOS Trustee Council is an ecosystem approach to restoration. It is unknown what impact an increase in salmon shark numbers may have on the PWS ecosystem. It is therefore important to document their role as apex predators in the spill region. An increased understanding of the food habits and trophic interactions of salmon sharks will compliment the EVOS Trustee Council objectives of an ecosystem approach to restoration.

The study will fill a void in the understanding of the trophic interactions between salmon shark populations and their prey in PWS. Research into the feeding habits of salmon sharks will help quantify salmon shark affects on commercially and ecologically important prey species and will contribute to our understanding of their role as apex predators in the spill region. The emphasis of our research will be to identify prey species, or prey groups, and examine temporal and spatial variation in prey consumed by salmon sharks. We are particularly interested in salmon shark predation on injured resources such as Pacific salmon, Pacific herring, and the possible predation on marine birds and harbor seals in PWS. The overall objective of the study is to contribute to the understanding of salmon shark ecology and document predator/prey interactions in the PWS ecosystem.

#### **C.** Location

Northeast and Southwest Prince William Sound.

#### COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

In both the first and second years of this study we will incorporate a traditional and local

Prepared 4/07/98

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knowledge component. The villages of Chenega and Tatitlik will be asked to further our knowledge of salmon shark abundance and distribution. Depending on the results of these discussions and our voluntary sampling program, we will hire local fishermen to catch salmon sharks in both the early spring and late fall when we may experience gaps in our temporal comparisons.

## **PROJECT DESIGN**

#### A. Objectives

#### **Overall objectives:**

- 1. Identify and enumerate prey species or prey groups consumed by salmon sharks in PWS.
- 2. Determine temporal and spatial variation in the prey consumed by salmon sharks in PWS.

#### Seasonal Objectives: Fall 1998:

- 1. Perform stomach contents analysis on salmon shark stomachs collected by Ken Goldman and ADF&G in the summer of 1998.
- 2. Make contacts with villagers and local fisherman about their seasonal experiences/ observations of salmon sharks throughout PWS.
- 3. Collect shark bycatch stomach samples from PWS commercial fishermen and researchers.

#### Spring 1999:

1. After identifying sites and times where salmon sharks have been consistently observed in the early spring, hire a charter to sample the area for 5 days to tag and release and collect stomach and vertebral samples from salmon sharks.

#### Summer 1999:

1. Tag and release and collect shark stomach and vertebral samples from sport fishing charters/ commercial fisherman and PWS researchers.

#### Fall 1999:

- 1. After identifying sites and times where salmon sharks have been consistently observed, hire a charter to sample the area for 5 days to tag and release and collect stomach and vertebral samples from salmon sharks.
- 2. Finish processing the stomachs collected in 1999.
- 3) Produce a preliminary report summarizing the temporal and spacial differences in the feeding habits of the PWS salmon sharks.

#### Spring 2000:

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1. Hire another charter to repeat previous years sampling.

## **Summer 2000:**

1. Repeat collections of shark stomach samples from sport fishing charters/ commercial fisherman and PWS researchers.

## Fall 2000:

- 1. Hire another charter to repeat previous years sampling
- 2. Finish processing the stomachs collected in 2000.

## Spring 2001:

3. Produce a final report summarizing the inter-annual differences in the temporal and spacial feeding habits of the PWS salmon sharks.

## Secondary objectives:

- 1. \*Assist in estimating population size with mark recapture experimentation. ADF&G and VIMS/ Ken Goldman
- 2. \*Assist in the experimental external tagging and injection of oxytetracycline (OTC), for age validation, of salmon sharks. ADF&G and VIMS/ Ken Goldman
- 3. \*Assist in establishing management strategies by modeling an age-growth relationship and demographics. VIMS/ Ken Goldman
- 4. \*Assist in tagging and tracking salmon sharks with satellite telemetry tags. Stanford/ Barbara Block
- \* Not primary objectives of this study, but will be completed as time allows in the interests of co-operative science. No further money is associated with these components of the study, each agency will provide the necessary materials to us and we will simply tag the shark or collect a sample.

## **B.** Methods

This project will obtain stomach samples in three ways:

The first method of collection will be voluntary and opportunistic contributions of salmon shark bycatch from the PWS commercial fishing fleet: purse seiners (July/ Aug), sablefish/ halibut longliners (Feb/March), gillnetters (June/ July), walleye pollock trawlers etc..

The second will be directed sampling in which we will target salmon shark schools using sport fishing charter fishermen such as: Bob Candopoulos (Saltwater Safari Co., Seward), Bob Day (Sound Adventures, Seward), and Luke Borer (sport fishing charters, Cordova). These fisherman will collect samples in July and August, peak availability of salmon sharks.

The third will be the chartering of local commercial fisherman to catch sharks in the off season (early spring/ late fall) when the sport fishing charters do not target the salmon sharks due to excessive rod-hours required for a product. This is a very important component to this study due to the uncertainty of what the salmon sharks are feeding upon in the times of low salmon abundance.

After a shark is caught, length measurements will be collected, total weight measured or estimated (from length/girth measurements), and sex determined. After measurement, if the shark is to be kept alive it will be tagged with a numbered ADF&G streamer tag, simultaneously injected with oxytetracycline for age validation; and released. If the shark is to be killed, vertebral and stomach content samples will be collected and maturity state will be determined. For females, size and presence of "pups", and for males clasper size will be recorded.

Other biological characteristics of the salmon sharks will be noted, such as: feeding behavior, schooling activities, interactions with marine mammals and/or birds, etc..

Stomach content ID will occur in one of two ways: 1) The contents will be identified onboard the collection vessel or, 2) The stomachs will be removed, frozen and shipped to the National Marine Fisheries Service, Auke Bay Laboratory (ABL) for identification. Standard methods for these procedures will include weighing the full gut, identifying all contents to the highest taxonomic resolution possible, estimating the volumetric component of each prey item or prey group, counting the total items, and weighing the empty gut.

Vertebral samples will be frozen and sent to Ken Goldman at VIMS for age determination. He will be producing an age-growth relationship and modeling the demographics of salmon sharks in Gulf of Alaska waters.

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

The major activities for this project include use of NOAA/ NMFS/ ABL biological lab space for sample analysis and storage, access to agency library materials and literature, and computers for database management and statistical analysis.

The Virginia Institute of Marine Science (VIMS) via Ken Goldman will provide us with all salmon shark stomach samples they collect from PWS in July and August 1998.

The Alaska Department of Fish and Game will provide us with salmon shark tags, oxytetracycline, tagging equipment and any stomach samples they collect in their sampling program.

Stanford University via Barbara Block will provide us with satellite tags and her program will perform the tracking of the sharks.

#### SCHEDULE

Prepared 4/07/98

## A. Measurable Project Tasks for FY 99-01 (October 1, 1998-September 30, 2001)

| June 1998-September 1998:    | Collection of opportunistic samples by Ken Goldman and others.  |
|------------------------------|---|
| October 1998-February 1999:  | Make contacts with commercial fishing fleet for collection of vertebral and stomach contents samples.               |
| March 1999:                  | PI's attend EVOS annual meeting and present a "pre-study poster".   |
| March 1999-September 1999:   | Collection and analysis of samples, both directed samples and samples from commercial and sport fishermen/charters. |
| October 1999-January 2000:   | Data write up, preparation for EVOS annual meeting.   |
| January 2000:                | EVOS Annual meeting PIs will present results from first year.   |
| March 2000-September 2000:   | Second year of collection and analysis of samples, both by agency and from commercial and sport fishermen/charters. |
| October 2000-September 2001: | Produce final reports and peer reviewed publications.   |

#### **B.** Project Milestones and Endpoints

Year 1:

Milestone: Be able to catch sharks in off-season (early spring/ late fall). Endpoint: Produce feeding database from 98-99 years data and first year food habits annual report.

Year 2:

Milestone: Add to feeding database.

Endpoint: Produce a second food habits annual report containing inter-annual comparisons.

Year 3:

Milestone: Cooperative data sharing.

Endpoint: Produce final synthesis report with quantitative aspects. Produce a peer reviewed report summarizing results in terms of spatial and temporal variation in salmon shark diets in PWS.

## **C.** Completion Date

September 30, 2001

Prepared 4/07/98

## PUBLICATIONS AND REPORTS

At least five written products will be produced from this study:

- 1. Two EVOS annual reports describing each years results.
- 2. An EVOS final report and/ or NOAA technical report describing the temporal, spacial, and inter-annual differences in the food habits of PWS salmon sharks. This will also include any observations of feeding behavior.
- 3. A peer reviewed report describing the temporal, spacial, and inter-annual differences in the food habits of PWS salmon sharks.
- 4. A peer reviewed and co-operative synthesis report which will bring together our feeding data with salmon shark population structure, distribution and abundance data.

## **PROFESSIONAL CONFERENCES**

The PIs will attend the EVOS Annual Meetings in the winter of 1999 and 2000 and American Elasmobranch Society (AES) Annual Meeting in the summer of 2000 (location and exact date TBA).

#### NORMAL AGENCY MANAGEMENT

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

## COORDINATION AND INTEGRATION OF RESTORATION EFFORT

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

## PROPOSED PRINCIPAL INVESTIGATORS

Audra L. J. Brase Auke Bay Laboratory, NMFS 11305 Glacier Highway Juneau, Alaska 99801-8626 (907)789-6057 FAX (907)789-6094 E-MAIL: Audra.Brase@noaa.gov

Audra Brase has been employed in the fisheries field for 5 years. She holds a Master of Science degree (1996) in Fisheries from the University of Alaska Fairbanks. The majority of her past work has been in the field of trophic ecology. Past research includes studies of larval walleye pollock feeding, plankton dynamics, population estimates and juvenile salmonids. She has worked on the EVOS Alaska Predator Ecosystem Experiment (APEX) forage fish component (163C) for over 1 year.

