RPWG
H

MEMORANDUM **14 FEBRUARY 1992**

TO: see Distribution

Stan Senner

FR: Stan Senner and Susan MacMullin

RE: Draft Restoration Framework

Here is a first draft of the Restoration Framework for your review and comment. The text is still very much at a draft stage, and your careful review is invited.

Please read for content and clarity from the standpoint of the interested public. Flag areas that need improving or additions (better yet, please suggest alternative text). Also note areas where you believe policy considerations must be resolved.

Late in the process, we began incorporating NEPA terminology intended to satisfy the requirements of the McVee proposal which was adopted by the Trustee Council. This aspect needs more work.

We also plan to add tear sheets or something like that to facilitate public comment, but the format and content are yet to be established.

This draft is in the format we envision for distribution to the public. We recognize that there are a number of minor changes to be made regarding format and consistency in style. Your suggestions are welcome, but don't invest too much energy in this.

Our goal is to distribute a second draft of the Restoration Framework to the Trustee Council on 24 or 25 February. To that end, please return your copy and comments to Stan at CACI by noon on Friday, 21 February. We are still more or less on a track to get this to a printer during the first week of March and out to the public in mid-March.

enclosure (1)

Barbara's Copy

Distribution

Restoration Team:

Gibbons, Morris, Montague, Brodersen, Rutherford, Rice, and Bergmann

Legal Advisors:

Swiderski, Sleater, O'Connor, Lisowski, and Belt

Restoration Subgroup:

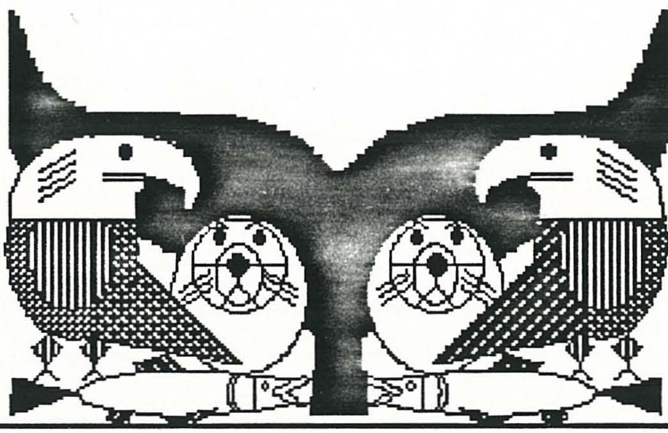
Weiner, MacMullin, Senner, Thompson, Gorbics, Strand, and Rabinowitch

Other:

Steele, Roy, Yender, Piper, Evans, Lattin, Williams, Spies, DeNault, and McGee

Bartam

DRAFT



RESTORATION PLANNING
FOLLOWING THE
EXXON VALDEZ OIL SPILL

CONFIDENTIAL

RESTORATION FRAMEWORK DOCUMENT

State of Alaska: Departments of Fish & Game, Law, Natural Resources, and Environmental Conservation
United States: Environmental Protection Agency, National Oceanic & Atmospheric Administration, Departments of Agriculture and Interior

Dear Reviewer:

The governments' legal battles over the *Exxon Valdez* oil spill have come to a close. With the monies provided by the settlement, it is time to begin the restoration and recovery process throughout the spill area. The courts have entrusted this task to the undersigned, six State and Federal Trustees who, in consultation with the public, are responsible for determining how the settlement money is to be spent.

Volume I of this document is a key step in setting up the process for decisions that will be made throughout the next decade. It provides background information and proposes a framework on which we will build for the future. It is intended to be a public scoping document to elicit comments and suggestions from you. We are anxious to consider how the public views this process and receive suggestions on how to best realize our mutual goal of restoration and recovery of the resources and services affected by the oil spill. This effort will culminate in the development of an overall Restoration Plan which will be the blueprint we use for the next 10 years.

Volume II of this document sets out a workplan to be conducted in 1992. Activities proposed comprise those that may be deemed important to undertake in 1992 prior to the final development of a restoration plan. It is anticipated that a workplan will be developed annually, laying out the activities the Trustees have approved for that year.

This document has already profited from numerous public comments already received on earlier restoration documents and from public meetings held in many communities throughout the spill area. A complete accounting of previous suggestions received from the public may be found in two documents, **Restoration Planning Following the *Exxon Valdez* Oil Spill: August 1990 Progress Report** and **Restoration Following the *Exxon Valdez* Oil Spill: Proceedings of the Public Symposium, July 1990.**

Written comments must be received by _____________, at the following address:

Trustee Council
645 G Street, 4th Floor
Anchorage, Alaska 99501

Questions concerning this document or its distribution should be directed to the same address.

We appreciate your interest and look forward to your participation in this important process.

Sincerely,

Michael A. Barton
Regional Forester
Alaska Region
Forest Service
Department of Agriculture

Charles E. Cole
Attorney General
State of Alaska

Curtis V. McVee
Special Assistant to the Secretary
Office of the Secretary
Department of the Interior

Steven Pennoyer
Director
Alaska Region
National Marine Fisheries Service

Carl L. Rosier
Commissioner
Alaska Department of
Fish and Game

John R. Sandor
Commissioner
Alaska Department of
Environmental Conservation

CHAPTER I
INTRODUCTION

Restoration Framework

The intent of this document, the "Restoration Framework," is to seek public comment on the development of a proposed Restoration Plan for the areas affected by the *Exxon Valdez* oil spill. The State and Federal Trustees and the Environmental Protection Agency (EPA) have prepared this document for the public to summarize what has been learned in the oil spill program to date and explain the process which is being followed now that settlement with Exxon has been achieved.

The Restoration Framework also includes a discussion of the restoration broad approaches and specific restoration options under consideration by the Trustees. Finally, an updated summary of injury is provided. The summary gives information on the extent of injury documents by the State and Federal governments through the 1991 field season in the results of the Natural Resource Damage Assessment (NRDA) studies.

An important step in planning the restoration of the oil spill area is to prepare a comprehensive Restoration Plan (See Chapter VIII). This Restoration Framework document is intended to facilitate meaningful public participation in preparation of the draft Restoration Plan, which is scheduled for publication in September 1992. This framework also will provide the structure under which restoration activities will be conducted during development of the comprehensive plan. The issues, questions, and ideas identified by the public will help us determine the appropriate scope of our planning and analysis.

Background

The T/V *Exxon Valdez* ran aground on Bligh Reef in Prince William Sound on the early morning of March 24, 1989, spilling approximately 11 million gallons of North Slope crude oil, making this the largest oil spill in United States history. For the first three days after the spill the weather was calm and the amoeba-like slick lengthened and widened, staying in the vicinity of the grounded tanker and off the beaches. Even with these seemingly ideal circumstances for oil recovery, the amount of oil in the water completely overwhelmed the manpower and equipment available to contain and recover the oil. A major windstorm on March 27, 1989 pushed the oil in a southwesterly direction and oiled beaches on Smith, Naked, and Knight islands. The oil continued to spread, contaminating islands, beaches, and bays in Prince William Sound. Four days into the spill, oil entered the Gulf of Alaska. The leading edge of the slick reached the Chiswell Islands off the coast of the Kenai Peninsula on April 2, and the Barren Islands on April 11, nineteen days into the spill. By May 18 oil had moved some 470 miles and had fouled shorelines of Prince William Sound, the Kenai Peninsula, lower Cook Inlet, the Kodiak Archipelago, and the Alaska Peninsula. More than 1,200 miles of coastline were oiled, including portions of the Chugach National Forest, Alaska Maritime, Kodiak, and Alaska Peninsula/Becharof national wildlife refuges, Kenai Fjords National Park, Katmai National Park and Preserve, and Aniakchak National Monument and Preserve. Oil reached shorelines as far away as the Alaska Peninsula, nearly 600 linear miles from Bligh Reef.

The magnitude of the efforts of the state and federal governments, the public, and Exxon to contain and clean up the oil, rescue wildlife, and study the effects of the spill is unprecedented. During 1989 efforts to contain and clean up the spill and rescue oiled wildlife involved a massive effort. Skimmer ships were sent throughout the spill zone to vacuum oil from the water. Booms were positioned to keep oil from reaching important commercial salmon hatcheries in Prince William Sound and Kodiak. A fleet of fishing vessels known as the "Mosquito Fleet" played an important role in protecting these hatcheries, in corralling oil to assist the skimmer ships, and in capturing and transporting oiled wildlife to rehabilitation centers. After oil contaminated shorelines, a beach clean-up program was activated. Various local committees, with community and government agency participation, provided recommendations to the U.S. Coast Guard about areas that should receive priority for clean-up. An army of workers cleaned shorelines, using techniques ranging from cleaning rocks by hand to high pressure hot-water washing. Fertilizers were applied to some oiled shorelines to increase the activity of oil-metabolizing bacteria in a procedure known as bioremediation. When deteriorating weather brought an end to cleanup work in the fall of 1989, a large amount of oil remained on the shorelines. Although winter storms proved extremely effective in cleaning many beaches, spring shoreline surveys indicated that much work remained to be done in 1990. Crews operating from boats and helicopters cleaned oiled shorelines in Prince William Sound, along the Kenai and Alaska peninsulas, and on the Kodiak Archipelago. Manual pick up of remaining oil was the principal method used during 1990, but bioremediation and relocation of oiled berms to the active surf zone were also used in some areas. An additional shoreline survey and limited cleanup work took place during 1991.

The State and Federal Trustee agencies rapidly planned and mobilized the field studies--the Natural Resources Damage Assessment (NRDA)--to determine the injuries being sustained in the oil-spill area. Even with the rapid deployment of studies, some opportunities to gather injury data were irretrievably lost during the early weeks of the spill due to the complexity and volume of the work at hand and the available resources. Shortly after the spill a legal framework was established and expert peer reviewers were retained to provide independent scientific review of on-going and planned studies and assist with synthesis of results. Most damage assessment studies were completed during 1991, although some data analyses are still underway. The Trustee agencies, with the assistance of the EPA, initiated restoration planning activities in late 1989 to identify restoration alternatives and procedures and to implement limited-scale projects during 1990 and 1991.

Legal Context of the Settlement

On October 8, 1991 the United States and the State of Alaska settled their claims against Exxon Corporation and Exxon Shipping Company.

Exxon and Exxon Shipping entered guilty pleas to criminal charges filed in the United States District Court. The companies admitted violating provisions of the Clean Water Act, the Migratory Bird Treaty Act and the Refuse Act. The sentences entered by United States District Judge H. Russel Holland included one of the largest fines ever imposed in a criminal action--$150 million.

Exxon Corporation and its subsidiary companies also entered into the civil settlement agreement with the United States and the State of Alaska. The governments had filed lawsuits against the Exxon companies, seeking to recover damages for injuries to natural resources and the restoration and replacement of natural resources. The Exxon companies agreed to pay $900 million.

Thousands of private individuals and other litigants are still pursuing claims against Exxon, seeking to collect billions of dollars in damages. The litigation in the Alaska Superior Court has been tentatively set for trial during April 1993. No trial date has been set for the litigation in the United States District Court.

<u>Payment Terms and Conditions</u>

Criminal Fines and Restitution

Exxon and Exxon Shipping were fined $150 million. The sum of $125 million was remitted (forgiven) and $25 million was paid as follows:

- $12 million deposited into the North American Wetlands Conservation Fund
- $13 million deposited into the Crime Victims Fund

The Exxon companies also agreed to pay $100 million as restitution. Fifty million dollars was paid to the United States and $50 million to the State of Alaska. These funds are to be used exclusively for restoration projects within the Alaska. These funds are not subject to joint administration by the State and Federal Trustees.

Civil Settlement

For restoration of injuries sustained due to the oil spill, the Exxon companies agreed to pay the United States and the State of Alaska $900 million over a period of 10 years, including $90 million in 1991, $150 million in 1992, $100 million in 1993, and eight annual payments of $70 million each through the year 2001. An additional $100 million may be payable between the years 2002 and 2006, if injuries not anticipated at the time of settlement should become evident.

Spending Guidelines

The criminal restitution funds paid to the United States and the State of Alaska ($50 million to each) must, by order of the United States District Court, be used "exclusively for restoration projects, within the State of Alaska, relating to the *Exxon Valdez* oil spill." The court order states that "restoration includes: restoration, replacement, and enhancement of affected resources, acquisition of equivalent resources and services; and long-term environmental monitoring and research programs directed to the prevention, containment, cleanup and amelioration of oil spills."

There are different more narrow spending guidelines for the civil settlement monies ($900 million). Those guidelines are set forth in a Memorandum of Agreement between the United States and the State of Alaska. The Memorandum of Agreement is attached to this report as Appendix B.

The civil spending guidelines provide in part that the governments shall jointly use such monies for purposes of "restoring, replacing, enhancing, rehabilitating or acquiring the equivalent of natural resources injured as a result of the *Exxon Valdez* oil spill and the reduced or lost services provided by such resources." The governments also may use the money to reimburse themselves for expenses they have incurred regarding the oil spill, including costs of litigation, response and damage assessment. All expenditures by the governments must be by unanimous agreement of the Trustees and must be for the restoration of natural resources within Alaska unless otherwise agreed.

Definitions.

Consent Decree: The agreement among the United States, the State of Alaska, Exxon Corporation, Exxon Shipping Company, Exxon Pipeline Company, and the T/V *Exxon Valdez* settling the civil claims asserted by the governments. The document was filed in the United States District Court for the District of Alaska in civil actions A91-082 (United States v. Exxon Corp.) and A91-083 (State of Alaska v. Exxon Corp.) and approved and entered by United States District Judge H. Russel Holland on October 8, 1991. Trustees. (Appendix A)

Memorandum of Agreement: The agreement by the United States and the State of Alaska to resolve their claims against one another and to act as co-trustees in the collection and joint use of all natural resource damage recoveries resulting from the *Exxon Valdez* oil spill. The document was filed in the United States District Court for the District of Alaska in civil action A91-081 (United States v. State of Alaska) and approved and entered by United States District Judge H. Russel Holland on August 28, 1992. (Appendix B)
1991

Trustees: The federal Clean Water Act and other laws authorize the cap? federal and cap? state trustees to assume certain responsibilities with respect to natural resources that are damaged by oil spills. The Consent Decree requires that the Trustees unanimously agree on the use of the civil settlement funds to restore the natural resources injured by the spill.

The Federal Trustees are:

- Secretary of the Department of the Interior
- Secretary of the Department of Agriculture
- Administrator of the National Oceanic and Atmospheric Administration

The State Trustees are:

- Commissioner of the Alaska Department of Fish and Game
- Commissioner of the Alaska Department of Environmental Conservation
- Attorney General of the State of Alaska

The Trustees have established a Trustee Council in Alaska to make decisions regarding the allocation of restoration funds (See Chapter VIII).

Restoration: The term restoration generally includes direct restoration, replacement, enhancement, and acquisition of equivalent resources:

- Direct restoration refers to measures taken, usually on site and in addition to response actions, to directly promote or enhance the recovery of an injured, lost, or destroyed natural resource to its baseline condition or function. The definition of direct restoration includes any administrative actions that may be taken by Federal or State agencies, such as limiting certain activities in the affected areas, to promote recovery of injured resources.

- Replacement refers to substituting an injured, lost or destroyed natural resource with a resource of the same or similar type.

- Acquisition of equivalent resources includes the purchase or protection of natural resources that are similar or related to the injured natural resources in terms of ecological values, functions, or services provided.

Should this be an injured resource or service?

- Enhancement measures can be employed to ultimately return an on injured resources or services to a state of recovery that is beyond the pre-spill level.

- Habitat protection measures can maintain and enhance prospects for the recovery of an injured resource or can be ways to acquire equivalent resources and services.

questions:
should commas go after three in a series?
should all state & federal be in caps?
Is ongoing hyphenated or not? some places it is
Clean up needs to conform to part of speech
Is sport fishing hyphenated? (some places)
Is oil-spill area hyphenated!

CHAPTER II
OVERVIEW OF RESTORATION PLANNING TO DATE

Responsibility for full restoration of the natural resources injured, lost, or destroyed by the oil spill resides with Federal and State Trustee agencies. Restoration planning is a dynamic and evolving process that involves many considerations. The need for restoration depends on the nature, extent, and persistence of injuries to natural resources and services and the adequacy of natural recovery. The primary information sources regarding resource injury are the studies conducted by State and Federal agencies as part of the Natural Resources Damage Assessment (NRDA). Other sources of information include data gathered as part of the oil spill response, public comments, and studies conducted outside of the damage assessment program.

Public Participation

The Trustees recognized the importance of public participation in developing a successful restoration program and, to the extent possible, have attempted to involve and inform the public with regard to restoration planning through several public activities and publications. In March 1990 a public symposium was held to provide a forum for the public and experts from within and outside of Alaska to express their views on what a restoration program should accomplish. In April and May of 1990 eight public scoping meetings were held in Cordova, Valdez, Whittier, Homer, Kodiak, Seward, Anchorage, and Kenai-Soldotna to gain a sense of the public's priorities for the restoration program.

Unfortunately, despite these efforts, opportunities for public participation prior to the settlement were limited due to the need for the details and results of the NRDA studies to remain confidential due to pending litigation with the parties responsible for the oil spill.

Technical Consultation

Technical Workshop

In addition to these public meetings, there was a three-day technical workshop in April 1990 to begin scientific input into the restoration planning process. This event provided the first opportunity for an exchange of ideas on restoration among scientists and natural resource managers. Participants included Federal and State resource managers, as well as selected scientists, and technical experts under contract to the governments. This workshop was closed to the public because confidential litigation-related damage assessment information was discussed.

Guided by an overview of preliminary damage assessment results, these experts explored a broad range of preliminary options that could be implemented to restore injured ecological, archaeological, and recreational resources in Prince William Sound and the Gulf of Alaska. Potential restoration projects were identified and evaluated and feasibility studies were suggested to test the likelihood of success for some of these activities. Participants also identified other information needed through restoration planning and studies.

Peer Review

In addition to the technical workshop described above, there were on-going consultations with selected nationally recognized scientists and natural resource experts, most of whom have had experience with Alaskan resources. These experts have provided guidance throughout the restoration planning process, especially helping to identify information needs and to critique proposals for restoration studies and projects.

Habitat Protection

Resource experts and the public have consistently identified protection of fish and wildlife habitats as a key method of preventing further harm to, and assisting the recovery of, natural resources and services injured by the oil spill. Suggested approaches have included land acquisition and changes in management practices on public lands. To follow through on these suggestions, the Restoration Planning Work Group conducted two special projects related to habitat acquisition and protection.

One option concerned designation of protected coastal and marine habitats. As part of this evaluation, all State of Alaska and Federal conservation systems that protect or affect the management of marine habitats and resources were reviewed. These protected area designations can help maintain ecosystem integrity by controlling activities that disrupt ecological processes or that physically damage the environment, thereby minimizing further stress on (delete space) recovering resources. If properly designed, protection designations can accommodate conservation objectives as well as other pre-existing uses.
A variety of State and Federal designations for protecting marine and coastal habitats are now in existence. These include national marine sanctuaries, national wildlife refuges, and Alaska State marine parks. Each system has a different purpose, management approach, historical funding level, and track record. A workshop was conducted on marine habitat protection systems in August 1991 to review and discuss these different systems and the potential applicability of existing protected area designations as part of the overall oil spill restoration strategy. The workshop included managers and administrators of state and federal protected areas who provided information on their respective designation systems. The possibility of creating a new type of protection designation

is this a new paragraph?

addressing needs specific to the spill area was also explored.

It is a complex undertaking to objectively identify key upland habitats that are linked to the recovery of injured resources and evaluate potential protection strategies. Consequently, The Nature Conservancy was invited to provide technical assistance. The Nature Conservancy, a non-profit organization, was selected due to its extensive experience in identification, protection, and long-term management of significant ecological resources throughout the Western Hemisphere and in working successfully with private landowners, government agencies and other organizations. Drawing on the experience of their experts across the country, The Nature Conservancy prepared a handbook entitled: **Options for Identifying and Protecting Strategic Fish and Wildlife Habitats and Recreation Sites (December 1991).** The purpose of the handbook is to provide a menu of identification and protection tools, techniques, and strategies that may be applicable to restoration planning efforts associated with private lands within the oil spill area. The Nature Conservancy conducted this work under a cost-share agreement with the U.S Forest Service, funded by the U.S. Environmental Protection Agency.

Recovery Literature Review

Estimating the rate and adequacy of natural recovery are fundamental to selecting restoration measures, because in some cases it may be most appropriate to allow natural recovery to proceed without further intervention by man (i.e., the "no action" alternative from the NRDA regulations). To supplement NRDA information on the recovery of injured resources, RPWG contracted for the review and critical synthesis of the existing scientific literature on the recovery of marine mammals, marine birds, commercially important fish and shellfish, and invertebrates following environmental perturbations, including other oil spills. Researchers at Point Reyes Bird Observatory are reviewing and synthesizing the literature on recovery of marine birds. Recovery literature for fish and shellfish is being reviewed by the University of Washington Fisheries Research Institute. Hubbs-Sea World Research Institute and the Pacific Estuarine Research Laboratory at San Diego State University are reviewing the recovery literature for marine mammals and intertidal and subtidal invertebrate communities. The results of this work will help guide restoration scientific and monitoring efforts and help ensure the wise use of restoration resources.

Restoration Science Studies

As damage assessment results were reviewed and evaluated, RPWG identified potential restoration implementation projects. This involved ongoing consultation with principal investigators for the damage assessment studies, agency experts, and outside peer reviewers to review the nature and extent of injuries from the oil spill. In many cases additional information is needed before a restoration option can be evaluated or implemented. Thus, the Trustees approved a series of small-scale restoration science studies in 1990 and 1991. Restoration science

is ongoing hypenated or not? some places it is studies provide information needed to evaluate or carry out potential restoration implementation activities. Three types of studies were conducted:

- Feasibility studies to test the practicality and effectiveness of proposed direct restoration techniques;
- Technical support studies to provide biological or other information necessary to identify, evaluate, or conduct potential restoration activities; and
- Monitoring studies to document the extent and rate of natural recovery of an injured resource.

These studies are described in the 1990 and 1991 reports on **State/Federal Natural Resource Damage Assessment and Restoration Plans for the *Exxon Valdez* Oil Spill** and in three Federal Register notices (see references at end of this document).

Monitoring

In 1991 RPWG initiated a planning effort to develop an integrated monitoring strategy to follow the progress of recovery of injured natural resources in the spill area. The program will determine if and when natural recovery will restore injured resources to their pre-spill baseline conditions and monitor the effectiveness of restoration measures selected and implemented. It may also detect latent injuries and reveal long-term trends in the environmental health of ecosystems affected by the oil spill. The duration of recovery monitoring will depend on the severity and duration of effects resulting from the spill and the rate of recovery of injured resources and services.

The duration of recovery monitoring will depend on the time necessary to establish a trend for recovery, and this in turn will necessarily depend on the duration of effects resulting from the oil spill. Continuation of some level of monitoring beyond recovery may be appropriate because it enhances our understanding of how our changing environment affects the species we manage and protect. While some monitoring is already underway, the development of a more comprehensive and better integrated monitoring program is required. In 1992 the Trustees will develop a conceptual design for a recovery monitoring plan that addresses overall goals and objectives, how best to integrate monitoring, the required infrastructure for implementation and management, funding mechanisms, and relationships to other monitoring programs within the spill area. This effort will serve to guide a subsequent more detailed planning effort scheduled for later in 1992 aimed at establishing a technical design for each species and/or habitat to be monitored, a data management system and quality assurance plan to handle all monitoring data, cost estimates for each monitoring component, and a strategy for review and update to ensure that the most appropriate and cost-effective monitoring methods will be used.

Note: This version does not yet incorporate comments from Spies

CHAPTER III SUMMARY OF INJURY

The *Exxon Valdez* oil spill occurred just prior to the most active season of the year in southcentral Alaska. This is true for the fishing and tourism industries, as well as biologically. During the two-month period after the spill, seaward migrations of salmon fry, major migrations of birds, and the primary reproductive period for most species of birds, mammals, fish, and marine invertebrate species took place. The organisms involved in these critical periods of their life cycles encountered the most concentrated, volatile, and potentially damaging forms of the spilled oil. All species were not affected in the same way. Resources continue to be exposed to oil buried in the intertidal zone as well as to oil that was washed to the subtidal zone in some areas. More than 1,200 miles of coastline were oiled, including portions of the Chugach National Forest, Alaska Maritime, Kodiak, and Alaska Peninsula/Becharof national wildlife refuges, Kenai Fjords National Park, Katmai National Park and Preserve, and Aniakchak National Monument and Preserve. Oil from the T/V *Exxon Valdez* impacted shorelines nearly 600 miles from Bligh Reef.

Marine Mammals

Following the spill, studies of humpback whales, Steller sea lions, sea otters, harbor seals, and killer whales were initiated. The Steller sea lion study was completed and the humpback whale study was discontinued following the 1990 field season. Humpback whale investigations were limited to photo identification of whales, estimations of reproductive success, and possible displacement of whales from preferred habitats. It was not possible to take tissue samples for petroleum hydrocarbon analysis to document exposure. The study did not show direct oil spill mortalities or reproductive failures for humpback whales.

The sea lion study was completed following the 1990 pup counts. Some tissue samples were analyzed for petroleum hydrocarbon concentrations, and although there was some indication of exposure to oil, it was difficult to determine what populations were affected because of the sea lions' active seasonal movements. Because of an ongoing pre-spill population decline and premature pupping of sea lions, it was not possible to distinguish post- from pre-spill population effects clearly.

Studies of killer whales, based on photo-identification studies, have indicated that a significant number of whales are missing from at least one and possibly two pods in Prince William Sound. Changes have also been observed in killer whale distribution, social structure, and incidence of anatomical abnormalities. The causes of these changes continue to be researched. Injuries to harbor seals and sea otters have been clearly indicated and studies of these species are continuing.

Sea Otters

The population of sea otters in Prince William Sound before the spill was estimated to have been as high as 10,000. The total sea otter population of the Gulf of Alaska was estimated to be at least 20,000. Statewide, the sea otter population is estimated at 150,000. Sea otters were particularly vulnerable to the spill. As the oil moved through Prince William Sound and the Gulf of Alaska, it covered large areas inhabited by otters. When sea otters became contaminated by oil, their fur lost its insulating capabilities, leading to death from hypothermia. Sea otters also died as a result of ingestion of oil and perhaps inhalation of toxic aromatic compounds that evaporated from the slick shortly after the spill. The effects of oil were documented by repeated surveys of wild populations; by recovery of beach cast carcasses; analysis of tissues for petroleum hydrocarbons and indicators of reduced health; by tracking sea otters outfitted with radio transmitters (including those released from rehabilitation centers); and estimating total mortality from the number of sea otter carcasses recovered following the oil spill. These studies concentrated on developing an estimate of sea otter mortality in Prince William Sound and along the Kenai Peninsula, the population most affected by the spill. During 1989, a total of 1,011 sea otter carcasses were recovered in the spill area, cataloged, and stored in evidence trailers. Of these, 876 were recovered dead from the field and 135 died in rehabilitation centers or other facilities. The total number of sea otters estimated to have been killed directly by the spill ranges from 3,500 to 5,500 animals throughout the spill area.

Sub-lethal initial exposure and long-term continuing exposure to petroleum hydrocarbons may be continuing to injure sea otters. Preliminary findings of the Coastal Habitat and Shellfish studies identified significantly elevated levels of petroleum hydrocarbons in intertidal and subtidal sediment samples within the spill zone as well as in benthic marine invertebrates identified as sea otter prey in western Prince William Sound. Blood samples collected from caught sea otters caught in 1990 and 1991 identified significant differences in several blood parameters between eastern and western Prince William Sound. Males in the western Prince William Sound had significantly higher eosinophil counts as compared to males in the eastern Prince William Sound, suggesting systemic hypersensitivity reactions. Hematocrits and hemoglobins were also significantly elevated in these animals. Although there were no significant differences in hematological parameters between east and west female sea otters, some chemistry changes were consistent with changes observed in the males.

Studies have documented continuing injury to sea otters. Based on pre-spill data from Prince William Sound, very few prime age sea otters (animals between 2 and 8 years old) die each year and most mortality occurs among very young and old age classes. A high proportion of prime age sea otter carcasses were found during 1990 and 1991, indicating that the pattern of sea otter mortality in heavily oiled areas continues to be abnormal.

TABLE X. SUMMARY of INJURY TABLE From BOB SPIES' Slide Presentation at the FEB 6TH TRUSTEE Council MTG

INSERT for CHAPTER III
SUMMARY of INJURY

Results of boat surveys indicated continued declines in sea otter abundance within oiled habitats in Prince William Sound. Comparisons of pre- and post-spill estimates of sea otter abundance, based on boat surveys near shore, found that unoiled areas underwent a 13.5 percent increase in abundance, while oiled areas underwent a 34.6 percent decrease. In addition, the post-spill population in the oiled area is significantly lower than the best pre-spill estimate, indicating a real decline of 1,600 sea otters in Prince William Sound initially, and up to 2,200 in subsequent years.

Results of a study of sea otter pups demonstrate significantly higher post-weaning mortality in western Prince William Sound, compared to controls in the eastern Prince William Sound. In contrast, survival of adult female sea otters was significantly higher in western Prince William Sound compared to controls in the east. Pupping rates of adult females and survival of those pups through weaning in 1990 and 1991 were similar between eastern and western Prince William Sound and were considered normal.

Studies of the survival and reproductive success of sea otters released from rehabilitation centers indicate a high level of mortality of adult animals and significantly lower pupping rates than pre-spill mortality and pupping rates in Prince William Sound. Of the 193 sea otters released from rehabilitation centers, 45 were fitted with radio transmitters. As of July 31, 1991, 14 of these animals were still alive, 14 were known to be dead, and 16 were missing. One radio transmitter failed.

The observed changes in the age distributions of dying sea otters, continued declines in abundance, higher juvenile mortality, and higher mortality and lower pupping rates among oiled sea otters suggest a prolonged, spill-related effect on at least the western Prince William Sound sea otter population.

Harbor Seals

Two hundred harbor seals are estimated to have been killed by the spill. Only 19 seal carcasses were recovered following the spill, since seals sink when they die. Population changes were documented by summer and fall aerial surveys of known haulout areas. Toxicological and histopathological analyses were conducted to assess petroleum hydrocarbon accumulation and persistence and to determine toxic injuries to tissues. Severe debilitating lesions were found in the thalamus of the brain of a heavily oiled seal collected in Herring Bay 36 days after the spill. Similar but milder lesions were found in five other seals collected three or more months after the spill. During 1989, oiled harbor seals behaved abnormally, being lethargic or unwary. Petroleum hydrocarbon concentrations in bile were 5 to 6 times higher in seals from oiled areas one year after the spill. This indicates that seals were still encountering oil in the environment, were metabolizing stored fat reserves that had elevated levels of petroleum hydrocarbons, or both.[1]

There has never been a complete census of harbor seals in Prince William Sound. However, trend locations have been intermittently surveyed since the 1970s. Counts at the trend sites have declined by 40 percent between 1984 and 1988. A complete survey of Prince William Sound was completed during August 1991, resulting in an estimated population of 2,914 harbor seals. Natural Resource Damage Assessment studies conducted from 1989 through 1991 found differential rates of decline at oiled versus unoiled trend sites, with oiled sites having a higher rate of decline of harbor seals than unoiled sites.

Population surveys, which are reliable indicators of population trends, conducted in 1984 and 1988 indicated that harbor seal populations in Prince William Sound had declined prior to the spill, with similar declines in what were subsequently oiled and unoiled areas. From 1988 to 1990, however, the decline at oiled sites (35 percent) was significantly greater than at unoiled sites (13 percent). Trend surveys conducted in 1991 continue to indicate significantly lower numbers in oiled areas.

<u>Killer Whales</u>

Approximately 182 killer whales forming nine distinct family units or "pods" resided in Prince William Sound before the spill. This count is based on pre-spill documentation. These whales were studied intensively before the spill and their social structure and population dynamics are well known. Damage assessment studies of killer whales involved extensive boat-based surveys in Prince William Sound and adjacent waters. Whales were photographed and the photographs were compared to the Alaskan killer whale photographic database for the years 1977 to 1989 to determine changes in whale abundance, seasonal distribution, pod integrity, and mortality and natality rates.

The AB pod of 36 individual whales was sighted intact in September of 1988. When sighted on March 31, 1989, seven days after the spill, seven individuals were missing. Six additional whales were missing from the AB pod in 1990. Assuming that whales missing for two consecutive years are dead, the 1988-1989 and 1989-1990 mortality rates for AB pod were 19.4 percent and 20.7 percent, respectively. The average annual mortality seen in AB pod from 1984 to 1988 was 6.1 percent. An additional whale was missing in 1991. The approximate calving interval of killer whales is four years. Accordingly, some long-term effects may not be obvious for many years.

Another Prince William Sound pod, AT pod, is missing 11 whales. A subgroup

---

[1] Harbor seals are taken in some Alaska villages for subsistence. The State of Alaska conducted a program, separate from the damage assessment program, to test subsistence foods potentially affected by the spill to insure that they were safe for human consumption. The State of Alaska determined that harbor seals in the affected area were safe for people to eat (Oil Spill Health Task Force, July-August 1990 Report and September-October 1990 Report. Alaska Department of Fish and Game, Division of Subsistence).

ensure (some places it is spelled this way) of four AT pod members was photographed behind the *Exxon Valdez* three days after the grounding on Bligh Reef, and three of these animals are among the missing AT pod whales.

Several of the missing whales were females which left behind calves. It is unprecedented for females to abandon calves. The social structure of AB pod has changed. Where calves normally spend time with their mothers, they have been observed swimming with adult bulls. The occurrence of collapsed dorsal fins on two adult bulls is an indication of possible physiological injury. Explanations for the possible causes of death of these missing whales continue to be explored, although both natural causes and adverse fishery interactions have been rejected. Also, with the exception of the oil spill, to our knowledge there occurred no other significant event to explain the extraordinary mortality incurred by killer whales in PWS over this time frame.

Terrestrial Mammals

Studies were conducted on terrestrial mammals that may have been exposed to oil through foraging in intertidal habitats. These species included brown bear, mink, black bear, Sitka black-tailed deer, and river otters.

Brown bears are long-lived animals and forage seasonally in the intertidal and supratidal areas of the Alaska Peninsula and the Kodiak Archipelago. Preliminary analysis of brown bear fecal samples show that some brown bears were exposed to petroleum hydrocarbons. Elevated levels of petroleum hydrocarbon metabolites, among the highest ever recorded, were found in bile from a yearling brown bear found dead in 1989. Two radio-collared female brown bears with documented petroleum hydrocarbons in feces have since failed to reproduce.

Mink and other small mammals that are known to feed and spend part or all of their time in the intertidal zone are difficult to study. They are known to crawl off into burrows or the brush if sick or injured and carcasses are unlikely to be found. Also, information on pre-spill populations of these animals is minimal. Scientists developed a laboratory study to test reproductive effects of oil on ranchbred mink, in which they were fed food mixed with small, non-lethal amounts of weathered oil. Although changes in reproductive rates or success were not documented, it was found that oil-contaminated food moved through the intestines of the animals at a more rapid rate than did clean food, possibly providing less nutrition to the animals.

No field studies were carried out for black bear due to the difficulty of finding, collaring, or otherwise investigating these animals in the dense underbrush in which they reside. However, a literature search confirmed that these animals do forage in the intertidal zone in the spill area.

The deer study found no evidence of injury based on intensive searches of beaches that revealed no mortality attributable to the spill. However, deer taken for purposes of testing for safety for human consumption (not part of the damage assessment process) found slightly elevated petroleum hydrocarbons in some tissues in deer (which feed on kelp in intertidal areas) but it was determined that the deer were safe to eat.

River Otters

A few river otter carcasses were found by cleanup workers. River otters forage in streams and shallow coastal habitats that were contaminated by the spill. Analysis of river otter bile and blood samples indicated that petroleum hydrocarbons are being accumulated by this species. Blood haptoglobin continue to be elevated in oiled areas in 1991. Studies of radio-tagged animals in Prince William Sound showed that home ranges in oiled areas are twice that of unoiled areas, suggesting difficulty in securing sufficient prey in a home range of "normal" size. In 1991, body lengths, body weights, and diversity of diet species were lower in oiled areas.