Leland (Lee) B. Hulbert Auke Bay Laboratory, NMFS 11305 Glacier Highway Juneau, Alaska 99801-8626 (907)789-6058 FAX (907)789-6094 E-MAIL: Lee.Hulbert@noaa.gov

Lee has been employed as a Fisheries Research Biologist at the Auke Bay Laboratory, NMFS for 1 year and has two years prior work experience in fisheries biology at ABL. He holds a B.S. degree (1992) in Fisheries Biology from Humboldt State University. He has extensive commercial fishing experience in Prince William Sound and has also fished commercially in Bristol Bay, Togiak, Cook Inlet, the Gulf of Alaska, and S.E. Alaska. He has worked on the EVOS Alaska Predator Ecosystem Experiment (APEX) forage fish component (163C) for over 2 years.

#### **OTHER PERSONNEL**

- Kenneth (Ken) Goldman, PhD candidate, Virginia Institute of Marine Science, VA Expertise in aging of sharks.
- John A. Musick, PhD, Professor, Virginia Institute of Marine Science, VA Ken Goldman's advisor.

William (Bill) Bechtol, ADF&G Homer, AK Fisheries biologist involved in management of potential salmon shark fishery.

Doug Vincent-Lang, ADF&G Anchorage, AK Fisheries biologist involved in management of potential salmon shark fishery.

Barbara Block, PhD, Associate Professor Stanford University, CA Expertise in satellite telemetry of large fishes (marlin, tuna, sharks).

#### LITERATURE CITED

Borer, L. Personal Communication. Charter fishermen, Cordova, Alaska.

- Compagno, L. J. V. 1984. FAO species catalog, V. 4: Sharks of the world; Part I Hexanchiformes to lamniformes. Fisheries Synopsis No. 125. Rome, Italy: Food and Agricultural Organization of the United Nations.
- Goldman, K. Personal Communication. Ph.D. candidate, Virginia Institute of Marine Science, Virginia.
- Haldorson, L. J. Personal Communication. Principal Investigator EVOS Alaska Predator Ecosystem Experiment (APEX) study. Professor, University of Alaska Fairbanks -Juneau Center School of Fisheries and Ocean Sciences, Juneau, Alaska.
- Paust, B. and R. Smith. 1986. Salmon Shark Manual: The development of a commercial salmon shark, *Lamna ditropis*, fishery in the North Pacific. Alaska Sea Grant Publication 86-01.
- Sano, O. 1959. Notes on salmon shark as a predator of salmon (*Oncorhynchus* sp.) In the North Pacific Ocean. Hokkaido Prefectural Fish. Res. Lab. 16(2): 65-75.
- Sano, O. 1960. The Investigation of salmon shark as a predator of salmon in the North Pacific, 1959. Bull. Hokkaido Reg. Fish. Res. Lab. 22: 68-82.
- Strasburg, D. W. 1958. Distribution abundance and habitats of pelagic sharks in the central Pacific Ocean. Fisheries Bulletin No. 138. Washington D. C.: U. S. Fish and Wildlife Service.

FY 99 EXXON VALDEZ TRUSTL UNCIL PROJECT BUDGET October 1, 1998 - September 30, 1999

|   | Authorized  | Proposed   | and the second second         |                             |                              | Warden and and a   | 1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1. |  |
|---|---|--|-------------------------------|-----------------------------|------------------------------|--------------------|--|--|
| Budget Category:  | FY 1998   | FY 1999  |                               |                             |                              |                    |  |  |
|   |   |  |                               |                             |                              |                    |  |  |
| Personnel   |   | \$44.0   | national street second as the | a and the bases             |                              |                    | Support of the second                  |  |
| Travel  |   | \$8.2  |                               |                             |                              |                    |  |  |
| Contractual   |   | \$29.8   |                               |                             | and the second second second |                    | e gang one tot                         |  |
| Commodities   |   | \$0.0  | 1.11<br>T                     |                             |                              |                    |  |  |
| Equipment   |   | \$0.5  |                               | LONG RA                     | NGE FUNDIN                   | <b>IG REQUIREN</b> | MENTS                                  |  |
| Subtotal  | \$0.0   | \$82.5   |                               | Estimated                   | Estimated                    | Estimated          |  |  |
| General Administration  |   | \$8.7  |                               | FY 2000                     | FY 2001                      | FY 2002            |  |  |
| Project Total   | \$0.0   | \$91.2   |                               | \$91.2                      | \$44.0                       |                    |  |  |
|   |   |  |                               |                             |                              | 2. 1 A             |  | a second and a second |
| Full-time Equivalents (FTE)   |   | 0.8  |                               |                             |                              |                    |  |  |
|   |   |  | Dollar amount                 | s are shown ir              | n thousands of               | dollars.           |  |  |
| Other Resources   |   | \$12.8   |                               |                             |                              |                    |  |  |
| NOAA Contributions: Co PI A. B<br>K for a total contribution of: 12.8 | Brase, .5 mo @<br>8K  | : 1.8K , Co-PI                                       | L. Hulbert 1.5 i              | mo.@ 5.4K, F                | ishery Biologis              | st M. Sturdeva     | int 1 mo @ 5.6                         | 5  |
| FY 99   | Project Nun<br>Project Title<br>Spill Injurec<br>Agency: No | nber: 99<br>e: Investigat<br>I Resources<br>OAA/ ABL | tions of Salm<br>in Prince W  | ion Shark D<br>/illiam Soun | iet and Pred                 | dation on          | I<br>T<br>S                            | FORM 3A<br>TRUSTEE<br>AGENCY<br>SUMMARY  |

## FY 99 EXXON VALDEZ TRUST UNCIL PROJECT BUDGET October 1, 1998 - September 30, 1999

| Personnel Costs:                     | Personnel Costs:             |          | Months   | Monthly |                | Proposed |
|--------------------------------------|------------------------------|----------|----------|---------|----------------|----------|
| Name                                 | Position Description         | Step     | Budgeted | Costs   | Overtime       | FY 1999  |
| Audra Lee Janiak Brase               | Fisheries Research Biologist | GS/ 9/ 1 | 5.0      | 4.4     | 0.0            | 22.0     |
| Leland B. Hulbert                    | Fisheries Research Biologist | GS/ 9/ 1 | 5.0      | 4.4     | 0.0            | 22.0     |
|                                      |                              |          |          |         |                | 0.0      |
|                                      |                              |          |          |         |                | 0.0      |
|                                      |                              |          |          |         |                | 0.0      |
|                                      |                              |          |          |         |                | 0.0      |
|                                      |                              |          |          |         |                | 0.0      |
|                                      |                              |          |          |         |                | 0.0      |
|                                      |                              |          |          |         |                | 0.0      |
|                                      |                              |          |          |         |                | 0.0      |
|                                      |                              |          |          |         |                | 0.0      |
|                                      |                              |          |          |         |                | 0.0      |
|                                      | Subtot                       | al       | 10.0     | 8.8     | 0.0            |          |
|                                      |                              |          |          | Per     | sonnel Total   | \$44.0   |
| Travel Costs:                        |                              | Ticket   | Round    | Total   | Daily          | Proposed |
| Description                          |                              | Price    | Trips    | Days    | Per Diem       | FY 1999  |
| RT Juneau to Cordova for tradit      | ional knowledge seminar      | 0.4      | 1        | 2       | 0.2            | 1.2      |
| RT Cordova to Chenega for trac       | litional knowledge seminar   | 0.8      | 1        | 1       | 0.2            | 0.5      |
| RT Cordova to Tatitlik for tradition | onal knowledge seminar       | 0.3      | . 1      | 1       | 0.2            | 0.5      |
|                                      |                              |          |          |         |                | 0.0      |
| RT Juneau to Cordova for shark       | sport fishing charter        | 0.4      | 1        | 5       | 0.2            | 1.4      |
| RT Juneau to Seward for shark        | fishing charter              | 0.6      | 1        | 5       | 0.2            | 1.6      |
|                                      |                              |          | _        |         |                | 0.0      |
| RT Juneau to Anchorage for EV        | OS Annual Meeting            | 0.5      | 2        | 10      | 0.2            | 3.0      |
|                                      |                              |          |          |         |                | 0.0      |
|                                      |                              |          |          |         |                | 0.0      |
|                                      |                              |          |          |         |                | 0.0      |
|                                      |                              |          |          |         | Transfer 1     | 0.0      |
|                                      |                              |          |          |         | i ravei i otal | \$8.2    |
|                                      | Γ                            |          |          |         | <b></b>        |          |
|                                      | Project Number               |          |          |         | F              | ORM 3B   |

FY 99Project Number:<br/>Project Title: Investigations of Salmon Shark Diet and Predation on<br/>Spill Injured Resources in Prince William SoundFORM 3B<br/>Personnel<br/>& Travel<br/>DETAIL

## FY 99 EXXON VALDEZ TRUST UNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

| Contractual Costs:   |                     | Proposed    |
|--|---------------------|-------------|
| Description  |                     | FY 1999     |
| Chartering a commercial vessel to catch salmon sharks for 5 days                 |                     | 10.0        |
| Chartering a commercial vessel to catch salmon sharks for 5 days                 |                     | 10.0        |
| Contract for Ken Goldman to process vertebrae and collect stomach samples        |                     | 7.5         |
| 5 days observation time aboard Seward sport fishing charter vessel (\$100/ day)  |                     | 0.5         |
| 5 days observation time aboard Cordova sport fishing charter vessel (\$166/ day) |                     | 0.0         |
|  |                     | 0.0         |
| Shipping samples (\$50/ shipment)  |                     | 1.0         |
|  |                     |             |
|  |                     |             |
|  |                     |             |
|  |                     |             |
| When a non-trustee organization is used, the form 4A is required.                | Contractual Total   | \$29.8      |
| Commodities Costs:   |                     | Proposed    |
| Description  |                     | FY 1999     |
| none   |                     |             |
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|  | Commodition Total   |             |
|  | Commodities Total   | \$0.0       |
|  |                     |             |
| Project Number:  |                     |             |
| Project Title: Investigations of Salmon Shark Diet a                             | nd Predation on Cor | ntractual & |
| Spill Injured Resources in Prince William Sound                                  |                     | mmodities   |
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|  |                     |             |

## FY 99 EXXON VALDEZ TRUSTE

JNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

| New Equipment Purchases:  | Number    | Unit         | Proposed |
|---|-----------|--------------|----------|
| Description   | of Units  | Price        | FY 1999  |
| ziploc bags, coolers, wet-lock boxes, gloves, rain-gear, knives, scalpals, sharpening stones, etc |           |              | 0.5      |
|   |           |              | 0.0      |
|   |           |              | 0.0      |
|   |           |              | 0.0      |
|   |           |              | 0.0      |
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|   |           |              | 0.0      |
|   |           |              | 0.0      |
|   |           |              | 0.0      |
| These purchases associated with replacement equipment should be indicated by placement of an P    | Now Equ   | inmont Total | 0.0      |
| Existing Equipment Degree   | New Lyu   | Number       | φ0.0     |
| Existing Equipment Usage:   |           | of Unito     | Ageney   |
|   |           |              | Agency   |
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| r   |           |              |          |
| Project Number:   |           | F            | ORM 3B   |
| Project Title: Investigations of Salmon Shark Diet and Pre  | dation on | E F          | auinment |
| Spill Injured Resources in Prince William Sound   |           |              |          |
|   |           |              |          |
|   |           | L            |          |





# Seldovia Village Tribe

P.O. Drawer L Seldovia, Alaska 99663 (907) 234-7898 Fax: (907) 234-7637

Number: 99410

Title: Lower Cook Julet youth Area Watch

#### YOUTH AREA WATCH

#### Geographic Area:

Cook Inlet and Kachemak Bay including Seldovia Bay

The Seldovia Village Tribe is seeking funding for a Youth Area Watch, similiar to the Chugach School District currently funded project. Seldovia is an oil spill impacted area and developing, educating, and training students with skills that will assist in restoration process is vital to the community for now and in the future.

This project will involve students from Kenai Peninsula Borough School District - Seldovia, Port Graham and Nanwalek. These communities are oil spill impacted and would benefit immensily from this activity.

Youth Area Watch project provides students in the oil spill impacted area with research and monitoring projects funded through the Trustee Council. This project will assist students in the restoration process and help develop skills that will provide for oil spill restoration activities now and for the future. Creating an awareness and developing life-long skills in students that can be useful in adulthood are important to the oil spill impacted communities.

Projects that are important to Seldovia include: harbor seal biosampling, salmon enhancement projects, shellfish data collection including mussels, clams and chitons, fish monitoring. These project will help the students develop a better understanding of our wild resources, and may help in assisting in restoring declining populations. The success of long-term effective resoration and management of subsistence resources is dependent upon the youth of our communities.

Requesting technical assistance

APR 1 5 1998 EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL



# Juvenile Herring and Walleye Pollock Overwintering During an El Niño Event

| Project Number:                               | 41)<br>99 <del>***</del>       |   |
|---|--------------------------------|---|
| Restoration Category:                         | Research                       | DECEIVED                                  |
| Proposer:                                     | University of Alaska Fairbanks | APR 1 3 1998                              |
| Lead Trustee Agency:<br>Cooperating Agencies: | ADFG<br>none                   | EXXON VALDEZ OIL SPILL<br>TRUSTEE COUNCIL |
| Alaska SeaLife Center:                        | no                             |   |
| Duration:                                     | 1st year, 3-year project       |   |
| Cost FY 99:                                   | \$186,500                      |   |
| Cost FY 00:                                   | \$186,500                      |   |
| Cost FY 01:                                   | \$186,500                      |   |
| Geographic Area:                              | Prince William Sound           |   |
| Injured Resource/Service:                     | Pacific herring                |   |

## ABSTRACT

Sp ..

El Niño events are sources of thermal perturbations that marine organisms must adapt to. Year class strength of herring and pollock are strongly influenced by physical and biological conditions occurring during the juvenile phase; overwintering conditions appear to be critical. We hypothesize that the 1998 El Niño event could bring about herring and pollock prey availability fluctuations and shifts in metabolic rates, thus altering nutritional status and survival. We will test this hypothesis by comparing relative abundance, distribution, whole body energy, and feeding ecology of juvenile herring and pollock in nursery areas before, during, and after the El Niño event.
#### **INTRODUCTION**

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Overfishing is causing a world-wide crisis; 70% of the world's fish stocks are either depleted or almost depleted, according to the UN Food and Agriculture Organization. Thus, there is considerable movement toward integrating ecosystem considerations into fisheries and coastal resource management (Sharp 1995). Gaining insight into the impacts of anomalous thermal conditions upon coastal ecosystems has been given a high priority by NOAA. Such insight is critical for ecosystem fisheries management on both local and global scales. Currently, the consequences of warm periods on growth and survival of pelagic forage fishes have not been described. This proposed study will be a beginning point for determining if El Niño markedly affects the pelagic food web in coastal south-central Alaska.

Sea surface and benthic temperatures in the Gulf of Alaska undergo long-term warming and cooling cycles (Royer 1989). The interannual difference between temperatures of bottom water at 250 m depth during warm and cold periods is on the order of 4.5°C (Royer 1989). El Niño events are additional sources of thermal perturbations that marine organisms must adapt to; for example, a 40 g pollock at 7°C needs 200% more energy to meet metabolic needs than one at 3°C (Paul 1986).

This year's El Niño is the strongest oceanographic anomaly within the past 50 years. Both the rapid growth and absolute magnitude of this event have raised legitimate concerns about adverse impacts on the U.S. coastline and coastal fisheries. It is the third pulse perturbation affecting Prince William Sound's marine community in 34 years following the 1989 *Exxon Valdez* oil spill (36,000 metric tons of north Slope crude oil effecting 900 km of coast line in PWS), and the 1964 earthquake.

Fish communities in highly perturbed systems shift species composition and abundance to attain new equilibrium levels (Andersen and Ursin 1978, Auster 1988). The 1989 *Exxon Valdez* oil spill was an anthropogenic perturbation occuring in between two major natural pulse perturbations, the earthquake and the El Niño. Therefore, the *Exxon Valdez* oil spill reduced the time the marine community has to stabilize from 34 years to 9 years. No government agency has programs examining this type of chaotic pulse perturbation.

The terminating SEA project was funded to sample juvenile herring and pollock during one winter (1996–1997). Our proposed sampling protocol will allow direct statistical comparisons with the SEA project work, which is the only data base of its type (for example, continuous temperature measurements at three depths in four bays since March 1996). No agency, including the Alaska Department of Fish and Game or the National Oceanic and Atmospheric Administration (NOAA), has a statistically rigorous temporal and spatial data base measuring the pre-, El Niño, and post-conditions of the near-shore marine environment in Prince William Sound.

Prince William Sound (PWS) contains a biologically rich, poorly known, high-latitude coastal ecosystem (Paine et al. 1996). Pacific herring (*Clupea pallasi*) and walleye pollock (*Theragra chalcogramma*) are the primary pelagic forage fishes in the region and are important prey of sea birds, marine mammals, and other fishes; many of these species are on the "not recovering" EVOS list and are the focus of major research projects (NVP and APEX). They also support commercial and subsistence harvests. The PWS herring population crashed in 1993 (Paine et al.

Prepared 04/09/98

1996), but appears to be recovering. A limited fishery occurred during winter-spring of 1996–97. Presently, herring and pollock represent ~84% of the residential nekton and nektobenthos community in PWS (Stokesbury unpublished data). Preliminary data indicate that year-class strength of herring and pollock is strongly influenced by the physical and biological conditions occurring during their first year of life; overwintering conditions appear to be critical.

As part of the EVOS-funded SEA project (components 98320-T and 98320-U) the primary assessment of abundance, distribution, and nutritional status of juvenile herring and pollock has been conducted in PWS. Broadscale surveys were conducted in October 1995, and March and July 1996; these indicated that the bays within PWS were nursery areas where juvenile herring spent the first two years of their life cycle (Stokesbury unpublished data). Based on this distribution a systematic factorial sampling design was created. Four bays—Eaglek, Whale, Zaikof, and Simpson—were sampled during October 1995: March, May, June, July, August, and October 1996, and March, May, July, and August 1997. Measurements of fish densities and distribution (based on acoustic surveys with net collection verification), age–weight–length, stomach contents, and energetic measurements for herring and pollock; and zooplankton species' composition, temperature, salinity, light intensity, bathymetry, and freshwater input were collected. Further, temperature loggers (30 min interval) were placed at 5, 25, and 50 m within each bay during March 1996, providing a continuous temperature data series. SEA is terminating its field program with a final sample in March 1998.

## NEED FOR THE PROJECT

### A. Statement of Problem

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For age 0 pelagic fishes in high latitude areas the first winter appears to be a critical period in the recruitment process. Pacific herring store energy during the spring and summer months and use it to survive the winter (Paul et al. 1997; Paul and Paul 1997). Walleye pollock must feed throughout the winter since they do not store large amounts of energy the way herring do (Paul unpublished). The extreme oceanographic events associated with this winter's El Niño will occur at the critical period in both species' juvenile life cycle. Warmer than normal conditions could cause higher metabolic demands for both herring and pollock and their prey. The herring population in PWS is at an extremely sensitive phase as it is recovering from a severe crash. If the El Niño has detrimental effects on lower trophic levels while increasing the fishes' metabolic rate, the extent of starvation during the winter could be altered with disastrous results for the partially recovered herring population. Preliminary results from March 1998 suggest that the herring population may be lower than the 1997 ADFG prediction (J. Kirsch, personal communication).

## **B.** Rationale/Link to Restoration

This information will enable us to understand the dynamics of the recovery of the herring species; it will aid in future fisheries management of the resource and provide critical information for other "not recovered" species that rely on Pacific herring and walleye pollock as primary forage prey in PWS.

### C. Location

Our study area is Prince William Sound. The benefits from this research will directly affect the Sound and the information will also be applicable to many other areas, species, and fisheries. Cordova is the logistical base for the departure of vessels.

#### COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Cordova-area residents participate directly by bidding on our ship charters. We have used traditional knowledge of herring distribution for our survey design, and we also employ local Cordovans as well as other Alaska residents as technicians, vessel owners, and vessel crew. We purchase supplies, fuel, and equipment locally and often use local hotels or bed-and-breakfasts during our stays. We make our data and impressions readily available to ADFG Cordova herring researchers and managers to aid in their resource management decisions.

#### **PROJECT DESIGN**

#### A. Objectives

The research objectives of this project are to:

- 1. Measure the relative abundance, distribution patterns, length, wet weight, and whole body energy content of age 0 herring and pollock in four bays through the winter of 1998–1999.
- 2. Examine the feeding ecology of herring and pollock.
- 3. Compare these data with existing data for 1995–1997 and additional sampling (2 years) to detect anomalous El Niño-related conditions occurring in this coastal ecosystem.