Birds

Among the most conspicuous effects of the *Exxon Valdez* oil spill was the injury to birds. Seabirds are particularly vulnerable to oil because they spend much of their time on the sea surface while foraging. Oiled plumage insulates poorly and loses buoyancy and birds die from hypothermia or drowning. Birds surviving initial acute exposure may then ingest oil by preening. Approximately 36,000 dead birds were recovered after the spill; at least 31,000 of these deaths were attributed to the effects of oil. In addition to the large number of murres, sea ducks, and bald eagles, carcasses of loons, cormorants, pigeon guillemots, grebes, murrelets, and other species were also recovered (see attached comprehensive list of bird carcasses logged into evidence trailers by September 25, 1989). Only a small proportion of the total number of birds estimated to have been killed were recovered, as many undoubtedly floated out to sea, sank, were scavenged, were trapped and hidden in masses of oil and were not visible, were buried under sand and gravel by wave actions, decomposed, or simply beached in an area where they were not found. Additionally, it is known that, in a number of cases, carcasses found shortly after the spill were not turned in to receiving stations. Analyses provided by computer models that account for some of these variables estimate that the total number of birds killed by the spill ranges from 300,000 to 645,000, with the best approximation that between 375,000 and 435,000 birds died. These estimates reflect only direct mortality occurring in the months immediately following the spill, and does not address chronic effects or loss of reproductive output.

Okay Okay do

Common and Thick-billed Murres

Murres are the third most abundant seabird in Alaska (after tufted puffins and black-legged kittiwakes). A total of approximately 1,400,000 murres reside in the Gulf of Alaska (Unimak Pass to the Canadian border in southeastern Alaska).

The total population of murres in Alaska is approximately 12,000,000. The murre colonies on the Chiswell Islands are the most visited by tourists in Alaska. In 1989 and 1990 murres were the most heavily affected bird species. Oil in Prince William Sound affected major wintering areas of murres and other species. As oil moved out of Prince William Sound and along the Kenai Peninsula and the Alaska Peninsula, it hit coastlines and nearshore waters of major seabird nesting areas, such as the Chiswell and Barren Islands, as well as numerous smaller colonies. The oil hit these areas outside Prince William Sound at the same time that adult murres were congregating on the water near colonies in anticipation of the nesting season. Approximately 22,000 murre carcasses were recovered following the spill. Colony surveys indicate that an estimated minimum of 120,000 to 140,000 breeding adult murres in the major colonies that were surveyed were killed by the spill. Extrapolating this information to other known murre colonies hit by the spill (but not specifically studied), the mortality of breeding adult murres is estimated to have been 172,000 to 198,000. However, area-wide, including wintering and non-breeding birds, the total mortality of murres is estimated to be about 300,000. Numbers of breeding murres declined in 1989 from pre-spill counts or estimates at Alaska Peninsula sites (50-60 percent), the Barren Islands (60-70 percent), and the Triplet Islands near Kodiak Island (35 percent). These dramatic decreases persisted in 1990 and 1991. No significant changes in murre numbers were noted for the control areas on the Semidi Islands and Middleton Island as compared to pre-spill data. Murres exhibit strong fidelity to traditional breeding sites and infrequently immigrate to new colonies.

Normally, murres breed in densely packed colonies on cliff faces. Each murre colony initiates egg laying almost simultaneously. This synchronized breeding behavior helps the birds repel predators such as gulls and ravens. In oiled areas, murre colonies have exhibited a much lower populations than before the spill, breeding is later than normal, and breeding synchrony has been disrupted. These structural and behavioral changes in colonies have caused complete reproductive failure during 1989, 1990, and 1991, and thus lost production of at least 300,000 chicks. Murre colonies in unoiled areas displayed none of these injuries and had normal productivity.

Bald Eagles

Of the estimated Alaskan bald eagle population of 39,000 birds (27,000 adults and 12,000 fledglings), an estimated 4,000 reside in Prince William Sound and an estimated 8,000 to 10,000 in the coastal environments of the northern Gulf of Alaska. One hundred fifty-one (151) dead bald eagles were found following the spill. Although there is considerable uncertainty regarding the total mortality of bald eagles, it is estimated that several times this amount may have been killed by the initial spill. Seventy-four percent of radio-tagged bald eagles that died during subsequent studies ended up in the forest or in other places where they would likely not have been found. It is conservatively estimated that 553 bald eagles were killed directly by the spill. To assess injuries to bald eagles, helicopter and fixed-wing surveys were flown to estimate populations and productivity. Radio transmitters were attached to bald eagles to estimate survival, distribution, and exposure to oiled areas. Bald eagles in Prince William Sound were most intensively studied. Productivity surveys in 1989 indicate a failure rate of approximately 85 percent for nests on moderately or heavily oiled beaches compared to 55 percent on unoiled or lightly oiled beaches. This resulted in a lost production of at least 133 chicks in Prince William Sound in 1989. Nest success and productivity on the Alaska Peninsula were also lower in 1989 than in 1990, but differences between years for other coastal areas affected by the spill were less apparent. Nest occupancy was lower in oiled areas than in unoiled areas in both 1989 and 1990. Bald eagles have a delayed sexual maturity and have a relatively long life span under normal circumstances. Consequently, although reproduction apparently rebounded to more normal levels in 1990, population impacts as a result of poor reproduction and the death of hundreds of adult eagles in 1989 may not be readily apparent for several years. Population indices form surveys in 1982, 1989, 1990, and 1991 changed little from year to year and suggest a static bald eagle population in Prince William Sound.

from ?

Sea Ducks

More than 2,000 sea duck carcasses were recovered after the spill, including more than 200 harlequin ducks. Studies concentrated on harlequins, goldeneyes, and scoters, species that use the intertidal and shallow subtidal habitats most heavily affected by the spill. Harlequins were most affected, consistent with the fact that they feed in the shallow water area of the intertidal zone. This is the only species of sea duck studied that both nests in the spill area and feeds in the shallow intertidal zone. All of these species feed on invertebrates such as mussels which, in 1991, continue to show evidence of petroleum hydrocarbon contamination. Contaminated mussel beds are expected to continue to cause injury to harlequins and other sea ducks that feed on mussels.

About 33 percent of the harlequins collected in the spill area had poor body condition (reduced body fat) and about 40 percent had tissues contaminated with petroleum hydrocarbons, especially concentrated in bile and liver samples. The 1991 survey indicates harlequin population declines and a near total reproductive failure in oiled areas of Prince William Sound.

Other Birds

Should it be Kittlitz's as on the following page

Boat surveys were initiated in Prince William Sound and other areas of the spill zone to estimate abundance and examine population changes of waterbirds between pre-spill and post-spill surveys, and to compare changes in oiled and unoiled zones. Overall declines (treating oiled and unoiled areas together) in Prince William Sound populations occurred between 1972/1973 and the years after the oil spill for the following 16 out of 39 species or species groups examined: grebes, cormorants, northern pintail, harlequin duck, oldsquaw, scoters, goldeneyes, bufflehead, black oystercatcher, Bonaparte's gull, black-legged kittiwake, arctic tern, pigeon guillemot, Brachyramphus (marbled and Kittlitz') murrelets, and northwestern crow. Harlequin ducks, black oystercatchers, pigeon guillemots, northwest crows, and cormorants declined more in oiled areas than in unoiled areas since the early 1970s. Comparisons of post-spill survey data with 1984 pre-spill data found that harlequin ducks, black oyster-catchers, murres, pigeon guillemots, cormorants, arctic terns, and tufted puffins declined more in oiled areas as compared to unoiled areas.

(see note on page 18)

Marbled and Kittlitz's murrelet populations declined dramatically in Prince William Sound since surveys done in 1972 and 1973. In 1973, the estimated murrelet population in the Sound was 304,000 birds, while murrelet populations were estimated to be 107,000 in 1989, 81,0000 in 1990, and 106,000 in 1991. The length of time between pre-spill and post-spill surveys makes it difficult to determine the contribution of the spill to this decline. However, the high proportion of murrelets killed by the spill in Prince William Sound relative to the number present when the spill occurred and the documentation of internal petroleum hydrocarbon contamination of apparently healthy murrelets collected in oiled areas indicate that the spill had a significant effect on murrelets. Disturbance associated with cleanup activities likely impacted numbers of murrelets observed in the spill area in 1989.

needs a hyphen

Although only nine black oystercatcher carcasses were found after the spill, this species is completely dependent upon the intertidal zone, the community most significantly injured by the spill. In addition to mortality caused directly by the spill, oiling affected their reproductive success. Relative egg volume of clutches and weight gained by chicks on oiled sites were substantially lower than on unoiled sites. The difference in weight gain may be driven by food quality since the biomass of food delivered to oiled sites was significantly greater than that delivered to unoiled sites. Hatching success, fledgling success, and productivity were not significantly different between oiled and unoiled sites. Direct disturbance by clean-up activities significantly reduced oystercatcher productivity on Green Island during 1990.

Pigeon guillemots are nearshore diving seabirds that gather daily on intertidal rocks near their colonies during the breeding season and forage by probing into intertidal and subtidal recesses and kelp. Five hundred sixteen (516) carcasses were recovered following the spill. It is estimated that between 1,500 and 3,000 guillemots were killed by the spill, representing as high as 10 percent of the cataloged pigeon guillemot population in the Gulf of Alaska. Boat surveys indicate that in 1973, the Prince William Sound guillemot population was approximately 14,600, while in 1989, 1990, and 1991, the estimated populations were, respectively, 4,000, 3,000, and 6,600. Although the evidence suggests that guillemots were declining prior to the spill, there were significantly greater declines in oiled areas. Throughout the four islands of the Naked Island group, post-spill surveys showed a 40 percent decline in guillemots during peak colony attendance hours compared to pre-spill surveys. Declines corresponded to the degree of shoreline oiling. Preliminary analysis indicates that fledgling weight, chick growth rate, and nesting success were significantly lower in post-spill years as compared to pre-spill years. Petroleum hydrocarbons were found on eggs and in tissue in 1989 and on eggs in 1990.

The extent of injury to certain species, including loons, cormorants, and gulls will probably never be known because pre-spill information on numbers of these birds in the spill area are not available. Studies did not document injury to certain bird species such as Peale's peregrine falcons or songbirds.

Fish/Shellfish

No massive die-offs of adult fish were found following the spill, and adult salmon, for example, were evidently able to migrate to spawning areas after the spill. However, fish are most vulnerable to oil contamination during the early stages of their life cycles. Accordingly, most fish studies initially focused on this phase of fish life history. During 1991, scientists will begin to be able to assess effects on adult fish such as salmon that would have been exposed to oil as eggs or larvae. Species most affected by the spill were those that spawn in the intertidal zone (salmon and herring) or feed in the shallow areas next to shore (Dolly Varden).[2] Less than ten dead rockfish were found during the spill and their deaths were attributed to oil. Several species of coastal and offshore fish (pollock, halibut, sablefish, cod, yellowfin and flathead sole, and rockfish) show evidence over a large geographic area of continuing exposure to petroleum hydrocarbons in areas affected by the spill, but significant injury has yet to be documented. Samples from pollock, which feed in the water column, taken as far away as 500 miles from the wreck site on Bligh Reef, showed elevated petroleum hydrocarbon metabolite concentrations in their bile. This indicates that the water column or food supply was affected at great distances from the spill. Because salmon and other fish species can metabolize petroleum hydrocarbons, these contaminants are unlikely to concentrate in edible fish tissues. Indicators of exposure in fish include increased levels of hydrocarbon metabolites in bile and activities of mono-oxygenase enzymes in liver tissue. Since injuries from chronic exposure to oil may not manifest themselves for a number of years, it is premature to conclude that coastal and offshore species were not injured; therefore, certain studies are continuing.

Pink Salmon

The full extent of short-term injury to wild pink salmon cannot be assessed until after the 1991 run returns have been enumerated. Although the overall catch of pink salmon in Prince William Sound during 1990 was an all-time record (as predicted before the spill), this was primarily due to strong runs of hatchery-produced salmon. Salmon survival associated with the Armin F. Koerning hatchery, located in the middle of a heavily oiled area of the spill zone, was half that of Ester Hatchery, located outside the area of the spill. Wild production of pink salmon did not mirror the record production of hatchery fish. Seventy-five percent of wild pink salmon spawn in the intertidal portion of streams in Prince

[2] The State of Alaska imposed the highest possible standards for commercial fishery openings and for processing plant inspections to insure that all commercially harvested salmon were free from contamination. Salmon subject to commercial harvest in the spill area were rigorously tested to insure that the catch was safe for human consumption.

William Sound. Wild stock salmon did not shift spawning habitat following the spill and deposited eggs in intertidal areas of oiled streams. In the summer of 1989, a 70 percent greater mortality of pink salmon eggs occurred in eggs laid in oiled streams as compared to control streams. A 115 (delete space) percent difference in egg mortalities between oiled and unoiled streams in 1991 equates to 40 to 50 percent egg mortality in oiled, and less than 20 percent in unoiled streams in 1991. Egg mortality was greater in 1991 than in previous study years. Fry growth was decreased in oiled streams as compared to unoiled streams. The role of the spill, as well as the role of natural variability in causing the increased 1991 egg mortality, are being analyzed. Eggs and larvae of wild populations continue to be exposed to oil in intertidal gravel in oiled areas.

Pink salmon juveniles were exposed to petroleum hydrocarbons from the spill in near shore marine habitats in oiled portions of Prince William Sound in 1989. Growth rates of juvenile pink salmon were lower in oiled locations in 1989. Growth rates during initial marine residency of pink salmon are directly related to survival. There was no evidence of continued reduced growth of juvenile salmon in nearshore waters in 1990. Laboratory experiments in 1991 confirmed that ingestion of food contaminated with whole oil can cause reduced growth and increased mortality of juvenile pink salmon.

Larvae from heavily oiled streams showed gross morphological abnormalities, including club fins and curved spines. The pink salmon that returned to Prince William Sound in the summer of 1990 were exposed to oil as larvae as they swam under the slick in 1989, but not as eggs which were more directly exposed to oil than the larvae. The 1990 return of both wild and hatchery pink salmon was 20 to 25 percent lower than expected without the spill, resulting in a return of 15 to 25 million less fish. Fish that returned in 1991 were the first that were exposed to oil as eggs. In 1991, returns of wild stocks were low in both oiled and unoiled streams.

Sockeye Salmon

Commercial harvest of sockeye salmon was curtailed in portions of Cook Inlet, Chignik, and Kodiak in 1989 because of the spill, resulting in an unusually high number of adults migrating to spawn in certain lake spawning systems (Kenai/Skilak lakes, Red and Akalura lakes). Returning adults that arrive at the spawning areas are referred to as the "escapement". This overescapement resulted in poor growth rates and poor survival to the smolt stage, perhaps due to too little food for the increased number of juveniles that needed to be supported by nursery lake productivity. This is expected to cause a 20 to 50 percent decline in adult returns in 1993 and 1994. Total closure of the commercial and sport sockeye fisheries may be necessary for the Kenai and Red Lake systems in those years.

Dolly Varden and Cutthroat Trout

Prince William Sound is the northern extreme of the range of cutthroat trout. Both cutthroat trout and Dolly Varden use nearshore and estuarine habitat for feeding throughout their lives (in contrast to salmon which migrate out to sea). The highest concentrations of bile petroleum hydrocarbon metabolites in all fish sampled were found in Dolly Varden. Tagging studies have demonstrated that the annual mortality of adult Dolly Varden was 32 percent greater in oiled areas than in unoiled areas. The larger cutthroat trout also showed higher levels of mortality in oiled and unoiled areas. In 1989-1990, there was 57 percent greater mortality and in 1990-1991, a 65 percent greater mortality in oiled streams as compared to unoiled streams. Additionally, cutthroat trout growth rates were reduced 68 percent in 1989-1990 and 71 percent in 1990-1991 in oiled areas.

Pacific Herring

Populations of Pacific herring were spawning in shallow eelgrass and algal beds at the time of the spill. The effects of oil on egg survival, hatching success, larval development, and recruitment to the spawning population were studied. Study results show a large increase in the percentage of abnormal embryos and larvae in oiled areas of Prince William Sound during the 1989 reproductive season. Larvae in oiled areas also had a greater incidence of eye tumors. Whether the adult population has been affected by these larval injuries will not be determined until the 1989 and 1990 cohorts return to spawn in 1992 and 1993.

There was evidence of oil contamination in adult fish in 1989 and 1990. In 1989, hydrocarbon metabolites occurred in the bile and in whole fish and there were significant changes in the parasite burden of adults found in oiled as compared to unoiled sites. The parasite burden of the adult herring returned to baseline levels in 1991. Processing and analysis of 1991 egg, larvae and adult herring data continues.

Rockfish and Other Fish

Rockfish were the only fish species for which adult fish were observed dying immediately after the spill. Rockfish showed lethal and sublethal injuries, including tissue lesions, consistent with exposure to hydrocarbons. Other species that showed petroleum hydrocarbon metabolites in the bile in 1989 included halibut, pollock, rock sole, yellowfin sole, flathead sole, and Pacific cod, and in 1990 Dover sole and sablefish. Fishing pressure increased on rockfish when salmon seasons were closed in 1989, and these fishing pressures have not returned to pre-spill levels.

Coastal Habitat

The intertidal zone was the most severely contaminated habitat. Intertidal habitats are highly productive and biologically rich. They are particularly vulnerable to the grounding of oil, its persistence, and effects of associated clean-up activities. An interdisciplinary team with expertise in plant and systems ecology, marine biology, and statistical analysis was established to conduct field studies to assess the effects of oil on intertidal ecosystems.

Supratidal

Results of studies in the Kodiak/Alaska Peninsula area suggest that oil both in the supratidal habitat and beach cleanup disturbance decreased the productivity of grasses and other vegetation including beach rye grass, that help stabilize beach berms. In one instance, cleanup activities completely removed the vegetation. Increased production of supratidal vegetation was found in Prince William Sound in 1989. This finding corresponds with information from other oil spills. It is not known whether this increased production was a result of decreased browsing by terrestrial mammals, a fertilizer effect of the oil, or the fertilizer used in bioremediation.

hyphen
hyphen

Intertidal

Natural populations of intertidal organisms were significantly reduced along heavily oiled shorelines, such as at Herring Bay. Densities of intertidal algae (*Fucus*), barnacles, limpets, amphipods, isopods, and marine worms were reduced. Although there were increased densities of mussels in oiled areas, they were significantly smaller than mussels in the unoiled areas and the total biomass of mussels was significantly lower. Intertidal organisms continue to be exposed to petroleum hydrocarbons from the more heavily oiled sediments.

In 1991, relatively high levels of oil were found in mussels, in the dense underlying mat (byssal-thread substrate) and in underlying sediments of certain oiled mussel beds. These beds were not cleaned or removed during the cleanup process. These oiled mussel beds are potential sources of contamination for harlequin ducks, black oystercatchers, and juvenile sea otters, all of which feed on mussels and show continued biological injury. The oil found in dense byssal mat substrates or underlying sediments associated with some mussel beds was relatively unweathered and may continue to contaminate overlying mussel beds. The extent and magnitude of oiled mussel beds is not known and continues to be investigated.

hyphen

Intertidal fishes were less abundant in oiled areas than in unoiled areas. In addition, gill parasitism and respiration rates were significantly higher in fish from oiled sites compared to unoiled sites.

Fucus

Fucus, the dominant intertidal algae, was severely affected by the oil and subsequent cleanup activities. The percentage of intertidal areas covered by *Fucus* was reduced following the spill, due to both oil and aggressive cleanup techniques. Opportunistic algae, which characteristically flourish in disturbed areas, increased in biomass. The average size of *Fucus* was reduced, the number of reproductive sized plants greatly decreased, and the remaining plants of reproductive size decreased in reproductive potential due to fewer fertile receptacles per plant. There was also reduced recruitment of *Fucus* at oiled sites.

hyphen
hyphen

Subtidal Habitats

Between 1989 and 1991, oil concentrations declined in intertidal sediments sampled at most oiled location, while the concentration in shallow subtidal sediments (3-20 meters) remained about the same or in some cases, increased slightly. Patterns of sediment toxicity to test organisms (marine amphipods and larval bivalve molluscs) reflected similar patterns. In 1990, significant toxicity only was associated with intertidal sediment samples from heavily oiled sites, but in 1991, toxicity was associated primarily with sediment samples from the shallow subtidal zone. There is evidence that animals living on or near the sea floor continue to be exposed to petroleum hydrocarbons. Petroleum hydrocarbon metabolites and increased mono-oxygenase enzyme activities have been found in the bile and liver of yellowfin sole, rock sole, and flathead sole. Concentrations of petroleum hydrocarbon metabolites in the bile of these species did not decline substantially from 1989 and 1990, but did generally decline from 1990 to 1991. This contrasts with Dolly Varden which feed close to shore and where petroleum hydrocarbon metabolites in bile decreased markedly form 1989 to 1990. Many subtidal and intertidal species, particularly fish, actively metabolize and rapidly eliminate petroleum hydrocarbons from their tissues.

Clams metabolize hydrocarbons very slowly and consequently accumulate them in high concentrations. Contaminated clams and other invertebrates are a potential continuing source of petroleum hydrocarbons for sea otters and other species that forage in the shallow subtidal zone. Petroleum hydrocarbon accumulation in mussels experimentally placed in the water column in oiled areas was significant during the summer of 1989, but decreased to barely detectable accumulations by 1990. Sediment traps collected significant concentrations of petroleum hydrocarbons during the winter of 1990-1991, indicating that oil was still being mobilized subtidally. Initial 1990 study results show a significant effect on benthic organisms associated with eelgrass beds. These are known to be highly productive habitats. The composition of benthic animal communities on soft-bottom habitats as deep as 40 meters was also significantly altered in oiled areas.

Other Resources and Services

The spill directly impacted archaeological sites and artifacts, subsistence recreation, and wilderness and intrinsic values. Cleanup activities and the hypen associated significant increases in human activity throughout the spill zone resulted in additional injuries to these resources.

Archaeological Sites and Artifacts

Archaeological sites along the shoreline were injured by the spill. Review of spill response data revealed injuries occurred at a minimum of 35 archaeological sites. Among these are burial sites and home sites. These injured sites are distributed on both federal and state lands. While injury to these 35 sites was documented during cleanup, a spill-wide assessment of injuries to archaeological resources has yet to be completed. In addition to oil contamination, increased knowledge of the location of archaeological sites has increased the rate of looting. Additional injury due to erosion caused by oil spill response activities was documented.

A study was conducted to determine impacts caused by oil contamination on radiocarbon dating of archaeological resources and to investigate the potential for cleaning artifacts and materials to allow such dating. Results indicate significant injury to the ability to date artifacts and materials by Carbon 14 analysis.

Subsistence

Surveys undertaken by state researchers before the spill and in 1990 indicated that subsistence users in the oil-spill area significantly reduced their use of subsistence resources after the spill, primarily because of their concerns about contamination of these resources. The oil spill disrupted the subsistence lifestyle of some communities that have historically relied upon these resources for a significant portion of their diet. Some communities virtually or entirely ceased subsistence harvests in 1989 and have only gradually begun to resume harvests, while other communities continued some reduced level of subsistence harvest in 1989 and thereafter. Warnings were issued by the state in 1989 for people to avoid consumption of intertidal invertebrates (such as mussels and clams, which bioaccumulate petroleum hydrocarbons) found along shorelines contaminated by oil. After the spill, an oil spill health task force was formed, including the state and federal governments, subsistence users, and Exxon. This group helped oversee studies conducted by the state and others in conjunction with the Food and Drug Administration and National Oceanic Atmospheric Administration in 1989, 1990, and 1991 on subsistence food resources such as seals, deer, salmon, ducks, clams, and bottomfish. Based upon the test results these resources, with the exception of clams and mussels in certain oiled areas such as Windy Bay, were determined to be safe for human consumption.

Recreation

(text to be added)

Wilderness and Intrinsic Values

(text to be added)

This page intentionally left blank.

CHAPTER IV
INJURY CRITERIA

Settlement Guidance

The use of the restoration trust funds must be linked to injuries resulting from the *Exxon Valdez* oil spill. Specifically, the settlement requires that funds recovered for natural resource damages be spent to restore, replace, enhance, rehabilitate or acquire the equivalent "of natural resources injured as a result of the oil spill and the reduced or lost services provided by such resources."

"Natural resources" are defined as the land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources belonging to or managed by Federal and State governments." Services provided by natural resources include such activities as subsistence hunting and fishing and recreation. Restoration funds also may be spent on archaeological resources--"sites and artifacts"--that were injured, lost, or destroyed as a result of the oil spill. (These references were taken from the Consent Decree and Memorandum of Agreement. For full text see Appendices A and B.)

Proposed Criteria

How do we determine which natural resources, natural resource services, and archaeological resources are in need of restoration? Although information on injuries and recovery rates is available from the NRDA studies and other sources, there is a need to agree on what constitutes "injury" in order to spend restoration funds. The following factors are proposed:

- evidence of consequential injury; and
- adequacy and rate of natural recovery.

The concepts underlying these factors are described below.

Injury to Natural Resources

The following definition of injury could be applied to biological natural resources in the spill area:

> A natural resource has experienced "consequential injury" if it has sustained a loss (a) due to exposure to spilled *Exxon Valdez* oil, or (b)

which otherwise can be attributed to the oil spill and clean up. "Loss" includes:

- significant direct mortality;
- significant declines in populations or productivity;
- significant sublethal and chronic effects to adults or other life history stages; or
- degradation of habitat, due to alteration or contamination of flora, fauna, and physical components of the habitat.

This definition covers a wide range of natural resources injuries. Consequential loss is most certain where there was significant direct mortality (e.g., bald eagle and sea otters) or if studies revealed a population decline linked to the oil spill (e.g., harbor seal). Where only eggs or juvenile life history stages are known to have been harmed (e.g. Pacific herring), it is more difficult to establish consequential injury. In such cases, however, if the injury is manifested or inferred at the population level, the injury can be considered consequential. This definition also includes injury to the underlying habitats which were oiled (e.g., intertidal zone), some of which were in specially designated areas, such as parks, forests, and refuges.

In some cases our knowledge of the degree of injury and linkage to the oil spill are imperfect, due to the difficulty of obtaining the desired documentation or the geographic scope or other limitations of the damage assessment studies. The killer whale is one example; the brown bear is another. In these cases judgments must be rendered about how rigidly or narrowly the injury criteria and definition are applied.

Recovery Concept

To maximize the benefits of restoration expenditures, we need to consider whether natural recovery has occurred or is occurring before investing restoration dollars. These involve both scientific and practical considerations. In a scientific sense, full ecological recovery has been achieved when the pre-spill flora and fauna are again present, healthy, and productive, and there is a full complement of age classes. A fully recovered ecosystem will be one which provides the same functions and services as pre-spill, undamaged systems.

Our ability to scientifically determine if recovery has occurred or when it will occur is limited, due to such problems as the quality and quantity of information on pre-spill, "baseline" conditions. For each injured resource and service, however, the rate of natural recovery should be estimated, based on the best information available from NRDA studies and the scientific literature. If it appears that recovery will be nearly complete before the benefits of a restoration study or project can be realized, then common sense suggests that spending restoration dollars is not justified. On the other hand, if it appears that the time to recovery is prolonged, it is worth considering technically feasible, cost-effective restoration options.

Archaeological sites and artifacts are not living, renewable resources and have no capacity to heal themselves. Thus, the concept of recovery only has limited application to these resources.

Injury to Natural Resource Services

A variety of natural resource services were injured and are considered for restoration. Examples are subsistence hunting, fishing, and gathering, wildlife viewing, a service provided by marine birds and mammals; sport fishing, a service provided by salmon, Dolly Varden and cutthroat trout; and recreation, including such activities as kayaking and backcountry camping.

Intrinsic values are also natural resources services potentially injured by the oil spill. Intrinsic values, for example, may include the sense of many Americans that the oil spill violated their perception of the spill area as a pristine wilderness. Formally designated Wilderness Areas (e.g., within Katmai National Park and Preserve) are a special case of a natural resources service, because there is not only a perception of wilderness, but Congress has legislated that each Wilderness Area shall maintain specific pristine physical qualities.

For each natural resources service, we first must consider whether there is evidence of consequential injury to the service. Secondly, we must consider whether that service is being provided again due to the recovery of the natural resource that provides the service.

This page intentionally left blank.

CHAPTER V
OPTIONS CRITERIA AND EVALUATION

Throughout the Natural Resources Damage Assessment and the public participation to date there have been hundreds of suggestions about ways to restore injured natural resources. To aid the Trustees and the public in determining which of the many restoration approaches and options are appropriate under the terms of the settlement and most beneficial, objective criteria have been developed to assist in the selection of potential restoration projects. These criteria presented below have generally guided the Trustee's decisions to date and are now put forward for public comment:

A. The effects of any other actual or planned response or restoration actions:

Are there other actions such as additional clean-up work, that bear on the recovery of a resource targeted by a given restoration option?

B. Potential to improve the rate or degree of recovery:

Will implementation of a restoration option make a difference in the recovery of an injured resource or service? What is the prospect for success?

C. Technical feasibility:

Are the technology and management skills available to successfully implement the proposed restoration option in the oil-spill-area environment?

D. Potential effects of the action on human health and safety:

Are there hazards to or adverse impacts on humans associated with implementation of the restoration option?

E. The relationship of the expected costs of the proposed actions to the expected benefits:

Do benefits equal or exceed costs? This is not intended to be a straight cost/benefit analysis, but a broad consideration of the direct and indirect costs and the primary and secondary benefits associated with implementation of the restoration option.

F. Cost effectiveness:

Does this restoration option achieve the desired objective at the least cost?

G. Consistency with applicable federal and state laws and policies:

Is the restoration option consistent with the directives and policies with which the Trustee agencies must comply? Potential conflicts must be evaluated and resolved prior to implementation.

H. Potential for additional injury resulting from proposed actions, including long-term and indirect impacts:

Will implementation of the restoration option result in additional injury to target resources or services or injury to other resources and services? Is the project of net environment benefit?

I. Degree to which the proposed action enhances the resource or service:

Would the restoration option enhance (i.e., improve on or create additional) injured resources or services?

J. Degree to which proposed action benefits more than one resource or service:

Would the restoration option benefit multiple resources and services, both injured target resources and services, as well as secondary resources and services?

K. Importance of starting the project within the next year:

Would delay in the project result in further injury to a resource or service or would we forego a restoration opportunity?

Further Evaluation of Restoration Options

A number of potential restoration options have satisfied these criteria in a very preliminary screening. Those options are presented in the next chapter, VII. Following public comment, each option will be subjected to more detailed technical review and evaluation to determine which restoration option or suite of options are the most appropriate to implement. Following implementation, the effectiveness of each option or suite of options will be evaluated using data collected from environmental monitoring to ensure that the rates of recovery for each injured species and habitat are meeting stated goals.

Database Review and Evaluation

For some injured resources or services, more than one restoration option may need to be implemented to ensure recovery. In cases where injury to a particular resource or service is known to vary in severity throughout the spill zone, different options or suites of options may need to be implemented at different sites within the spill zone.

To determine which options are most appropriate to implement at any given site, existing databases for each injured resource or service will be reviewed. Data relevant to this evaluation may be found in the scientific literature, Geographic Information Systems (GIS), and the reports of recently completed damage assessment and restoration studies. The database for each injured resource and service should be screened to consider:

1) the nature and severity of injury
2) the rate of natural recovery
3) life history requirements
4) factors limiting recovery
5) persistence of contaminants
6) opportunities to accelerate the rate of recovery
7) costs to accelerate recovery
8) legal status and existing management directions

Many of these evaluation are underway. With this information, the Trustees will determine if intervention on behalf of an injured resource or service is necessary or whether the injured resource or service is best left to recover on its own. The Trustees will also gauge how much restoration or enhancement will be required or whether it will be possible given the present status (and the nature) of the injured resources or services. Finally, the Trustees will assign costs of implementing specific restoration options or suites of options at one or more sites throughout the spill zone.

For some injured resources and services, much of the above information is in hand; but in other cases there are substantial deficiencies in the databases that will impede the process to formulate and implement timely restoration options. To remedy this, additional field work will be recommended to provide the needed information. Detailed study plans for work considered in 1992 are found in Volume II, the 1992 Annual Work Plan. They have been developed in consultation with scientists representing each of the Trustee agencies, outside peer reviewers, and the Chief Scientist.

Recovery Monitoring

As restoration options are formulated and implemented, monitoring will be conducted to evaluate the effectiveness of restoration and to identify where additional restoration actions may be necessary. Monitoring is also required in order to consider no-action/natural recovery as a restoration alternative of the

^if

Natural Resource Damage Assessment Rules apply. In this situation, there may be no technically feasible or cost-effective means to restore or accelerate recovery of an injured resource or service.

CHAPTER VII
POST SETTLEMENT ADMINISTRATION

The Restoration Fund

The Federal and State settlement of the civil suit against Exxon will result in a total payment of $900 million for restoration over 10 years. (The specific terms of the settlement agreement are described more fully in Chapter I.) Exxon will pay the governments a scheduled sum for restoration each year as shown below:

SCHEDULED DATE	AMOUNT
December 1991	$90 Million
December 1992	$150 Million
September 1993	$100 Million
September 1994	$70 Million
September 1995	$70 Million
September 1996	$70 Million
September 1997	$70 Million
September 1998	$70 Million
September 1999	$70 Million
September 2000	$70 Million

These monies will be deposited in the Federal Court Registry Investment System in Houston and drawn into the Joint Use Account in Alaska as funds are needed for restoration. The money deposited in the Houston account will be invested and accrue interest for the restoration fund. Each year, as the annual work plan and restoration budget is approved by the Trustees, money needed to fund the restoration work will be transferred into the accounts of the appropriate Trustee agencies.

The Federal Office of Management and Budget has directed the Federal Trustees to submit a unified plan and budget for restoration each Federal fiscal year (October 1-September 30). Each year's final budget submission is due no later than nine months before the fiscal year begins.

The settlement with Exxon also has a reopener provision, which allows the government to claim an additional $100 million between September 1, 2002 and September 1, 2006, if there is evidence of injury that was neither known nor anticipated at the time of the settlement. Any restoration projects funded with this money must have costs that are not "grossly disproportionate to the magnitude of the benefits anticipated."

Organization

The post-settlement organization is largely guided by the Memorandum of Agreement and Consent Decree which was filed in the United Stated District Court of Alaska on August 24, 1991. A copy of this document is reproduced in Appendices A and B. These documents resolved legal claims between the State of Alaska and the United States governments and, in order to maximize the funds available for restoration, set forth terms for fulfilling their obligations to assess injuries and to restore, replace, rehabilitate, enhance, or acquire the equivalent of the natural resources or services injured, lost, or destroyed as a result of the oil spill. A part of these terms is devoted to the organization to carry out these obligations.

The Trustees are responsible for making all decisions regarding funding, injury assessment and restoration. These decisions must be made by unanimous agreement of the six Trustees. The State of Alaska Trustees are the Commissioners of the departments of Environmental Conservation and Fish and Game and the Alaska Attorney General. The Federal Trustees are the secretaries of Interior and Agriculture and the Administrator of the National Oceanic and Atmospheric Administration (NOAA). The Federal Trustees do not participate directly in most restoration decisions, but have delegated authority to do so to their designated representatives on the Alaska-based Trustee Council. These representatives are the Alaska Regional Forester for the Department of Agriculture, the Special Assistant to the Secretary of the Interior, and the Regional Director for the National Marine Fisheries Service, National Oceanic Atmospheric Administration. Some of the Federal Trustees, however, have reserved some decisions to themselves directly, such as approval of the participants to the Public Advisory Group. The State Trustees themselves, unlike their Federal counterparts, serve on the Trustee Council.

The Trustee Council appointed a Restoration Team to take on the management and administrative functions for implementation of the restoration program. Each Trustee has designated one representative from his agency, except for the Attorney General of Alaska, who appointed the Commissioner of the Department of Natural Resources to the Restoration Team. The Trustee Council has formed various subgroups from agency staff to work on components of the restoration program, such as financial, public participation, and habitat protection. The organization chart approved by the Trustee Council on February 5, 1992 is shown below.