#### **B.** Methods

We hypothesize that an El Niño event could bring about herring and pollock prey availability fluctuation and shifts in metabolic rates and thus alter their nutritional status and survival. These measurements will reflect the carrying capacity of the system during the El Niño event and allow comparisons with measurements from non-El Niño years. Fishes will be sampled during October 1998 and March 1999. (If the second year of this project is funded, sampling would be carried out in the same months during 1999–2000.)

We are using a factorial design based on Green's (1979) principles of sampling, which is statistically rigorous both spatially and temporally. Samples will be collected in Eaglek Bay, Whale Bay, Zaikof Bay, and Simpson Bay, which are spatially segregated in roughly the north, west, south, and east areas of PWS, respectively. Herring spawn and/or recruit within each of these bays, which are located at distinct positions along the prevailing Gulf of Alaska-influenced PWS current. Upon entering each bay a series of CTD water profiles and vertical zooplankton tows from the bottom and from 30 m depth will be collected. A series of acoustic transects, spaced at 0.25 km intervals and beginning at 2000 hours, will be completed to measure fish

Prepared 04/09/98

densities and spatial distribution (primarily for herring and pollock). Several seine collections will be made following the acoustic survey to validate the acoustic signal and to provide fish samples for age–length–weight, energetic, and diet measurements. The continuous data loggers will be downloaded, replaced if necessary, and reset. Finally, a repeat series of CTD and zooplankton samples will be completed during daylight hours just prior to departure for the next bay.

Seine catch data will be examined to determine the species proportion and size modes for the acoustic echo integration measurements  $(kg \cdot m^{-3})$  and converted into numbers of individual fish per species and per size mode, along each transect within each bay. Stomach contents of fish from each site will be analyzed and the prey identified to the lowest possible taxonomic level. Zooplankton species composition will be determined and compared with the diet of fish from the same site. Whole body energy content  $(kJ \cdot g^{-1} \text{ wet weight})$  will be determined by bomb calorimetry. Fish will be freeze-dried and then placed in a convection oven at 60°C until they reach a constant weight. Dried whole bodies will then be ground in a mill with one subsample of 0.3 to 1.0 g burned per fish.

This is a statistically strong sampling procedure. All of the equipment including Sea-Bird CTD water profilers; temperature loggers; a 120-kHz BioSonics 101 echosounder; 250 x 20 m, 25 mm stretch mesh anchovy seine; zooplankton nets; and miscellaneous gear have been purchased by the terminating EVOS-funded SEA program.

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

The University of Alaska Fairbanks is the only entity included in this proposal.

Contracts under this proposal are for a vessel charter (through local PWS vessel owners) used to collect data in the field, and for the Prince William Sound Science Center to conduct acoustic surveys.

### SCHEDULE

### A. Measurable Project Tasks for FY 99 (October 1, 1998 – September 30, 1999)

| October 9–16:           | Fall cruise at four diel sites                        |
|-------------------------|---|
| November 1–February 28: | Analysis of acoustic survey, body energy, zooplankton |
|                         | composition, and diet composition data                |
| March 9–16:             | Spring cruise at four diel sites                      |
| March 31:               | Compose FY00 proposal                                 |
| April 1–September 30:   | Analysis of acoustic survey, body energy, zooplankton |
|                         | composition, and diet composition data                |

## **B.** Project Milestones and Endpoints

| FY 99<br>September: | Complete monitoring of El Niño event  |
|---------------------|---|
| FY 00<br>September: | Complete monitoring of first year after El Niño event   |
| FY 01<br>September: | Complete monitoring of second year after El Niño event; submit final report for the project and primary publication |

## C. Completion Date

September 30, 2001

## PUBLICATIONS AND REPORTS

We plan to submit articles for publication in journals, including the following, during FY99:

Distribution, abundance, and nutritional status of juvenile herring and walleye pollock overwintering in Prince William Sound, Alaska, during an El Niño event. Stokesbury, K. D. E., Foy, R., Paul, A. J. *Ecology*.

If the subsequent years are funded, then in FY01 we will submit:

Effects of an El Niño event in a high-latitude marine ecosystem. Stokesbury, K. D. E., Foy, R., Paul, A. J. *Nature*.

## **PROFESSIONAL CONFERENCES**

During FY99, we will attend the Annual EVOS Restoration Workshop in March.

## **COORDINATION AND INTEGRATION OF RESTORATION EFFORT**

This project will provide insight into the impact of anomalous thermal conditions on the productivity of the northern Gulf of Alaska coastal ecosystem. Therefore, it will benefit many state and federal projects currently underway in this region. This project will use a sampling protocol similar to that of the SEA herring project (98320-T and -U), allowing the continuation of that data base for monitoring purposes and field testing its overwintering model. It will add a near-shore component to the GLOBEC research currently underway. Further, it will provide critical information on primary forage fish in PWS; such data will aid EVOS-funded NVP and APEX projects. Finally it will be useful to ADFG as it will provide survival and condition estimates for recruiting juvenile herring and walleye pollock into the local fisheries.

#### **PROPOSED PRINCIPAL INVESTIGATORS**

Kevin D. E. Stokesbury University of Alaska Fairbanks Institute of Marine Science School of Fisheries and Ocean Sciences Fairbanks, AK 99775-7220 Phone: 907-474-5184 Fax: 907-474-1943 E-mail: kstokes@ims.uaf.edu

Augustus J. Paul University of Alaska Fairbanks Seward Marine Center Institute of Marine Science School of Fisheries and Ocean Sciences P.O. Box 730 Seward, AK 99664 Phone: 907-224-5261 Fax: 907-224-3392 E-mail: ffajp@uaf.edu

#### PRINCIPAL INVESTIGATORS

#### Kevin D. E. Stokesbury

K. D. E. Stokesbury is in charge of all field activities and coordination of all analyses among the many components of the SEA herring project. This coordination includes working with the hydroacoustics personnel at Prince William Sound Science Center and integrating the energetics analysis conducted by A. J. Paul. He is also responsible for statistical design and data analysis, and will write reports and journal articles for publication.

#### Education

Ph.D. Université Laval, Quebec City, Quebec, 1994; (Area of specialization: Marine Ecology). Programme d'apprentissage du français parlé et écrit. Université du Québec à Chicoutimi, 1990. M.Sc. Acadia University Wolfville, Nova Scotia, 1987; (Area of specialization: Marine

- M.Sc. Acadia University, Wolfville, Nova Scotia, 1987; (Area of specialization: Marine Ecology).
- B.Sc. (specialization), Acadia University, Wolfville, Nova Scotia, 1984; (Area of specialization: Marine Biology).

#### Work Experience

Research Associate, SEA Herring Project, University of Alaska Fairbanks; 2/25/96 to present Research Associate, EMAP (adjunct professor), Center for Marine Science Research, University of North Carolina at Wilmington; 5/27/94–2/10/96

- Ph.D. Graduate Student, Université Laval, Quebec, Canada; 9/1/90-10/27/94
- Biologist (Contract to Nova Divers), Protan Scotia Marine Canada Ltd., Lower Woods Harbour Nova Scotia, Canada; 11/8/89–5/3/90
- Biologist, MONENCO Maritimes Limited, Halifax, Nova Scotia, Canada; 8/25/89–11/7/89; 9/1/88 12/23/88; 9/1/87–11/15/87
- Diving Technician, Fisheries and Oceans Canada, Biological Research Station, St. Andrews, New Brunswick, Canada; 4/24/1988–8/19/1988
- Invertebrate Technician, Fisheries and Oceans Canada Biological Research Station, St. Andrews, New Brunswick, Canada; 1/4/88–3/31/88
- Diving Technician, Fisheries and Oceans Canada, St. Halifax, Nova Scotia, Canada; 5/1/87– 8/28/87; 5/1/82–8/28/84 summers only; 5/1/81–8/28/81
- Diver and field biologist, TPH Applied Fisheries Research, Wolfville, Nova Scotia, Canada; 5/1/86–8/30/86; 5/1/85–8/30/85

#### Publications

- Stokesbury, K. D. E. and S. W. Ross. 1997. Spatial distribution and an absolute density estimate of juvenile spot, *Leiostomus xanthurus*, in the tidal fringe bordering a North Carolina salt marsh. Mar. Ecol. Prog. Ser.149: 289–294
- Stokesbury, K. D. E. and J. H. Himmelman. 1995. Examination of orientation of the giant scallop, *Placopecten magellanicus*, in natural habitats. Can. J. Zool. 73:1945–1950
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- Stokesbury, K. D. E., and John H. Himmelman. 1993. Spatial distribution of the giant scallop *Placopecten magellanicus* in unharvested beds in the Baie des Chaleurs, Québec. Mar. Ecol. Prog. Ser. 96: 159–168.
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- Stokesbury, K. D. E., and M. J. Dadswell. 1991. Mortality of juvenile clupeids during passage through a tidal, low-head hydroelectric turbine at Annapolis Royal Nova Scotia. N. Am. J. Fish. Manag.11: 149–154.
- Stokesbury, K. D. E., and M. J. Dadswell. 1989. Seaward migration of juveniles of three herring species (*Alosa*) from an estuary in the Annapolis River, Nova Scotia. Can. Field-Nat. 103(3): 388–393.

#### **Augustus John Paul**

#### Education

Ph.D. 1987 Hokkaido University, Hokkaido, JapanM.S. 1973 University of AlaskaB.S. 1969 University of Massachusetts, Amherst

### Experience

Biological Oceanography and Marine Biology, Institute of Marine Science, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, 1971–present.