Under the terms of the Memorandum Of Agreement, the Trustees are to accomplish the following within 90 days of receipt of any recovery monies:

- agree on an organizational structure for decision making;
  [INSERT ORGANIZATION CHART]

- establish procedures for meaningful public participation in the injury assessment and the restoration process; and

- establish a public advisory group to advise the Trustees.

The first payment of recovery money was received on December 13, 1991. The 90-day period ends on March 12, 1992.

<u>Evaluation of Options for Identifying and Protecting Marine and Upland Habitats</u>

Protection of marine and adjacent upland habitats from further disturbance and environmental change will reduce the potential for adverse cumulative effects that can slow the recovery of injured resources and services. Acquisition or protection of strategic habitats and recreation sites also can replace or serve as equivalent to injured resources and services.

The following steps describe a general process to identify, rank and protect candidate upland and marine habitats for protection. Conceptually, the process follows techniques and strategies employed previously by The Nature Conservancy throughout the United States, including Alaska **(Options for Identifying and Protecting Strategic Fish & Wildlife Habitats and Recreation Sites: A General Handbook, December 1991).**

A. The first step in the conservation process is to identify the resources and services, including habitats and species, requiring protection. This step must be based on scientific inventories of candidate sites with the objective of determining the distribution and abundance of injured species or of habitats upon which injured species are dependent.

B. The second step is to use the information obtained from the inventories and rank candidate sites. Ranking criteria could include, but are not limited to, use of the site by one or more injured species, potential for land-use changes that may further impact injured species, and the prospect that failure to protect will foreclose restoration opportunities.

C. Once habitats or sites are ranked, the next major step is to develop a plan and strategy to achieve high priority sites taking into account any level of protection afforded by existing law or regulations. The protection plan should include a number of options. At an early stage, available funding should also be assessed.

Upland Habitats

Land status and legal ownership need to be established, public interests determined, and landowners need to be consulted early in the process. There is also a need to work closely with attorneys and perform an adequate level of "due diligence" before obtaining any interest in real property or timber, mineral or development rights. The most cost-effective option(s) to acquisition should be selected.

Marine Habitats

Public interests and needs, as well as the ownership and political boundaries of marine and adjacent uplands, must be assessed. Various State and Federal designations (e.g., Alaska State Park and Marine Park; State Refuge, Sanctuary, or Critical Habitat Area; National Marine Sanctuary, National Estuarine Research Reserve, National Park, National Wildlife Refuge) have been evaluated for their applicability to restoration goals (see Chapter II).

D. Once a site has been placed in protected status, the last step is to restore and maintain the land for the benefit of the injured resources or services. A sound management plan based on scientific and professional advice, and funds to support a management program are essential parts of the protection plan.

Public Participation Plan

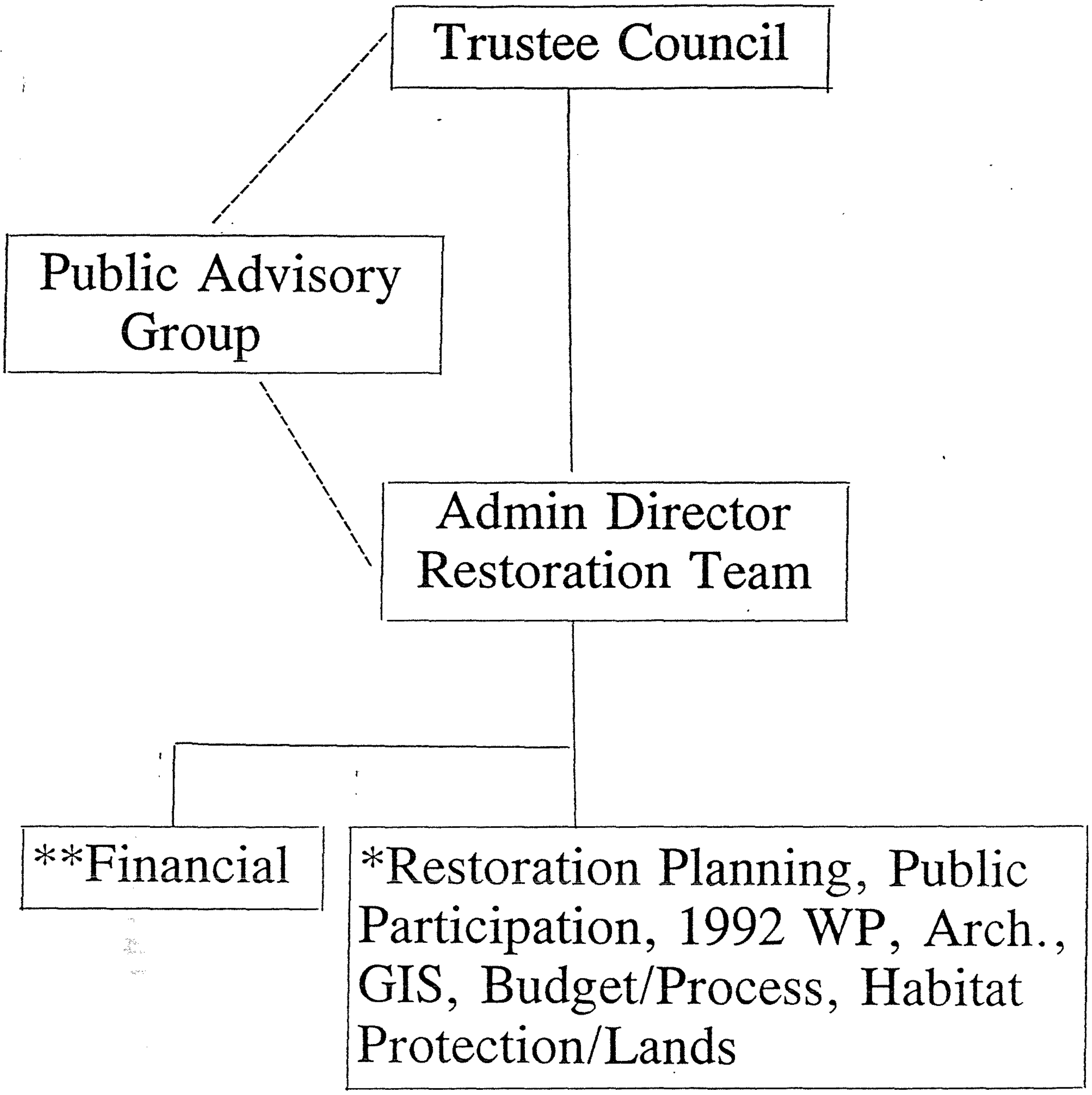
The importance of public participation in the restoration process was recognized during the Exxon settlement and is an integral part of the agreements between Exxon, and the State and Federal governments. The Memorandum of Agreement filed with the court on August 29, 1991 specifies that:

> "... the Trustees shall agree to an organizational structure for decision making under this MOA and shall establish procedures providing for meaningful public participation in the injury assessment and restoration process, which shall include establishment of a public advisory group to advise the Trustees...."

The Trustee Council instructed State and Federal restoration planners to conduct public meetings and solicit written comments on a program of public access and participation. This process began in January 1992 with meetings held in spill-affected communities as well as Juneau, Anchorage, and Fairbanks. Those comments are being evaluated for recommendations to the Trustee Council regarding role, structure, and operating procedures for a Public Advisory Group.

This section outlines the goals of the public participation program, the type of information available to the public, a brief overview of the restoration process to date, and possible criteria for a Public Advisory Group.

EXXON VALDEZ Oil Spill (approved by Trustee Council 2/5/92)



* Groups will be formed and disband as appropriate

**Does not include audit function. RT will develop a proposal for combined state/federal audit

Goals and Objectives

The goals and objectives of a public participation plan are as follows:

- establish legitimacy and ensure public acceptance of the restoration process and structure;
- involve relevant constituencies;
- disseminate information concerning the restoration process in a timely manner;
- invite and encourage public review and comment to guide development and implementation of restoration programs;
- provide the public with resources to independently understand and evaluate proposals and programs; and
- ensure that the Trustee Council receives and understands the advice and comments from the public.

Information Availability

Although the results of the damage assessment studies are still confidential in March 1992, there is significant information available about injuries and restoration. Examples of the types of information currently available to the public are:

- the 1989, 1990, and 1991 Natural Resource Damage Assessment and Restoration plans
- publicly available work/study plans
- progress reports and bibliographies published by the restoration team.

These documents, as well as an extensive collection of information on the *Exxon Valdez* oil spill, are available at the Oil Spill Public Information Center located at:

Oil Spill Public Information Center
645 G Street
Anchorage, Alaska 99501
(907) 278-8008
800-478-SPIL (Inside Alaska)
800-273-SPIL (Outside Alaska)
907-276-7178 (FAX)

Information is also available through public meetings and mailings. Mailing lists will be maintained and updated on a regular basis. These lists will be used along with community meetings and the Public Advisory Group as major components of the public participation program. The following information will be made available to the public for review and comment:

- Meeting agendas
- Informational packets
- Documents and plans

The comments received will be synthesized and made available to staff and the Trustee Council for their consideration and use.

Community Meetings

There are, at a minimum, three rounds of community meetings planned in 1992. The first set of meetings was designed to provide opportunity for comment on the public participation process and the establishment of a Public Advisory Group.

The second set of meetings will provide an opportunity for review and comment on the Restoration Framework. These meetings are scheduled for April and May 1992.

A third round of meetings will be conducted to provide opportunity for comment on a draft Restoration Plan. It is anticipated that annual work plans will be developed to implement the Restoration Plan.

Public Advisory Group

Public meetings are currently being conducted to receive input on the public participation program in general and the Public Advisory Group in particular. Issues include its role, responsibilities and membership.

It is anticipated that the members of the advisory group would be nominated by the public and appointed by unanimous consent of the Trustees, based on the following criteria:

- knowledge of the region, its people, its communities and their primary activities;
- knowledge of areas affected by the oil spill and the cleanup;
- affiliation, either formally or informally, with one or more of the principal interests;
- expertise and recognized authority in at least one of the areas of interest;

- credibility with the segments of the public whose views the member claims to represent; and
- ability to analyze restoration information and provide meaningful comment as it relates to the individual member's area(s) of expertise.

Additional Public Outreach

Other options for public outreach will be developed as the restoration program proceeds. One restoration tool identified by the Trustees is the educational process. Materials can be developed to stress the importance of careful use of natural resources to ensure the least damage to the environment.

The *Exxon Valdez* oil spill is the most studied spill in history. There are lessons to be learned and a story to be told. Damage assessment studies are still held confidential, but it is expected that when this information is released, the principal investigators will publish their results in technical journals and proceedings. One or more symposia may be held in an attempt to comprehensively tell the story of the injuries caused. Significant additional information will then become available to the public.

Compliance with NEPA

To comply with the requirements of the National Environmental Policy Act (NEPA), 42 U.S.C. 4321-4370a, the Trustees will integrate the NEPA process with its restoration planning process to ensure that planning and decisions reflect environmental values, delays are avoided, and that potential conflicts are resolved early in the process. The Trustees will use the NEPA process to encourage and facilitate public involvement in decisions that affect the restoration of the spill affected areas and to identify and assess the reasonable alternatives to proposed actions that will avoid or minimize any resulting adverse effects. This framework document begins the process of determining the scope of issues to be addressed and of identifying the significant issues related to restoration. The Trustees intend to issue a draft environmental impact statement at the time the draft restoration plan is issued, and a final environmental impact statement will be issued with the final restoration plan. The draft environmental impact statement will identify permits, licenses, and other entitlement that must be obtained in implementing the proposed action. For example, this may include consistency, to the maximum extent practicable, with the State coastal zone management program and measures protecting cultural resources pursuant to the National Historic Preservation Act.

Restoration Plan: Schedule for OY4

In this first year following settlement, the Trustees will develop a draft Restoration Plan. The purpose of the draft plan will be to present in detail the options and alternative suites of options that will best achieve restoration of injured resources and services, based on scientific and agency recommendations, public comments, and the judgement of the Trustees.

The Trustee Council approved the following schedule for March 1992 through February 1993. Public review and comment on these documents will be an essential element of the process.

March 1992:	Restoration Framework Document to Public for Review
	Draft 1992 Annual Restoration Workplan to Public for Review
April 1992:	Public Comments Due on Restoration Framework Document
	Public Comments Due on 1992 Annual Restoration Workplan
May 1992:	Request for Proposals for 1993 Annual Restoration Workplan to Public and Agencies
August 1992:	Proposals for 1993 Annual Restoration Workplan Due from Public and Agencies
September 1992:	Draft Restoration Plan to Public for Review
	Draft Proposals for 1993 Annual Restoration Workplan to Public for Review
October 1992:	Public Comments Due on Draft Restoration Plan
	Public Comments Due on Proposals for 1993 Annual Restoration Workplan
February 1993:	Publication of Restoration Plan
	Publication of 1993 Annual Restoration Workplan

Appendix A

AGREEMENT AND CONSENT DECREE

Appendix B

MEMORANDUM OF AGREEMENT

APPENDIX C
BACKGROUND ON RESOURCES AND SERVICES SELECTED FOR FURTHER CONSIDERATION

The success of developing and implementing restoration options depends in large measure on our understanding of the injured resources and services. This chapter provides a summary of the basic life history traits of the injured species and the characteristics and values of other injured or lost resources and services. This information provides a basis to better understand the restoration options under consideration. These options are described in chapter VI.

Life History Summaries

In order to better understand the injury and recovery potential of the injured species, it is helpful to understand the life histories of the individual species. Many of the species affected by the *Exxon Valdez* oil spill have not been extensively studied, especially in subarctic environments, but each species has developed a unique set of characteristics enabling it to survive in its environment. Biologically informed decisions will decrease the chances of causing additional injury, and can substantially increase the probability of successfully restoring populations.

This page will include a life history and INJURY diagram for Sea Otters

Sea Otter *(Enhydra lutris)*

Range

Sea otters presently occur in the coastal waters of central California throughout the southern coast of Alaska from Southeast to the Aleutian Islands. The range extends out to the Kamchatka Peninsula and south to Japan. Sea otter habitat is found throughout the oil-spill area.

Reproduction

Male sea otters reach sexual maturity at 5-7 years of age; females are capable of breeding at 4-5 years of age; and possibly younger. Mating and pupping occur throughout the year, although in Prince William Sound most otters mate in September-October with pups born from May-June. They are capable of reproducing annually although the reproductive period varies among individuals Space and areas. Sea otters give birth to a single pup, rarely twins. Pups are generally weaned by mid-November.

Habitat Use and Requirements

Sea otters prefer shallow coastal waters that are generally less than 40 meters deep, with soft substrates as well as rocky substrates. Sea otters will use kelp beds as resting areas, but their geographic distribution is not dependent on kelp. Intertidal rocks, exposed beaches, and algal covered rocks are used by some otters for resting. The importance of haulout sites are poorly understood: They are not considered essential to otter survival in California, but may be very important for otters in northern climates. Males and females tend to segregate except during breeding. Immature and non-breeding males often congregate in large groups. Resident males defend territories during the breeding season. Protected waters on lee shorelines are often used by sea otters during storms.

Food Habits

Sea otters eat a wide variety of prey, and can greatly influence prey availability over time. They prefer benthic invertebrates, but in some areas they prey heavily on benthic fishes. In Prince William Sound, clams, mussels and crabs are the dominant prey. There is a lot of variation in individual diets. Females with pups tend to forage in shallower areas where smaller mussels and clams are available in short dives from the surface.

Human Interactions

In the late 1800s sea otters had been eliminated from most of their historic range due to excessive fur harvesting by the Russian and American fleets. In 1911, commercial sea otter harvesting was stopped and the remnant populations began to expand. The Marine Mammal Protection Act of 1972 placed a moratorium on harvesting marine mammals, including sea otters. An exemption for Alaskan

Natives allows take for subsistence purposes.

Primary References

Alaska Department of Fish and Game. 1985. Sea otter. pages 119-130 in Alaska habitat management guide. Life histories and habitat requirements of fish and wildlife. Alaska Dept. Fish Game, Juneau, AK 429 pp.

Jameson, R.J. 1989. Movements, home range, and territories of male sea otters off central California. Mar. Mamm. Sci. 5:159-172.

Reidman, M.L. and J.A. Estes. 1990. The sea otter (*Enhydra lutris*): behavior, ecology, and natural history. U.S. Fish Wildl. Serv., Biol. Rept. 90(14). 126pp.

Blank page

insert sea otter life history figure

Harbor Seal *(Phoca vitulina richardsi)*

Range

Harbor seals are found in coastal waters of the North Pacific Ocean from northern Mexico to Alaska as far north as the Bering Sea. In the western Pacific they occur from Japan to Siberia.

Reproduction

Males and females become sexually mature when they are 3-7 years old. Breeding occurs from late June through July. Harbor seals have a delayed implantation of about 11 weeks, with an actual gestation period of about 225 days. Pups are born between late May and mid-July. Usually a single pup is born. Pups are generally nursed for 3-6 weeks. Sexually mature adults breed annually.

Habitat Use and Requirements

Harbor seals usually occupy coastal waters generally less than 60 meters deep. Seasonally, they may enter coastal rivers and lakes. They have been recorded as far as 100 kilometers away from the coast. Haulout areas are especially important for harbor seals. Rocks, isolated beaches with protective cliffs, ice floes, and sand or mud bars are used for resting, pupping and nursing young. They are especially important during the molt, which occurs throughout the summer from June-October, but peaks in late July-September.

Harbor seals have been declining in much of Alaska for unknown reasons since about the mid 1970s.

Food Web Interrelationships

Harbor seals are opportunistic predators and consume a wide variety of fish and invertebrates. Walleye pollock, herring, salmon, eulachon and cephalopods are important prey for seals in the Gulf of Alaska.

> Predation - Killer whales, sharks and stellar sea lions are known predators. Predation combined with other causes of mortality (disease, starvation, entanglement, hunting) kill about 75% of all harbor seals in their first three years.

Human Interactions

The Marine Mammal Protection Act of 1972 placed a moratorium on harvesting marine mammals, including harbor seals. An exemption for Alaskan Natives allows take for subsistence. Harbor seals are harvested by numerous Alaska villages, but the magnitude of the subsistence harvest is not known. Conflicts with commercial fishermen, competition with humans for food, and disturbance from haulout sites pose the greatest threats to harbor seals. Seals are especially vulnerable to disturbance during the molt and during pupping, when a separation may cause the mother-pup bond to weaken resulting in the death of the pup.

Primary References

Alaska Department of Fish and Game. 1985. Harbor seal life history and habitat requirements Southwest and Southcentral regions. pages 55-61 in Alaska habitat management guide. Life histories and habitat requirements of fish and wildlife. Alaska Dept. Fish Game, Juneau, AK 429 pp.

Pitcher, K.W. 1980. Food of the harbor seal, *Phoca vitulina richardsi*, in the Gulf of Alaska. Fishery Bulletin 78:544-549.

Brown Bear (*Ursus arctos*)

Range

Brown bears (grizzly bears) once ranged from the Great Plains to northern Alaska. They are still abundant in Alaska and parts of Canada, but they have been eliminated from most of the southern part of their range. They are found throughout Alaska except on some islands in specific regions of the state.

Reproduction

Brown bears reach sexual maturity between 3.5-9.5 years of age. The typical breeding interval for females to produce cubs is every 3-4 years, but may be longer for some individuals. Mating occurs between May and July, peaking in early June. The gestation period lasts about 6 months and the cubs, usually 2, are born in the den during hibernation. Most cubs are born in January. Survival of cubs to yearlings (1.5 years old) ranges from 53%-69%, depending on location. Cubs generally remain with their mother for 2.5 years.

Habitat Use

Bears inhabiting coastal habitats in southcentral/southwest Alaska tend to have home ranges of approximately ___ for females and __ for males. These home ranges cover a wide variety of habitat types and supply food throughout the seasons and denning sites in winter. In the spring, the bears often search the coastline for food. In summer, anadromous fish streams provide important food sources for the bears and many bears may be found congregated together at streams with exceptionally large salmon runs (i.e. in Katmai National Park). In late summer and fall, upland sites with abundant berries are used in addition to salmon streams. Dens are generally located on moderately sloping mountain sides, leeward of the prevailing winds. Dens are excavated under trees or boulders and are seldom used in consecutive years. Brown bears enter their dens in late October and November and emerge each spring.

Food Habits

Brown bears are omnivores. They eat a wide variety of plants including roots and/or berries of some species. During the spring, brown bears often prey upon young moose, deer and caribou. They also scavenge beaches for dead marine mammals and eat sedges and grasses in wetlands. They are capable of killing adult ungulates. Spawning salmon also provide an important component of their diets.

Human Interactions

Limited harvest of brown bears are allowed in some areas. Habitat alterations and disturbance near concentrated food sources can impact local populations.

Primary References

Alaska Department of Fish and Game. 1985. Brown bear life history and habitat requirements Southwest, Southcentral, and Arctic regions. pages 149-163 in Alaska habitat management guide. Life histories and habitat requirements of fish and wildlife. Alaska Dept. Fish Game, Juneau, AK 429 pp.

Ballard, W.B. 1982. Home range, daily movements, and reproductive biology of brown bear in Southcentral Alaska. Can. Field Nat. 96:1-3.

Jonkel, C.J. 1987. Brown Bear. in M. Novak, J.A. Baker, M.E. Obbard and B. Malloch, eds. Wild furbearer management and conservation in North America. Minis. of Nat. Res. Ontario

River Otter (*Lutra canadensis*)

Range

Historically, river otters were found throughout North America with the exception of the arid southwest. In Alaska they are found in all areas except the Aleutian Islands, the off shore islands of the Bering Sea, and the arctic coast east of Point Lay. Their Alaskan distribution remains unchanged although they are no longer found in parts of their original range in the contiguous United States.

Reproduction

River otters reach sexual maturity in 2-3 years, although males are usually unsuccessful breeders until they are 5-7 years old. Mating occurs in early spring with adult females breeding shortly after giving birth. Otters have delayed implantation with an actual gestation period of 60 to 63 days. Most births in Alaska occur in May. Litter size varies from 1-6, but litters of 2 to 3 are most common. Pups remain in the den for about 2 months before accompanying the mother in daily activities. Family groups often include 1 or more females who help with training the new pups. These females are probably offspring of the mother's previous litters. Male pups probably leave the family group at about 1 year of age. Otters can breed annually once they become mature and they may live to be 20 years old.

Habitat Use

In coastal Alaska, river otters tend to have elongated home ranges which follow the coastline. Rocky shorelines of small inlets and coves are preferred. Ranges of males may overlap with females, but otters generally avoid contact except during the breeding season. Riparian vegetation along the coast and inland by streams and lakes are important areas for otters. These sites provide resting and denning places, as well as protective cover for travelling. Den sites are located in natural cavities in old growth forests or in rock cavities, or in burrows or lodges of other animals. Latrine sites are established along the shoreline in areas of old growth forest and adjacent to suitable feeding areas. These sites are used as resting areas as otters travel along their home ranges. Home ranges vary with the quality of habitat. Ranges reported for southeastern Alaska varied from 7 to 40 kilometers. Family groups have smaller ranges than adult males.

Food Habits

River otters in coastal Alaska feed primarily in intertidal and shallow subtidal areas, but they also feed in fresh water streams and lakes if fish are available. Boney fish are the most important part of their diet but crusteans and mollusc are also important. In British Columbia, surfperch, sculpin, flounder, rockfish and greenling were the primary prey of coastal otters.

Human Interactions

River otters are trapped for their fur.

Primary References

Larsen, D.N. 1983. Habitats, movements, and foods of river otters in coastal southeastern Alaska. Unpubl. M.S. Thesis, Univ. of Alaska Fairbanks. 149pp.

Melquist, W.E. and A.E. Dronkert. 1987. River otter. Pages 627-641 in M. Novak, J.A. Baker, M.E. Obbard and B. Malloch, eds. Wild furbearer management and conservation in North America. Minis. of Nat. Res. Ontario.

Reid, D.G., W.E. Melquist, J.D. Woolington, J.M. Noll. 1986. Reproductive effects of intraperitoneal transmitter implants in river otters. J. Wildl. Manage. 50:92-94.

Solf, J.D. 1989. Land otter. Wildlife Notebook Series, Alaska Dept. Fish and Game.

Stenson, G.B., G.A. Badgero and H.D. Fisher. 1984. Food habits of the river otter *Lutra canadensis* in the marine environment of British Columbia. Can. J. Zool. 62:88-91.

Woolington, J.D. 1984. Habitat use and movements of river otters at Kelp Bay, Baranof Island, Alaska. Unpub. M.S. Thesis, Univ. of Alaska Fairbanks, 147 pp.

Killer Whale *(Orcinus orca)*

Range

Killer whales have been documented in all the oceans of the world. They appear to be abundant in the coastal waters from Washington through the Gulf of Alaska.

Reproduction

Killer whales are a long-lived species with lifespan estimates ranging from 25-40 years. Females reach sexual maturity when they reach about 5 meters in length. They give birth to a single calf in about ___, after an estimated gestation period of 15 months. Cows will nurse the calf for 12 months and provide additional care for 2 years or longer. The interval between calves is not well documented, estimates range from 3 - 8 years. Female calves remain with the pod for life, male calves may leave when they become sexually mature or they may remain with the pod as non-breeders.

Social Structure and Habitat Use

Okay

Killer whales live in social groups called pods. Pods usually consist of less than 40 animals, but may exceed 100 individuals. The whales form matrilineal subgroups within each pod. The matrilineal group consist of a female and her offspring. New matrilineal groups may form as a female calf matures and produces her own offspring.

There are two types of pods. Resident pods remain in a specific area throughout the year. Matrilineal groups of the same pod interact with each other on a regular basis. Transient pods do not occupy a consistent area. They appear irregularly in areas occupied by resident pods and may cover great distances throughout the year.

Food Habits

Killer whales are opportunistic predators. Fish are the primary food source but marine mammals and birds are also prey for the whales. A study in the North Pacific found squid, fish, other cetaceans, and pinnipeds to be common food sources. Transient pods appear to prey on more marine mammals than the whales in resident pods.

Human Interactions

The Marine Mammal Protection Act of 1972 placed a moratorium on harvesting marine mammals, including killer whales. Some whales are still shot, and sometimes killed, in conflicts with fishermen. Their striking appearance have made them an attraction for tourist industries. Each whale has unique markings which makes individual identification possible.

References

Heyning, J.E. and M.E. Dahlheim. 1988. Orcinus orca. pages. 1-9 in Mammalian Species. Am. Soc. Mamm.

COMMON MURRE *(Uria aalge inornata)*

Range

The species has a holarctic distribution primarily south of the Arctic Circle. The subspecies U. a. inornata is found from Oregon to Point Hope, Alaska.

Migration

Murres winter in offshore waters before returning to their nesting colonies in the spring.

Breeding Chronology

Murres arrive at nesting colonies in April and May. A single egg is laid in June and incubated by both adults for 28-34 days. Hatching occurs between July 10 and early August. Chicks fledge to the ocean in August. Little is known about the behavior of fledged chicks and subadults. Common murres do not breed until they are 5 years old or older, and subadults do not return to visit the colonies until they are 2-3 years old.

Breeding Behavior

The breeding success of common murres is dependent on the physical characteristics of the colony site, which typically is on a cliff face, and the density of murres nesting on each ledge. Since murres do not build nests, the slope of the nesting ledge is important to prevent the eggs from rolling off the cliff. The width of the ledge influences the number of birds that can nest and therefore, vulnerability to predation. High nesting densities (greater than 10 birds per square meter) have the greatest breeding success. Higher densities help to synchronize breeding behavior so that eggs are laid over a short period of time and chicks hatch and fledge together. This increases the ability of the murres to protect their young from predators. Most murres return to the same ledge to breed each year.

Food Web Interrelationships

Common murres eat a variety of fish and shrimp. Primary species include capelin, sand lance, walleye pollock and euphausiids.

> Predation - Predatory birds, particularly gulls (*Larus spp.*) and bald eagles (*Haliaeetus leucocephalus*), can have a significant impact on the breeding success of the colonies. Low nesting densities of murres, chicks which hatch and fledge later than their neighbors, and eggs or chicks exposed when the adults are disturbed from the ledges, are especially vulnerable.

Spare

Human Interaction

Entanglement in fishing nets does not appear to be a problem for murre colonies within the *Exxon Valdez* oil spill area. Fishing and tourism activities which disturb the murres at their nesting ledges can exacerbate predation. Subsistence harvest of the eggs and murres is not common within the oil spill area.

Primary References

Birkhead, T.R. 1977. The effect of habitat and density on breeding success in the common guillemot (*Uria aalge*). J.Anim. Ecol. 46:751-764.

Birkhead, T.R., E. Greene, J.D. Biggins, and D.N. Nettleship. 1985. Breeding site characteristics and breeding success in thick-billed murres. Can. J. Zool. 63:1880-1884.

Hatch, S.A. and M.A. Hatch. 1989. Attendance patterns of murres at breeding sites: implications for monitoring. J. Wildl. Manage. 53:483-493.

Sanger, G.A. 1986. Diets and food web relationships of seabirds in the Gulf of Alaska and adjacent marine regions. U.S. Dep. Commer., NOAA, OCSEAP Final Rep. 45:631-771.

Tuck, L.M. 1960. The murres. Canadian Wildlife Series:1. Queen's Printer, Ottawa.

Williams, A.J. 1974. Site preferences and interspecific competition among guillemots *Uria aalge* (L) and *Uria lomvia* (L.) on Bear Island. Ornis Scand. 5:113-121

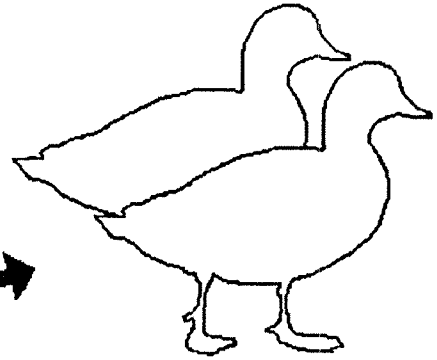
Wynne, K., D. Hicks and N. Munro. 1991. 1990 Salmon gillnet fisheries observer programs in Prince William Sound and South Unimak Alaska. Rep. to NMFS. Saltwater Inc. Anch. Alaska. 72 pp.

Harlequin Ducks

ADULTS

In early May, paired harlequins congregate at the mouths of anadromous fish streams. The pairs fly upstream to search for suitable nest sites. Wintering harlequins feed on mussels and crustaceans in shallow costal waters.

INJURY: Pairs not congregating at streams; nest site searches limited or non-existent. Possible continued exposure from contaminated prey.



NESTS

Located along shallow and swift rivers and streams. 3 to 7 eggs are laid in May and incubated for 28 - 30 days.

INJURY: No nests discovered in EVOS area.

BROODS

Broods hatch in July. They remain in freshwater with the female until August when they return to coastal waters.

INJURY: Few broods observed within EVOS area indicating either reproductive failure at nesting and/or poor brood survival.

This page will include a life history diagram for Harlequin Ducks - Insert mock up

Harlequin Duck *(Histrionicus histrionicus)*

Range

In North America, the western population is found from the Seward Peninsula, throughout the Aleutian Islands and south to central California and the northern Rocky Mountains.

Migration

In Alaska, harlequin ducks begin arriving on their wintering grounds in the Aleutian Islands and in the Gulf of Alaska in mid-September. Adults begin congregating at the mouths of suitable breeding streams in May.

Breeding Chronology

Harlequins do not breed until their second year. Egg laying begins between May 10 and May 30. Three to 7 eggs are incubated by the female for 28-30 days. The males leave the females early in the incubation period and begin congregating for the molt. Hatching occurs from early to mid-July. Females with broods remain in freshwater streams until August when they migrate to marine habitats. Adults breed annually after reaching maturity.

Habitat Use

take out space

Paired harlequins congregate at the mouths of anadromous fish streams in May. The pairs fly inland to search for nesting sites. Typically nests are located along shallow rivers and streams with gravel or rocky substrates, and nest sites are located on islands or islets under dense vegetation. Harlequins may return to the same nest site in consecutive years. Slow stretches in oxbows, or lee sides of curves, are used by broods for feeding and resting. Turbulent stretches of streams are preferred feeding places for adults in freshwater. Shallow coastal areas and intertidal reaches are used by non-breeders and males during the summer. Wintering harlequins forage in small groups along exposed coasts and in bays.

Food Web Interrelationships

Breeding birds and broods feed mostly on aquatic invertebrates and larvae. When available, salmon roe may be an important food source for all harlequins. Wintering harlequins feed predominately on molluscs and crustaceans.

Human Interactions

Harlequin ducks can be legally harvested each fall. Disturbance to molting flocks may stress individuals, and both disturbance and loss of nesting habitat can affect populations.

Primary References

Bellrose, F.C. 1980. Ducks, Geese, and Swans of North America. Stackpole Books. 540 pp.

Bengtson , S.-A. 1966. Field studies on the harlequin duck in Iceland. Wildfowl Trust 17th Ann. Rept., pp. 79-94.

______ . 1972. Breeding ecology of the Harlequin Duck (*Histrionicus histrionicus* L.) in Iceland. Ornis Scand. 3:1-19.

Dzinbel, K. A. and R. L. Jarvis. 1982. Coastal feeding ecology of harlequin ducks in Prince William Sound, Alaska, during summer. 6-10pp. IN D.N. Nettleship, G.A. Sanger and P.F. Springer Eds. Marine Birds: Their feeding ecology and commercial fisheries relationships - Proc. of the Pac. Seabird Group Symposium, Seattle, WA.

Forsell, D.J. and P.J. Gould. 1981. Distribution and abundance of marine birds and mammals wintering in the Kodiak area of Alaska. U.S. Fish and Wildl. Serv. OBS-81/13 72 pp.

Inglis, I. R., J. Lazarus, R. Torrance. 1989. The pre-nesting behavior and time budget of the harlequin duck (*Histrionicus histrionicus*). Wildfowl 40:55-73.

Patten, S.M. 1990. Prince William Sound harlequin duck breeding habitat analysis feasibility study. Appendix 1. **NRDA BIRD STUDY No. 11.**

Black Oystercatcher *(Haematopus bachmani)*

Range

okay

Inhabits coastal areas from the Aleutian Islands to Baja California.

Migration

Black oystercatchers are generally believed to be year-round residents at their breeding areas; however, observations from Alaska indicate that some birds may disperse in the winter.

Breeding Chronology

Nest scrapes are built on rock outcroppings and gravel beaches, and are sometimes lined with broken shells. One to 3 eggs are laid and incubated by both adults for 24-29 days. Eggs are laid from mid-May to early July; second clutches may be laid if the first clutch is destroyed. Although the chicks are precocious, they are fed by the adults. Feeding can continue even after the chicks have fledged. Survivorship of chicks to fledging can be very low, less than 20%. They are particularly vulnerable to predation in the first week after hatching. Chicks are capable of flying in about 40 days. Oystercatchers might take 2 or 3 years to reach sexual maturity.

Habitat Use

Oystercatchers occupy rocky and gravelly coastal areas. The highest breeding density occurs on low elevation, gravel shorelines, with little wave action. The eggs and young are cryptically colored and rely on camouflage to protect them from predators. Adults feed in the intertidal zone. During the first week after hatching, chicks remain near the nest site and adults bring food from the intertidal zone. After the first week, chicks follow the adults to the intertidal zone at low tide.

Food Web Interrelationships

Black oystercatchers feed primarily on intertidal invertebrates. Mussels and limpets are the primary prey species, but they also eat clams and chitons.

> Predation - Flightless chicks are vulnerable to predation, especially in the first week after hatching. During this time the adults brood the chicks and their movements may alert predators to the location of the chicks. Young chicks react by freezing whereas older chicks will run from predators. Gulls, ravens, mink and river otters are known predators.

Human Interactions

Although black oystercatchers are not harvested, destruction of, or disturbance at, nesting habitats can adversely impact local populations.

Primary References

Groves, S. 1984. Chick growth, sibling rivalry, and chick production in American black oystercatchers. Auk 101:525-531.