1989– Associate Professor of Marine Science

1982–1989 Research Associate

1977–1982 Oceanographer

1971–1977 Laboratory Assistant

### **Selected Publications**

- Paul, A. J., J. M. Paul and E. D. Brown. Fall and spring somatic energy content for Alaskan Pacific herring (*Clupea pallasi*) relative to age, size and sex. J. Exp. Mar. Biol. Ecol. In press.
- Paul, A. J., J. M. Paul and E. D. Brown. 1996. Ovarian energy content of Pacific herring from Prince William Sound, Alaska. Alaska Fishery Research Bulletin. 3(2):103–111.
- Paul, A. J., J. M. Paul and R. L. Smith. 1995. Compensatory growth in Alaska yellowfin sole, *Pleuronectes asper*, following food deprivation. *J. Fish. Biol.* 46:442–448.
- Paul, A. J., J. M. Paul and R. L. Smith. 1994. Energy and ration requirements of juvenile Pacific halibut (*Hippoglossus stenolepis*) based on energy consumption and growth rates. J. Fish. Biol. 44:1023–1031.
- Paul, A. J., J. M. Paul and R. L. Smith. 1993. The seasonal changes in somatic energy content of Gulf of Alaska yellowfin sole, *Pleuronectes asper. J. Fish. Biol.* 43:131–138.
- Paul, A. J., J. M. Paul and R. L. Smith. 1992. Energy and ration requirements of flathead sole (*Hippoglossoides elassodon* Jordan and Gilbert 1880) based on energy consumption and growth. *ICES J. Mar. Sci.* 49:413–416.
- Smith, R. L., A. J. Paul and J. M. Paul. 1991. Daily ration estimates for yellowfin sole, *Limanda aspera* (Pallas), based on laboratory consumption and growth. J. Fish. Biol. 38:243–250.
- Smith, R. L., A. J. Paul and J. M. Paul. 1990. Seasonal changes in energy and the energy cost of spawning in Gulf of Alaska Pacific cod. J. Fish. Biol. 36:307–316.

Prepared 04/09/98

- Paul, A. J., J. M. Paul and R. L. Smith. 1990. Consumption, growth and evacuation in Pacific cod, *Gadus macrocephalus*. J. Fish Biol. 37:117–124.
- Paul, A. J., J. M. Paul and R. L. Smith. 1990. Energy ingestion and conversion rate in pollock (*Theragra chalcogramma*) fed different prey types. J. Cons. Int. Exp. Mer 46:232–234.
- Paul, A. J., J. M. Paul and R. L. Smith. 1990. Rates of oxygen consumption of yellowfin sole, (*Limanda aspera* [Pallas]) relative to body size, food intake and temperature. J. Cons. Int. Exp. Mer. 47:205–207.
- Paul, A. J. and A. Fuji. 1989. Bioenergetics of the Alaskan crab *Chionoecetes bairdi* (Decapoda: Majidae). J. Crust. Biol. 9: 25–36.
- Smith, R. L., J. M. Paul and A. J. Paul. 1989. Gastric evacuation in walleye pollock, *Theragra chalcogramma. Can. J. Fish. Aquat. Sci.* 46(2):489–493.
- Paul, A. J., J. M. Paul and R. L. Smith. 1988. Respiratory energy requirements of the cod Gadus macrocephalus Tilesius relative to body size, food intake, and temperature. J. Exp. Mar. Biol. Ecol. 122:83–89.
- Smith, R., A. J. Paul and J. M. Paul. 1988. Aspects of energetics of adult walleye pollock, *Theragra chalcogramma* (Pallas), from Alaska. J. Fish Biol. 33:445–454.
- Paul, A. J. 1986. Respiration of juvenile pollock, *Theragra chalcogramma* (Pallas), relative to body size and temperature. *J. Exp. Mar. Biol. Ecol.* 97:287–293.
- Harris, R. K., T. Nishiyama and A. J. Paul. 1986. Carbon, nitrogen and caloric content of eggs, larvae, and juveniles of the walleye pollock, *Theragra chalcogramma*. J. Fish. Bio. 29:87– 98.

## LITERATURE CITED

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Auster, P. J. 1988. A review of the present state of understanding of marine fish communities. Northw. Atl. Fish. Sci. 8: 67–75

Green, R. H. 1979. Sampling design and statistical methods for environmental biologists. John Wiley & Sons, New York.

Paine, R. T., J. L. Ruesink, A. Sun, E. L. Soulanille, M. J. Wonham, C. D. G. Harley, D. R. Brumbaugh and D. L. Secord. 1996. Trouble on oiled waters: lessons from the *Exxon Valdez* oil spill. Annu. Rev. Ecol. Syst. 27: 197–235.

Paul, A. J. 1986. Respiration of juvenile pollock, *Theragra chalcogramma* (Pallas), relative to body size and temperature. J. Exp. Mar. Biol. Ecol. 97: 287–293.

Paul, A. J. and J. M. Paul. 1997. Comparisons of whole body energy content of captive fasting age zero Alaska Pacific herring (*Clupea pallasi*) and cohorts over-wintering in nature. J. Exp. Mar. Biol. Ecol. In press.

Paul, A. J., J. M. Paul, E. D. Brown. 1997. Fall and spring somatic energy content for Alaskan Pacific herring (*Clupea pallasi*) relative to age, size and sex. J. Exp. Mar. Biol. Ecol. In press.

Royer, T. C. 1989. Upper ocean temperature variability in the Northeast Pacific Ocean: is it an indicator of global warming? J. Geophy. Res. 94: 18175–18183.

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1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

|   | Authorized   | Proposed  |   | n an an that the state of the         |   | ieprie bestand in    | eletis menter | e se and a second a second a |
|---|--|---|---|---------------------------------------|---|----------------------|---------------|------------------------------|
| Budget Category:  | FY 1998  | FY 1999   |   |                                       |   |                      |               |                              |
| Dereannal   |  |   | and the second second                                 |                                       | Sec. Sector Levins  |                      |               |                              |
| Traval  |  | <u>\$89.5</u>   |   |                                       | and the second se |                      |               | AP and a second              |
| Contractual   |  | Φ57 C   |   |                                       |   |                      |               |                              |
| Commodities   |  | \$37.0<br>\$1.7   |   |                                       |   |                      |               |                              |
| Equipment   |  | ψι./  |   |                                       |   |                      | MENITS        |                              |
| Subtotal  |  | ¢154 A  |   | Echimated                             | Estimated   | Estimated            |               |                              |
| Indirect  |  | <u> </u>  |   | Estimated<br>FY 2000                  | FY 2001   | EStimated<br>FY 2002 |               |                              |
| Project Total   |  |   |   | \$186.5                               | \$186.5   | 112002               |               |                              |
|   |  | \$100.0   | a contra de como a como                               | φ100.5                                | <u>φτου.υ</u>   | Na                   |               |                              |
| Full-time Equivalents (FTF)   |  | 21  |   |                                       |   |                      |               |                              |
|   |  | . ۱<br>   | Dollar amount   | s are shown ir                        | hthousands of   | dollars              |               |                              |
| Other Resources   |  | <u></u>   |   |                                       |   |                      |               |                              |
| Comments:   |  |   |   |                                       |   | •                    |               |                              |
| The indirect rate is 25% TD<br>Trustee Council with the Ur<br>Personnel costs for Ph.D. s<br>Travel to Anchorage from S | C (with subco<br>niversity of Ala<br>student include<br>Seward is by p | ntracts greate<br>ska.<br>• two semeste<br>ersonal vehicl | r than \$25,000<br>rs of non-resid<br>e at the UAF ra | ent tuition (\$5,<br>ate of \$0.31 pe | gotiated by the<br>616).<br>er mile.  | e Exxon Valde        | ez Oil Spill  |                              |
|   |  |   | //  |                                       |   |                      | <br>] [       |                              |
| FY 99<br>Name: University of Alaska Fairbanks   |  |   |   |                                       | FORM 4A<br>Non-Trustee<br>SUMMARY   |                      |               |                              |

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1999 EXXON VALDEZ TRUCE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