L'Hyver, M. and E.H. Miller. 1991. Geographic and local variation in nesting phenology and clutch size of the black oystercatcher. Condor 93:892-903.

Purdy, M.A. and E.H. Miller. 1988. Time budget and parental behavior of breeding American black oystercatchers (*Haematopus bachmani*) in British Columbia. Can. J. Zool. 66:1742-1751.

Webster, J.D. 1941. Feeding habitats of the black oystercatcher. Condor 43:175-180

______. 1941. The breeding of the black oystercatcher. Wilson Bull. 53:141-156.

Marbled Murrelet *(Brachyramphus marmoratus)*

Range

North Pacific Coast, from central California to the Aleutian Islands, and from the Kamchatka Peninsula to northern Japan.

Migration

Marbled murrelets return to coastal waters near breeding areas each spring. The dates are variable, usually occurring in Alaska from April to May. The adults and fledged young leave the breeding areas in the fall for unidentified wintering areas. Between 10-25% of the summer breeding population of PWS remain throughout the winter, and probably concentrate in protected bays and straits during winter storms.

Breeding Chronology

Documented evidence of breeding chronology is based primarily on follicle development of collected birds, documented nests and movements of breeding adults. These data suggest that laying can occur as early as late April in the southern part of their range. Egg laying in the Gulf of Alaska probably occurs in late May or June. Marbled murrelets lay a single egg that is incubated by both adults for about 30 days. Fledged chicks begin to appear with the adults on coastal waters from mid July to early August. Adult survivorship, life span, reproductive period, and age at first breeding are unknown.

Habitat Use and Requirements

During the breeding season, marbled murrelets make crepuscular (twilight) flights between inland and coastal areas. Extensive searches for marbled murrelet nests were unsuccessful until 1974. A total of 23 tree nests have been discovered in North America, 4 of which were found as a result of efforts related to the oil spill. Current data suggest that most marbled murrelets nest in mature forests. Most of the nests have been located in large conifers, but ground nests have also been recorded. Marbled murrelets are solitary nesters, and have been located as far as 40-50 kilometers from the coast. Marbled murrelets feed in coastal waters, and occasionally in large lakes. They have been known to dive to a depth of 50 meters.

Food Web Interrelationships

Marbled murrelets eat small fishes and crustaceans. Important species within the Gulf of Alaska and Cook Inlet include capelin, cod, sand lance and a variety of shrimp.

Human Interactions

In 1990 marbled murrelets were the most commonly caught seabird in salmon gillnets in the Prince William Sound Copper River flat drift fishery. Although this represented a very small proportion of the population, it may have local significance. The loss of nesting habitat due to logging or development of mature forest would have a greater impact on the population. Population declines over the southern portion of their range have caused the species to be considered for listing as "threatened" in the Pacific Northwest and is already listed as "endangered" in California.

Primary References

Carter, H.R. and S.G. Sealy. 1986. Year-round use of coastal lakes by marbled murrelets. Condor 88:473-477.

_______. 1987. Inland records of downy young and fledgling marbled murrelets. Murrelet 68:58-63.

Kuletz, K.J. 1988. Relative distribution of Marbled and Kittlitz's murrelets in Kachemak Bay, Alaska. Abstract. Pacific Seabird Group Bulletin 16:60.

_________. 1992. Unpublished NRDA progress report.

Nelson et al 1992.

Reed and Wood 1991.

Sanger, G.A. 1986. Diets and food web relationships of seabirds in the Gulf of Alaska and adjacent marine regions. U.S. Dep. Commer., NOAA, OCSEAP Final Rep. 45:631-771.

Sealy, S.G. 1974. Breeding phenology and clutch size in the marbled murrelet. Auk 91:10-23

Wynne, K., D. Hicks and N. Munro. 1991. 1990 Salmon gillnet fisheries observer programs in Prince William Sound and South Unimak Alaska. Rep. to NMFS. Saltwater Inc. Anch. Alaska. 72 pp.

Pigeon Guillemot (*Cepphus columba*)

Range

Pigeon guillemots are found along the north Pacific coast from southern California to the Bering Sea and Aleutian Islands in Alaska. They are also found from the Chukchi Sea to northern Japan.

Migration

Migration patterns are largely unknown in Alaska. They arrive at breeding areas in late April and early May, and depart from Prince William Sound for wintering grounds in late August, although a portion remain all winter.

Breeding Chronology

In Prince William Sound, pigeon guillemots have been documented on their breeding areas in May and the peak of egg laying occurs in June. Clutches normally consist of two eggs which are laid 3 days apart. Eggs are incubated for 30-32 days by both adults. Chicks hatch between late June and late July. Fledging occurs approximately 38 days after hatching. Pigeon guillemots probably do not begin breeding until they are 3-5 years of age.

Habitat Use and Requirements

Guillemot nests are usually located in natural cavities beneath boulders, at the base of cliffs, in talus slopes, or in rock cavities at the tops of cliffs. They are also known to nest in abandoned puffin burrows, and are probably the only alcid known to regularly use man-made structures (e.g., docks and bridges) for nesting. Often several nests are found close to each other, forming a low density nesting colony. At some locations adequate nest sites probably determine the breeding bird density, but they do not appear limiting in Prince William Sound. The adults use the supratidal and intertidal areas in front of the nest sites for social activities (e.g., pair bond maintenance) and feeding throughout the breeding season.

Pigeon guillemots feed in nearshore waters, generally no more than a few kilometers from land. During the breeding season they tend to feed near their colony, and individuals are often site specific. During winter most of the population leaves for unknown waters. In Prince William Sound an estimated 27-43% of the summer population were present in March.

Food Habits

This species has a "generalist" feeding behavior, consuming a very wide variety of fish and shellfish. Capelin, sand lance, Pacific sandfish, sculpin and herring are some of the more important species, as well as shrimp and small crabs. Dietary preference can vary significantly between individuals.

Human Interactions

Because of their nearshore foraging habits and small, stable colonies, pigeon guillemots are considered a good "indicator species" for the nearshore marine environment.

Primary References

Divoky, G.J. 1992. Age of recruitment and recruitment potential in relation to nest-site availability in the black guillemot. Pac. Seabird Group. Abstact 7. Charleston Oregon

Eldridge, W.D. and K.J. Kuletz. 1980. Breeding and feeding ecology of pigeon guillemots (*Cepphus columba*) at Naked Island, Alaska. Unpubl. Rep. U.S. Fish Wildl. Serv.

Kuletz, K.J. 1981. Feeding ecology of the pigeon guillemot (*Cepphus columba*) at Naked Island, Prince William Sound, Alaska and surveys of the Naked Island complex. Unpubl. Rep. U.S. Fish Wildl. Serv.

Kuletz, K.J. 1983. Mechanisms and consequences of foraging behavior in a population of breeding pigeon guillemots. M.S. Thesis. Univ. of Calif. Irvine, 79 pp.

Sanger, G.A. 1986. Diets and food web relationships of seabirds in the Gulf of Alaska and adjacent marine regions. U.S. Dep. Commer., NOAA, OCSEAP Final Rep. 45:631-771.

Bald Eagle *(Haliaeetus leucocephalus)*

Range

Bald eagles are found from Alaska and Canada to the northern edge of Mexico. Within Alaska, they are most numerous in the southern coastal regions.

Migration

Eagles in coastal Alaska winter near their nesting territories. Interior nesting birds may move to large open rivers or the ocean. Most will wander during the late fall and early winter in search of prey, such as late spawning salmon.

Reproduction

Adults which do not overwinter near their nesting sites, return to the same nesting territory each year. Nests are usually used for more than one breeding season. In high density nesting areas, defended territories are approximately 1 linear mile of coastline, but not all nests will be active or successful. Egg laying begins in early April when the female lays 1-3 eggs with 2 being the most common clutch size. Incubation lasts about 34 days. In late August, or about 75 days after hatching, the fully feathered young are ready to leave the nest. Fifty percent nest failure is not uncommon. Few eagles successfully fledge their young and even though the adults continue to feed them for several weeks, survival after fledging is low. Bald eagles become sexually mature when they are 6 years old or older.

Habitat Use

Bald eagles in Alaska nest along lakes, rivers and the coastal waters. Most nests are usually located along the coast in the older, larger trees. Coastal areas with more than 1 nest/mile are considered to be good nesting areas. This high productivity is associated with undisturbed habitat, a clean environment, abundant food resources and minimal human disturbance. Bald eagles have few predators other than humans.

Food Habits

Fish are the primary prey of bald eagles but they will also feed on waterfowl, carrion, sea birds and even on garbage at landfills. Winter and spring can be the critical periods for bald eagles. During the late fall and early winter eagles will often be seen feeding along rivers where they have access to spawning and dead salmon. During spring they feed on eulachon, spawning herring and sand lance.

Human Interaction

A bounty for bald eagles was in affect in Alaska from 1917 to 1953. With statehood in 1959, bald eagles in Alaska received federal protection under the Bald Eagle Protection Act of 1940. This Act prohibits harming or harassment of eagles. Land management agencies have included additional restrictions on activity near nest sites (300 ft. buffer zone around nest trees) which has further helped the stability of populations.

Primary References

Alaska Department of Fish and Game. 1985. Bald eagle life history and habitat requirements Southwest and Southcentral regions. pages 229-240 in Alaska habitat management guide. Life histories and habitat requirements of fish and wildlife. Alaska Dept. Fish Game, Juneau, AK 429 pp.

Gerrard, J.M. and G.R. Bortolotti. 1988. The bald eagle, haunts and habits of a wilderness monarch. Smithsonian Inst. Press, Washington D.C. 177 pp.

Hodges, J. I. and F. C. Robards. 1982. Observations of 3,850 bald eagle nests in southeast Alaska. Pp. 37-46 in W. N. Ladd and P. F. Schempf, eds., Proceedings of a symposium and workshop: Raptor management and biology in Alaska and western Canada. U.S. Fish and Wildlife Service, Anchorage, Alaska.

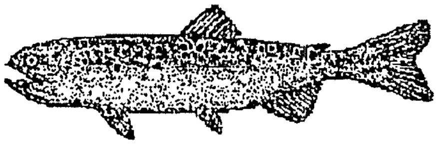
Imler, R.H., and E.R. Kalmbach. 1955. The bald eagle and its economic status. USDI, Fish Wildl. Serv. Circ. 30

Schoen, J. W., M. D. Kirchhoff and J. F. Hughs. 1988. Wildlife and old-growth forests in Southeast Alaska. Natural Areas Journal. Volume 8 (3).

Stalmaster, M.V. 1987. The Bald Eagle. Universe Books. New York, NY 227 pp.

This page will be a life history diagram for cutthroat trout. Insert mock-up

Cutthroat Trout



ADULTS IN FRESHWATER

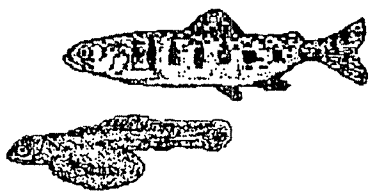
Wild cutthroat mature in 2 to 10 years and may spawn in several consecutive years. Spawning occurs in late fall and winter in small tributaries to coastal streams.

INJURY: Reduced growth

EGG STAGE

Eggs are laid in shallow gravel riffles well above the intertidal zone and hatch 28 to 40 days later.

INJURY: None expected



FRY & JUVENILES

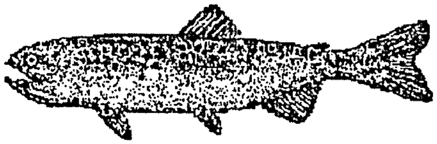
Wild cutthroat remain in freshwater until reaching approximately 20 - 25 cm in length. Growth is largely dependent on environmental conditions. Smolt migrate to estuaries between March and July, and return to fresh water in the fall.

INJURY: Unknown or none

ADULTS AT SEA

Cutthroat return to estuarine and nearshore marine waters each spring. They eat a variety of small fish and shrimp.

INJURY: Reduced growth.
Lower survival rates.



Coastal Cutthroat Trout (Onchorhynchus clarki clarki)

Range

California to Prince William Sound, Alaska

Migration

Smolts and adults migrate to sea between March and July. The time spent at sea varies from 12 to 150 days. While at sea cutthroat trout travel along shorelines rarely migrating farther than 70 km. from their natal streams. Adults return to freshwater lakes to overwinter and then migrate to their natal streams to spawn in the spring.

Reproductive Period

Sexual maturity is reached at 2 to 3 years for males and between 3 to 6 years for females.

Spawning/Hatching

Spawning takes place from February to May depending on location; hatching occurs 6 to 7 weeks after spawning.

Survival/Life Span

Cutthroat trout have a relatively high rate of survival for adults. Survival rates between spawning migrations were 39% from first to second spawning migrations, 17% between second and third, and 11% from third to fourth.

Habitat Use and Requirements

Adults - In marine environments cutthroat inhabit inshore areas foraging along gravel beaches, mouths of creeks, and in eel grass beds. Adults return to freshwater lakes to overwinter, and then spawn in small coastal streams or small tributaries to coastal streams and rivers.

remove space

Fry and Juveniles - Young-of-the-year cutthroat inhabit low- velocity margins, backwaters and side channels, adjacent to main channel pools and riffles. They tend to stay close to where they were spawned. Older juveniles have a greater range of movement within their natal stream.

Food Web Interrelationships

Adults - Adults in marine waters feed on a variety of small fish and shrimp.

Fry and Juveniles - Fry feed primarily on insects and crustaceans. Larger sized juveniles prey on small sticklebacks and salmon.

Predation - In marine waters cutthroat may be preyed upon by Pacific hake, spiny dogfish, harbor seals and adult salmon.

Human Interactions

Cutthroat trout are not commercially fished in Alaska. They are a highly prized sport fish, and are susceptible to overharvest due to small stock sizes. Anadromous cutthroat populations have declined during the past 15 - 20 years. Reasons cited for these declines include loss of stream habitat due to logging activities and increased urbanization.

Primary References

Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries, Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Asessments Division, Rockville, MD, 329 p.

Pauley, G.P., K. Oshima, K.L. Bowers, and G.L. Thomas. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Northwest) -- Sea-run cutthroat trout. U.S. Fish Wild. Serv. Biol. Rep. 82(11.26). U.S. Army Corps of Engineers TR EL-82-4. 21 pp.

Giger, R. 1972. Ecology and management of coastal cutthroat trout in Oregon. Oregon State Game Commission, Fishery Research Report No. 6 Corvallis, Oregon.

Sumner, F. H. 1953. Migrations of Salmonids in Sand Creek, Oregon. American Fisheries Society 82:139-150.

Armstrong, R. H. 1971. Age, food, and migration of sea-run cutthroat trout, Salmo clarki, at Eva lake, southeastern Alaska. Trans. Amer. Fish. Soc. no.2:302-306.

Trotter, P. C. 1989. Coastal cutthroat trout: a life history compendium. Trans. Amer. Fish. Soc. 118:463-473.

<u>Pink Salmon (*Oncorhynchus gorbuscha*)</u>

Range

Pacific Ocean north of 40°N Latitude.

Migration

Fry emerge from streams from late March through June and rapidly move to feeding areas in nearshore migratory corridors. After about 8 weeks, fry move to offshore waters where they mature for 12-15 months before returning to natal streams to spawn.

Reproductive Period

Mature at 2 years. Adults die after spawning.

Spawning/Hatching

Spawning occurs from June to mid-September; hatching occurs in October - January.

Survival/Life Span

Typical egg to fry survival is 5-10%; fry to adult survival is from 2-5%. The life cycle is complete in 2 years.

Habitat Use and Requirements

<u>Adults</u> - Migrate to the high seas where they mature. Adult pink salmon return to natal streams to spawn and some travel considerable distances upstream. However, in Prince William Sound as much as 75% may spawn in the intertidal zone. Spawning reds (egg nests) are mostly built in riffles with gravelly substrates and water velocity of 35-45 centimeters per second. All adults die after spawning.

<u>Fry and Juveniles</u> - Fry spend very little time in freshwater; they migrate to nearshore marine waters soon after emerging. When they reach approximately 7 centimeters in length, in approximately 8 weeks, they migrate to offshore waters. Virtually all fry in Prince William Sound migrate and feed along the western shore of the sound.

Food Web Interrelationships

<u>Adults</u> - Primary prey include euphausiids, squid and other invertebrates and small fishes.

<u>Fry and Juveniles</u> - In nearshore nursery areas fry feed on copepods and

other zooplankton. Juveniles eat larger invertebrates and small fishes.

Predation - Eggs, alevins, and fry are eaten by cutthroat trout, Dolly Varden, coho salmon, other fishes and aquatic birds. Juvenile and adult salmon in offshore areas are consumed by a variety of predatory birds, marine mammals, and predatory fishes including other salmon. Bears, otters, and other mammalian and avian predators eat spawning salmon.

Human Interactions

Wild and hatchery pink salmon are the basis for ~~a~~ multi-million dollar fisheries and occur together in mixed stock harvests. Hatchery runs established to augment natural production and enhance fisheries can sustain a higher harvest rate, and may pose a threat to important wild pink salmon populations if stock specific management practices are not implemented to protect wild stocks, particularly those damaged by oil impacts.

Primary references

Alaska Department of Fish and Game. 1985. Pink salmon life history and habitat requirements Southwest and Southcentral, Arctic, Western and Interior regions. pages 519-536 in Alaska habitat management guide. Life histories and habitat requirements of fish and wildlife. Alaska Dept. Fish Game, Juneau, AK 429 pp.

Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries, Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Asessments Division, Rockville, MD, 329 p.

Pauley, G.P., K. Oshima, K.L. Bowers, and G.L. Thomas. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Northwest) -- Pink salmon. U.S. Fish Wild. Serv. Biol. Rep. 82(11.26). U.S. Army Corps of Engineers TR EL-82-4. 18 pp.

Pacific Herring (*Clupea pallasi*)

Range

North Pacific Ocean, from Baja California to the Beaufort Sea and to Japan

Migration

Migrates from offshore coastal areas to nearshore coastal waters near natal spawning areas in early spring.

Reproductive Period

First breeds between 2-4 years old. Spawns annually.

Spawning/Hatching

Spawn in March - early June in Prince William Sound; hatching occurs 14-25 days after laying depending on water temperatures during incubation.

Survival/Life Span

Egg to juvenile mortality is probably over 99%; lifespan is up to 19 years.

Habitat Use and Requirements

Adults - Little information is available about the offshore distribution of adults. They are found to depths of 150 meters. Adults return to nearshore waters to spawn in early spring where they remain until moving to nearshore rearing areas to feed. In early fall, the herring move offshore to deeper waters where they remain until spring. Herring spawn in intertidal and subtidal areas. Spawning substrates include kelp, eelgrass, prominent rocks or artificial substrates, such as nets and other debris.

Larvae and Juveniles - Larvae are easily dispersed by local currents. Juveniles probably remain in shallow waters, but may follow food sources to deep water, until they migrate to offshore waters in the fall.

Food Web Interrelationships

Adults - Primary prey include planktonic crustaceans, euphausiids and fish larvae.

Larvae and Juveniles - Larvae eat a variety of zooplankton including crustacean, mollusc and insect larvae as well as copepods and fish eggs. Juveniles primarily feed on crustaceans, mollusc and fish larvae.

Predation - Herring are an important prey base for a large number of species. The eggs provide food for a variety of shorebirds, diving birds, gulls, invertebrates and some fish. Larvae are eaten primarily by jellyfish, as well as amphipods, fish and others. Adults are food for larger fish, sharks, seals, sea birds and whales.

Human Interactions

Herring are the basis for a multi-million dollar fishery and a long standing subsistence harvest. In addition, they are an important prey of many species birds, mammals and other fishes.

Primary references

Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries, Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Asessments Division, Rockville, MD, 329 p.

Pauley, G.P., K. Oshima, K.L. Bowers, and G.L. Thomas. 1988. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Northwest) -- Pacific herring. U.S. Fish Wild. Serv. Biol. Rep. 82(11.26). U.S. Army Corps of Engineers TR EL-82-4. 14 pp.

Rockfish (*Sebastes spp.* and *Sebastolobes spp.*)

There are over 50 different species of rockfish with highly variable life history characteristics. The genera are not well studied and specific information is limited. Yelloweye rockfish (*Sebastes ruberrimus*) are a commercially important species in Alaska and have been used to represent the life history characteristics.

Range

Yelloweye rockfish range from Baja California to the Cook Inlet in the Gulf of Alaska.

Migration

Movement and migration patterns are unknown for the species. Seasonal migrations may not exist, though some species move long distances throughout their lifetime. Movement to deeper water is common with size and age.

Reproductive Period

Yelloweye rockfish first breeds between 14 and 19 years old. They breed annually after reaching maturity.

Spawning/Hatching

Rockfish do not lay eggs, but release live planktonic larvae. Yelloweye rockfish release larvae from April through June in southeastern Alaska.

Survival/Life Span

Yelloweye males have reached 103 years of age, and females at 114 have been documented. Males tend to be fewer at older ages.

Habitat Use and Requirements

Very little life history information is available.

> Adults - yelloweye rockfish are found around coastal reefs and were abundant over varied rocky bottoms that included ragged, steep pinnacles and boulder fields at 90-100 meter depths of southeastern Alaska. Depths vary by species, age, and size, with depths up to 365 meters recorded. Most yelloweyes are caught at depths of 75-135 meters.
>
> Larvae and Juveniles - vary by species. Some are pelagic, some drift with kelp, others quickly become demersal. Very little is known about this life stage for most species of rockfish. Some juvenile yelloweye were noted in boulder fields at 90-100 meter depths in southeastern Alaska.

Food Web Interrelationships

Yelloweye rockfish are opportunistic predators. They feed on a variety of crabs, shrimp, snails and fish.

> Predation - small rockfish and rockfish larvae are eaten by other fishes, including larger rockfish.

Human Interactions

Rockfish provide an important secondary fishery in the Gulf of Alaska.

DOLLY VARDEN (Salvelinus malma) - Anadromous populations

move over to margin like others

Range

Arctic coast of Alaska to southern British Columbia

Migration

Anadromous Dolly Varden spend summers in nearshore marine environments. From October through November they migrate to freshwater streams and lakes to spawn. Dolly Varden overwinter in freshwater until spring, returning to coastal waters following ice-breakup.

Reproductive Period

Maturation age is variable, occurring usually between 4 and 7 years. Although post-spawning mortality is high, some females have survived to spawn four times.

Spawning/Hatching

Spawning activity occurs from September through November for most Dolly Varden populations. Hatching occurs 4 or 5 months later with free swimming fry emerging in April or May.

Survival/Life Span

Egg to alevin survival has been estimated to be 40.7%, alevin to smolt 1.1%, and smolt to spawning adult 23.5% Life span can range up to 12 years.

Habitat Use and Requirements

Adults - Outmigration from freshwater to marine environments occur each spring. Adults stay in estuary and nearshore coastal habitats until returning to freshwater streams to spawn. Immature fish, and nonspawning adults return to freshwater later than spawning adults. Spawning occurs in streams with gravel substrates, slow to moderate water velocities, and temperatures between 0.5 and 13°C. Adults overwinter in deep lakes or river pools, and near groundwater spring areas.

Fry and Juveniles - Younger fry rely on logs, undercut stream banks, and other debris to provide cover from predators. Juveniles prefer quiet pools near swift currents. They overwinter in deep pools and lakes.

Food Web Interrelationships

Adults - smelt, herring, juvenile salmon, sandlance and other small fish and invertebrates are eaten while the Dolly Varden are in marine water. Juvenile salmon, sticklebacks and invertebrates are preyed on in freshwater.

Fry and Juveniles - aquatic invertebrates, larvae, and fish eggs are the primary prey. Fry and juveniles feed primarily near the stream and lake bottoms.

Human Interactions

move to margin

Dolly Varden are ~~is~~ an important sport fish. In 1990 an estimated 11,418 were caught in Prince William Sound by sport anglers.

Primary References

Alaska Department of Fish and Game. 1985. Arctic char life history and habitat requirements Southwest and Southcentral, Arctic, Western and Interior regions. pages 317-338 in Alaska habitat management guide. Life histories and habitat requirements of fish and wildlife. Alaska Dept. Fish Game, Juneau, AK 429 pp.

Armstrong, R. H. 1974. Migration of anadromous Dolly Varden Salvelinus malma in southeastern Alaska. J. Fish. Res. Board Can. 31:435-444.

Armstrong, R. H., and James E. Morrow. 1980. The Dolly Varden char, Salvelinus malma. In : "Charrs; Salmonid fishes of the genus Salvelinus" E. K. Balon, Ed., Dr. Junk bv Publishers, Hague, Netherlands, pp. 99-140.

Morrow, J. E. 1980. The freshwater fishes of Alaska. Alaska Northwest Publishing Company, Anchorage, Alaska, 248.

Hepler, K., A. Hoffmann, and P. Hansen. 1990. Injury to Dolly Varden char and cutthroat trout in Prince William Sound. Alaska Department of Fish and Game. Draft OSIAR report. Anchorage, Alaska.

Sockeye Salmon (*Oncorhynchus nerka*)

Range

Sockeye salmon occur from northern California, to Point Hope Alaska. They are also found from northeastern Siberia to northern Japan.

Migration

Smolts outmigrate in late spring or early summer usually after spending 1-2 years in freshwater. For the first few months smolts rear in nearshore marine areas, and by early winter they begin feeding in offshore areas such as the Gulf of Alaska. The fish remain offshore until returning to their natal streams between May and September.

Reproductive Period

They commonly mature in their fifth or sixth year of life and they die after spawning.

Spawning/Hatching

Spawning typically occurs between July and October. Hatching occurs in mid-winter to early spring with fry emerging from April to June.

Habitat Use and Requirements

> Adults - migrate to offshore waters to feed for 2-3 years before returning to their natal streams to spawn. They spawn on lake shoals and in rivers and streams with lakes or slow moving reaches as part of the system. Spawning occurs over small to medium sized gravels with good water flow. The adults die after spawning, and their carcasses contribute to the nutrient level of the system.
>
> Juveniles - soon after emerging from the reds (egg nests), young sockeye migrate to lakes or slow flowing reaches of streams. For the first few weeks they reside in shallow water at the lake edge. They then move to deeper water where they feed in schools in the upper 20 meters of the lake at night. They remain in freshwater for 1-2 years before outmigrating to coastal waters as smolt. For the first 6 months in marine waters, they are found within 50 km of the shoreline.

Food Web Interrelationships

> Adults - euphausiids, amphipods, copepods and young fishes are the primary prey while in the high seas. Adults do not feed once they near freshwater.

Juveniles - While in freshwater, young juveniles feed on small insects and insect larvae. Juveniles in pelagic lake water feed on zooplankton. After migrating to saltwater the smolts feed on a variety of small crustaceans, plankton and fish larvae.

Predation - Predatory fishes and marine mammals prey upon sockeye salmon in saltwater. Bears and gulls are the primary predator of spawning adults. Juveniles are preyed upon by other anadromous fish species including Dolly Varden and rainbow trout. Juveniles are also an important prey species of some bird species.

Human Interaction

Sockeye salmon are recreationally and commercially harvested. They receive the highest market price of any salmon species and support multi-million dollar fisheries in Alaska.

Primary references

Alaska Department of Fish and Game. 1985. Sockeye salmon life history and habitat requirements Southwest and Southcentral, Arctic, Western and Interior regions. pages 537-553 in Alaska habitat management guide. Life histories and habitat requirements of fish and wildlife. Alaska Dept. Fish Game, Juneau, AK 429 pp.

Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries, Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Asessments Division, Rockville, MD, 329 p.

The *Exxon Valdez* oil spill affected several resources and services normally provided to the public. These include: archaeological sites and artifacts, subsistence, wilderness and intrinsic values, and recreation.

Archaeological Resources

Archaeological sites and the artifacts contained within them constitute an important part of our national and state heritage. These sites also have international importance in that they constitute a significant link in our knowledge and understanding of Native peoples who have inhabited Arctic and subarctic regions for many thousands of years. These resources help us understand our ancestors' past and enable greater appreciation for the richly varied cultures found in Alaska. The oil-spill area contains both ancient and more recent archaeological sites.

The U.S. Congress recognized the significance of archaeological resources when it passed the Archaeological Resources Protection Act of 1979. In that act they recognized that:

> "Archaeological resources on public lands and on Indian lands are an accessible and irreplaceable part of the Nation's heritage."

Similarly, the Alaska State Legislature passed the Alaska Historic Preservation Act. That law states:

> "It is the policy of the state to preserve and protect the historic, prehistoric and archeological resources of Alaska from loss, desecration and destruction so that the scientific, historic and cultural heritage embodied in these resources may pass undiminished to future generations. To this end...historic, prehistoric and archeological resources of the state are properly the subject of concerted and coordinated efforts exercised on behalf of the general welfare of the public..."

Recreation and Wilderness and Intrinsic Values

Alaska has the most significant assemblage of park, refuge and forest lands in the United States, and much of this land is still wild. It fact, large portions of the park, refuge and forest land under federal management in the spill area have been designated wilderness areas by the Congress under the Wilderness Act of 1964. Such lands are included within Katmai National Park, and the Becharof National Wildlife Refuge, both areas were contaminated with *Exxon Valdez* oil. Areas within the Chugach National Forest and Kenai Fjords National Park are in Wilderness Study area status. Under state management, the Kachemak Bay State Wilderness Park lies on the outer coast of the Kenai Peninsula and it too, felt the effects of the oil spill.

In

These designated wilderness lands and the thousands more acres of undesignated, but none-the-less wild and developed lands provide, in part, the basis for an important component of Alaska's tourist economy, one used by residents and visitors alike. A wide range of activities take place on these lands, some by individuals or small groups seeking a personal experience, and others with the aid of businesses that provide a variety of professional services enabling visitors to use and enjoy the wilderness. Recreational activities include: hunting, fishing, subsistence, hiking, camping, skiing, sightseeing, power boating, kayaking and photography. Beyond those who actively use these lands thousands of Americans benefit by knowing that, in Alaska, large areas of undeveloped lands provide habitat for natural and healthy populations of wildlife.

Subsistence

Many people, most notably rural residents of Prince William Sound, the Kenai Peninsula, lower Cook Inlet, and the entire Kodiak archipelago use a wide variety of subsistence resources to provide for essential needs. Considerable subsistence harvest occurs on both state and federal lands within the spill area. Several small communities have limited commercial services available and relatively undeveloped economic systems within their daily sphere of activity and travel. Subsistence resources, such as fish, birds, and marine and terrestrial mammals, provide vital food resources without which people could not live. Many of these same resources provide products that serve important functions in daily life and play a significant role in cultural practices and traditions. Several resources are shared with members of the communities unable to obtain them and/or are traded for other needed items.

Although no single Federal or State statute defines the full range of subsistence uses or users, both the Alaska Constitution and the Alaska National Interest Lands Conservation Act address the value and importance of subsistence.

The Alaska Constitution, in Article VIII "Natural Resources" Section 3 states:

> "Wherever occurring in the natural state, fish wildlife, and waters are reserved to the people for common use."

In 1980 Congress approved the Alaska National Interest Lands Conservation Act. Title VIII, "Subsistence Management and Use" recognizes two important concepts: the need for continued opportunity for subsistence, and the uniqueness of the Alaska situation. ANILCA Section 801 (1) states:

> "[T]he continuation of the opportunity for subsistence uses by rural residents of Alaska, including both Natives and non-Natives on public lands and by Alaska Natives and non-Natives on Native lands is essential to the physical, economic, traditional and cultural existence and to non-Natives physical, economic, traditional, and social existence."

ANILCA Section 801 (2) states:

> "[T]he situation in Alaska is unique in that, in most cases, no practical alternative means are available to replace the food supplies and other items gathered from fish and wildlife which supply rural residents dependent on subsistence uses."

Primary References

Archaeological Resources Protection Act of 1979, 16 USC 470 aa note

Alaska Historic Preservation Act, Alaska Statute 41.35.010

1916 Organic Act, 16 USC 1, 39 Stat. 535

1916 Organic Act legislative history, ARA Leisure Services v U.S., 831 F.2d 193 (9th Cir. 1987)

Wilderness Act, (to be filled in)

Kachemak Bay State Park Wilderness Act, Alaska Statute 41.21.140

Alaska Constitution, Article VIII "Natural Resources"

Alaska National Interest and Conservation Act (ANILCA), 16 USC 3101 noted

RPWG 17

Privileged and Confidental
Attorney Work Product
Attorney-Client Communication

DRAFT
Restoration Framework
(target for completion: March 1992)

Volume I: Progress Report and Program Outline

subject	timing	assignment[1]	pages
i. Executive Summary	**Feb-Mar**	**RPWG/Manag (Stan S./Susan M.)**	**2**

I. Introduction

A. Background	**Dec**	**RPWG/Manag (Ken R.)**	**2**

Identify purpose of this document. Summarize history of oil spill events, including response and clean-up; pre-settlement NRDA program, including restoration; and the criminal and civil settlements.

B. Legal context	**Dec-Jan**	**Legal/RPWG (Stan S./Barbara I.)**	**2-3**

Describe major elements (i.e., terms, guidance, schedules) of both criminal and civil settlements, especially as concerning the expenditure of and decisions about money. Provide legal background, drawing on CERCLA, NRDA regulations, and case histories (e.g., Ohio case).

II. Restoration Planning to Date	**Nov-Dec**	**RPWG (Ruth Y.)**	**3-4**

Highlight restoration planning activities and results, including public participation, technical reviews, and scientific studies. This should include material already presented in the August 1990 progress report, because the Restoration Framework should be a stand-alone document.

III. Summary of Injury	**Jan-Feb**	**Spies/Manag (John S.)**	**4-5**

This should update and replace the April 1991 document (the 18-page summary), covering the range of injuries from the ecosystem level to individual resources. The main text should probably contain only a summary, with a more detailed version in an appendix. Where possible, the summary should include information on natural recovery, including estimates of times needed for recovery. Studies that failed to document injuries should also be mentioned.

[1]The name(s) of the individual in parentheses is the RPWG member tentatively assigned lead or oversight responsibility for this section.

IV. Criteria for selecting injured resources/services for further consideration

	Nov-Dec	Spies/RPWG/ Manag/Legal (Art W.)	2

Describe how determinations are to be made regarding which resources and services are need of restoration planning and implementation. For example, how is the adequacy of natural recovery determined?

V. Background on resources/services selected for further consideration

A. Life history summaries	Dec-Jan	RPWG/Spies/PIs (Karen K.)	8-10

Summarize major features of life histories for at least key injured species. Purpose is to provide biological context for consideration of restoration options (e.g., what aspects of life histories provide opportunities for restoration and/or are sensitive and in need of protection?).

B. Other resources/ services	Dec-Feb	Manag/agencies (Sandy R./Ken R.)	4-5

Similar to V.A above. Provide background on such resources/services as archaeological and historical sites, subsistence, and recreation. Could also provide background on broader economic importance of various resources and services.

VI. Criteria for selecting restoration options for detailed evaluation

	Nov-Dec	RPWG/Legal (Stan S./Art W.)	3

Describe how preliminary determinations have been made about which options are worthy of further evaluation. These criteria include technical feasibility, cost effectiveness, etc. Note: these criteria are not used to decide whether to implement a given restoration option; only to determine that there is sufficient cause to evaluate an option fully.

VII. Endpoints and options

A. Further evaluation	Jan-Feb	RPWG/Legal (?)	10

List endpoints and options that have been selected for further review, as per the criteria presented in VI. An "endpoint" describes a goal (e.g., enhance productivity of salmonids); an "option" describes a means to achieve an endpoint (e.g., increase escapement through management, improve spawning habitats in streams, etc.). Thus, there will be one or more options described under each endpoint. The options should be annotated with 1-2 sentence descriptions--just enough to allow reader to understand what is intended by a particular option.

B. Previously rejected **Dec-Jan** **RPWG/Legal (Ken R./Barbara I.)** **3-4**

List options that have been deemed infeasible and inappropriate and explain why. For example, some members of the public suggested using oil spill funds to end the high seas drift net fishery. This option has been rejected (by RPWG) because it does not benefit target species and is being addressed by Congress and the United Nations.

VIII. Implementation of settlement

A. Post settlement administration **Jan-Mar** **Manag (Mark B.)** **3-4**

Describe the structure and functions of the Trustees' program to implement the settlement, including roles, responsibilities, and public participation. This should focus on allocation of funds for restoration, but also should include management of the fund.

B. Technical evaluation of options through science studies, econ. analysis, matrices, etc. **Jan-Feb** **RPWG/Manag/ Spies (John S.)** **2-3**

Describe what steps will be taken to analyze the options presented in VII. This should discuss how options will be evaluated, not the substance of those evaluations. For example, what types of economic analyses and science studies are to be used? This should include a discussion of the process by which habitats will be identified and screened for potential protection and/or acquisition.

C. Public participation **Jan-Mar** **Manag/RPWG/ Legal (Susan M.)** **2-3**

Describe in detail the role of the public and opportunities for review and participation. This should participation in development of the Restoration Plan, as well as longer-term participation in the selection, implementation, and oversight of restoration projects and results.

D. Compliance with NEPA and other laws **Jan-Feb** **Manag/Legal (Sandy R./Ken R.)** **2**

Describe relationship of restoration planning and implementation to such laws as NEPA, historic preservation, Coastal Zone Management, etc. How will these laws be addressed, by whom, and in what time frame. [Need policy determination whether a "Restoration Plan" requires a programmatic EIS.]

E. Restoration Plan **Feb-Mar** **RPWG/Manag (Stan S.)** **2**

Outline content and purpose of Restoration Plan, which will be developed following public participation. Discuss timing of the initial document (March 1993 is the target) and the intent to revise it periodically during the 10-year settlement payout period.

II: 1992 Work Plan

Includes science studies (damage assessment, restoration, etc.), technical services, and other projects, as in Pink Book. This is essentially son of pink book.

Target for public release of Volume II: March

[SES:11/20/91:framewor.sch]

RPWG
H

RESTORATION FRAMEWORK

RPWG REVIEW COPY

2/3/92

COMMENTS DUE BY COB 2/5/92

Master

text.IA

I. Introduction

A. Restoration Framework

Since March 24, 1989 when the Exxon Valdez ran aground in Prince Wiliam Sound, the Federal and State Resource Trustees and the Environmental Protection Agency have directed many activities to preparing for restoration. In August 1990, the Restoration Planning Work Group[1] published a report on the progress of restoration planning (Restoration Following the EXXON VALDEZ Oil Spill: August 1990 Progress Report, Restoration Planning Work Group.) The document that you have in hand, the "Restoration Framework" was originally intended to update the August 1990 progress report. However, the settlement of the State and Federal governmnets' litigation means that the resources and attention that had been concentrated on litigation and damage assessment is now concentrated on restoration. Prior to settlement, the governments were also hampered by concerns that any restoration work might not be considered reimbursable. With these concerns aside, this document provides the opportunity to expand the scope of the framework document to furnish the public with a suite of restoration options. These options are found in Section VII-A.
Other sections provide a status report on restoration planning to date (Section II), a summary of injury (Section III), and a information on the implementation of the settlment (Section VIII).

The purpose of this document is two-fold. The Trustees and EPA are providing information on the restoration planning process and the results of that process. The second purpose is to provide a focused request for public comment. The readers are requested to assess the information in this document, especially that

---

[1] RPWG was composed of representatives from the Alaska Department of Fish and Game, the Alaska Department of Natural Resources, Alaska Department of Environmental Conservation, U.S. EPA, U.S. Park Service, U.S. Forest Service, and the National Oceanographic and Atmospheric Administration.

provided in sections IV, V, and VI, and give comment.

I. Introduction

A. Background

The T/V *Exxon Valdez* ran aground on Bligh Reef in Prince William Sound on the night of March 23-24, 1989, spilling approximately 11 million gallons of North Slope crude oil, making this the largest oil spill in United States history. For the first three days of the spill as the weather was calm, the slick lengthened and widened amoeba-like, staying in the vicinity of the grounded tanker and off the beaches. Even with these seemingly ideal circumstances for oil recovery, the amount of oil in the water completely overwhelmed efforts to contain and recover the oil. A major windstorm on March 27, 1989, pushed the oil in a southwesterly direction and oiled beaches on Little Smith, Naked, and Knight Islands. The oil continued to spread, contaminating islands, beaches, and bays in Prince William Sound. Four days into the spill, oil began to enter the Gulf of Alaska. The leading edge of the slick reached the Chiswell Islands off the coast of the Kenai Peninsula on April 2, 1989, and the Barren Islands on April 11, 1989, nineteen days into the spill. By May 18, 1989, oil had moved some 470 miles and had fouled shorelines of Prince William Sound, the Kenai Peninsula, the Kodiak Archipelago, and the Alaska Peninsula. More than 1,200 miles of coastline were oiled, including portions of the Chugach National Forest, Alaska Maritime, Kodiak, and Alaska Peninsula/Becharof National Wildlife Refuges, Kenai Fjords National Park, Katmai National Park and Preserve, and Aniakchak National Monument and Preserve. Oil reached shorelines as far away as the Alaska Peninsula nearly 600 miles from Bligh Reef.

The magnitude of the efforts of the state and federal governments, the public, and Exxon to contain and clean up the spill, rescue wildlife, and study the effects of the spill is unprecedented. During 1989, the response to contain and cleanup the spill and rescue oiled wildlife involved a massive effort. Skimmer ships were sent throughout the spill zone to vacuum oil from the water surface. Booms were positioned to keep oil from reaching important commercial salmon hatcheries in Prince William Sound. A fleet of fishing vessels, known as the "Mosquito Fleet," played an important role in protecting these hatcheries, in corralling oil to assist the skimmer ships, and in capturing oiled wildlife and transporting these animals to rehabilitation centers. After oil contaminated shorelines, a beach cleanup program was activated. Various local committees, with community and government agency participation, provided recommendations to the U.S. Coast Guard about areas that should receive priority for cleanup. An army of workers cleaned shorelines, using techniques ranging from cleaning rocks by hand to high pressure hot water washing. Fertilizers were applied to some oiled shorelines to increase the activity of oil-metabolizing bacteria, in an experimental procedure known as bioremediation. When deteriorating weather brought an end to cleanup work in the fall of 1989, a great amount of oil remained on the shorelines. Although winter storms proved extremely effective in cleaning many beaches, spring shoreline surveys indicated that much work remained to be done in 1990. Crews operating from boats and helicopters cleaned oiled shorelines in Prince William Sound, along the Kenai and Alaska Peninsulas, and on the Kodiak Archipelago. Manual pick up of remaining oil was the principal method used during 1990, but bioremediation and relocation of oiled berms to the active surf zone were also used in some areas. An additional shoreline survey and limited cleanup work took place during 1991.

The state and federal Trustee agencies were forced to mobilize field studies rapidly with little time for planning. Even with the rapid deployment of studies, however, some opportunities to gather injury data were irretrievably lost during the early weeks of the spill. A legal framework was subsequently established and expert peer reviewers were retained to provide independent scientific review of ongoing and planned studies and assist with synthesis of results. Most studies were completed during 1991, although data analysis is still underway. Information provided in Section III of this document provides summary information on injuries to natural resources. The Trustee agencies, with the assistance of the U.S. Environmental Protection Agency, initiated restoration planning activities in 1989, to identify alternatives and procedures and to implement limited scale projects during 1990 and 1991.

On October 8, 1991, the Federal District Court in Anchorage, Alaska, accepted a criminal plea agreement and civil consent decree negotiated by the federal and state governments with Exxon Corporation and Exxon Shipping Company (companies). Exxon Corporation pled guilty to a violation on the migratory Bird Treaty Act and Exxon Shipping Company pled guilty to a violation of the Clean Water Act, a violation of the Refuse Act, and a violation of the Migratory Bird Treaty Act. The companies were fined $150 million ($125 million were remitted due to their taking responsibility for their actions and cooperating with the federal criminal investigation) and agreed to pay an additional $100 million ($50 million to the federal Trustee agencies in Alaska and $50 million to the State of Alaska) as restitution. As part of the civil consent decree, the companies agreed to pay $900 million to the federal and state Trustee over a 10 year period. A reopener allows the Trustees to request up to an additional $100 million, should injuries not anticipated at the time of the settlement become evident during the 10 year payout period.

The consent decree requires the three federal (Secretary of the Interior, Secretary of Agriculture, and Administrator of the National Oceanic and Atmospheric Administration) and three state Trustees (Commissioner of Fish and Game, Commissioner of Environmental Conservation, and Attorney General) to unanimously agree on use of settlement funds to restore resources injured by the spill. The Trustee have established a Trustee Council in Alaska to make restoration decisions. Additional organizational needs are now being considered and a final organizational structure, that will include a public advisory group, is expected to be in place by ______ __, 1992.

An important step in planning the restoration of Prince William Sound and the Gulf of Alaska is to prepare a comprehensive Restoration Plan. This Restoration

Framework document provides the public with information about spill injuries, restoration planning activities, and restoration options in order to facilitate meaningful public participation in preparation of the comprehensive Restoration Plan. This document will also provide the structure under which restoration activities will be conducted during development of the comprehensive plan.

IB. LEGAL CONTEXT

On ___________, 1991 the United States and the State of Alaska settled pending criminal and civil claims against Exxon[1] which arose from the Exxon Valdez oil spill. The criminal claims were based upon violations of the Federal Water Pollution Control Act (Clean Water Act), the Refuse Act, and the Migratory Bird Act. The civil claims, filed primarily under the Clean Water Act, were for injuries to natural resources and for the restoration and/or replacement of those resources. Those settlements provided in aggregate for the payment by Exxon of $1,000,000,000 to the United States and Alaska to reimburse the governments their response, damage assessment and litigation costs and to pay for the restoration, replacement or acquisition of the equivalent of those natural resources adversely affected by the Exxon Valdez oil spill.

The specific payment terms and conditions are as follows:

1. Criminal Restitution - $100,000,000 to be divided equally between the State of Alaska and the United States. This money must be used by the governments exclusively for restoration[2] projects relating to the EVOS within the State of Alaska.

2. Civil Settlement - $900,000,000 to be paid in the

[1]Exxon Corporation, Exxon Shipping, Exxon Pipeline and the T/V Exxon Valdez

[2]Refer to definition of restoration if not already defined

following installments:

December 9, 1991	-	$ 90,000,000
December 1, 1992	-	$150,000,000
September 1, 1993	-	$100,000,000
September 1, 1994	-	$ 70,000,000
and each year thereafter thru		
September 1, 2001	-	$ 70,000,000

An additional $100,000,000 may be claimed for natural resource habitat losses or population declines not reasonably anticipated at the time of settlement. This money would be payable in the years 2002 thru 2006.

As with the criminal restitution funds, there are spending guidelines for civil settlement monies. Those guidelines are set forth in a Memorandum of Agreement between the State of Alaska and the United States. The guidelines provide in relevant part that the governments shall jointly use such monies for purposes of restoring, replacing, enhancing, rehabilitating or acquiring the equivalent of natural resources injured as a result of the EVOS and the reduced or lost services provided by such resources. The governments may also use the money to reimburse themselves for expenses they have incurred regarding the oil spill including costs of litigation, response and damage assessment. All expenditures by the governments must be by unanimous agreement of the natural resource trustees[3] and be with regard to the restoration of natural

[3] Set forth if not already done in text

resources within the State of Alaska unless otherwise agreed.

II. OVERVIEW OF RESTORATION PLANNING TO DATE

The goal of restoration planning, which builds upon the spill response and damage assessment process, is to identify and evaluate appropriate measures that can be taken to enhance or accelerate the restoration of the natural resources injured by the oil spill. Restoration planning leads to implementation of an approved restoration program.

"Restoration" or "rehabilitation" is defined as ..."actions undertaken [in addition to response actions] to return an injured resource to its baseline condition as measured in terms of the injured resource's physical, chemical of biological properties or the services it previously provided..." by the Natural Resource Damage Assessment Regulations [43 CFR Subtitle A 11.14 (11)], which are not mandatory but have provided a model for restoration planning. ("Baseline" means the condition or conditions that would have existed had the discharge of oil not occurred. [43 CFR Subtitle A 11.14 (e)].)

Restoration generally includes direct restoration, replacement, and acquisition of equivalent resources:

* Direct restoration refers to measures taken, usually on site and in addition to response actions, to directly promote or enhance the recovery of an injured, lost, or destroyed natural resource to its baseline condition or function. The definition of direct restoration includes any administrative actions that may be taken by Federal or State agencies, such as limiting certain activities in the affected areas, to promote recovery of injured resources.

* Replacement refers to substituting an injured, lost or destroyed natural resource with a resource of the same or similar type.

* Acquisition of equivalent resources includes the purchase or protection of natural resources that are similar or related to the injured natural resources in terms of ecological values, functions, or services provided. For example, one could purchase undamaged and unprotected wildlife habitats as alternatives to direct restoration of injured habitats.

Responsibility for full restoration of the natural resources injured, lost, or destroyed by the oil spill resides with Federal and State natural resource trustee agencies. Consequently, in late 1989 an interagency Restoration Planning Work Group (RPWG) was established to develop a restoration plan for the natural resources affected by the Exxon Valdez oil spill. The RPWG included representatives of each of the six trustee agencies and the U.S. Environmental Protection Agency.

Restoration planning is a dynamic and evolving process that involves many considerations. For example, the need for restoration depends on the nature, extent, and persistence of natural resources injuries and the adequacy of natural recovery. The primary information sources regarding resource injury are the studies conducted by state and federal agencies as part of the natural resources damage assessment. (Results of these studies are summarized in Section III.) Other sources of information have included data gathered as part of the oil spill response, public comments, and studies conducted outside the damage assessment process.

Public Participation

RPWG recognized the importance of public participation in developing a successful restoration program from the outset and intended to make it an integral component of the restoration planning process. RPWG attempted to involve and inform the public with regard to restoration planning through a variety of public activities and publications. In March 1990, a public symposium was organized by RPWG to provide a forum for the public and experts from within and outside of Alaska to express their views on what a restoration plan should entail. In April and May of 1990, RPWG held eight public scoping meetings in some of the communities that were directly affected by the Exxon Valdez oil spill to gain a sense of the public's priorities for the restoration program. Additionally, the RPWG has accommodated requests for meetings with interested individuals or groups of concerned citizens on an ongoing basis.

At the 1990 public symposium and the public scoping meetings, most participants called for a holistic, ecosystem approach to restoration. Many also recommended long-term monitoring and research to follow any restoration efforts. Many participants expressed a strong preference for use of restoration funds within the spill area and state of Alaska, with the possible exception of using resources out of state to help restore migratory resources injured by the spill. Almost all participants supported habitat protection as key to helping many resources injured by the spill recover. Suggestions included direct land acquisition, purchase of timber rights, more protective designations of public lands, and a variety of other protection methods. Participants expressed frustration regarding confidentiality of the findings of NRDA studies conducted by the state and federal governments, maintaining they could not provide meaningful comment without this information. More detailed descriptions of the comments and suggestions made by the public at these meetings can be found in two documents produced by RPWG: Restoration Following the *Exxon Valdez* Oil Spill: Proceedings of the Public Symposium and Restoration Planning Following the Exxon Valdez Oil spill: 1990 Progress Report. Several Federal Register Notices were also published, providing summaries of restoration planning activities and the opportunity to comment.

Despite these efforts, RPWG did not achieve the level of public participation it had originally envisioned. Carrying out the intent for meaningful public review and comment on all restoration activities was complicated by the need for natural resource damage assessment results and conclusions to remain confidential and unavailable to the public due to pending litigation with the parties responsible for the oil spill. The settlement agreement reached with the responsible parties will enable the public to be more fully integrated into the restoration planning process.

Technical Consultations

Technical Workshop

In addition to these public meetings, the Restoration Planning Work Group conducted a technical workshop in the April of 1990 for scientific input into the restoration planning process. The three-day workshop provided the first opportunity for a general exchange of ideas on restoration among scientists and natural resource managers. Participants included members of the Restoration Planning Work Group, Federal and State resource managers, and scientists and technical experts under contract to the governments. This workshop was closed to the public because confidential litigation-related damage assessment information was to be discussed.

Guided by an overview of available natural resource damage assessment results, these experts explored a broad range of options that could be implemented to restore injured ecological, cultural, and recreational resources in Prince William Sound and the Gulf of Alaska. Potential restoration projects were identified and evaluated and feasibility studies to test the likelihood of success for some of these activities were suggested. Participants also identified other information needs to help focus restoration planning.

Habitat Protection

Protection of fish and wildlife habitat was identified by the public and resource experts consulted as a key method of assisting and speeding the recovery of natural resources injured by the oil spill. Suggested approaches included land acquisition and changes in management practices. RPWG conducted two projects related to the acquisition of equivalent resources restoration alternative.

Marine Habitat Protection Systems

One option being considered is to facilitate natural recovery of injured resources through protection of coastal and marine habitats. As part of the evaluation of restoration alternatives, the Restoration Planning Work Group has reviewed various conservation systems that protect or effect the management of marine habitats and resources. These protected area designations can help maintain ecosystem productivity by controlling activities that disrupt ecological processes or that physically damage the environment, thereby minimizing further stress and facilitating recovery of the injured natural resources. If properly designed, protection designations can accommodate conservation objectives as well as other pre-existing uses.

A variety of state and federal designations for protecting marine and coastal habitats are now in existence, such as the National Marine Sanctuaries, National Wildlife Refuges, and Alaska State Marine Parks. Each system has a different purpose, management approach, and track record. RPWG conducted a workshop on marine habitat protection systems in August of 1991 to review and discuss these different systems and the potential applicability of existing protected area designations as part of the overall oil spill restoration strategy. The workshop included managers and administrators of state and federal protected areas who provided information on their respective designation systems. The possibility of creating a new type of protection designation addressing needs specific to Prince William Sound and the Gulf of Alaska was also explored.

Protection of Upland Habitat

The marine and intertidal habitats where most oil spill injuries occurred are ecologically linked to adjacent upland habitats. The water quality in streams and estuaries where salmon spawn depends on the adjacent uplands. Eagles nest and roost in large trees along the coasts and streams, and marbled murrelets nest in association with mature forested uplands. Harlequin ducks nest in riparian habitats and feed in the streams as well as in nearby intertidal and estuarine areas. Common and thick-billed murres and other seabirds nest on off-shore islands.

Tourism and recreation activities, such as sport fishing and camping, also depend on the quality and accessibility of shorelines and uplands. The diversity, productivity, and uses of intertidal and estuarine habitats and of freshwater streams along the coast depend on the ecological integrity of the adjacent uplands. Continued productivity in the undamaged parts of the regional ecosystem, including strategic marine, intertidal and estuarine habitats and adjacent uplands, may be necessary for the recovery of biological communities that were injured.

RPWG recognized that objectively identifying key upland habitats that are linked to the recovery of injured resources and selecting protection strategies that might be applicable to the area affected by the oil spill could require a complex evaluation. Consequently, RPWG called upon The Nature Conservancy for technical assistance. The Nature Conservancy, a 40 year-old international, non-profit organization, was selected due to its extensive experience in identification, protection, and long-term management of significant ecological resources throughout the Western Hemisphere and in working successfully with private landowners, government agencies and other organizations. The Nature Conservancy develops creative approaches to economic and recreational development with habitat protection where appropriate. Drawing on the experience of their experts across the country, The Nature Conservancy prepared a general handbook for RPWG entitled: Options for Identifying and Protecting Strategic Fish and Wildlife Habitats and Recreation Sites (December 1991). The purpose of the handbook is to provide the RPWG with an overview of the variety of identification and ranking processes and protection tools, techniques, and strategies that the Conservancy and others use generally and that may be applicable to the RPWG's restoration planning efforts associated with private lands within the oil spill area. The Nature Conservancy conducted this work under a challenge cost-share agreement with the U.S Forest Service, funded by the U.S. Environmental Protection Agency.

Recovery Literature Review

Estimating the recovery period for injured resources and determining the adequacy of natural recovery is fundamental to selecting restoration measures. In many cases it may be most appropriate to allow natural recovery to proceed without further intervention by man (i.e. no action alternative). To supplement information NRDA and other studies would yield on rates of natural recovery of injured resources, RPWG decided to conduct a review and critical synthesis of the existing scientific literature on the recovery of marine mammals, marine birds, and other ecological resources following environmental perturbations, including other oil spills. This work is being conducted through contract by nationally recognized experts on these resources. Researchers at Point Reyes Bird Observatory are reviewing and synthesizing the literature on recovery of marine birds. Recovery literature for fish and shellfish is being reviewed by the University of Washington Fisheries Research

Institute. Hubbs-Sea World Research Institute and Pacific Estuarine Research Laboratory is reviewing the recovery literature for marine mammals and intertidal and subtidal invertebrate and plant communities. The results of this work will guide restoration scientific and monitoring efforts and help ensure the wise use of restoration resources.

Peer Review

In addition to the projects described above, RPWG has consulted on an ongoing basis with selected nationally recognized scientists and natural resource experts, most with some experience with Alaskan resources, for guidance throughout the restoration planning process.

Monitoring

RPWG in 1991 initiated a planning effort to develop an integrated monitoring strategy to follow the progress of recovery of injured natural resources in waters and adjacent uplands of Prince William Sound and the Gulf of Alaska. The program will determine if and when natural recovery will restore injured resources to their baseline conditions and monitor the effectiveness of restoration measures selected and implemented. It will also detect any latent injury and reveal long-term trends in the environmental health of ecosystems affected by the oil spill. The duration of recovery monitoring will depend on the severity and duration of effects resulting from the spill.

Restoration Science Studies

In cases for which the nature of the resource injury, loss, or destruction was reasonably clear, and when no alternatives would be foreclosed, RPWG felt implementation of certain restoration activities, prior to completion of a full natural resource damage assessment and a final restoration plan, was desirable. As damage assessment results were reviewed and evaluated, RPWG identified potential restoration implementation projects. This involved ongoing consultation with principal investigators for the damage assessment studies, agency experts, and outside peer reviewers to review the nature and extent of injuries from the oil spill.

RPWG initiated a series of small-scale restoration science studies in 1990 and 1991. Restoration science studies provide information used to evaluate potential restoration implementation activities. Three types of studies were conducted:

* Feasibility studies test the practicality and effectiveness of proposed direct restoration techniques;

* Technical support studies provide biological or other information necessary to identify, evaluate, or conduct potential restoration activities; and

* Monitoring studies document the extent and rate of natural recovery of an injured resource.

These studies are described in the 1990 and 1991 reports on State/Federal Natural Resource Damage Assessment and Restoration Plans for the Exxon Valdez Oil Spill and in three Federal Register Notices (see references at end of this document).

Restoration Matrices/Development of Restoration Options

The restoration planning process, based on all of the activities and efforts outlined above, identified a broad array of restoration alternatives. RPWG organized this preliminary list into a series of summary tables or matrices that portray restoration options in relation to categories of potentially injured resources. These matrices were presented in the 1990 Progress Report. RPWG began to evaluate and screen these options using criteria described in Section VI of this report. This evaluation, which incorporated results from the Natural Resource Damage Assessment and restoration science studies, yielded a refined list of restoration options that are responsive to the injuries from the spill, appropriate under the law, feasible, and cost-effective.

The goal of the Trustees and EPA is the recovery of the injured ecosystem as a whole rather than recovery of individual components of the system. In general, priority will be given to restoration alternatives which benefit multiple rather than single species or resources. By necessity, however, individual elements of the restoration program may be species or resource specific. Selections for the final restoration plan will take into account further input from technical experts and comments and concerns received from the public.

Text III

Draft: January 29, 1992

III. Summary of Injury

The *Exxon Valdez* oil spill occurred just prior to the most biologically active season of the year in southcentral Alaska. During the two month period after the spill, seaward migrations of salmon fry, major migrations of birds, and the primary reproductive period for most species of birds, mammals, fish, and marine invertebrate species took place. The organisms involved in these critical periods of their life cycles encountered the most concentrated, volatile, and potentially damaging forms of the spilled oil. Oil affected different species differently. Resources continue to be exposed to remaining oil in the intertidal zone as well as to oil that mobilized to the subtidal zone in some areas.

MARINE MAMMALS

Following the spill, studies of humpback whales, Steller sea lions, sea otters, harbor seals, and killer whales were started. The Steller sea lion study was completed and the humpback whale study was discontinued following the 1990 field season. Humpback whale investigations were limited to photo identification of whales, estimations of reproductive success, and possible relocations of whales. It was not possible to take tissue samples for petroleum hydrocarbon analysis to document exposure. The study did not show direct oil spill mortalities or reproductive failures for humpback whales.

The sea lion study was completed following the 1990 pup counts. Some tissue samples were analyzed for petroleum hydrocarbon concentrations, and although there was some indication of exposure to oil, it was difficult to determine what populations were affected because of the sea lions' active seasonal movements. Because of an ongoing pre-spill population decline and premature pupping of sea lions, it was not possible to distinguish post- from pre-spill population effects clearly.

Studies of killer whales, based on photo-identification studies, have indicated that a significant number of whales are missing from at least one and possibly two pods in Prince William Sound. Changes have also been observed in killer whale mortality rates, distribution, social structure, and incidence of anatomical abnormalities. The cause of these changes remains uncertain. Injuries to harbor seals and sea otters have been clearly indicated and studies of these species are continuing.

Sea Otters: The population of sea otters in Prince William Sound before the spill was estimated to have been as high as 10,000. The total sea otter population of the Gulf of Alaska was estimated to be at least 20,000. Statewide, the sea otter population is estimated at 150,000. Sea otters were particularly vulnerable to the spill. As the oil moved through Prince William Sound and the Gulf of Alaska, it covered large areas inhabited by otters. When sea otters become contaminated by oil, their fur loses its insulating capabilities, leading to death from hypothermia. Sea otters also died as a result of ingestion of oil and perhaps inhalation of toxic aromatic compounds that evaporated from the slick shortly after the spill. The effects of oil were documented by repeated surveys of wild populations; by recovery of beach cast carcasses; analysis of tissues for petroleum hydrocarbons and indicators of reduced health; by tracking sea otters outfitted with radio transmitters (including those released from rehabilitation centers); and estimating total mortality from the number of sea otter carcasses recovered following the oil spill. These studies concentrated on developing an estimate of sea otter mortality in Prince William Sound and along the Kenai Peninsula, the population most affected by the spill. During 1989, a total of 1,011 sea otter carcasses were recovered in the spill area, cataloged, and stored in evidence trailers. Of these, 876 were recovered dead from the field and 135 died in rehabilitation centers or other facilities. The total number of sea otters estimated to have been killed directly by the spill ranges from 3,500 to 5,500 animals throughout the spill area.

Sub-lethal initial exposure and long-term continuing exposure to petroleum hydrocarbons may be continuing to injure sea otters. Preliminary findings of the Coastal Habitat and Shellfish studies identified significantly elevated levels of petroleum hydrocarbons in intertidal and subtidal sediment samples within the spill zone as well as in benthic marine invertebrates identified as sea otter prey in western Prince William Sound. Blood samples collected from wild caught sea otters in 1990 and 1991 identified significant differences in several blood parameters between eastern and western Prince William Sound. Males in the western Prince William Sound had significantly higher eosinophil counts as compared to males in the eastern Prince William Sound, suggesting systemic hypersensitivity reactions. Hematocrits and hemoglobins were also significantly elevated in these animals. Although there were no significant differences in hematological parameters between east and west female sea otters, some chemistry changes were present which were consistent with changes observed in the males.

Studies have documented continuing injury to sea otters. Based on pre-spill data from Prince William Sound, very few prime age sea otters (animals between 2 and 8 years old) die each year and most mortality occurs among very young and old age classes. A high proportion of prime age sea otter carcasses were found during 1990 and 1991, indicating that the pattern of sea otter mortality in heavily oiled areas continues to be abnormal.

Results of boat surveys indicated continued declines in sea otter abundance within oiled habitats in Prince William Sound. Comparisons of pre- and post-spill estimates of sea otter abundance, based on boat surveys near shore, found that unoiled areas underwent a 13.5 percent increase in abundance, while oiled areas underwent a 34.6 percent decrease. In addition, the post-spill population in the oiled area is significantly lower than the best pre-spill estimate, indicating a real decline of 1,600 sea otters in Prince William Sound initially, and up to 2,200 in subsequent years.

Results of a study of sea otter pups demonstrate significantly higher post-weaning mortality in western Prince William Sound, compared to controls in the eastern Prince William Sound. In contrast, survival of adult female sea otters was significantly higher in western Prince William Sound compared to controls in the east. Pupping rates of adult females and survival of those pups through weaning in 1990 and 1991 were similar between eastern and western Prince William Sound and were considered normal.

Studies of the survival and reproductive success of sea otters released from rehabilitation centers indicate a high level of mortality of adult animals and significantly lower pupping rates than pre-spill mortality and pupping rates in Prince William Sound. Of the 193 sea otters released from rehabilitation centers, 45 were fitted with radio transmitters. As of July 31, 1991, fourteen of these animals were still alive, 14 were known to be dead, and 16 were missing. One radio transmitter failed.

The observed changes in the age distributions of dying sea otters, continued declines in abundance, higher juvenile mortality, and higher mortality and lower pupping rates among oiled sea otters suggest a prolonged, spill-related effect on at least the western Prince William Sound sea otter population.

Harbor Seals: Two hundred harbor seals are estimated to have been killed by the spill. Only 19 seal carcasses were recovered following the spill, since seals sink when they die. Population changes were documented by summer and fall aerial surveys of known haulout areas. Toxicological and histopathological analyses were conducted to assess petroleum hydrocarbon accumulation and persistence and to determine toxic injuries to tissues. Severe debilitating lesions were found in the thalamus of the brain of a heavily oiled seal collected in Herring Bay 36 days after the spill. Similar but milder lesions were found in five other seals collected three or more months after the spill. During 1989, oiled harbor seals behaved abnormally, being lethargic or unwary. Petroleum hydrocarbon concentrations in bile were 5 to 6 times higher in seals from oiled areas one year after the spill. This indicates that seals were still encountering oil in the environment, were metabolizing stored fat reserves that had elevated levels of petroleum hydrocarbons, or both.[1]

There has never been a complete census of harbor seals in Prince William Sound. However, trend locations have been intermittently surveyed since the 1970s. Counts at the trend sites have declined by 40 percent between 1984 and 1988. a complete survey of Prince William Sound was completed during August 1991, resulting in an estimated population of 2,914 harbor seals. Natural Resource Damage Assessment studies conducted from 1989 through 1991 found differential rates of decline at oiled versus unoiled trend sites, with oiled sites having a higher rate of decline of harbor seals than unoiled sites.

Population surveys, which are reliable indicators of population trends, conducted in 1984 and 1988 indicated that harbor seal populations in Prince William Sound had declined prior to the spill, with similar declines in what were subsequently oiled and unoiled areas. From 1988 to 1990, however, the decline at oiled sites (35 percent) was significantly greater than at unoiled sites (13 percent). Trend surveys conducted in 1991 continue to indicate significantly lower numbers in oiled areas.

<u>Killer Whales</u>: Approximately 182 killer whales forming nine distinct family units or "pods" resided in Prince William Sound before the spill. This count is based on pre-spill documentation. These whales were studied intensively before the spill and their social structure and population dynamics are well known.

---

[1]Harbor seals are taken in some Alaska villages for subsistence. The State of Alaska conducted a program, separate from the damage assessment program, to test subsistence foods potentially affected by the spill to insure that they were safe for human consumption. The State of Alaska determined that harbor seals in the affected area were safe for people to eat (Oil Spill Health Task Force, July-August 1990 Report and September-October 1990 Report. Alaska Department of Fish and Game, Division of Subsistence).

Damage assessment studies of killer whales involved extensive boat-based surveys in Prince William Sound and adjacent waters. Whales were photographed and the photographs were compared to the Alaskan killer whale photographic database for the years 1977 to 1989 to determine changes in whale abundance, seasonal distribution, pod integrity, and mortality and natality rates.

The AB pod of 36 individual whales was sighted intact in September of 1988. When sighted on March 31, 1989, seven days after the spill, seven individuals were missing. Six additional whales were missing from the AB pod in 1990. Assuming that whales missing for two consecutive years are dead, the 1988-1989 and 1989-1990 mortality rates for AB pod were 19.4 percent and 20.7 percent, respectively. The average annual mortality seen in AB pod from 1984 to 1988 was 6.1 percent. An additional whale was missing in 1991. The approximate calving interval of killer whales is four years. accordingly, some long-term effects may not be obvious for many years.

Another Prince William Sound pod, AT pod, is missing 11 whales. A subgroup of four AT pod members was photographed behind the *Exxon Valdez* three days after the grounding on Bligh Reef, and three of these animals are among the missing AT pod whales.

Several of the missing whales were females which left behind calves. It is unprecedented for females to abandon calves. The social structure of AB pod has changed. Where calves normally spend time with their mothers, they have been observed swimming with adult bulls. The occurrence of collapsed dorsal fins on two adult bulls is an indication of possible physiological injury. Explanations for the possible causes of death of these missing whales continue to be explored.

TERRESTRIAL MAMMALS

Studies were conducted on terrestrial mammals that may have been exposed to oil through foraging in intertidal habitats. These species included brown bear, mink, black bear, Sitka black-tailed deer, and river otters.

Brown bears are long-lived animals and forage seasonally in the intertidal and supratidal areas of the Alaska Peninsula and the Kodiak Archipelago. Preliminary analysis of brown bear fecal samples show that some brown bears were exposed to petroleum hydrocarbons. Elevated levels of petroleum hydrocarbon metabolites were found in bile from a yearling brown bear found dead in 1989. Two radio-collared female brown bears with documented petroleum hydrocarbons in feces have since failed to reproduce.

Mink and other small mammals that are known to feed and spend part or all of their time in the intertidal zone are difficult to study. They are known to crawl off into burrows or the brush if sick or injured and carcasses are unlikely to be found. Also, information on pre-spill populations of these animals is minimal. Scientists developed a laboratory study to test reproductive effects of oil on ranch-bred mink, in which they were fed food mixed with small, non-lethal amounts of weathered oil. Although changes in reproductive rates or success were not documented, it was found that oil-contaminated food moved through the intestines of the animals at a more rapid rate than did clean food, possibly providing less nutrition to the animals.

No field studies were carried out for black bear due to the difficulty of finding, collaring, or otherwise investigating these animals in the dense underbrush in which they reside. However, a literature search confirmed that these animals do forage in the intertidal zone in the spill area.

The deer study found no evidence of injury based on intensive searches of beaches that revealed no mortality attributable to the spill. However, deer taken for purposes of testing for safety for human consumption (not part of the damage assessment process) found slightly elevated petroleum hydrocarbons in some tissues in deer (which feed on kelp in intertidal areas) but it was determined that the deer were safe to eat.

River Otters: A few river otter carcasses were found by cleanup workers. River otters forage in streams and shallow coastal habitats that were contaminated by the spill. Analysis of river otter bile and blood samples indicated that petroleum hydrocarbons are being accumulated by this species. Blood haptoglobin continue to be elevated in oiled areas in 1991. Studies of radio-tagged animals in Prince William Sound showed that home ranges in oiled areas are twice that of unoiled areas. In 1991, body lengths, body weights, and diversity of diet species were lower in oiled areas.

BIRDS

Among the most conspicuous effects of the *Exxon Valdez* oil spill was the injury to birds. Seabirds are particularly vulnerable to oil as they spend much of their time on the sea surface while foraging. Oiled plumage insulates poorly and loses buoyancy and birds die from hypothermia or drowning. Birds surviving initial acute exposure may then ingest oil by preening. Approximately 36,000 dead birds were recovered after the spill; at least 31,000 of these deaths were attributed to the effects of oil. In addition to the large number of murres, sea ducks, and bald eagles, carcasses of loons, cormorants, pigeon guillemots, grebes, murrelets, and other species were also recovered (see attached comprehensive list of bird carcasses logged into evidence trailers by September 25, 1989). Only a small proportion of the total number of birds estimated to have been killed were recovered, as many undoubtedly floated out to sea, sank, were scavenged, were trapped and hidden in masses of oil and were not visible, were buried under sand and gravel by wave actions, decomposed, or simply beached in an area where they were not found. Additionally, it is known that, in a number of cases, carcasses found shortly after the spill were not turned in to receiving stations. Analyses provided by computer models that account for some of these variables estimate that the total number of birds killed by the spill ranges from 300,000 to 645,000, with the best approximation that between 375,000 and 435,000 birds died. These estimates reflect only direct mortality occurring in the months immediately following the spill, and does not address chronic effects or loss of reproductive output.