| Name   Position Description   Budgeted   Costs   Overtime   FY 195     Stokesbury, K.   Principal Investigator/Research Associate   6,5   5,2   33,   33,     Paul, A. J.   Principal Investigator/Assoc. Professor   1,0   8,2   8,     McDonald, J.   Technician   3,0   5,0   15,     TBN   Technician   3,0   4,2   12,     TBN   Ph.D. Student   12,0   1,7   20,     Adjustment to recognize rounding   25,5   24,3   0,0     Frequencies and the prince of | Pers          | sonnel Costs:   |   |                          | Months                           | Monthly                         |                   | Proposed                                    |
|---|---------------|---|---|--------------------------|----------------------------------|---------------------------------|-------------------|---|
| Stokesbury, K.   Principal Investigator/Research Associate   6.5   5.2   33.     Paul, A. J.   Principal Investigator/Assoc. Professor   1.0   8.2   8.     McDonald, J.   Technician   3.0   5.0   15.     TBN   Technician   3.0   4.2   12.     TBN   Ph.D. Student   12.0   1.7   20.     Adjustment to recognize rounding   25.5   24.3   0.0   -0.     Travel Costs:   Personnel Total   \$89.5     Description   Price   Trips   Days   Per Diem   FY 199     Fairbanks to Anchorage – Annual EVOS meeting   0.3   2   10   0.1   1.     Seward to Anchorage – Annual EVOS meeting   0.1   1   5   0.1   0.0     Adjustment to recognize rounding   0.1   1   5   0.1   0.0     Adjustment to recognize rounding   0.1   1   5   0.1   0.0   |               | Name  | Position Description  |                          | Budgeted                         | Costs                           | Overtime          | FY 1999                                     |
| Subtotal   25.5   24.3   0.0     Personnel Total   \$89.5     Travel Costs:   Ticket   Round   Total   Daily   Propose     Description   Price   Trips   Days   Per Diem   FY 199     Fairbanks to Anchorage – Annual EVOS meeting   0.3   2   10   0.1   1     Fairbanks to Cordova for fieldwork (2 trips for 2 people)   0.4   4   12   0.1   2     Seward to Anchorage – Annual EVOS meeting   0.1   1   5   0.1   0.     Adjustment to recognize rounding   0.1   1   5   0.1   0.   |               | Stokesbury, K.<br>Paul, A. J.<br>McDonald, J.<br>TBN<br>TBN                             | Principal Investigator/Research Associate<br>Principal Investigator/Assoc. Professor<br>Technician<br>Technician<br>Ph.D. Student<br>Adjustment to recognize rounding |                          | 6.5<br>1.0<br>3.0<br>3.0<br>12.0 | 5.2<br>8.2<br>5.0<br>4.2<br>1.7 |                   | 33.8<br>8.2<br>15.0<br>12.6<br>20.4<br>-0.5 |
| Personnel Total   \$89:     Travel Costs:   Ticket   Round   Total   Daily   Propose     Description   Price   Trips   Days   Per Diem   FY 199     Fairbanks to Anchorage – Annual EVOS meeting   0.3   2   10   0.1   1.     Fairbanks to Cordova for fieldwork (2 trips for 2 people)   0.4   4   12   0.1   2.     Seward to Anchorage – Annual EVOS meeting   0.1   1   5   0.1   0.     Adjustment to recognize rounding   0.1   1   5   0.1   0.   | CHARGE COUNTY |   | Subtotal  | and south and the second | 25.5                             | 24.3                            | 0.0               |   |
| Travel Costs:   Ticket   Round   Total   Daily   Propose     Description   Price   Trips   Days   Per Diem   FY 199     Fairbanks to Anchorage – Annual EVOS meeting   0.3   2   10   0.1   1.     Fairbanks to Cordova for fieldwork (2 trips for 2 people)   0.4   4   12   0.1   2.     Seward to Anchorage – Annual EVOS meeting   0.1   1   5   0.1   0.     Adjustment to recognize rounding   0.1   1   5   0.1   0.   |               |   |   |                          |                                  | Per                             | sonnel Total      | \$89.5                                      |
| DescriptionPriceTripsDaysPer DiemFY 199Fairbanks to Anchorage – Annual EVOS meeting0.32100.11Fairbanks to Cordova for fieldwork (2 trips for 2 people)0.44120.12.Seward to Anchorage – Annual EVOS meeting0.1150.10.Adjustment to recognize rounding0.1150.10.  | Trav          | rel Costs:  |   | Ticket                   | Round                            | Total                           | Daily             | Proposed                                    |
| Fairbanks to Anchorage – Annual EVOS meeting   0.3   2   10   0.1   1.     Fairbanks to Cordova for fieldwork (2 trips for 2 people)   0.4   4   12   0.1   2.     Seward to Anchorage – Annual EVOS meeting   0.1   1   5   0.1   0.     Adjustment to recognize rounding   0.1   1   5   0.1   0.   |               | Description   |   | Price                    | Trips                            | Days                            | Per Diem          | FY 1999                                     |
| Travel Lotall Shi   |               | Fairbanks to Anchorage – A<br>Fairbanks to Cordova for fie<br>Seward to Anchorage – Anr | Innual EVOS meeting<br>Idwork (2 trips for 2 people)<br>Inual EVOS meeting<br>Adjustment to recognize rounding  | 0.3<br>0.4<br>0.1        | 2<br>4<br>1                      | 10<br>12<br>5                   | 0.1<br>0.1<br>0.1 | 1.6<br>2.8<br>0.6<br>0.6                    |

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1999 EXXON VALDEZ TRUSSEÉ COUNCIL PROJECT BUDGET

October 1, 1998 – September 30, 1999

| Contractual Costs:  | Proposed  |
|---|---|
| Description   | FY 1999   |
| Field vessel<br>Subcontract to PWSSC for acoustics surveys  | 30.0<br>27.6                                    |
| Contractual Tota  | \$57.6  |
| Commodities Costs:  | Proposed  |
| Description   | FY 1999   |
| Calorimeter<br>Replacement thermisters (6 @ \$200/ea)<br>Field supplies (bags, rope, wet gear, etc.)  | 0.1<br>1.2<br>0.4                               |
| Commodities Total   | \$1.7   |
| FY 99   Project Number: 99xxx   Image: Second seco | FORM 4B<br>ontractual &<br>ommodities<br>DETAIL |

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## 1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

| New Equipment Purchases:        |   | Number   | Unit         | Proposed                     |
|---------------------------------|---|----------|--------------|------------------------------|
| Description                     |   | of Units | Price        | <br>FY 1999                  |
|                                 |   |          |              |                              |
| Those purchases associated with | replacement equipment should be indicated by placement with an R.   | New Equ  | ipment Total | \$0.0                        |
| Existing Equipment Usage:       |   |          | Number       |                              |
| Description                     |   |          | of Units     |                              |
|                                 |   |          |              |                              |
| FY 99                           | Project Number: 99xxx<br>Project Title: Juvenile Herring and Walleye Pollock<br>Overwintering During an El Niño Event<br>Name: University of Alaska Fairbanks |          | F            | ORM 4B<br>quipment<br>DETAIL |

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## PWS/Kodiak Waste Management Community Awareness Training Video And Manual

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EXXON VALDEZ OIL SPILL

**TRUSTEE COUNCIL** 

Project Number:

99415

Restoration Category: General Restoration

Proposer: Prince William Sound Economic Development Council

Lead Trustee Agency: ADEC Cooperating Agencies:

Alaska SeaLife Center: No

Duration: 1<sup>st</sup> year, 1-year project

Cost FY 99: \$76,300

Cost FY 00: \$0

Cost FY 01: \$0

Cost FY 02: \$0

Geographic Area: Prince William Sound and Kodiak Island

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 recreations, both of which are affected by the adverse environmental and visual effects of pollution.

#### ABSTRACT

This project will develop a community awareness video to facilitate implementation of the Prince William Sound Waste Management Plan and the Kodiak Island Borough Master Waste Management Plan. The need for an awareness and training program to help villagers make use of new waste management procedures and the new drop-off sites is a logical extension of the PWS/Kodiak waste management plans funded, in part, by the Exxon Valdez Oil Spill Trustee Council. The villages on Kodiak Island include Akhiok, Karluk, Larsen Bay, Old Harbor, Ouzinkie, Port Lions, and Chiniak ;and in Prince William Sound they include Chenega Bay and Tatitlek.

#### INTRODUCTION

In FY 97-98, the Prince William Sound Economic Development Council (PWSEDC) implemented the construction of EnVironmental Operation Stations (EVOS) in the 5 communities of the Sound: Cordova, Chenega, Tatitlek, Whittier and Valdez. In addition, PWSEDC assisted in creating a comprehensive used oil management system in each community.

The PWS communities received EVOS buildings which met their specific needs,

and were built with demographics and infrastructure of each community in mind. While the larger towns of Cordova, Valdez and Whittier have more people trained to handle hazardous waste, etc., the villages of Chenega Bay and Tatitlek are isolated and limited in opportunities for training existing and new personnel.

In FY 97-98, the Kodiak Island Borough in conjunction with the Kodiak Area Native Association produced a waste management plan which includes the building of similar used oil and hazardous waste stations in each village on Kodiak Island.

In their Master Plan for Waste Management, the Kodiak Island Borough state that the six remote coastal villages on Kodiak Island lack much of the basic training that is needed to operate the planned oil and hazardous waste stations properly. Furthermore, those communities on the road system still face issues related to certain waste streams, including used oil and wastewater sludge.

The proposed communities awareness video, with accompanying training manual, will help ensure that the goal of each waste management plan is achieved by reducing marine pollution that may be slowing the recovery of oil spill-affected species and habitats. In addition, the accompanying manual will be made available to each household to use as a reference guide for household hazardous waste questions.

#### NEED FOR THE PROJECT

#### A. Statement of Problem

Studies have shown that 80% of marine pollution is generated by land-based sources (United Nations, 1995). Pollution in Prince William Sound and in the waters surrounding Kodiak Island affects the following injured resources: intertidal and subtidal organisms, harlequin ducks, black oystercatchers, sea otters, harbor seals, and other seabirds, shorebirds, and marine mammals.

In both areas, the services most likely affected are subsistence and recreation, both of which are influenced by the adverse environmental and visual effects of pollution.

The waste management plans and used oil stations address pollution entering Prince William Sound and the waters around Kodiak Island from a 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.

The used oil stations will provide a facility for the villagers to bring their used oil and hazardous waste material. However, unless those using the facility are properly trained on how to use these facilities and how to handle hazardous material, the stations will be of little use.

Training videos for workers in the EVOS buildings plus a manual for each household will help villagers change habits to break the cycle of pollution, demonstrate examples of improper disposal in villages, on boats and in the wilderness, and establish policies for disposal of waste for home and boats.

## B. Rationale/Link to Restoration

The waste streams generated within communities and which are entering the waters in Prince William Sound and the waters around Kodiak Island on an ongoing basis are affecting fish, wildlife and human uses injured by the spill, including the disruption of important habitat. Any decrease in local pollution would have the effect of reducing the stress on injured fish and wildlife 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. The people most likely to benefit are subsistence and recreation users, 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 effects of chronic marine pollution can substantially increase the stress on fish and wildlife resources; and
- with regard to the mortality of seabirds, chronic marine pollution is believed to be at as important as large-scale oil spills

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

### C. Location

The video will be shot on location at EnVironmental Operation Stations in Tatitlek and possibly another in a Kodiak location such as Old Harbor. The video, along with enough manuals for each household, will be distributed to each community. The communities on Kodiak include; Akhiok, Karluk, Larsen Bay, Old Harbor, Ouzinkie, Port Lions and Chiniak. The villages in Prince William Sound will include Chenega Bay and Tatitlek.

# COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

The same representatives from each community that were involved in the waste oil stations in Prince William Sound and Kodiak Island will be liaisons for this project.

These liaisons will be our link to each community to explore traditional methods of handling waste and to assist in relaying information about lifestyles and problems they face in disposing of wastes in their communities.

### **PROJECT DESIGN**

## A. Objectives

1. Produce a community awareness video to facilitate implementation of the Prince William Sound Waste Management Plan, and the Kodiak Island Borough Master Waste Management plan.

To produce a manual to be distributed to every household in participating villages which will contain all the material covered in the video, plus additional guide to proper handling of wastes.

### **B.** Methods

Production of the video and training manual will be a partnership effort involving the Prince William Sound Economic Development Council (project manager), Wild North Productions (producer), and various consultants including Phillips Environmental, the ADEC, and the Kodiak Island Borough. ÷...

The video will be shot on location at the EnVironmental Operation Station in Tatitlek and possibly another in a Kodiak location such as Old Harbor. The video will clearly demonstrate the need to address the marine pollution problem, and the importance of adopting new techniques and habits to reduce or eliminate that pollution. Methods used to accomplish these goals include using local people to set examples on how these new techniques and habits can be incorporated into everyday life; at home, on boats or in the wilderness. Once viewers can picture themselves doing what they see on the screen, they will be quicker to adopt new ways of handling waste materials.