Common and Thick-billed Murres: Murres are the third most abundant seabird in Alaska (after tufted puffins and black-legged kittiwakes). A total of approximately 1,400,000 murres reside in the Gulf of Alaska (Unimak Pass to the Canadian border in southeastern Alaska). The total population of murres in Alaska is approximately 12,000,000. The murre colonies on the Chiswell Islands are the most visited by tourists in Alaska. In 1989 and 1990 murres were the most heavily affected bird species. Oil in Prince William Sound affected major wintering areas of murres and other species. As oil moved out of Prince William Sound and along the Kenai Peninsula and the Alaska Peninsula, it hit major seabird nesting areas such as the Chiswell and Barren Islands, as well as numerous smaller colonies. The oil hit these areas outside Prince William Sound at the same time that adult murres were congregating on the water near colonies in anticipation of the nesting season. Approximately 22,000 murre carcasses were recovered following the spill. Colony surveys indicate that an estimated minimum of 120,000 to 140,000 breeding adult murres in the major colonies that were surveyed were killed by the spill. Extrapolating this information to other known murre colonies hit by the spill (but not specifically studied), the mortality of breeding adult murres is estimated to have been 172,000 to 198,000. However, area-wide, including wintering and non-breeding birds, the total mortality of murres is estimated to be about 300,000. Numbers of breeding murres declined in 1989 from pre-spill counts or estimates at Alaska Peninsula sites (50-60 percent), the Barren Islands (60-70 percent), and the Triplet Islands near Kodiak Island (35 percent). These dramatic decreases persisted in 1990 and 1991. No significant changes in murre numbers were noted for the control areas on the Semidi Islands and Middleton Island as compared to pre-spill data. Murres exhibit strong fidelity to traditional breeding sites and infrequently immigrate to new colonies.

Normally, murres breed in densely packed colonies on cliff faces. Each murre colony initiates egg laying almost simultaneously. This synchronized breeding behavior helps the birds repel predators such as gulls and ravens. In oiled areas, murre colonies have exhibited a much lower populations than before the spill, breeding is later than normal, and breeding synchrony has been disrupted. These structural and behavioral changes in colonies have caused complete reproductive failure during 1989, 1990, and 1991, and thus lost production of at least 300,000 chicks. Murre colonies in unoiled areas displayed none of these injuries and had normal productivity.

Bald Eagles: Of the estimated Alaskan bald eagle population of 39,000 birds (27,000 adults and 12,000 fledglings), an estimated 4,000 reside in Prince William Sound and an estimated 8,000 to 10,000 in the coastal environments of the northern Gulf of Alaska. One hundred fifty-one (151) dead bald eagles were found following the spill. Although there is considerable uncertainty regarding the total mortality of bald eagles, it is estimated that several times this amount may have been killed by the initial spill. Seventy-four percent of radio-tagged bald eagles that died during subsequent studies ended up in the forest or in other places where they would likely not have been found. It is conservatively estimated that 553 bald eagles were killed directly by the spill. To assess injuries to bald eagles, helicopter and fixed-wing surveys were flown to estimate populations and productivity. Radio transmitters were attached to bald eagles to estimate survival, distribution, and exposure to oiled areas. Bald eagles in Prince William Sound were most intensively studied. Productivity surveys in 1989 indicate a failure rate of approximately 85 percent for nests on moderately or heavily oiled beaches compared to 55 percent on unoiled or lightly oiled beaches. This resulted in a lost production of at least 133 chicks in Prince William Sound in 1989. Nest success and productivity on the Alaska Peninsula were also lower in 1989 than in 1990, but differences between years for other coastal areas affected by the spill were less apparent. Nest occupancy was lower in oiled areas than in unoiled areas in both 1989 and 1990. Bald eagles have a delayed sexual maturity and have a relatively long life span under normal circumstances.

Consequently, although reproduction apparently rebounded to more normal levels in 1990, population impacts as a result of poor reproduction and the death of hundreds of adult eagles in 1989 may not be readily apparent for several years. Population indices form surveys in 1982, 1989, 1990, and 1991 changed little from year to year and suggest a static bald eagle population in Prince William Sound.

Sea Ducks: More than 2,000 sea duck carcasses were recovered after the spill, including more than 200 harlequin ducks. Studies concentrated on harlequins, goldeneyes, and scoters, species that use the intertidal and shallow subtidal habitats most heavily affected by the spill. Harlequins were most affected, consistent with the fact that they feed in the shallow water area of the intertidal zone. This is the only species of sea duck studied that both nests in the spill area and feeds in the shallow intertidal zone. All of these species feed on invertebrates such as mussels which, in 1991, continue to show evidence of petroleum hydrocarbon contamination. Contaminated mussel beds are expected to continue to cause injury to harlequins and other sea ducks that feed on mussels.

About 33 percent of the harlequins collected in the spill area had poor body condition (reduced body fat) and about 40 percent had tissues contaminated with petroleum hydrocarbons, especially concentrated in bile and liver samples. The 1991 survey indicates harlequin population declines and a near total reproductive failure in oiled areas of Prince William Sound.

Other Birds: Boat surveys were initiated in Prince William Sound and other areas of the spill zone to estimate abundance and examine population changes of waterbirds between pre-spill and post-spill surveys, and to compare changes in oiled and unoiled zones. Overall declines (treating oiled and unoiled areas together) in Prince William Sound populations occurred between 1972/1973 and the years after the oil spill for the following 16 out of 39 species or species groups examined: grebes, cormorants, northern pintail, harlequin duck, oldsquaw, scoters, goldeneyes, bufflehead, black oystercatcher, Bonaparte's gull, black-legged kittiwake, arctic tern, pigeon guillemot, Brachyramphus (marbled and Kittlitz') murrelets, and northwestern crow. Harlequin ducks, black oystercatchers, pigeon guillemots, northwest crows, and cormorants declined more in oiled areas than in unoiled areas since the early 1970s. Comparisons of post-spill survey data with 1984 pre-spill data found that harlequin ducks, black oystercatchers, murres, pigeon guillemots, cormorants, arctic terns, and tufted puffins declined more in oiled areas as compared to unoiled areas.

Marbled and Kittlitz's murrelet populations declined dramatically in Prince William Sound since surveys done in 1972 and 1973. In 1973, the estimated murrelet population in the Sound was 304,000 birds, while murrelet populations were estimated to be 107,000 in 1989, 81,0000 in 1990, and 106,000 in 1991. The length of time between pre-spill and post-spill surveys makes it difficult to determine the contribution of the spill to this decline. However, the high proportion of murrelets killed by the spill in Prince William Sound relative to the number present when the spill occurred and the documentation of internal petroleum hydrocarbon contamination of apparently healthy murrelets collected in oiled areas indicate that the spill had a significant effect on murrelets. Disturbance associated with cleanup activities likely impacted number of murrelets observed in the spill area in 1989.

Although only nine black oystercatcher carcasses were found after the spill, this species is completely dependent upon the intertidal ecosystem, the ecosystem most significantly injured by the spill. In addition to mortality caused directly by the spill, oiling affected their reproductive success. Relative egg volume of clutches and weight gained by chicks on oiled sites were substantially lower than on unoiled sites. The difference in weight gain may be driven by food quality as the biomass of food delivered to oiled sites was significantly greater than that delivered to unoiled sites. Hatching success, fledging success, and productivity were not significantly different between oiled and unoiled sites.

Direct disturbance by clean-up activities significantly reduced oystercatcher productivity on Green Island during 1990.

Pigeon guillemot are nearshore diving seabirds that gather daily on intertidal rocks near their colonies during the breeding season and forage by probing into intertidal and subtidal recesses and kelp. Five hundred sixteen (516) carcasses were recovered following the spill. It is estimated that between 1,500 and 3,000 guillemots were killed by the spill, representing as high as 10 percent of the cataloged pigeon guillemot population in the Gulf of Alaska. Boat surveys indicate that in 1973, the Prince William Sound guillemot population was approximately 14,600, while in 1989, 1990, and 1991, the estimated populations were, respectively, 4,000, 3,000, and 6,600. Although the evidence suggests that guillemots were declining prior to the spill, there were significantly greater declines in oiled areas. Throughout the four islands of the Naked Island group, post-spill surveys showed a 40 percent decline in guillemots during peak colony attendance hours compared to pre-spill surveys. Declines corresponded to the degree of shoreline oiling. Preliminary analysis indicate that fledging weight, chick growth rate and nesting success were significantly lower in post-spill years as compared to pre-spill years. Petroleum hydrocarbons were found on eggs and in tissue in 1989 and on eggs in 1990.

The extent of injury to certain species, including loons, cormorants, and gulls will probably never be known because pre-spill information on numbers of these birds in the spill area are not available. Studies did not document injury to certain bird species such as Peale's peregrine falcons or songbirds.

FISH/SHELLFISH

No massive die-offs of adult fish were found following the spill, and adult salmon, for example, were evidently able to migrate to spawning areas after the spill. However, fish are most vulnerable to oil contamination during the early stages of their life cycles. Accordingly, most fish studies initially focused on this phase of fish life history. During 1991, scientists will begin to be able to assess affects on adult fish such as salmon that would have been exposed to oil as eggs or larvae. Species most often affected by the spill were those that inhabit and spawn in the intertidal zone (salmon) or in the shallow areas next to shore (herring and Dolly Varden).[2] Less than ten dead rockfish were found during the spill and their deaths were attributed to oil. Several species of coastal and offshore fish (pollock, halibut, sablefish, cod, yellowfin and flathead sole, and rockfish) show evidence over a large geographic area of continuing exposure to petroleum hydrocarbons in areas affected by the spill, but significant injury has yet to be documented. Because salmon and other fish species can metabolize petroleum hydrocarbons, these contaminants are unlikely to concentrate in edible fish tissues. Indicators of exposure in fish include increased levels of hydrocarbon metabolites in bile and activities of mono-oxygenases in liver tissue. Since injuries from chronic exposure to oil may not manifest themselves for a number of years, it is premature to conclude that coastal and offshore species were not injured; therefore certain studies are continuing.

Pink Salmon: The full extent of short term injury to pink salmon cannot be assessed until after the 1991 run returns have been enumerated. Although the overall catch of pink salmon in Prince William Sound during 1990 was an all-time record (as predicted before the spill), this was primarily due to strong runs of hatchery-produced salmon. Salmon survival associated with the Armin F. Koerning hatchery, located in the middle of a heavily oiled area of the spill zone, was half that of Ester Hatchery, located outside the area of the spill. Wild production of pink salmon did not mirror the record production of hatchery fish.

---

[2]The State of Alaska imposed the highest possible standards for commercial fishery openings and for processing plant inspections to insure that all commercially harvested salmon were free from contamination. Salmon subject to commercial harvest in the spill area were rigorously tested to insure that the catch was safe for human consumption.

Seventy-five percent of wild pink salmon spawn in the intertidal portion of streams in Prince William Sound. Wild stock salmon did not shift spawning habitat following the spill and deposited eggs in intertidal areas of oiled streams. In the summer of 1989, a 70 percent greater mortality of pink salmon eggs occurred in eggs laid in oiled streams as compared to control streams. A 115 percent difference in egg mortalities between oiled and unoiled streams in 1991 equates to 40 to 50 percent egg mortality in oiled, and less than 20 percent in unoiled streams in 1991. Egg mortality was greater in 1991 than in previous study rears. Fry growth was decreased in oiled streams as compared to unoiled streams. The role of the spill as well as the role of natural variability in causing the increased 1991 egg mortality are being analyzed. Eggs and larvae of wild populations continue to be exposed to oil in intertidal gravel in oiled areas.

Pink salmon juveniles were exposed to petroleum hydrocarbons from the spill in near shore marine habitats in oiled portions of Prince William Sound in 1989. Growth rates of juvenile pink salmon were lower in oiled locations in 1989. Growth rates during initial marine residency of pink salmon are directly related to survival. There was no evidence of continued reduced growth of juvenile salmon in nearshore waters in 1990. Laboratory experiments in 1991 confirmed that ingestion of food contaminated with whole oil can cause reduced growth and increased mortality of juvenile pink salmon.

Larvae from heavily oiled streams showed gross morphological abnormalities, including club fins and curved spines. The pink salmon that returned to Prince William Sound in the summer of 1990 were exposed to oil as larvae as they swam under the slick, but not as eggs which were more directly exposed to oil than the larvae. The 1990 return of both wild and hatchery pink salmon was 20 to 25 percent lower than expected without the spill, resulting in a return of 15 to 25 million less fish. Fish that returned in 1991 were the first that were exposed to oil as eggs. In 1991, returns of wild stocks were low in both oiled and unoiled streams.

Sockeye Salmon: Commercial harvest of sockeye salmon was curtailed in portions of Cook Inlet, Chignik, and Kodiak in 1989 because of the spill, resulting in an unusually high number of adults migrating to spawn in certain lake spawning systems (Kenai/Skilak Lakes, Red and Akalura Lakes). Returning adults that arrive at the spawning areas are referred to as the "escapement". This overescapement resulted in poor growth rates and poor survival to the smolt stage, perhaps due to too little food for the increased number of juveniles that needed to be supported by nursery lake productivity. This is expected to cause a 20 to 50 percent decline in adult returns in 1993 and 1994 Kodiak harvest. Total closure of the commercial and sport sockeye fisheries may ne necessary for the Kenai and Red Lake systems in those years.

Dolly Varden and Cutthroat Trout: Prince William Sound is the northern extreme of the range of cutthroat trout. Both cutthroat trout and Dolly Varden use nearshore and estuarine habitat for feeding throughout their lives (in contrast to salmon which migrate out to sea). The highest concentrations of bile petroleum hydrocarbon metabolites in all fish sampled were found in Dolly Varden. Tagging studies have demonstrated that the annual mortality of adult Dolly Varden was 32 percent greater in oiled areas than in unoiled areas. The larger cutthroat trout also showed higher levels of mortality in oiled and unoiled areas. In 1989-1990, there was 57 percent greater mortality and in 1990-1991, a 65 percent greater mortality in oiled streams as compared to unoiled streams. Additionally, cutthroat trout growth rates were reduced 68 percent in 1989-1990 and 71 percent in 1990-1991 in oiled areas.

Pacific Herring: Populations of Pacific herring were spawning in shallow eelgrass and algal beds at the time of the spill. The effects of oil on egg survival, hatching success, larval development, and recruitment to the spawning population were studied. Study results show a large increase in the percentage of abnormal embryos and larvae in oiled areas of Prince William Sound during the 1989 reproductive season. Larvae in oiled areas also had a greater incidence of eye tumors. Whether the adult population has been affected by these larval injuries will not be determined until the 1989 and 1990 cohorts return to spawn in 1992 and 1993.

There was evidence of oil contamination in adult fish in 1989 and 1990. In 1989, hydrocarbon metabolites occurred in the bile and inn whole fish and there were significant changes in the parasite burden of adults found in oiled as compared to unoiled sites. The parasite burden of the adult herring returned to baseline levels in 1991. Processing and analysis of 1991 egg, larvae and adult herring data continues.

Rockfish and Other Fish: Rockfish were the only fish species for which adult fish were observed dying immediately after the spill. Rockfish showed lethal and sublethal injuries, including tissue lesions, consistent with exposure to hydrocarbons. Other species that showed petroleum hydrocarbon metabolites in the bile in 1989 included halibut, pollock, rock sole, yellowfin sole, flathead sole, and Pacific cod, and in 1990 Dover sole and sablefish. Fishing pressure increased on rockfish when salmon seasons were closed in 1989, and these fishing pressures have not returned to pre-spill levels.

COASTAL HABITAT

The coastal tidal zone, commonly known as the "intertidal zone," was the most severely contaminated habitat. Intertidal habitats are highly productive and biologically rich. They are particularly vulnerable to the grounding of oil, its persistence, and effects of associated clean-up activities. An interdisciplinary team with expertise in plant and systems ecology, marine biology, and statistical analysis, was established to conduct field studies to assess the effects of oil on intertidal ecosystems.

Supratidal: Results of studies in the Kodiak/Alaska Peninsula area suggest that oil in the supratidal habitat and beach cleanup disturbance decreased the productivity of grasses and other vegetation including beach rye grass, that help stabilize beach berms. In one instance, cleanup activities completely removed the vegetation. Increased production of supratidal vegetation was found in Prince William Sound in 1989. This finding corresponds with information from other oil spills. It is not known whether this increased production was a result of decreased browsing by terrestrial mammals or a fertilizer effect of the oil.

Intertidal: Natural populations of intertidal organisms were significantly reduced along heavily oiled shorelines such as Herring Bay. Densities of intertidal algae (*Fucus*), barnacles, limpets, amphipods, isopods, and marine worms were decreased. Although there were increased densities of mussels in oiled areas, they were significantly smaller than mussels in the unoiled areas and the total biomass of mussels was significantly lower. Intertidal organisms continue to be exposed to petroleum hydrocarbons from the more heavily oiled sediments. Petroleum hydrocarbon accumulation in filter feeding mussels experimentally placed in the water column in various oiled areas was significant during the summer of 1989, but decreased to detectable accumulations by 1990. Sediment traps collected significant concentrations of petroleum hydrocarbons during the winter of 1990-1991, indicating that oil was still being mobilized to depths.

In 1991, relatively high levels of oil were found in mussels and the dense underlying mat (byssal substrate) of certain oiled mussel beds. These beds were not cleaned or removed during the cleanup process. These oiled mussel beds are potential sources of contamination for harlequin ducks, black oystercatchers, and juvenile sea otters, all of which feed on mussels and show continued biological injury. The oil found in some dense byssal mat substrates associated with some mussel beds was relatively unweathered and may continue to contaminate overlying mussel beds. The extent and magnitude of oiled mussel beds is not known and continues to be investigated.

Intertidal fishes were less abundant in oiled areas than in unoiled areas. In addition, gill parasitism and respiration rates were significantly higher in fish from oiled sites compared to unoiled sites.

Fucus, the dominant intertidal plant, was severely affected by the oil and subsequent cleanup activities. The percentage of intertidal areas covered by Fucus was reduced following the spill and opportunistic plant species which characteristically flourish in disturbed areas were increased. The average size of Fucus was reduced, the number of reproductive sized plants greatly decreased, and the remaining plants of reproductive size decreased in reproductive potential due to fewer fertile receptacles per plant. There was also reduced recruitment of Fucus at oiled sites.

SUBTIDAL HABITATS

Between 1989 and 1991, oil concentrations declined in intertidal sediments sampled at most oiled location, while the concentration in shallow subtidal sediments (3-20 meters) remained about the same or in some cases, rose slightly. Patterns of sediment toxicity to test organisms (marine amphipods and larval bivalve molluscs) reflected similar patterns. In 1990, significant toxicity was associated only with intertidal sediment samples from heavily oiled sites, bit in 1991, toxicity was associated primarily with sediment samples from the shallow subtidal zone. There is evidence that animals living on or near the sea floor continue to be exposed to petroleum hydrocarbons. petroleum hydrocarbon metabolites and increased mono-oxygenase activities have been found in the bile and liver of yellowfin sole, rock sole, and flathead sole. Concentrations of petroleum hydrocarbon metabolites in the bile of these species did not decline substantially from 1989 and 1990, but did generally decline from 1990 to 1991. This contrasts with Dolly Varden which feed close to shore and where petroleum hydrocarbon metabolites in bile decreased markedly form 1989 to 1990. Many subtidal and intertidal species, particularly fish, actively metabolize and eliminate petroleum hydrocarbons from their bodies relatively rapidly.

Clams metabolize hydrocarbons very slowly and consequently accumulated them in high concentrations. Contaminated clams and other invertebrates are a potential continuing source of petroleum hydrocarbons for sea otters and other species that forage in the shallow subtidal zone. Samples from pollock, which feed in the water column, taken as far away as 500 mile from the wreck site on Bligh Reef, showed elevated petroleum hydrocarbon metabolite concentrations in their bile. This indicates that the water column or food supply was affected at great distances from the spill. Initial 1990 study results show a significant effect on benthic organisms associated with eelgrass beds. These are known to be highly productive habitats. The composition of benthic animal communities on soft-bottom habitats as deep as 40 meters were also significantly altered in oiled areas.

ARCHAEOLOGICAL AND SUBSISTENCE RESOURCES

The spill directly impacted archaeological sites and subsistence resources. Cleanup activities and the associated significant increases in human activity throughout the spill zone resulted in additional injuries to these resources.

Archaeological Resources: Archaeological sites along the shoreline were injured by the spill. Review of spill response data revealed injuries occurred at a minimum of 35 archaeological sites. Among these are burial sites and home sites. These injured sites are distributed on both federal and state lands. While injury to these 35 sites was documented during cleanup, a spill-wide assessment of injuries to archaeological resources has yet to be completed. In addition to oil contamination, increased knowledge of the location of archaeological sites may puts them at risk from looting. Additional injury due to erosion caused by oil spill response activities was documented.

A study was conducted to determine impacts caused by oil contamination on radiocarbon dating of archaeological resources and to investigate the potential for cleaning artifacts and materials to allow such dating. Results indicate significant injury to the ability to contextually date artifacts and materials by Carbon 14 analysis.

Subsistence Resources: Surveys undertaken by state researchers before the spill and in 1990 indicated that subsistence harvesters in the area affected by the oil spill significantly reduced their use of subsistence resources after the spill, primarily because of their concerns about possible contamination of these resources. The oil spill disrupted the subsistence lifestyle of some communities that have historically relied upon these resources. Some communities virtually or entirely ceased subsistence harvests in 1989 and have only gradually begun to resume harvests, while other communities continued some reduced level of subsistence harvest in 1989 and thereafter. Warnings were issued by the state in 1989 for people to avoid consumption of intertidal invertebrates (such as mussels and clams, which bioaccumulate petroleum hydrocarbons) found along shorelines contaminated by oil. After the spill, an oil spill health task force was formed, including the state and federal governments, subsistence users, and Exxon. This group helped oversee studies conducted by the state and others in conjunction with FDA and NOAA in 1989, 1990, and 1991, on subsistence food resources such as seals, deer, salmon, ducks, clams, and bottomfish. Based upon the test results these resources, with the exception of clams and mussels in certain oiled areas such as Windy Bay, were determined to be safe for human consumption.

[Senner, TEXT.IV, 01/27/92]

Section IV: Injury Criteria

A. Settlement Guidance

The use of State/Federal restoration trust funds must be linked to injuries resulting from the Exxon Valdez oil spill. Specifically, the settlement requires that funds recovered for natural resources damages must be spent to restore, replace, enhance, rehabilitate or acquire the equivalent "of natural resources injured as a result of the oil spill and the reduced or lost services provided by such resources " (citation)

"Natural resources" means land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources belonging to or managed by Federal and State governments (citation). Services provided by natural resources include such activities as subsistence hunting and fishing and recreation. Restoration funds also may be spent on archaeological resources--"sites and artifacts"--that were injured, lost, or destroyed as a result of the oil spill (citation).

B. Proposed Criteria

How do we determine which natural resources, natural resources services, and archaeological resources are in need of restoration? Section III presents the results of the studies carried out in the State/Federal Natural Resources Damage Assessment, which is the primary source of information about EVOS injuries. There also is information available from other sources, such as the public or from the "shoreline assessments" conducted by State and Federal response agencies.

Although information on injuries is available from these various sources, there is need for a standard for what constitutes "injury" for purposes of on which resources and services restoration funds may be spent. The following factors are proposed:

(1) evidence of consequential injury; and

(2) adequacy and rate of natural recovery.

The concepts underlying these factors are described below.

C. Injury to Natural Resources

Elaborating on B.1 above, the following definition of injury could be applied to natural resources in the spill area:

> A natural resource has experienced "consequential injury" if it has sustained a loss (a) due to exposure to spilled Exxon Valdez oil, or (b) which otherwise can be attributed to the oil spill and clean up. "Loss" includes:
>
> (1) significant direct mortality;
>
> (2) significant declines in populations or productivity;
>
> (3) significant sublethal and chronic effects to adults or other life history stages; and
>
> (4) degradation of habitat due to alteration or contamination of flora, fauna, and physical components of the habitat.

This definition covers a wide range of natural resources injuries. Consequential loss is most certain where there was significant direct mortality (e.g., bald eagle and sea otters) or if studies revealed a population decline linked to the oil spill (e.g., harbor seal). Where only eggs or juvenile life history stages are known to have been harmed (e.g. Pacific herring), it is more difficult to establish consequential injury. In such cases, however, if the injury is manifested or inferred at the population level, the injury can be considered consequential. Lastly, this definition includes injury to the underlying habitats which were oiled (e.g., intertidal zone).

D. Recovery Concept

To maximize the benefits of restoration expenditures, we need to consider whether natural recovery has occurred or is occurring as well as the quality of the recovery before investing restoration dollars. These involve both scientific and practical considerations. In a scientific sense, full recovery has been achieved when the pre-spill floral and faunal constituents of natural communities are again present, healthy, and productive, and there is a full complement of age classes. In a broader sense, a fully recovered ecosystem will be one which provides the same functions and services as undamaged systems.

Our ability to scientifically determine if recovery has occurred or when it will occur is limited, due to such problems as the quality and quantity of information on pre-spill, "baseline" conditions. For each injured resource, however, the rate and quality of natural recovery should be estimated, based on the best information available from NRDA studies and the scientific literature. If it appears that recovery will be nearly complete before the benefits of a restoration study or project can be realized, then common sense suggests that spending restoration dollars is not justified. On the other hand, if it appears that the time to recovery is long, it is worth considering technically feasible, cost effective restoration options.

Archaeological sites and artifacts are not living, renewable resources and have no capacity to heal themselves. Thus, the concept of recovery only has limited application to these resources.

E. Injury to Natural Resources Services

A variety of natural resources services potentially were injured and should be considered for restoration. Examples are wildlife viewing, a service provided by marine birds and mammals; sport fishing, a service provided by Dolly Varden and cutthroat trout; recreation, including such activities as kayaking and backcountry camping; and subsistence hunting, fishing, and gathering.

Intrinsic values are also natural resources services potentially injured by the oil spill. Intrinsic values, for example, may include the sense of many Americans that the oil spill violated their perception of the spill area as a pristine wilderness. Formally designated Wilderness Areas (e.g., within

Katmai National Park and Preserve) are a special case of a natural resources service, because there is not only a perception of wilderness, but Congress has legislated that each Wilderness Area shall maintain certain pristine physical qualities.

For each natural resources service, we first must consider whether there is evidence of consequential injury to the service. Secondly, we must consider whether that service is being provided again due to the recovery of the natural resource that provides the service.

Section 5A

A. LIFE HISTORIES

The Exxon Valdez Oil Spill affected many different species as well as habitats. Each species relies on different habitat characteristics and follows different life cycles. These characteristics are important for understanding the level of injury experienced by a population, its potential recovery rate, as well as developing restoration techniques. The following pages briefly describe the life histories of many of the species impacted by the oil spill. Primary references are cited as footnotes with full citations appearing in Appendix ??.

COMMON MURRE (*Uria aalge inornata*)

Range:

The species has a holarctic distribution predominately south of the arctic circle. The subspecies *U. a. inornata* is found from Oregon to Point Hope Alaska.

Migration:

Murres winter in offshore waters before returning to their nesting colonies in the spring.

Breeding Chronology:

Murres arrive at nesting colonies in April and May. The single egg is laid in June and incubated by both adults for 28-34 days. Hatching occurs between July 10 and early August. Chicks fledge to the ocean in August. Very little is known about the behavior of fledged chicks and subadults. Common murres do not breed until they are 5 years old or older, and subadults do not return to visit the colonies until they are 2 or 3 years old.

Breeding Behavior:

The breeding success of common murres is highly dependent on the physical characteristics of the colony site and the density of murres nesting on each ledge. Since murres do not build nests, the slope of the nesting ledge is important to prevent the eggs from rolling off the cliff. The width of the ledge influences the number of birds that can nest and therefore the vulnerability to predation. High nesting densities (greater than 10 birds/meter^2) have the greatest breeding success. The nesting density helps to synchronize breeding behavior so that eggs are laid over a short period of time and therefore chicks hatch and fledge together. This increases the ability of the murres to protect their young from predators. Most murres return to the same ledge for breeding each year.

Predation:

Predatory birds, particularily gulls (*Larus spp.*) and bald eagles (*Haliaeetus leucocephalus*), can have a significant impact on the breeding success of the colonies. Low nesting densities of murres, chicks which hatch and fledge later than their neighbors, and eggs or chicks exposed when the adults are disturbed from the ledges, are especially vulnerable to predation.

Food Habits:

Common murres eat a variety of fish and shrimp. Primary species include capelin, sand lance, walleye pollock and euphausiids.

Human Interaction:

Entanglement in fishing nets does not appear to be a problem for murre colonies within the Exxon Valdez Oil Spill area. Fishing and tourism activities which disturbs the murres from their nesting ledges can cause greater losses to predation. Subsistence harvest of the eggs and murres is not common within the oil spill area.

Harlequin Duck (*Histrionicus histrionicus*)

Range:

In North America, the western population is found from the Seward Peninsula, throughout the Aleutian Islands and south to central California and the northern Rocky Mountains.

Migration:

In Alaska, harlequin ducks begin arriving on their wintering grounds in the Aleutian Islands and in the Gulf of Alaska in mid-September. Adults begin congregating at the mouths of suitable breeding streams in May.

Breeding Chronology:

Harlequins do not breed until their second year. Egg laying begins between May 10 and May 30. Three to 7 eggs are incubated by the female for 28-30 days. The males leave the females early in the incubation period and begin congregating for the molt. Hatching occurs from early to mid-July. Females with broods remain in freshwater streams until August when they migrate to marine habitats. Adults breed annually after reaching maturity.

Habitat Use:

Paired harlequins congregate at the mouths of anadromous fish streams in May. The pairs fly inland to search for nesting sites. Most nests are located along shallow rivers and streams with gravel or rocky substrates. Preferred nesting sites are located on islands or islets under dense vegetation. Harlequins may return to the same nest site in consecutive years. Slow stretches in oxbows, or lee sides of curves, are used by broods for feeding and resting. Turbulent stretches of streams are preferred feeding places for adults in freshwater. Shallow coastal areas and intertidal reaches are used by non-breeders and males during the summer. Wintering harlequins forage in small groups, along exposed coasts and in bays.

Food Web Interrelationships:

Breeding birds and broods feed mostly on aquatic invertebrates and larvae. Salmon roe is an important food source for all harlequins and may be the primary food while it is available. Wintering harlequins feed predominately on mollusc and crustaceans. Molluscs are often consumed along with their shells.

Human Interactions:

Harlequin ducks can be legally harvested each fall. Disturbance to molting flocks may cause additional stress to individuals. Disturbance and loss of nesting habitat can also impact the population.

American Black Oystercatcher (Haematopus bachmani)

Range:

Inhabits coastal areas from the Aleutian Islands to Baja California.

Migration:

Black Oystercatchers are generally believed to be year-round residents at their breeding areas; however, observations from Alaska indicate that the birds move to an unknown destination for the winter.

Breeding Chronology:

Nest scrapes are built on rock crevices and gravel beaches in May. One to 3 eggs are laid and incubated by both adults for 24 to 29 days. Eggs are laid from mid-May to early July, second clutches may be laid if the first clutch is destroyed. Chicks are precocious but are fed by the adults until they fledge. Sibling rivalry often lowers the survivorship of one of the chicks. Survivorship of chicks to fledging can be very low (less than 20%). They are particularly vulnerable to predation in the first week after hatching. They are capable of flying in approximately 40 days. Oystercatchers do not reach sexual maturity until they are 4 years old.

Habitat Use:

Oystercatchers occupy rocky coastal areas. They nest on rocky outcrops or rock and shell beds on small islets or on the mainland. Nests consist of scrapes, sometimes lined with broken shells. The eggs and young are cryptically colored and rely on camoflaging to protect them from predators. The adults feed in the intertidal zones. During the 1st week after hatching the chicks remain near the nest site and the adults bring food from the intertidal zone. After the first week, the chicks follow the adults to the intertidal zone at low tide.

Food Web Interrelationships:

Black oystercatchers feed primarily on intertidal invertebrates. Common mussels (Mytilus spp.) and limpets (Acmaea spp.) are the primary prey species.

Flightless chicks are vulnerable to predation, especially in the first week after hatching. During this time the adults brood the chicks and their movements may alert predators to the location of the chicks. Gulls, ravens and river otters are known to prey on oystercatchers.

Human Interactions:

Although black oystercatchers are not harvested, destruction of, or disturbance at, nesting habitats can have adverse impacts on local populations.

Marbled Murrelet (Brachyramphus marmoratus)

Range:

Pacific Coast, from central California to the Aleutian Islands, and from the Kamchatka Peninsula to northern Japan.

Migration:

Marbled murrelets return to coastal waters near breeding areas each spring. The dates are variable, usually occuring in Alaska in April or May. The adults and fledged young leave the breeding areas in the fall for unidentified wintering areas.

Breeding Chronology:

Documented evidence of breeding chronology is based primarily on follicle development of collected birds. These data suggest that laying can occur as early as late April in the southern part of their range. Most egg laying probably occurs in June in the Gulf of Alaska. Marbled murrelets lay a single egg which is incubated by both adults. The incubation length and hatching dates are unknown. Fledged chicks begin to appear with the adults on coastal waters in August and September [?]. Adults begin to molt in .

Habitat Use and Requirements:

During the breeding season, marbled murrelets make crepuscular flights between inland and coastal areas. Extensive searches for marbled murrelet nests were unsuccessful until the late 1960's. A total of ?? nests have been discovered in N. America, 4 of which were found as a result of efforts related to the oil spill. Current data suggest that marbled murrelets nest in old growth forests. Most of the nests have been located in large trees, but some ground nests have also been recorded. Marbled murrelets have solitary nest sites, and have been located as far as 7 km from the coast.

Marbled murrelets feed in coastal waters. They have been known to dive to a maximum depth of 50 meters. The winter distribution is unknown. Some remain in the Gulf of Alaska throughout the winter and probably concentrate in protected bays and straights during winter storms.

Food Web Interrelationships:

Marbled murrelets eat small fishes and crustaceans. Important species within the Gulf of Alaska and Cook Inlet include capelin, cod, sand lance and a variety of shrimp.

Human Interactions:

In 1990 marbled murrelets were the most commonly caught seabird with an estimated total mortality between 700 and 1700 birds. This represents a small portion of the population, but may have some local significance. The loss of nesting habitat due to logging or development of old growth forest would have a greater impact on the population. Population declines over the southern portion of their range has caused the species to be considered for listing as "Threatened" outside of Alaska.

Pigeon Guillemot (Cepphus columba)

Range:

Pigeon guillemots are found along the north Pacific coast from southern California to the Bering Sea and Aleutian Islands in Alaska. They are also found from the Chukchi Sea to northern Japan.

Migration:

Arrive at breeding areas in [April **?**]. Depart for wintering grounds in **?**.

Breeding Chronology:

In Prince William Sound (PWS), pigeon guillemots have been documented on their breeding areas in May. The first nests with eggs were observed in late May with the peak of egg laying occuring in June. Clutches normally consist of two eggs which are laid three days apart. Eggs are incubated for 30-32 days by both [**?**] adults. Chicks hatch between late June and late July. Fledging occurs approximately 38 days after hatching. Pigeon guillemots probably do not begin breeding until they are between 3-5 years of age.

Habitat Use and Requirements:

Pigeon guillemot nests are usually located in natural cavities beneath boulders, at the base of cliffs, or in talus slopes; they are also known to nest in abandoned puffin burrows. Several nests are often found close to eachother, forming a low density nesting colony. Adequate nest sites probably determine the breeding bird density. The adults use the supratidal and intertidal areas in front of the nest sites for social activities (e.g. pair bond maintenance) and feeding throughout the breeding season.

Pigeon guillemots feed in nearshore benthic waters, generally no more than a few kilometers from land. During the breeding season they feed in **[pairs, small groups, large groups?]**. During winter most of the population leaves for **.....?** In Prince William Sound an estimated 27-43% of the summer population was present in March.

Food Habits:

This species has a "generalist" feeding behavior consuming a very wide variety of fish and shellfish. Capelin, sand lance, Pacific sandfish and herring are some of the more important species as well as shrimp and crabs. Dietary preference can vary significantly between individuals.

Human Interactions:

[**Kathy, do you have suggestions for this section?]**

BALD EAGLE (*Haliaeetus leucocephalus*)

Range:

Bald Eagles are found in Alaska, Canada, to the southern United States. They are most numerous in coastal Alaska.

Migration:

Bald Eagles winter in areas with open water. Interior nesting birds may move to large open rivers or the ocean. Most will wander during the late fall and early winter in search of prey such as late spawning salmon.

Reproduction:

Nesting begins in early April with courtship behavior. This includes bringing nesting materials to the nest site and courtship flights. The nesting territory will be defended from other eagles. In high density nesting areas, defended territories are approximately 1 linear mile of coastline per active nest. Adults return to the same nesting territory each year. During late April to early May the female lays one to three eggs with two being the most common clutch size. Incubation lasts about 34 days. In late August, or about 75 days after hatching, the fully feathered young are ready to leave the nest. The adults will continue to feed the newly fledged young for several weeks.

Habitat Use:

Bald eagles in Alaska nest along lakes, rivers and the coastal waters. Most nests are usually located along the coast in old-growth trees with an average age of more than 400 years. Some coastal areas have as many as one nest per beach mile.

This high productivity is associated with undisturbed habitat, a clean environment, abundant food resources and minimal human disturbance. Bald eagles have few predators outside of humans.

Food Habits:

Fish are the primary prey of bald eagles but they will also feed on wounded waterfowl, carrion, sea birds and even on garbage at landfills. Many bald eagles have died of lead poisoning from ingesting lead shot while feeding on waterfowl or from lead shrapnel found in hunter killed big game. Winter and spring can be the critical periods for bald eagles. During the late fall and early winter eagles will often be seen feeding along rivers where they have access to spawning and dead salmon. During spring they will often feed on spawning herring and sand lance.

Management and Protection:

A bounty for bald eagles was in affect in Alaska from 1917 to 1953. During this time over 100,000 eagles were killed. With statehood in 1959, the bald eagle in Alaska received federal protection under the Bald Eagle Protection Act of 1940. This act made it illegal to kill or possess any part of an eagle, including feathers. Additional restrictions on activity near nest sites has further helped the stability of populations.

BIBLIOGRAPHY:

Bortolotti, G. R. 1984. Physical development of nesting bald eagles with emphasis on the timing of growth events. Wilson Bulletin 96:524-42.

Hodges, J. I. and F. C. Robards. 1982. Observations of 3,850 bald eagle nests in southeast Alaska. Pp. 37-46 in W. N. Ladd and P. F. Schempf, eds., Proceedings of a symposium and workshop: Raptor management and biology in Alaska and western Canada. U.S. Fish and Wildlife Service, Anchorage, Alaska.

Jacobson, Michael J. 1989. A survey of the adult Bald Eagle population in Southeast Alaska. Unpublished Report. Juneau: U.S. Fish and Wildlife Service Raptor Management Studies.

Luther, R., M. Hermans, and B. Wright. 1990. Bald Eagles of Alaska's Coastal Rain Forest: A correspondence course. University of Alaska Southeast, Office of Continuing Education. Juneau, Alaska.

Schoen, J. W., M. D. Kirchhoff and J. F. Hughs. 1988. Wildlife and old-growth forests in Southeast Alaska. Natural Areas Journal. Volume 8 (3).

Stalmaster, Mark V. 1987. The Bald Eagle. New York: Universe

Books.

Sea Otter (_Enhydra lutris_)

Range:

Sea otters are found from the coast of southern California throughout the southern coast of Alaska to the Kamchatka Peninsula and south to Japan.

Reproduction:

Male sea otters reach sexual maturity between 5-7 years of age, females are capable of breeding between 4-5 years of age. Mating and pupping occur throughout the year, although most otters mate in September-October in Prince William Sound (PWS) with pups born in May. Sea otters give birth to a single pup, rarely twins. Pups are generally weaned by mid-November. They are capable of reproducing annually although the reproductive period varies between individuals and areas.

Habitat Use and Requirements:

Sea otters prefer shallow coastal waters that are generally less than 40 meters deep. They are found in areas with soft substrates as well as rocky substrates. Sea otters will use kelp beds as resting areas, but are not dependent on kelp for their distribution. Haulout areas such as intertidal rocks, exposed beaches, and algal covered rocks, are used by some otters for resting but are not considered essential to otter survival. Males and females tend to segregate except during the mating season. Immature and non-breeding males often congregate in large groups. Resident males defend territories during the breeding season. Protected waters on lee shorelines are used by sea otters during storms. Rough water can prevent sea otters from feeding and can cause severe stress in winter.

Food Habits:

Sea otters eat a wide variety of prey species, and can greatly influence prey availability over time. They prefer benthic invertebrates but will eat fish and other prey if the invertebrates no longer abundant. In Prince William Sound, otters eat mostly clams, mussels and crabs. The diet also differs between males and females. Females with pups tend to forage in shallower areas where smaller mussels and clams are available. Single adults of both sexes can forage in deeper areas with larger prey, because they are not tending a pup at the surface.

Human Interactions:

In the late 1800's sea otters had been eliminated from most of their historic range due to excessive fur harvesting in Russia and the United States. In 1911, sea otter harvesting was stopped and the remnant populations began to expand. Sea otters will expand their ranges into unoccupied territory if there is adequate food and protection. The Marine Mammal Protection Act of 1972 placed a moratorium on harvesting marine mammals, including sea otters. An exemption for Alaskan Natives allows take for subsistence.

Harbor Seal (Phoca vitulina richardsi)

Range:

Harbor seals are found in coastal waters from northern Mexico, throughout the Alaskan coast as far north as the Bering Sea, and south to northern Japan. They are also found in some rivers and lakes within Southcentral Alaska.

Reproduction:

Males and females become sexually mature when they are 3 to 7 years old. Breeding occurs from late June through July. Harbor seals have a delayed implantation of about 11 weeks, with an actual gestation period of about 225 days. Pups are born between late May and mid July. Usually a single pup is born, rarely twins. Pups are generally nursed for 3 to 6 weeks. Sexually mature adults breed annually.

Habitat Use and Requirements:

Harbor seals occupy coastal waters generally less than 60 meters deep, and even explore some coastal rivers and lakes. They have been recorded as far as 100 km away from the coast. Haulout areas are especially important for harbor seals. Rocks, isolated beaches with protective cliffs, ice floes, and sand or mud bars are used for resting, pupping and nursing young. They are especially important during the molt which occurs throughout the summer from June to October.

Food Web Interrelationships:

Harbor seals are opportunistic predators and consume a wide variety of fish and invertebrates. Walleye pollock, herring, salmon, eulachon and cephalopods are important prey for seals in the Gulf of Alaska.

Predation: Killer whales, sharks and stellar sea lions are known to prey on harbor seals. Predation combined with other causes of mortality (disease, desertion, entanglement, poaching) kill 74 -79% of all harbor seals in their first three years.

Human Interactions:

The Marine Mammal Protection Act of 1972 protects harbor seals. An estimated ## of harbor seals are harvested annually for subsistence by Native Alaskans. Conflicts with commercial fishermen and disturbance from haulout sites pose the greatest threats to harbor seals. Seals are especially vulnerable to disturbance during pupping when a separation may cause the mother-pup bond to be weak resulting in the death of the pup.

Brown Bear (Ursus arctos)

Range:

Brown bears are found throughout Alaska except for some islands in specific regions of the state. They are abundant in Alaska and parts of Canada, however they have been eliminated from most of the southern part of their range. They are still found in parts of Montana and Idaho.

Reproduction:

Brown bears reach sexual maturity between 3.5 and 6.5 years of age. The typical breeding interval for females to produce cubs is every 3 to 4 years, but it may be longer for some individuals. Mating occurs between May and July, with the peak in early June. The gestation period lasts about 6 months and the cubs, usually 2, are born in the den during hibernation. Most cubs are born in . Survival of cubs to yearlings (1.5 years old) ranges from 53% to 69% depending on location. Cubs generally remain with their mother for 2.5 **[?]** years.

Habitat Use:

Bears inhabiting coastal habitats in southcentral/southwest Alaska tend to have home ranges of approximately for females and for males. These home ranges cover a wide variety of habitat types which supply food throughout the seasons and denning sites in winter. In the spring, the bears often search the coastline for dead marine mammals and eat the exposed grass in wetlands. In summer anadromous fish streams provide important food sources for the bears and many bears may be found congregated together at streams with exceptionally large salmon runs (i.e. in Katmai National Park). In late summer and fall upland sites with abundant berries are used in addition to salmon streams. Dens are generally located on moderately sloping mountain sides, leeward of the prevailing winds. Dens are excavated under trees or boulders and are seldom used in consecutive years. Brown bears enter their dens in and emerge each spring.

Food Habits:

Brown bears are omnivores. They eat a wide variety of plants including roots and/or berries of some species. During the spring brown bears often prey upon young moose, deer and caribou as well as scavange beaches for dead marine mammals. They are also capable of killing adult ungulates. Spawning salmon provide an important component of their diets.

Human Interactions:

Brown bears are managed by the Alaska Department of Fish and Game. Limited harvests are allowed in some areas. Habitat alterations and disturbance near concentrated food sources can impact local populations.

Anadromous Cutthroat Trout (Onchorhynchus clarki clarki)

Range: California to Resurrection Bay, Alaska

Migration:

Smolts outmigrate between March and July. Adults return to natal streams during fall and outmigrate in spring.

Reproductive Period:

Wild cutthroat mature in 2-10 years (hatchery fish may spawn in first year). May spawn in several consecutive years.

Spawning/Hatching:

Spawning occurs from late fall to late winter; Hatching occurs 28-40 days later depending on temperature.

Survival/Life Span:

Habitat Use and Requirements:

Adults - Migrate to estuarine and nearshore marine areas in the spring. They spawn at shallow gravel riffles in small tributaries to coastal streams and remain in freshwater to overwinter.

Fry and Juveniles - wild cutthroat remain in freshwater for 1 to 9 years as fry and parr. They become smolts as they migrate to estuaries between March and July. Juveniles usually spend only one summer in estuaries before returning to their natal streams during the adult migration.

Food Web Interrelationships:

Adults - Adults are carnivorous and prey on sticklebacks and young salmon while in freshwater. In the ocean, a variety of small fishes and shrimp are eaten.

Fry and Juveniles - Fry feed primarily on insects and crustaceans. Larger sized juveniles prey on small sticklebacks and salmon.

Predation - Cutthroat alevins and fry are eaten by sculpins, salmon, and some birds. Marine mammals and seabirds prey on the juveniles and adults at sea.

Human Interactions:

Cutthroat trout are not commercially fished in Alaska. They are an important recreational fishing resource providing $$$$ in $19??. This species has been used to indicate environmental stress because it is very sensitive to changes in stream temperatures and turbidity.

Pink Salmon (Oncorhynchus gorbuscha)

Range:

North Pacific Ocean - north of 40°N Latitude (most abundant salmon in North Pacific)

Migration:

Fry outmigrate to shallow marine waters soon after emerging between late March and mid-May. Juveniles migrate to offshore waters where they mature and return as adults about 18 months later.

Reproductive Period:

Mature at 2 years. Adults die after spawning.

Spawning/Hatching:

Spawning occurs from June to late August; Hatching occurs in December - January.

Survival/Life Span:

Egg to fry survival is 10%; Fry to adult is %4; Lifespan is 2 years.

Habitat Use and Requirements:

Adults - Migrate to the high seas where they remain until returning to their natal streams to spawn. Most spawn in the lower reaches of coastal streams, although some spawn far upstream. Redds are built in riffles with gravelly substrates and with water velocity of 35-45 cm/s. All adults die after spawning.

Fry and Juveniles - Fry spend very little time in freshwater, they migrate to estuaries soon after emerging, when they reach approximately 7 cm in length. Juveniles remain in waters over the continental shelf until they near maturity.

Food Web Interrelationships:

Adults - Primary prey include euphausiids, fishes, squid and other invertebrates.

Fry and Juveniles - Fry eat very little while in freshwater. Once in nearshore nursery areas, copepods and zooplankton are primary prey species. Larger juveniles eat more invertebrates and smaller fishes.

Predation - Eggs, alevins, and fry are eaten by cutthroat trout, Dolly Varden, Coho salmon, other fishes and predatory birds. Mammals and large birds eat adult salmon when they return to freshwater to spawn. Other salmon, trout, and lampreys are estuary and marine predators along with seals, sea lions and killer whales.

Human Interactions:

Pink salmon are the most abundant salmon species and are the basis for a multi-million dollar fishery in Alaska. Most pink salmon are caught using purse seines and gill nets in coastal waters as they return to spawn. Hatcheries have been established to help maintain the populations and the fishing industry. **(rewrite this!)**

Pacific Herring (Clupea pallasi)

Range:

North Pacific Ocean, from Baja California to the Beaufort Sea and to Japan

Migration:

Migrates from offshore areas to coastal waters near natal spawning areas in early spring.

Reproductive Period:

First breeds between 2-4 years old. Spawns annually.

Spawning/Hatching:

Spawn in April - May; Hatching occurs 10-21 days after laying.

Survival/Life Span:

Larvae to juvenile survival is 1%; Lifespan is up to 19 years.

Habitat Use and Requirements:

Adults - Little information is available about the offshore distribution of adults. They are found to depths of 150 meters. Adults return to nearshore waters in early spring where they remain until returning to natal spawning grounds during summer. Herring spawn in intertidal and subtidal areas. Spawning substrates include kelp, eelgrass, Fucus, algae and prominent rocks.

Larvae and Juveniles - Larvae are easily dispersed by local currents. Juveniles remain in shallow waters until they migrate to offshore waters in the fall.

Food Web Interrelationshps:

Adults - Primary prey include planktonic crustaceans, euphausiids and fish larvae.

Larvae and Juveniles - Larvae eat a variety of crustacean, mollusc and insect larvae as well as copepods and fish eggs. Juveniles primarily feed on crustaceans, mollusc and fish larvae.

Predation - Herring are an important prey base for a large number of species. The eggs provide food for diving birds, gulls and some fish. Larvae are eaten by fish, jellyfish, amphipods and others. Adults are food for larger fish, sharks, seals, sea birds and whales.

Human Interactions:

Commercial fisheries...

Rockfish (<u>Sebastes</u> <u>spp.</u>)

Yelloweye Rockfish[1] (<u>Sebastes</u> <u>ruberrimus</u>)

Range:

Genus found.....

Yelloweyes are found from Baja to Cook Inlet

Migration:

Migration patterns unknown. Seasonal migrations may not exist. Some species move long distances throughout lifetime. Movement to deeper water is common with size and age.

Reproductive Period:

First breeds between 14 and 19 years old (Y.R.). Breeds annually after reaching maturity.

Spawning/Hatching:

Rockfish are ovoviparous - releasing live planktonic larvae in late June and July (Y.R.).

Survival/Life Span:

Survival - ? Lifespan - can be up to 90 years old (Y.R.).

Habitat Use and Requirements:

Very little life history information is available.

<u>Adults</u> - rockfish are found in areas of rough terrain, with steep cliffs, tall pinnacles and rocky reefs. Depths vary by species, age, and size, with depths up to 365 meters recorded.

---

[1]Yelloweye rockfish are common in the commercial catch of rockfish in the Gulf of Alaska. Information which applies specifically to yelloweye rockfish will be designated by (Y.R), all other information is generalized for the genus <u>Sebastes</u>.

Most Yelloweyes are caught at depths between 75 to 135 meters.

Larvae and Juveniles - vary by species. Some are pelagic, some drift with kelp, others quickly become demersal. Very little is known about this life stage for most species of rockfish.

Food Web Interrelationships:

Yelloweye rockfish are opportunistic predators. They feed on a variety of crabs, shrimp, snails and fish - including smaller rockfish.

Predation - small rockfish and rockfish larvae are eaten by other fishes, including larger rockfish.

Human Interactions:

DOLLY VARDEN (<u>Salvelinus</u> <u>malma</u>) - Anadromous populations

Range:

Migration:

Anadromous Dolly Varden spend summers in nearshore marine environments. From October through November they migrate to freshwater streams and lakes to spawn. Dolly Varden overwinter in freshwater until spring, usually returning to coastal waters during ice-breakup.

Reproductive Period:

Maturation age is variable. Usually between 4 and 7 years. Although post-spawning mortality is high, some individuals may spawn in 2 or 3 consecutive years.

Spawning/Hatching:

Spawning activity peaks in October and November in the Valdez area. Hatching occurs 4 or 5 months later with free swimming fry emerging in April or May.

Survival/Life Span:

Habitat Use and Requirements:

<u>Adults</u> - Outmigration from freshwater to marine environments occur each spring. Adults stay in estuary and nearshore coastal habitats until returning to freshwater streams to spawn. Immature fish, and nonspawning adults return to

freshwater later than spawning adults. Spawning occurs in streams with gravel substrates, slow to moderate water velocities, and temperatures between 0.5 and 13°C. Adults overwinter in deep lakes or river pools, and near groundwater spring areas.

Fry and Juveniles - Younger fry rely on logs, undercut stream banks, and other debris to provide cover from predators. Juveniles prefer quiet pools near swift currents. They overwinter in deep pools and lakes.

Food web Interrelationships:

Adults - smelt, herring, juvenile salmon, sandlance and other small fish and invertebrates are eaten while the Dolly Varden are in marine water. Juvenile salmon, sticklebacks and invertebrates are preyed on in freshwater.

Fry and Juveniles - aquatic invertebrates, larvae, and fish eggs are the primary prey. Fry and juveniles feed primarily near the stream and lake bottoms.

Human Interactions:

Sportfish...

The end

draft text

Restoration Framework Volume 1, Section V. (b)

"Other Resources/Services"

The Exxon-Valdez oil spill affected several resources and services normally provided to the public. These include: archaeological resources, subsistence resources, wilderness values, and recreation services. (This paragraph to be coordinated/consolidated with introduction to part (a))

Archaeological Resources

Archaeological sites and the artifacts contained within them constitute an important part of our national and state heritage. These sites also have international importance in that they constitute a significant link in our knowledge and understanding of Native peoples who have inhabited the arctic and subarctic regions for many thousands of years. These resources help us understand our ancestors' past and enable greater appreciation for our richly varied cultures in Alaska. The oil spill zone contains both ancient and more recent archaeological sites, and could contain Russian artifacts as well.

In our time, researchers from around the United States and the world have been attracted Alaska for opportunities to learn, and sometimes discover firsthand, information about our cultural heritage. Many rural Alaskans benefit from the knowledge yielded by these sites as they work to maintain important cultural traditions.

The Congress recognized the significance of archaeological resources when it passed the Archaeological Resources Protection

Act of 1979. In that act they recognized that:

> [A]rchaeological resources on public lands and on Indian lands are an accessible and irreplaceable[1] part of the Nation's heritage.

Similarly, the Alaskan Legislature passed the Alaska Historic Preservation Act. That law states:

> It is the policy of the state to preserve and protect the historic, prehistoric and archeological resources of Alaska from loss, desecration and destruction so that the scientific, historic and cultural heritage embodied in these resources may pass undiminished to future generations. To this end...historic, prehistoric and archeological resources of the state are properly the subject of concerted and coordinated efforts[2] exercised on behalf of the general welfare of the public...

Recreation Services and Wilderness Values

Alaska has the most significant assembage of park, refuge and forest lands in the United States. At the core, in fact the essence of these lands are Alaska's wilderness areas. Large portions of the park, refuge and forest land under federal management in the spill area have been designated wilderness by the Congress under the Wilderness Act of 1964. Such lands are included within Katmai National Park, Becharof National Wildlife Refuge and Chugach National Forest, all areas contaminated with Exxon-Valdez

[1]Emphasis added

[2]Emphasis added

oil.[3] Under state management, the Kachemak Bay State Wilderness Park lies on the outer coast of the Kenai Peninsula and it too, felt the affects of the oil spill.

These lands provide, in part, the basis for an important component of Alaska's tourist economy, one used by residents and visitors alike. A wide range of activities take place on these lands, some by individuals or small groups seeking a personal experience, and others with the aid of businesses which provide a variety of professional services that enable visitors to use and enjoy wilderness areas. Activities pursued include: hunting, fishing, subsistence, hiking, camping, skiing, sightseeing, power boating, kayaking and photography.

Despite significant and repeated efforts to clean up oil which struck the shorelines, oil persists in areas used by recreationists. These relatively undisturbed areas have been altered by the fact that oil is now present. The oil moves through the ecosystem's food chain as predators eat prey exposed to and sometimes contaminated with oil. The presence of oil irrefutably injured these public lands and diminishe their value. For example, the 1916 Organic Act as amended, makes it clear that national parks are to be carefully protected. Legislative history of that act says:

> The Secretary has an absolute duty, which is not to be compromised, to fulfill the mandate of the 1916 Act to take whatever actions and seek whatever relief as will

---

[3]Wilderness study lands are also contained in Kenai Fjords National Park and the Chugach National Forest.

safeguard the units of the National Park System.

Subsistence

Many people, most notably rural residents of Prince William Sound, the Kenai Peninsula, the lower Cook Inlet and the entire Kodiak archipelago use a wide variety of subsistence resources to provide for essential needs. It is recognized that considerable subsistence harvest occurs on both state and federal lands within the spill area. Several small communities have limited services available and relatively undeveloped economic systems within their daily sphere of activity and travel. Subsistence resources such as fish, birds, and marine and terrestrial mammals provide vital food resources without which people could not live. Many of these same resources provide products that serve important functions in daily life and play a significant role in cultural practices and traditions. Several resources are shared with members of the communities unable to obtain them and/or are traded for other needed items.

Although no single federal or state statute defines the full range of subsistence uses or users, it is clear that both the Alaska Constitution and the Alaska National Interest and Conservation Act (ANILCA) make clear and important statements as to the value and importance of subsistence.

The Alaska Constitution, in Article VIII "Natural Resources" Section 3 states:

> Wherever occurring in the natural state, fish wildlife, and waters are reserved to the people for common use.

In 1980, the Congress, after ten years of debate, approved ANILCA. Title VIII, "Subsistence Management and Use" recognizes two important concepts: the need for continued opportunity for subsistence, and the uniqueness of the Alaska situation. ANILCA Section 801 (1) states:

> [T]he continuation of the opportunity for subsistence uses by rural residents of Alaska, including both Natives and non-Natives on public lands and by Alaska Natives and non-Natives on Native lands is essential to the physical, economic, traditional and cultural existence and to non-Natives physical, economic, traditional, and social existence.

ANILCA Section 801 (2) states:

> [T]he situation in Alaska is unique in that, in most cases, no practical alternative means are available to replace the food supplies and other items gathered from fish and wildlife which supply rural residents dependent on subsistence uses.

Final paragraph to be coordinated with conclusion from part (a).

References:

1. Archaeological Resources Protection Act of 1979, 16 USC 470 aa note
2. Alaska Historic Preservation Act, Alaska Statute 41.35.010
3. 1916 Organic Act, 16 USC 1, 39 Stat. 535
4. 1916 Organic Act legislative history, ARA Leisure Services v U.S., 831 F.2d 193 (9th Cir. 1987)
5. Wilderness Act, (to be filled in)

6. Kachemak Bay State Park Wilderness Act, Alaska Statute 41.21.140

7. Alaska Constitution, Article VIII "Natural Resources"

8. Alaska National Interest and Conservation Act (ANILCA), 16 USC 3101 note

d:\sandy\evos\framwork.drf

[Senner, 01/29/92, TEXT.VI]

Section VI: Options Criteria

A. Settlement Guidance

Restoration funds are to be spent to "restore, replace, enhance, rehabilitate or acquire the equivalent" of injured natural resources, natural resources services, and archaeological sites and artifacts. The goal of restoration is "recovery"--to return a resource or service to its pre-spill condition (see discussion of recovery in Section IV). For any injury, there are several types of restoration which may be used singularly or in combination:

- "direct restoration" refers to measures in addition to clean up (i.e., response) actions, usually carried out on site, to directly restore or rehabilitate an injured resource or otherwise promote the recovery of such resources;
- "replacement" refers to substituting one resource for an injured resource of the same type;
- "acquisition of equivalent resources" means to compensate for an injured resource by substituting another resource that provides the same or substantially similar services as the injured resource.

Enhancement measures can be employed to ultimately return an injured resource or service to a level of recovery that is beyond the pre-spill level.

Habitat protection measures can maintain and enhance prospects for the recovery of an injured resource or can be ways to acquire equivalent resources and services. The definition of direct restoration includes any administrative or management actions that may be taken by Federal or State agencies, such as limiting certain activities in the affected areas, to foster recovery of injured resources or services.

B. Proposed Criteria

Throughout the Natural Resources Damage Assessment the restoration planning group has gathered ideas about ways to restore injured natural resources. These suggestions have come from the Trustee agencies and their management and scientific staff members, from outside scientists, and from the public, including through a series of scoping meetings held in April and May 1990 in oil-spill communities. As a result of these efforts, hundreds of ideas have been compiled and were presented initially in "Restoration Planning Following the Exxon Valdez Oil Spill: August 1990 Progress Report."

To aid the Trustees and the public in determining which of the many restoration approaches and options are appropriate under the terms of the settlement and most beneficial, it is necessary to have objective criteria against which potential projects can be screened. The following criteria have generally guided the Trustee's decisions to date and are proposed here for public comment:

A. The effects of any other actual or planned response or restoration actions;

Are there other actions, such as additional clean up work, that bear on the recovery of a resource targeted by a given restoration option?

B. Potential to improve the rate or degree of recovery;

Will implementation of a restoration option make a difference in the recovery of an injured resource or service? What is the prospect for success?

C. Technical feasibility;

Are the technology and management skills available to successfully the proposed restoration option in a northern environment?

D. Potential effects of the action on human health and safety;

Are there hazards to or adverse impacts on humans associated with implementation of the restoration option?

E. The relationship of the expected costs of the proposed actions to the expected benefits;

Do benefits equal or exceed costs? This is not intended to be a straight cost/benefit analysis, but a broad consideration of the direct and indirect costs and the primary and secondary benefits associated with implementation of the restoration option.

F. Cost effectivness;

Does this restoration option achieve the desired objective at the least cost?

G. Consistency with applicable federal and state laws and policies;

Is the restoration option appropriate given the directives and policies with which the Trustee agencies must comply? Potential conflicts must be evaluated and resolved prior decisions to implement.

H. Potential for additional injury resulting from proposed actions, including long-term and indirect impacts.

Will implementation of the restoration option result in additional injury to target resources or services or injury to other resources and services? Is the project of net environmental benefit?

I. Degree to which the proposed action enhances the resource or service;

Would the restoration option enhance--i.e., improve on or create additional--target resources and services?

J. Degree to which proposed action benefits more than one resource or service;

Would the restoration option benefit multiple resources and services, both injured target as well as secondary resources and services?

K. Importance of starting the project within the next year.

Would delay in the project result in further injury to a resource or service or would we forego a restoration opportunity?

In some cases restoration approaches or options are easily screened with existing information. In other cases it may be necessary to gather additional information, such as biological, ecological, or resource assessment data, to support the evaluation process. In all cases, however, the Trustees intend to proceed quickly, yet judiciously, with the restoration program, employing a common-sense approach decision making.

Text VII

Introduction

Approaches, as used in this context, are broad categories that contain [*include*] potential restoration actions or options that can be logically grouped in the same class. The goal of these approaches is to facilitate recovery of injured species and/or damaged resources. Figure x is a decision diagram that depicts the relationships between the different approaches. *Options* are distinctive restoration procedures specifically tailored to the target species and/or habitat. Options could be implemented if they fit [*conform to*] the criteria described in Section VI and are approved by the Trustees.

Five approaches have been identified by the Restoration Team. They are:

Management of Human Uses

Application of federal and/or state statutes to modify human use of resources or habitats. Increased or re-directed enforcement of existing fisheries, wildlife and land use regulations or policies.

Examples: a) Temporary decrease in bag limit for harlequin ducks,

b) More intensive management of injured fish and shellfish populations in the EVOS affected area.

Direct Restoration (Species and Habitats)

Measures taken, usually on-site, to directly rehabilitate or replace an injured species population, restore a damaged habitat or enhance services provided by a damaged resource.

Examples: a) Improve or supplement stream and lake habitats for spawning and rearing of wild salmonids.

b) Improve or create nesting habitat for colonial nesting seabirds.

Habitat Protection

Creation of "protected areas" in order to prevent further damage to resources injured by the Exxon Valdez oil spill. Management of protected designations would attempt to facilitate recovery with a minimum of interference with pre-existing uses.

Examples: a) Designate protected marine habitats.

b) Establish EVOS "special management area" on state lands.

Habitat Acquisition

Acquisition of damaged habitats, or ownership rights short of title, in order to protect wildlife, fisheries habitat or recreation sites. Acquisition of equivalent resources that are the same or substantially similar to the injured resources in terms of ecological values, functions or uses.

Examples: a) Acquire private inholdings within Kenai Fiords National Park.

b) Acquire extended buffer strips on anadromous fish streams.

c) Acquire timber rights on private lands known to support nesting populations of marbled murrelets.

Other Resources/Services

Options that do not fall within the above-defined approaches.

Examples: a) Develop a comprehensive program to monitor recovery of injured species and resources.

b) Endow a fund to support scientific research in the affected area.

c) Develop an education program on the affected area and the effects of the EVOS.

Evaluation

All options that successfully meet the criteria described in Section VI and are recommended for further evaluation by the Trustees will be subject to a more detailed technical assessment. This process is characterized in Section VIII B. Public review of these options is another element of the evaluation process; it is discussed in Section VII C. Options that come through all of the described types of evaluation will become part of the Restoration Plan. The content and purpose of the Plan is outlined in Section VIII E.

OPTION: Cultural Resource Protection

APPROACH CATEGORY: Management of Human Uses

AFFECTED RESOURCES/SERVICES: Cultural Resources

PURPOSE/JUSTIFICATION:

To reduce the incidence of looting and vandalism to archeological sites located within the affected area. Increases in looting and vandalism have occurred as a result of the EVOS.

ACTION:

- Create an archeological site stewardship program. This option centers on the recruitment, training, coordination, and maintenance of a corps of local citizens to watch over threatened archeological sites located within their "home" districts.
- Conduct public contact patrols and archeological site monitoring within the affected area. Resource agency personnel will carry out both the public information program and conduct the site monitoring.

INFORMATION NEEDED TO IMPLEMENT OPTION:

- Exact locations of of archeological sites.
- Current condition of archeological sites.
- Identification of volunteer participants to conduct basic field observations on the status of archeological sites.

IMPLEMENTATION TIMEFRAME: Three to five years.

OPTION: Create Intertidal Spawning Habitat for Herring

APPROACH CATEGORY: Direct Restoration

AFFECTED RESOURCES/SERVICES: Herring

PURPOSE/JUSTIFICATION:

Injuries to herring include a wide range of both lethal and sublethal effects to eggs and larvae. Intertidal spawning substrates, especially *Fucus*, was impacted by EVOS oil and cleanup activities. The purpose of this option is to increase the amount of spawning substrate in areas known to be utilized by spawning herring and to attempt to save eggs that have been dislodged by storms.

ACTION:

- Transplant spawning substrate into areas likely to to used by spawning herring.
- Anchor artificial spawning substrate into areas likely to to used by spawning herring.
- Transplant loose egg windrows that were displaced by storms into areas of the intertidal where they are likely to survive.

INFORMATION NEEDED TO IMPLEMENT OPTION:

- Maps depicting areas of preferential spawning habitat.
- Data describing artificial spawning substrates and its suitability for this species and habitat.

IMPLEMENTATION TIMEFRAME: One to three years.

OPTION: Creation/Acquisition of New Recreation Sites/Facilities

APPROACH CATEGORY: Habitat Acquisition

AFFECTED RESOURCES/SERVICES: Recreation Services

PURPOSE/JUSTIFICATION:

To enhance recreation support services in the affected area. To place into public ownership, sites that would increase opportunities for recreation users. Improve existing facilities on public lands.

ACTION:

- Identify sites, that are currently privately owned, for acquisition by the state or federal government, e.g. private inholdings in Kenai Fiords National Park, private lands identified in the Prince William Sound Area Plan.
- Evaluate proposed acquisitions for their use as recreation sites or for improving access to existing recreation areas.

- Evaluate existing publicly-owned lands, within the affected area, for improvements that would enhance recreation use, e.g. boat ramps in State Parks, wildlife viewing platforms in wetlands, etc.
- Solicit and review public input regarding the public's desires for enhanced recreation.
- Solicit and review input from ADNR Parks and Recreation, US Forest Service and the National Park Service regarding opportunities for recreation enhancement.

INFORMATION NEEDED TO IMPLEMENT OPTION:

- High resolution, multi-thematic maps of private lands in the affected area.
- Recreation needs assessments of the affected area and user groups.
- Land surveys and appraisals.

IMPLEMENTATION TIMEFRAME: Three to five years.

OPTION: Restore Oiled Mussel Beds

APPROACH CATEGORY: Direct Restoration

AFFECTED RESOURCES/SERVICES:

Intertidal zone, blue mussels (*Mytilus edulis*), harlequin duck, sea otter, black oystercatcher, river otter, subsistence.

PURPOSE/JUSTIFICATION:

- To determine the geographic extent and chemical characteristics of persistent EVOS oil in mussel beds.
- To determine the pathway of petroleum hydrocarbon contamination from mussels and sediments through higher trophic levels, i.e. birds and mammals.
- Determine and implement, if necessary, the most effective and least destructive method of cleaning oiled mussel beds.

ACTION:

- Conduct field surveys of and collect samples from oiled mussel beds.
- Conduct chemical analyses [GC/MS] of sediments and mussel tissue.
- Design and carry out studies to determine the linkage between persistent oil in mussels beds and wildlife potentially at risk, i.e. harlequin duck, black oystercatcher, sea otter and river otter.
- Design and carry out field studies to determine the most effective and least destructive method of cleaning oiled mussel beds.

INFORMATION NEEDED TO IMPLEMENT OPTION:

- Beach segment data from response surveys.
- Literature review of effects of oil on species potentially at risk.
- Review of treatment technology alternatives.

IMPLEMENTATION TIMEFRAME: Two to three years.

OPTION: Preservation of Archeological Resources

APPROACH CATEGORY: Direct Restoration

AFFECTED RESOURCES/SERVICES: Remote Archeological Sites

PURPOSE/JUSTIFICATION:

To restore injured arecheological sites through excavation and analysis. Several remote sites were injured by direct oiling and spill cleanup activities. They are too remote to effectively protect by periodic monitoring. These sites contain information about the economy and social structure of a culture which has almost totally disappeared. Irreplaceable information can be retrieved only through archeological excavation of the sites, each of which is unique.

ACTION:

Restoration of the damaged sites consists of excavation and collection of information. In addition, petroleum hydrocarbons from the EVOS are spreading through cultural deposits along with the normal movement of ground water. As these petroleum hydrocarbons degrade, they will contaminate these sites and render ineffective sample cleaning prior to treatment. Consequently, data needs to be collected and any contaminants in the sites removed before contamination becomes widespread.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Data from on-going and proposed NRDA studies conducted by ADNR, Ebert and Associates and SUNY Binghamton.

IMPLEMENTATION TIMEFRAME: Two years.

OPTION: Designate Protected Marine Habitats

APPROACH CATEGORY: Habitat Protection

AFFECTED RESOURCES/SERVICES:

Marine mammals, seabirds, finfish, invertebrates, algae and seagrasses.

PURPOSE/JUSTIFICATION:

Several injured species utilize the nearshore and intertidal marine environment for feeding and reproduction. Recovery of these species populations may require long-term protection measures for their marine habitat as well as extraordinary management of the injured species themselves. Designation of protected marine areas can be an effective means of preventing additional adverse impacts to injured wildlife, fisheries and the habitat upon which they depend.