The written manual, or guide, will contain all the material covered in the video, plus additional background and resource information. The key component to the manual will be a comprehensive guide to proper handling and disposal of solid waste at home, in landfills, on the boat, and at the used oil stations. Safe handling of hazardous waste materials will be addressed in detail as well. The manual will be written and edited by Josie Hartwell, former editor of two health industry magazines.

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

We believe that ADEC will be our Lead Agency for this project. We will cooperate fully with any other agencies that are found to be helpful or necessary to this project.

### SCHEDULE

### A. Measurable Project Tasks for FY 99

Oct. 1 - April 30: Initial project meetings. Video pre-production including research and script development to rough draft.

May 1 - June 15: Video Production, Prince William Sound & Kodiak Borough

June 16 - Aug. 31: Video post-production. Training manual completed and printed. Both products delivered to Prince William Sound Economic

Development Council

Sept. 1 - 20 1999: Distribution of product and public meetings.

Payment Schedule:

October 1, 1998: One-third of projected costs

June 15, 1999: One-third of projected costs or upon completion of all shooting

September 30, 1999: One third of projected costs

#### **B.** Project Milestones and Endpoints

Both of the objectives described in this proposal will be fully completed at the end of FY 99 (October 1999). Project milestones are described in the following schedule.

Oct. 1 - April 30: Research and script development for video and rough draft of training manual complete.

May 1 - June 15: Complete video image capture.

June 16 - Aug. 31: Video and training manual completed and delivered to Prince William Sound Economic Development Council.

Sept. 1 - 30: Prince William Sound Economic Development council to coordinate public meetings, and to distribute videos and training manuals to all communities.

#### C. Completion Date

The entire project will be completed by September 30, 1999 (FY 99). This includes the distribution of all videos and training manuals and any public meetings.

#### PUBLICATIONS AND REPORTS

The first, and final report for this project will be submitted in September 1999.

#### PROFESSIONAL CONFERENCES

No conferences are scheduled.

### COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project is a natural extension of the used oil stations in Prince William Sound and Kodiak Island Borough. The SWMPII project in Prince William Sound will be completed in April 1998 and the Kodiak Waste Management Plan used oil stations will be built this year. Prince William Sound Economic Development Council will coordinate with the engineers and parties involved in these projects to assure the video and manual meet the needs of the communities. Philips Services Corp. (PSC) will provide technical assistance to Wild North Productions in the development of the video and will provide technical input to Wild North Productions while filming for the video and in the editing of the video script as it pertains to waste management.

### PROPOSED PRINCIPAL INVESTIGATORS

Kara Merrell Kevin Hartwell Prince William Sound Economic Wild North Productions Development Council Post Office Box 22773 Post Office Box 2353 Juneau, AK 99802 Valdez, AK 99686 (907) 835-3775 (907) 780-3568 (907) 835-5770 (907) 780-3568 pwsedc@alaska.net hartwell@ptialaska.net

### PRINCIPAL INVESTIGATORS

Kevin Hartwell is an award-winning filmmaker who has been producing compelling documentary television for over 15 years. His work has been seen on ABC, NBC, PBS, ESPN, WTBS, SportsChannel and Prime Network. Hartwell was also science and technology editor for *Medio*, the first monthly magazine ever delivered on CD-ROM. Hartwell began producing Alaska natural history programming for Alaska One public television in 1996. He has won a national *Silver Telly Award*, and awards from the Alaska Broadcaster's Association and the 1998 International Wildlife Film Festival. His current projects, being produced in association with KTOO public television, include a documentary about the 10-year restoration of Prince William Sound following the *Exxon Valdez* Oil Spill, and two more programs for his *Wild Alaska* natural history series, including *Alaska's Wolves*, and *Alaska: Home of the Bald Eagle*.

Kara Merrell received a BA in Economic and International Relations from Trinity College, Washington D.C. in 1995. She has experience with project management through her involvement with the management of the EVOS stations in Prince William Sound, the Valdez Duck Flats and the Tatitlek Coho Release program.

#### OTHER KEY PERSONNEL

Tim Law, PE, Philips Services Corp. Ron Riemer, Environmental Engineer, Kodiak Island Borough

#### LITERATURE CITED

Not applicable.

| [                           | Authorized    | Proposed  |   |
|-----------------------------|---------------|-----------|---|
| Budget Category:            | FY 1998       | FY 1999   |   |
|                             |               |           |   |
| Personnel                   |               | \$0.0     |   |
| Travel                      |               | \$0.0     |   |
| Contractual                 |               | \$76.3    |   |
| Commodities                 |               | \$0.0     |   |
| Equipment                   |               | \$0.0     | LONG RANGE FUNDING REQUIREMENTS                   |
| Subtotal                    | \$0.0         | \$76.3    | Estimated Estimated Estimated                     |
| General Administration      |               | \$5.3     | FY 2000 FY 2001 FY 2002                           |
| Project Total               | \$0.0         | \$81.6    |   |
| -                           |               |           |   |
| Full-time Equivalents (FTE) |               | 0.0       |   |
|                             |               |           | Dollar amounts are shown in thousands of dollars. |
| Other Resources             |               |           |   |
| Comments:                   |               |           |   |
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|                             |               | iner. Ut  | イイン I TRUSTEE                                     |
| ГТУУ                        | Project Litle | •         | AGENCY  |
| l l                         | Agency:       |           | SUMMARY   |
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4/14/98, 1 of 8

| Personnel Costs: |                      |          | GS/Range/ | Months   | Monthly |              | Proposed |
|------------------|----------------------|----------|-----------|----------|---------|--------------|----------|
| Name             | Position Description |          | Step      | Budgeted | Costs   | Overtime     | FY 1999  |
|                  |                      |          |           |          |         |              | 0.0      |
|                  |                      |          |           |          |         |              | 0.0      |
|                  |                      |          |           |          |         |              | 0.0      |
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|                  |                      |          |           |          |         |              | 0.0      |
|                  | I                    | Subtotal |           | 0        | 0.0     | 0.0          | 0.0      |
|                  |                      | oubtotu  |           | 0.0      | Per     | sonnel Total | \$0.0    |
| Travel Costs:    |                      |          | Ticket    | Round    | Total   | Daily        | Proposed |
| Description      |                      |          | Price     | Trips    | Days    | Per Diem     | FY 1999  |
|                  |                      |          |           |          |         |              | 0.0      |
|                  |                      |          |           |          |         |              | 0.0      |
|                  |                      |          |           |          |         |              | 0.0      |
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|                  |                      |          | I         |          |         | Travel Total | 0.0      |
|                  |                      |          |           |          |         |              | φ0.0     |
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|                  | Project Number:      |          |           |          |         |              |          |
| FY 99            | Project Title        |          |           |          |         |              |          |
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|                  | Agency.              |          |           |          |         |              | DETAIL   |

| Contractual Costs:                       |  | Proposed                                     |
|--|--|--|
| Description                              |  | FY 1999                                      |
| 4A Linkage                               |  | 76.3   |
| When a non-trustee organization is used, | the form 4A is required. Contractual Total | \$76.3                                       |
| Commodities Costs:                       |  | Proposed                                     |
| Description                              |  | FY 1999                                      |
|  |  |  |
| ·  | Commodities Total                          | \$0.0  |
| FY 99 Project<br>Project<br>Agence       | F<br>Co<br>t Title:<br>y:                  | ORM 3B<br>ntractual &<br>mmodities<br>DETAIL |

| New Equipment   | Purchases:   | Number   | Unit         | Proposed |
|-----------------|--|----------|--------------|----------|
| Description     |  | of Units | Price        | FY 1999  |
|                 |  |          |              | 0.0      |
|                 |  |          |              | 0.0      |
|                 |  |          |              | 0.0      |
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|                 |  |          |              | 0.0      |
|                 |  |          |              | 0.0      |
|                 |  |          |              | 0.0      |
| Those nurchases | associated with replacement equipment should be indicated by placement of an R | New Equ  | inment Total | 0.0      |
| Existing Equipm | ant leave  |          | Number       |          |
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|                 | Project Number   |          | F            | ORM 3B   |
|                 |  |          | E            | quipment |
| 1133            |  |          |              |          |
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|                            | - A              | Authorized   | Proposed   |  |                                   |                          |                          | 小金谷   | Laurente Arteine                            |
|----------------------------|------------------|--|--|--|-----------------------------------|--------------------------|--------------------------|-------|---|
| Budget Category:           |                  | FY 1998  | FY 1999  |  |                                   |                          |                          |       |   |
| Personnel                  |                  |  | \$0.0  |  |                                   |                          |                          |       |   |
| Travel                     |                  |  | \$6.5  |  |                                   |                          |                          |       |   |
| Contractual                |                  |  | \$69.8   |  |                                   |                          |                          |       |   |
| Commodities                |                  |  | \$0.0  |  |                                   |                          |                          |       |   |
| Equipment                  |                  |  | \$0.0  |  | LONG R                            | ANGE FUNDI               | NG REQUIRE               | MENTS | anda an an ann an an an an an an an an an a |
| Subtotal                   |                  | \$0.0  | \$76.3   |  | Estimated                         | Estimated                | Estimated                |       |   |
| Indirect                   |                  |  |  |  | FY 2000                           | FY 2001                  | FY 2002                  |       |   |
| Project Total              |                  | \$0.0  | \$76.3   |  |                                   |                          |                          |       |   |
| ,                          |                  |  | · · · · · · · · · · · · · · · · · · ·            | General States                           |                                   |                          |                          |       |   |
| Full-time Equivalents (FTE | ≡)               |  | 0.0  |  |                                   |                          |                          |       |   |
|                            |                  |  | ·····  | Dollar amount                            | ts are shown ir                   | n thousands of           | f dollars.               |       |   |
| Other Resources            |                  |  |  |  |                                   |                          |                          |       |   |
| Comments:                  |                  |  |  |  |                                   |                          |                          |       |   |
|                            |                  |  |  |  |                                   |                          |                          |       |   |
| FY 99                      | F<br>F<br>A<br>N | Project Nu<br>Project Titl<br>Awareness<br>Name: Pri | mber:<br>e: PWS/Koo<br>Training `<br>nce William | diak Waste I<br>Video and M<br>Sound Eco | Managemer<br>Ianual<br>nomic Deve | nt Communi<br>Hopment Co | ty<br>unc <sup>i</sup> l |       | FORM 4A<br>Non-Trustee<br>SUMMARY           |

#### FY 99 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

| Pers | sonnel Costs:   |             |                       |        | Months   | Monthly                               |                     | Proposed   |
|------|---|-------------|-----------------------|--------|----------|---------------------------------------|---------------------|--|
|      | Name  | Position De | scription             |        | Budgeted | Costs                                 | Overtime            | FY 1999  |
|      |   |             |                       |        |          |                                       |                     | 0.0<br>0.0<br>0.0<br>0.0<br>0.0<br>0.0<br>0.0<br>0.0<br>0.0<br>0.0 |
|      |   | L           | Cubtotol              |        |          | 0.0                                   |                     | 0.0  |
|      |   |             | Subiola               |        | 0.0      | 0.0                                   | 0.0<br>Sonnel Total |  |
| Trav | rel Costs:  |             |                       | Ticket | Round    | Total                                 | Daily               | Proposed   |
|      | Description   |             |                       | Price  | Trips    | Davs                                  | Per Diem            | FY 1999  |
|      | Travel from Anchorage to Travel                                 | atitlek     | producer              | 1.0    | 1        | Duye                                  | 0.0                 | 1 1 1000   |
|      | Travel from Anchorage to O                                      | ld Harbor   | producer              | 0.8    | 1        |                                       | 0.0                 | 0.9  |
|      | 0   |             | •                     |        |          |                                       |                     | 0.0  |
|      | Travel from Anchorage to Ta                                     | atitlek     | crew                  | 1.0    | 1        |                                       |                     | 1.0  |
|      | Travel from Anchorage to O                                      | ld Harbor   | crew                  | 0.8    | 1        |                                       |                     | 0.8  |
|      | _   |             |                       |        |          |                                       |                     | 0.0  |
|      | Travel from Anchorage to Ta                                     | atitlek     | crew                  | 1.0    | 1        |                                       |                     | 1.0  |
|      | Travel from Anchorage to O                                      | ld Harbor   | crew                  | 0.8    | 1        |                                       |                     | 0.8  |
|      | _   |             |                       |        |          |                                       |                     | 0.0  |
|      | Total per diem (8 daysx x3 d                                    | crew membe  | rs x \$41.66 per day) |        |          |                                       |                     | 1.0  |
|      |   |             |                       |        |          |                                       |                     | 0.0  |
|      |   |             |                       |        |          |                                       |                     | 0.0  |
|      |   |             |                       |        |          |                                       | Travel Total        | \$6.5  |
|      | <u>an an taon 19</u> 40 ang |             |                       |        |          | · · · · · · · · · · · · · · · · · · · |                     |  |

FORM 4B Project Number: Project Title: PWS/Kodiak Waste Management Plan Community Personnel **FY 99** & Travel Awareness Training Video and Manual Name: Prince William Sound Economic Development Council DETAIL 4/10/98 Prepared: 1

FY 99 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

| Description   FY 1999     Image Capture (Tatitlek, Old Harbor)   12.0     Production Insurance   0.5     Logging and Computer Video Capture   3.5     Digital Editing Suite/Editor   7.5     Music   0.4     Narrator   0.5     VHS Video Copies   0.30     PWSEDC Project Management (13.1%)   10.0     Collateral Materians, including training manual   10.0     Producer/Writer   15.8     Video Stock (Betacam)   1.0     Contractual Total   \$69.8     Sormodities Costs:   Proposed     Pescription   FY 1999 |
|---|
| Image Capture (Tatitlek, Old Harbor)12.0Production Insurance0.5Logging and Computer Video Capture3.5Digital Editing Suite/Editor7.5Music0.4Narrator0.5VHS Video Copies0.3PWSEDC Project Management (13.1%)10.0Collateral Materians, including training manual10.0Phillips Environmental8.3Producer/Writer15.8Video Stock (Betacam)1.0Contractual Total\$69.8Sommodities Costs:ProposedPescriptionFY 1999  |
| Production Insurance0.5Logging and Computer Video Capture3.5Digital Editing Suite/Editor7.5Music0.4Narrator0.5VHS Video Copies0.3PWSEDC Project Management (13.1%)10.0Collateral Materians, including training manual10.0Phillips Environmental8.3Producer/Writer15.8Video Stock (Betacam)1.0Contractual Total\$69.8Commodities Costs:ProposedVescriptionFY 1999  |
| Logging and Computer Video Capture3.5Digital Editing Suite/Editor7.5Music0.4Narrator0.5VHS Video Copies0.3PWSEDC Project Management (13.1%)10.0Collateral Materians, including training manual10.0Phillips Environmental8.3Producer/Writer15.8Video Stock (Betacam)1.0Contractual Total\$69.8Commodities Costs:Proposed<br>FY 1999  |
| Digital Editing Suite/Editor7.5Music0.4Narrator0.5VHS Video Copies0.3PWSEDC Project Management (13.1%)10.0Collateral Materians, including training manual10.0Phillips Environmental8.3Producer/Writer15.8Video Stock (Betacam)1.0Contractual Total\$69.8\$commodities Costs:ProposedPescriptionFY 1999  |
| Music0.4Narrator0.5VHS Video Copies0.3PWSEDC Project Management (13.1%)10.0Collateral Materians, including training manual10.0Phillips Environmental8.3Producer/Writer15.8Video Stock (Betacam)1.0Contractual Total\$69.8Commodities Costs:ProposedPescriptionFY 1999   |
| Narrator0.5VHS Video Copies0.3PWSEDC Project Management (13.1%)10.0Collateral Materians, including training manual10.0Phillips Environmental8.3Producer/Writer15.8Video Stock (Betacam)1.0Contractual Total\$69.8Commodities Costs:ProposedPescriptionFY 1999   |
| VHS Video Copies0.3PWSEDC Project Management (13.1%)10.0Collateral Materians, including training manual10.0Phillips Environmental8.3Producer/Writer15.8Video Stock (Betacam)1.0Contractual Total\$69.8Commodities Costs:ProposedPescriptionFY 1999  |
| PWSEDC Project Management (13.1%)   10.0     Collateral Materians, including training manual   10.0     Phillips Environmental   8.3     Producer/Writer   15.8     Video Stock (Betacam)   1.0     Contractual Total   \$69.8     Commodities Costs:   Proposed     Pescription   FY 1999  |
| Collateral Materians, including training manual   10.0     Phillips Environmental   8.3     Producer/Writer   15.8     Video Stock (Betacam)   1.0     Contractual Total   \$69.8     Commodities Costs:   Proposed     Description   FY 1999   |
| Phillips Environmental   8.3     Producer/Writer   15.8     Video Stock (Betacam)   1.0     Contractual Total   \$69.8     Commodities Costs:   Proposed     Description   FY 1999  |
| Producer/Writer 15.8   Video Stock (Betacam) 1.0   Contractual Total \$69.8   Sommodities Costs: Proposed   Description FY 1999   |
| Video Stock (Betacam)   1.0     Contractual Total   \$69.8     Commodities Costs:   Proposed     Description   FY 1999  |
| Contractual Total     \$69.8       Commodities Costs:     Proposed       Description     FY 1999  |
| Contractual Total     \$69.8       Commodities Costs:     Proposed       Description     FY 1999  |
| Commodities Costs:<br>Description FY 1999   |
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| Commodities Total \$0.0   |
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| Project Number:   |
| <b>FY 99</b> Project Title: PWS/Kodiak Waste Management Community   |
| Awareness Training Video and Manual Commodities   |
| Name: Prince William Sound Economic Development Council DETAIL  |
|   |

#### FY 99 EXXON VALDEZ TRU COUNCIL PROJECT BUDGET October 1, 1998 - September 30, 1999

New Equipment Purchases: Number Unit Proposed Description of Units Price FY 1999 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Those purchases associated with replacement equipment should be indicated by placement of an R. **New Equipment Total** \$0.0 Existing Equipment Usage: Number Description of Units Project Number: FORM 4B Project Title: PWS/Kodiak Waste Management Community Equipment **FY 99** Awareness Training Video and Manual DETAIL Name: Prince William Sound Economic Development Council 4/10/98 Prepared:



rax mansmillar wemo 100. UI CAYOO 1000075 Vais 4/13/85 "1110 AM To HUG-H SHORT. Company F. UOS Two Tr. Courcil From TQH CHRUSTENSEN! Company -1/age IRA Council 11 Aacho--st 907276-7178 Telechoner 7 Bay HK Dept. Charge Fax # Telephone # 907 573 5132 5120 Return Call for pickup Destroy Disposition

#### CHENEGA RAY\_J.R.A. COUNCIL

# Number: 99416

Title: O'Brien Creek Restoration

APR 1 4 1998

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL 1

April 10, 1998

Exxon Valdez Oil Spill Trustee Council 615 C Euron, Euro 101 Anchorage, AK 99501

Dear Sirs:

The Chenega Bay IRA Council is requesting funding from the Exxon Valdez Oil Spill Trustee Council to rehabilitate O'Brien Creek so that coho salmon can be reestablished there. These calmon will be used as a subsidence ressure for the village.

Prior to the 1964 earthquake O'Brion Creek had a run of coho salmon. However, as a result of the earthquake, a slight berm has built up in the lower portion of the stream. This causes the lower stream to dewater blocking off access to spawning salmon

The U.S. Forest Service has looked at O'Brien Creek and believes it is a good candidate for rehabilitation. USFS has agreed to oversee the restoration work. They recommend that FY 99 he spent doing a detailed evaluation of the stream at an estimated cost of \$10,000 to \$12,000. This evaluation would produce an approach for fixing the stream and a cost estimate. The actual rehabilitation work would be done in FY 00.

We hope you will give this proposal serious consideration. The village has been trying for several years to establish a nearby run of salmon for subsistence use. O'Brien Creek appears to offer the best chance of accomplishing this.

Sincerely,

John A. Christensen, Sr., Administrator