ACTION:

- Determine dependency relationships between injured species and the nearshore marine environment of the affected area.
- Determine compatibility of existing uses of the nearshore marine environment and the recovery needs of the injured species.
- Evaluate adequacy of existing management of marine areas that are habitat for injured species.
- Identify geographic areas that require protection designation in order to expedite recovery of injured species.
- Develop a process for designating special marine protection areas.
- Develop a management scheme for each selected marine protection area.

INFORMATION NEEDED TO IMPLEMENT OPTION:

- Habitat requirements and natural history information on injured species.
- Existing management and use information for proposed protected areas.
- Injury and recovery projections from NRDA studies and literature.

IMPLEMENTATION TIMEFRAME: Two to three years.

OPTION: Expand Management in State Parks

APPROACH CATEGORY: Management of Human Uses

AFFECTED RESOURCES/SERVICES:

Intertidal and nearshore areas within State Park jurisdictions. Wildlife and fisheries resources located within State Park jurisdictions. Recreation sites within State Parks.

PURPOSE/JUSTIFICATION:

To augment State Park staff in order to provide special attention to management of injured resources as well as public education. Many of the injured wildlife species, e.g. sea otter, harbor seal, sea birds, uitilize State Parks as habitat. Intertidal communities, within State Parks, e.g. Kachemak Bay Wilderness Park, were severely impacted by the EVOS.

ACTION:

Hire and train several new park rangers to provide enhanced management of affected resources and to monitor their recovery on state lands. Provide interpretative services to inform park users about the EVOS and its impact upon the affected area and its resources. Assess the recovery of affected recreation sites and make recommendations for additional cleanup, if deemed necessary.

INFORMATION NEEDED TO IMPLEMENT OPTION:
Habitat maps of injured species. Impact maps depicting the onshore and nearshore distribution of EVOS oil. Fate and persistence data from NRDA and restoration science studies. Natural history information for injured species.

IMPLEMENTATION TIMEFRAME: Three to five years.

OPTION: Reduce or Redirect Sport Fishing Harvests

APPROACH CATEGORY: Management of human uses

AFFECTED RESOURCES/SERVICES: Dolly Varden and cutthroat trout

PURPOSE/JUSTIFICATION: The ultimate purpose is the development of a plan to manage Dolly Varden and cutthroat trout by modification of human use (replacement of lost recreational fishing opportunities in non-oiled areas), while aiding in the recovery of these species from oiled areas, as well as protecting the integrity of wild populations. Dolly

Varden and cutthroat trout incurred both direct lethal and sublethal injuries from the oil spill.

ACTION:

1) Close recreational fishing for injured Dolly Varden and cutthroat trout populations, or

2) Redirect recreational fishing to non-oiled coastal areas and drainages,

3) Alternatively, reduce bag limits in impacted coastal areas and drainages for either or both species.

INFORMATION NEEDED TO IMPLEMENT OPTION:

1) Monitor recovery of injured Dolly Varden and cutthroat trout populations in oiled areas.

2) Inventory known locations of cutthroat and Dolly Varden trout in non-oiled areas and establish watershed characteristics, population size, geographic distribution, migration, spawning stock identification, and other species present.

3) Determine land status and access to candidate locations, and present fishing effort and harvest.

IMPLEMENTATION TIMEFRAME: A Draft Dolly Varden and Cutthroat Trout Management plan will be available for public comment in 1996.

OPTION: Restrict/eliminate legal harvest (including trapping) of marine/terrestrial mammals

APPROACH CATEGORY: Management of human uses

AFFECTED RESOURCES/SERVICES: sea otter, harbor seal, brown bear, and river otter

PURPOSE/JUSTIFICATION: The purpose of this proposed action is to enhance the recovery potential for species injured by the EXXON Valdez oil spill by regulating human use. Continued legal hunting and trapping of injured species could retard the rate at which these species recover. All the above species demonstrated significant exposure to oil; sea otters and harbor seals were particularly vulnerable. Between 3500 and 5500 sea otters and 200 harbor seals were estimated to have been killed by the spill.

ACTION:

1) Through the Alaska Department of Fish and Game, restrict or, if necessary, close hunting/trapping for brown bear and river otter in oiled areas.

2) With the help of the U.S. Fish and Wildlife Service and the National Marine Fisheries Service, and as mandated by the Marine Mammal Protection Act of 1972, encourage the voluntary elimination or reduction in subsistence harvest of sea otter and harbor seal.

INFORMATION NEEDED: Obtain from cognizant management agencies, relevant data on harvest marine and terrestrial mammals.

Monitor population trends for all target species in oiled areas. Determine factors limiting population growth and estimate rates of recovery by restricting/eliminating legal harvests. In the special case of subsistence hunting for marine mammals (sea otter, harbor seal), determine responsible native villages/corporations and respective annual harvest levels. The value of lost hunting opportunities, trapping and subsistence use would also need to be calculated.

IMPLEMENTATION TIMEFRAME: For brown bear and river otter, final recommendations could be formulated in 1992 for implementation in 1993. For sea otter and harbor seal, an educational program

aimed at achieving a voluntary reduction or temporary elimination of subsistence harvest could be implemented in 1992.

OPTION: **Change management emphases and harvest practices for commercially important fish and shellfish**

APPROACH CATEGORY: **Management of human uses**

AFFECTED RESOURCES/SERVICES: **pink, chum and sockeye salmon, Pacific herring, rockfish, spot shrimp**

PURPOSE/JUSTIFICATION: **It is the purpose of this proposed option to enhance the recovery potential of species injured by the EXXON Valdez oil spill by regulating human use, in this case by regulating harvests. All the above species sustained both direct lethal and sublethal injury as a result of the spill.**

ACTION:

1) Reduce or temporarily eliminate harvests.

2) Redirect harvests for some target species (pink salmon) to better differentiate between wild (injured) and hatchery (uninjured) stocks and allow for greater escapement of wild stocks.

3) Increase harvests to prevent overescapement of sockeye salmon.

INFORMATION NEEDED TO IMPLEMENT OPTION:

1) For the mixed-stock pink salmon fishery, adjustments to harvest will be based on measurements of abundance and timing of returning adults. Coded-wire tagging returns and otolith marking results will help fulfill this need.

2) For rockfish and herring, adjustments to harvest could be made based on the success of studies to genetically differentiate among discrete stocks. These data can be used to predict how rapidly damaged or overfished stocks can be restored from adult migration or larval drift from outside the spill zone.

3) For spot shrimp, basic information on adult and larval abundance and distribution and habitat requirements will be needed before recommendations can be made to adjust harvests.

IMPLEMENTATION TIMEFRAME: With the exception of sockeye salmon, final recommendations to adjust harvests cannot be formulated for another three to five years. In the case of sockeye salmon, harvest adjustments on the Kenai River will begin as early as 1993.

OPTION: Test subsistence foods for residual hydrocarbon contamination and regulate harvest

APPROACH CATEGORY: Management of human uses

INJURED RESOURCES/SERVICES: Fish and shellfish (mussels, clams)

PURPOSE/JUSTIFICATION: It is the purpose of this proposed option to monitor subsistence foods for residual hydrocarbon contamination and to regulate subsistence harvest in the event that subsistence foods are found unfit for human consumption. Intertidal shellfish, particularly mussels and clams, accumulated significant burdens of petroleum hydrocarbons as a result of the oil spill. Once accumulated, petroleum hydrocarbons are not rapidly metabolized or depurated by these species. Some fish species also demonstrated significant exposures to oil immediately following the spill.

ACTION:

1) Monitor residual petroleum hydrocarbons in the edible flesh of subsistence food.

2) Restrict or temporarily eliminate harvest of fish and shellfish if edible tissues contain petroleum residues

exceeding State of Alaska or Environmental Protection Agency standards.

INFORMATION NEEDED TO IMPLEMENT OPTION:

1) Locate areas (beaches) where most subsistence fishing and shellfish gathering occurs in the spill zone.

2) Determine human harvest levels.

3) Monitor concentrations of polynuclear aromatic hydrocarbons (PAH) in edible tissues of fish, mussels and clams from these locations.

4) Compare to both State of Alaska and Environmental Protection Agency standards for PAHs.

IMPLEMENTATION TIMEFRAME:

Implement monitoring beginning in 1992.

OPTION: Develop integrated and comprehensive post-EVOS monitoring program

APPROACH CATEGORY: Monitoring

AFFECTED RESOURCES/SERVICES: coastal (intertidal and subtidal habitats), fish and shellfish, marine birds (includes sea ducks), marine and terrestrial mammals

PURPOSE/JUSTIFICATION: Natural recovery monitoring is essential where the "no action/natural recovery" restoration alternative of the Natural Resource Damage Assessment Rules apply. Monitoring is also needed to evaluate the effectiveness of restoration, identify where additional restoration may be appropriate, and determine when injury has been delayed.

ACTION: Design and implement a recovery monitoring program for resources and associated services injured by the oil spill.

INFORMATION NEEDED TO IMPLEMENT OPTION:

1) Which resources should be monitored,

2) Which indicators of species-, populations-, communities- or ecosystem-recovery are the most practical and cost-effective to measure,

3) Which survey designs and sampling strategies should be applied,

4) How should different monitoring components be integrated,

5) What institutional structure is needed to implement and manage monitoring, and

6) What are the costs and potential funding sources for the monitoring program?

IMPLEMENTATION TIMEFRAME: Some monitoring is on-going, but implement more integrated and comprehensive effort in 1993.

OPTION: Endow science fund to support long-term ecological research

APPROACH CATEGORY: Education and public information

AFFECTED RESOURCES/SERVICES: Prince William Sound ecosystem

PURPOSE/JUSTIFICATION: Ensuring that Prince William Sound will fully recover from the EXXON Valdez oil spill is a complex, long-term task that will involve many interests, significant funding and much uncertainty. In making a long-term commitment to the Sound's future, it is important to recognize that both basic and applied research is essential to making informed management decisions. What is required to accomplish this task is a process/institution to coordinate,

fund, interpret, and publish research results pertaining to the long-term (20 years or more) ecological health of Prince William Sound.

ACTION: Develop a process/institution to produce a comprehensive list of research priorities for Prince William Sound. This process/institution should provide a mechanism to coordinate research priorities that cuts across the issue- or mission-specific perspective of any one interest group or agency and focus on the entirety of the Sound. This approach will help ensure that the resources devoted to research are focused on the most important problems for the protection of the Sound. Through a research grants program, this process/institution will fill gaps in ongoing agency research and will serve as a regional sponsor for innovative research that has potential for long-term benefits to Prince William Sound. Finally, there is need to translate and disseminate the results of the research in a way to resolve present and future problems in Sound.

INFORMATION NEEDED TO IMPLEMENT OPTION:

1) What process/institutional structure is needed to implement and manage these functions,

2) Who participates in the process for setting research priorities,

3) Should this group have a fixed number of members, and how many, and how should this group operate; by majority rule or by consensus,

4) How should the endowment and grants program be managed, and

5) What kinds of information or information services should be provided ?

OPTION: Restoration of high intertidal Fucus zone

APPROACH CATEGORY: Manipulation of Resources, including species and habitats

AFFECTED RESOURCES/SERVICES: Intertidal brown alga, Fucus gardneri, and associated invertebrates and other species of algae

PURPOSE/JUSTIFICATION: The purpose of this option is to accelerate recovery of intertidal communities impacted by the EXXON Valdez oil spill and clean-up. Particularly vulnerable was the upper one meter of the Fucus zone which normally harbors a number of associated invertebrates and other species of algae. Fucus and associated biota are commonly utilized as food by both terrestrial and aquatic mammals as well as shorebirds.

ACTION: Conduct demonstration program at selected coastal sites to accelerate recovery of Fucus in upper intertidal zone by applying one or more of the following techniques:

1) a trickle irrigation system,

2) a biodegradable substratum modifier, and

3) a cobble assemblage transplant.

INFORMATION NEEDED TO IMPLEMENT OPTION:

1) Develop cost/benefit analysis for each of the three proposed restoration techniques,

2) Determine factors limiting recruitment of Fucus in the high rocky intertidal zone,

3) Monitor rate at which petroleum residuals are weathered and depurated from the high rocky intertidal zone.

4) Monitor rate of recovery of Fucus at sites categorized as intensely cleaned, less intensely cleaned, and oiled set-aside.

IMPLEMENTATION YEAR: Final recommendations will be made at the close of the 1992 field season; implementation of restoration
will begin in 1993.

OPTION: Establish Alternative (Early) Pink Salmon Runs to Protect Wild (Late) Pink Salmon Runs

APPROACH CATEGORY: Manipulation of Resources, including Species and Habitats

AFFECTED RESOURCES/SERVICES: Wild Pink Salmon Stocks

PURPOSE/JUSTIFICATION: Hatchery pink salmon production is comprised largely of late-run stocks that return at the same time as most damaged wild stocks of pink salmon in PWS. Harvest of hatchery stocks in mixed hatchery-wild stock fisheries causes increased fishing pressure on damaged wild stocks. Eggs and larvae of wild pink salmon stocks sustained both lethal and sublethal injuries as a result of the EXXON Valdez oil spill.

OPTION: Develop alternative (early) runs of hatchery reared pink salmon that will reduce fishing pressure on damaged wild (late) runs of pink salmon and accelerate recovery.

INFORMATION NEEDED TO IMPLEMENT OPTION:

1) Locate early-run upstream spawning populations of pink salmon in PWS.

2) Describe the biological (including genetic) characteristics of stocks that appear to be suitable for broodstock development.

3) Select suitable stock for development as broodstock for both odd and even year return.

IMPLEMENTATION TIMEFRAME: 7-10 years.

OPTION: Improve or Supplement Stream and Lake Habitats for Spawning and Rearing of Wild Salmonids

APPROACH CATEGORY: Manipulation of Resources, including Species and Habitats

AFFECTED RESOURCES/SERVICES: Wild Pink, Chum Salmon, Sockeye Salmon

PURPOSE/JUSTIFICATION: This option focuses on application of fish enhancement techniques to accelerate recovery of wild pink, chum and sockeye salmon stocks injured during the EXXON

Valdez oil spill. Both pink and chum salmon sustained injury as eggs and larvae by direct exposure to oil. The principle injury to sockeye populations was caused by overescapement due to closure of the fishery following the oil spill.

OPTION:

1) Enhance productivity of wild pink and chum salmon stocks by construction of spawning channels and/or by facilitating fish passage to spawning areas undamaged by the oil spill or previously unavailable to returning adults.

2) Alternatively, enhance productivity by fry rearing either in-stream or in a hatchery for subsequent release to streams where wild pink and chum salmon stocks were injured.

3) For sockeye salmon, fertilize lakes and streams to enhance productivity of food organisms utilized by larval and juvenile life stages.

4) Monitor efficacy of each restoration technique.

INFORMATION NEEDED TO IMPLEMENT OPTION:

1) Review existing literature and databases, assess status (rate of recovery) of injured stocks, determine potential for

enhancement and preliminary restoration techniques for specific candidate stocks, and identify sites where field studies will be needed.

2) Conduct field studies at candidate sites to collect additional data needed to select most appropriate restoration technique(s) for each injured salmonid stock.

3) Develop project design specifications and project cost estimates for selected restoration technique(s).

IMPLEMENTATION TIMEFRAME: Five to ten years.

OPTION: Develop Management Plans for Fish and Shellfish that Previously Did Not Require Intensive Management

APPROACH CATEGORY: Management of Human Uses

AFFECTED RESOURCES/SERVICES: Rockfish, Spot Shrimp

PURPOSE/JUSTIFICATION: The purpose is to protect and rebuild injured rockfish and spot shrimp stocks while providing for future sustained utilization. Both rockfish and spot shrimp suffered both direct lethal and/or sublethal injuries from the oil spill. In addition, the directed harvest and by-catch of rockfishes increased significantly in 1990 and 1991 as fishing effort was redirected from salmon and herring to groundfish. A fisheries management plan was not in place for either species prior to the spill as intensive management was not immediately required or contemplated.

ACTION: Develop a fishery management plan for each species inclusive of provision to modify human use activities (reduce or redirect commercial and sport harvests).

INFORMATION NEEDED TO IMPLEMENT OPTION:

1) Sample commercial and sport catches to describe age and size composition, natural mortality rates, general seasonal movements, relative stock abundance and relative recruitment of each species (there may have been 20 species of rockfish impacted by the spill).

2) Conduct genetic studies to describe each species and define stock boundaries within the oil spill area. Establish gene flow both within and outside the oil spill area to predict how rapidly injured populations might be restored from adult migration or larval drift from outside the oil spill area (natural recovery).

3) Describe current and past patterns of human use for rockfish and spot shrimp resources in PWS, by date, area, and fishery.

IMPLEMENTATION TIMEFRAME: Five years.

OPTION: Improve Stock Identification and Assessment in Support of More Intensive Management of Fisheries

APPROACH CATEGORY: Management of Human Uses

AFFECTED RESOURCES/SERVICES: Pink Salmon, chum salmon, Dolly Varden and Cutthroat Trout, Herring, Rockfish, and Spot Shrimp

PURPOSE/JUSTIFICATION: The purpose is to restore and protect important commercial and recreational species of fin and shellfish injured by the EXXON Valdez oil spill. In order to restore or redirect restoration efforts (make more informed decisions regarding more intensive management), more accurate stock assessments (understanding numerical changes in populations through time) will be required. This can be achieved by a better understanding of stock identification, recruiting processes, and improved population modeling capabilities. All the above species suffered direct lethal or sublethal injuries from exposure to oil.

ACTION:

1) Apply existing (on-the -shelf), or develop anew (state-of-the-art), genetic stock identification techniques to determine the discreetness, distribution and abundance of important commercial and recreational fin and shellfish stocks in PWS.

2) Evaluate, refine, select, or develop anew, numerical models to follow/predict population dynamics of injured stocks.

INFORMATION NEEDED TO IMPLEMENT OPTION:

1) Results of mark and recapture efforts employing coded-wire tags, marked otoliths, or other markers (allozyme protein electrophoresis and mitochondrial and nuclear DNA) are required to differentiate genetically discrete stocks in time and space.

2) Field sampling will need to be conducted to fulfill requirements of population models. Important model parameters include egg and larval survival, growth, recruitment, mortality (senescence, predation, catch), etc.

IMPLEMENTATION TIMEFRAME: Five to Ten years.

OPTION: Establish permanent monitoring sites in the EVOS area

INJURED RESOURCES/SERVICES: Potentially all injured resources

PURPOSE/JUSTIFICATION: Millions of dollars have been spent in documenting near-term damages of EVOS, but the public, the scientific community, and resource managers also want and need to understand the long-term effects of EVOS. To that end, a long-term monitoring plan is being developed for consideration by the Trustees (see Restoration Option No. __). Implementation of a monitoring plan requires the selection of monitoring sites in representative habitats throughout the EVOS area. Some sites will be ones at which damage assessment studies were conducted; others may need to be newly selected. Consideration should be given to establishing a small number of discrete sites on a permanent basis. At least two designations exist for such purposes: the U.S. Forest Service's "Research Natural Area" and NOAA's "Estuarine Research Reserve." Other designations also may be relevant, including the National Science Foundation's "Long-term Ecological Research" sites.

ACTION: To recommend designation of permanent sites for long-term monitoring of marine, intertidal, and upland injured resources in the EVOS area.

INFORMATION NEEDED TO IMPLEMENT OPTION: Development of this option must be integrated with development of a comprehensive monitoring plan. Information is needed on the types and distribution of sites required for a monitoring program and the status of the sites (e.g., ownership and management direction). For those sites where permanent protection is desirable and possible, designation options must be evaluated.

IMPLEMENTATION TIMEFRAME: Evaluation could be initiated in 1992; recommendations could be available in 1993.

DRAFT--RESTORATION FRAMEWORK
MACMULLIN
1/30/91

text VIIIA

VIII. Post Settlement Administration

A. The Restoration Fund

The Federal and State settlement of the civil suit against Exxon will result in a total payment of $900 million for restoration over ten years. (The specific terms of the settlement agreement are described more fully in Section 1B.) Exxon will pay the governments a scheduled sun for restoration each year as shown in the box below.

1.	December 1991	$ 90	million
2.	December 1992	150	" "
3.	September 1993	100	" "
4.	September 1994	70	" "
5.	September 1995	70	" "
6.	September 1996	70	" "
7.	September 1997	70	" "
8.	September 1998	70	" "
9.	September 1990	70	" "
10.	September 1991	70	" "

These monies will be deposited in the Federal Court Registry Investment System (CRIS) in Houston and drawn into the Joint Use Account in Alaska as funds are needed for restoration. The money deposited in the CRIS will be invested and accrue interest for the restoration fund. Each year, as the restoration budget is approved by the Trustee Council, money needed to fund the restoration work will be transferred into the accounts of each Trustee agency.

The Office of Management and Budget (OMB) which is part of the Federal Executive office, has directed the Federal Trustees to submit a unified plan and budget for restoration each fiscal year. The Federal fiscal year runs from October 1 - September 30. The final budget submission to OMB is due no later than nine months before the fiscal year begins.

The settlement with Exxon also has a provision which is called a reopener clause. This provision allows the government to claim another $100 million between September 1, 2002 and September 1, 2006 if there is evidence of injury that was neither known or anticipated at the time of the settlement. Any restoration projects funded by this money must have costs that are not "grossly disproportionate to the magnitude of the benefits anticipated."

B. Organization

The post-settlement organization is largely guided by the Memorandum of Agreement and Consent Decree (MOA) which was filed in the United Stated District Court of Alaska on August 24, 1991. A copy of this document is reproduced in Appendix __. The MOA resolved legal claims between the State of Alaska and the United States governments and, in order to maximize the funds available for restoration, set forth terms for fulfilling their obligations to assess injuries and to restore, replace, rehabilitate, enhance, or acquire the equivalent of the natural resources inured, lost, or destroyed as a result of the oil spill. A part of these terms is devoted to the organization to carry out these obligations.

The Trustees are responsible for making all decisions regarding funding, injury assessment and restoration. These decisions must be made by unanimous agreement by the Trustees. There are six Trustees. The State of Alaska Trustees are the Commissioners of the Departments of Environmental Conservation and Fish and Game and the Alaska Attorney General. The Federal Trustees are the Secretaries of Interior and Agriculture and the Administrator of the National Oceanic and Atmospheric Administration (NOAA). The Federal Trustees do not participate directly in most restoration decisions, but have designated representatives to the Alaska-based Trustee Council. These representatives are the Alaska Regional Forester for USDA, the Special Assistant to the Secretary of Interior, and the Regional Director for the National Marine Fisheries Service for NOAA. However, some of the Federal Trustees have reserved some decisions to themselves directly, such as approval of the participants to the Public Advisory Group. The State Trustees, unlike their Federal counterparts, serve on the Trustee Council.

The Trustee Council appointed a Resource Restoration Coordinating Group (RRCG) to take on the management and administrative functions for restoration. Each Trustee has designated one representative from his organization except for the Attorney General of Alaska who appointed the Commissioner of the Department of natural Resources to the RRCG. The Trustee Council intends to form subgroups from agency staff to work in various areas such as budgeting and finance, public participation, and habitat protection. The organization chart which was approved by the Trustee Council on December __, 1991 (OR FEB. 5 IF APPROVED) is shown below.

Under the terms of the MOA, the Trustees are to accomplish the following within 90 days of receipt of any recovery monies:

- agree on an organizational structure for decision making;

[INSERT ORGANIZATION CHART OR NEWER ONE IF TC APPROVES ONE FEBRUARY 5, 1992.]

- establish procedures for meaningful public participation injury assessment and the restoration process; and

- establish a public advisory group to advise the Trustees.

The first payment of recovery money was received on December 13, 1991 and the 90 day period ends on March 12, 1992.

FIRST DRAFT

VIII. IMPLEMENTATION OF SETTLEMENT

B. Further Evaluation of Restoration Options

Restoration options surviving initial screening and listed in Section VI are subjected to more detailed technical review and evaluation to determine for each injured species and habitat which candidate restoration option or suite of options are the most appropriate to implement. Following implementation, the effectiveness of each option or suite of options is evaluated through environmental monitoring to ensure that the rates of recovery for each injured species and habitat are meeting stated goals.

1. Scientific Database Review and Evaluation

It is recognized that for some injured species or habitats, more than one restoration option may have to be implemented to ensure recovery. In cases where injury to a particular species or habitat is known to vary in severity throughout the spill zone, different options or suites of options may need to be implemented at different sites within the spill zone.

To determine which options are most appropriate to implement at any given site, a detailed evaluation will need to be conducted of the existing database for each injured species or habitat. Data relevant to this evaluation may be found in the scientific literature, Geographic Information Systems (GIS), and the reports of recently completed damage assessment and restoration feasibility studies. The database for each injured species and habitat is evaluated for the purpose of establishing:

1) the nature and severity of injury
2) the rate of natural recovery
3) life history requirements
4) factors limiting recovery
5) persistence of contaminants
6) rate at which recovery can be accelerated
7) costs to accelerate recovery

With this information, one should be able to determine if intervention on behalf of an injured species or habitat is necessary or whether the injured species or habitat is best left to recover on its own. One also should be able to guage how much restoration or enhancement will be required or will be possible given the present status (environment carrying capacity, rate of recovery, etc.) of the injured species or habitat. Finally one should be able to assign costs of implementing specific restoration options or suites of options at one or more sites throughout the spill zone.

For some injured species and habitats, much of above information is in hand; but clearly for other injured species and habitats, there are substantial deficiencies in the databases that could seriously impede the process to formulate and implement timely restoration options. Much additional field work must be undertaken before the nature, geographic scope and costs of restoration can be determined for all injured species and habitats. Detailed study plans for work scheduled in 1992 designed to correct perceived data deficiencies can be found in Volume II of this document. They have been developed in consultation with scientists representing each of the Trustee Agencies. In an effort to ensure scientific quality, the design of each proposed study in Volume II has also been subjected to rigorous outside peer review.

2. Recovery Monitoring

As restoration options are formulated and implemented, monitoring will be conducted to evaluate the effectiveness of restoration, identify where additional restoration may be appropriate, and determine when injury has been delayed. Monitoring is also required where the "No-Action/Natural Recovery" alternative of the Natural Resource Damage Assessment Rules apply. In this situation, there may be no technically feasible or cost effective means to restore or accelerate recovery of an injured resource or habitat.

The duration of recovery monitoring will depend on the time necessary to establish a trend for recovery, and this in turn will necessarily depend on the severity and duration of effects resulting from the oil spill, but could be required for 10-20 years or more. Continuation of some level of monitoring beyond recovery should also be considered as it provides a baseline from which to assess impacts of future oil spills and other disturbances. It also generates a database that enhances our understanding of how our changing environment affects the species we manage and protect.

While some monitoring is already underway, the development of a more comprehensive and better integrated monitoring program is required. Early in 1992, the Trustees's will develop a "conceptual" design for a recovery monitoring plan that addresses overall goals and objectives, how best to integrate monitoring, the required infrastructure for implementation and management, funding mechanisms, and relationships to other monitoring programs within the spill area. This effort will serve to guide a subsequent more detailed planning effort scheduled for later in 1992 aimed at establishing a technical design for each species and/or habitat to be monitored, a data management system and quality assurance plan to handle all monitoring data, cost estimates for each monitoring component, and a strategy for review and update to ensure that the most appropriate and cost-effective monitoring methods will be used.

C. Evaluation of Options for Identifying and Protecting Marine and Upland Habitats

A diversity of birds, mammals, fish and other wildlife were killed by the spill or injured by contamination of prey and habitats. Many of these species are dependent on marine habitats

for activities such as feeding and resting, but many are also dependent upon upland habitats. Protection of both marine and upland habitats from further disturbance may reduce cumulative effects on injured fish and wildlife populations, and thereby accelerate recovery from the effects of the oil spill.

The following describes in general terms a process that could be followed to identify, rank (prioritize) and protect candidate upland and marine habitats for protection. Conceptually, the process follows techniques and strategies employed previously by The Nature Conservancy throughout the United States including Alaska.

Step 1. The first step in the conservation process is identify the habitats and or species requiring protection. This step must be based on scientific inventories of candidate sites with the objective of determining the distribution and abundance of injured species or habitats upon which injured species are dependent.

Step 2. The second step is to utilize the information obtained from the inventories and rank (prioritize) candidate sites. Ranking criteria could include but are not limited to: site is used by one or more injured species, potential for changes in land use may further impact injured species, the prospect that failure to protect will forclose restoration opportunities, etc. Ranking could also be based on public input.

Step 3. Once habitats or sites are ranked (prioritized), the next main step is to develop a protection plan and strategy to achieve protection of high priority sites. The protection plan should include a number of options. At an early stage, available funding should also be assessed.

Upland Habitats - Land status and legal ownership need to be established. Public interests must also be determined. Landowners need to be consulted early in the process. There is also a need to work closely with attorneys and perform an adequate level of "due diligence" before obtaining any interest in real property, or timber, mineral or development rights. The most cost-effective option(s) to acquisition should be selected.

Marine Habitats - Public interests as well as the political boundaries of state, federal and Native lands must be assessed. There is a need to work slowly and develop stong local "grassroots" and political support. Various state and federal designations (Alaska State Park, Marine Park, Refuge, Sanctuary, or Critical Habitat Area; National Marine Sanctuary, National Estuarine Research Reserve, National Park, National Wildlife Refuge) need to be evaluated for their applicabilty to stated restoration goals, or a new designation needs to be designed to deal with the political, social, and biological issues specific to this incident.

Step 4. Once the site has been placed in protected status, the last step is to restore/or maintain the land for the benefit of the injured species or habitats. A sound management plan based on thorough scientific research and professional advice is an essential part of the protection plan. Implicit in this requirement is the need to secure a source of funds (endowment) for management of the site over time.

RPWG 4

NRDA Master

Proposed Project Overview

Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

Projid	Title	Sponsor	PI	FY92 Cost	RPWG Recommendation	Comments
1N	Mile 18 Resident Sport Fish Pond	USFS	D. Schmid	25000.	Not reviewed	Implementation proposal
2G	Cultural Resource Protection	Chugach NF	Steve Hennig	480000.	Defer to NRDA	RPWG Discussion included considering in 1993+ or Re-examine 1991 proposals and integrate with 1992 proposals.
3N	Public Information and Education	NPS	Valerie Payne	100000.	Not reviewed	Implementation Proposal
4C	Monitoring the Fate and Persistence of Oil in NPS	NPS	Dr. Gail Irvine	165[illegible]	Rec. w/mod.	(Dissent noted) Coordinate/integrate with other studies on oil persistence and shoreline assessment
5B	Trophic Investigation of Intertidal Use by Birds and Mammals	NPS	Dr. Gail Irvine	785000.	Not recommended	(Dissent noted) Possibly expand other studies to include some of these elements and locations
6K	Population Monitoring Component - Sea Otter	USFWS		242000.	Defer to NRDA	Integrate studies 6-9 to address specific RPWG identified
7K	Habitat Utilization by Sea Otters	USFWS		160000.	Defer to NRDA	Integrate studies 6-9 to address specific elements that RPWG identified.
8K	Sea Otter Recovery Model Validation Component	USFWS		138000.	Defer to NRDA	Integrate 6-9 to address specific elements RpWG identified.
9K	Pathology and Toxicology Monitoring Component	USFWS		44000.	Defer to NRDA	Integrate studies 6-9 to address specific elements RPWG identified.
10	Management Strategies for Restoring and Protecting Birds and Sea Otters	USFWS		105000.	Consider 1993	Probably a RPWG function - may decide to contract later
11A	Monitoring Rate of Recovery/Continuing Changes of Murre Numbers/Productivity	USFWS		533000.	Recommend	Carefully review budget
12A	Aging of Alcid Carcasses from the EVOS: Obtaining Demographic Information	USFWS		220000.	Rec. w/mod.	(Dissent noted) Support objective A to protect option for later years

RPWG
H

Proposed Project Overview
Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

Projid	Title	Sponsor	PI	FY92 Cost	RPWG Recommendation	Comments
1N	Mile 18 Resident Sport Fish Pond	USFS	D. Schmid	25000.	Not reviewed	Implementation proposal
2G	Cultural Resource Protection	Chugach NF	Steve Hennig	480000.	Defer to NRDA	RPWG Discussion included considering in 1993+ or Re-examine 1991 proposals and integrate with 1992 proposals.
3N	Public Information and Education	NPS	Valerie Payne	100000.	Not reviewed	Implementation Proposal
4C	Monitoring the Fate and Persistence of Oil in NPS	NPS	Dr. Gail Irvine	165.	Rec. w/mod.	(Dissent noted) Coordinate/integrate with other studies on oil persistence and shoreline assessment
5B	Trophic Investigation of Intertidal Use by Birds and Mammals	NPS	Dr. Gail Irvine	785000.	Not recommended	(Dissent noted) Possibly expand other studies to include some of these elements and locations
6K	Population Monitoring Component - Sea Otter	USFWS		242000.	Defer to NRDA	Integrate studies 6-9 to address specific RPWG identified
7K	Habitat Utilization by Sea Otters	USFWS		160000.	Defer to NRDA	Integrate studies 6-9 to address specific elements that RPWG identified.
8K	Sea Otter Recovery Model Validation Component	USFWS		138000.	Defer to NRDA	Integrate 6-9 to address specific elements RpWG identified.
9K	Pathology and Toxicology Monitoring Component	USFWS		44000.	Defer to NRDA	Integrate studies 6-9 to address specific elements RPWG identified.
10	Management Strategies for Restoring and Protecting Birds and Sea Otters	USFWS		105000.	Consider 1993	Probably a RPWG function - may decide to contract later
11A	Monitoring Rate of Recovery/Continuing Changes of Murre Numbers/Productivity	USFWS		533000.	Recommend	Carefully review budget
12A	Aging of Alcid Carcasses from the EVOS: Obtaining Demographic Information	USFWS		220000.	Rec. w/mod.	(Dissent noted) Support objective A to protect option for later years

Proposed Project Overview
Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

Proposal Master

Projid	Title	Sponsor	PI	FY92 Cost	RPWG Recommendation	Comments
13L	Surveys to Monitor Marine Bird and Sea Otter Populations in area of EVOS	USFWS		275000.	Defer to NRDA	Continuation of NRDA bird study #2
14A	Pigeon Guillemot Recovery Enhancement and Monitoring	USFWS		303000.	Recommend	(Dissent noted) Question objectives D & F relative to forage fish. Review logistics
15A	Surveys to Identify Upland Use by Murrelets in the EVOS Zone	USFWs		100000.	Defer to NRDA	Combine with #16. Especially elements B and C
16A	Identification of Nesting Habitat Criteria and Reproductive Success	USFWS		240000.	Defer to NRDA	Need to review Progress reports from 1991 (see #87)
17A	Feeding Ecology and Reproductive Success of Black Oystercatchers in PWS	USFWS		200000.	Defer to NRDA	Progress report 1991 #6 included - need to review together
18A	Murre Recovery Modeling					Proposal not received
19A	Control/Eliminate Human Disturbance near Murre Colonies	USFWS		88000.	Not reviewed	
20A	Identification and Protection of Important Bald Eagle Habitats	USFWS		267000.	Not recommended	Already have enough information on nest locations, also governments are mandated to protect nest sites with buffer zones
21A	Develop Bald Eagle Population Model and Understanding of Survival Rates	USFWS		154000.	Rec. w/mod.	Combine with #23 to reduce capture effort
22A	Monitor Productivity of Bald Eagles within the EVOS area	USFWS		60000.	Recommend	

Proposed Project Overview
Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

Projid	Title	Sponsor	PI	FY92 Cost	RPWG Recommendation	Comments
13L	Surveys to Monitor Marine Bird and Sea Otter Populations in area of EVOS	USFWS		275000.	Defer to NRDA	Continuation of NRDA bird study #2
14A	Pigeon Guillemot Recovery Enhancement and Monitoring	USFWS		303000.	Recommend	(Dissent noted) Question objectives D & F relative to forage fish. Review logistics
15A	Surveys to Identify Upland Use by Murrelets in the EVOS Zone	USFWs		180000.	Defer to NRDA	Combine with #16. Especially elements B and C
16A	Identification of Nesting Habitat Criteria and Reproductive Success	USFWS		240000.	Defer to NRDA	Need to review Progress reports from 1991 (see #87)
17A	Feeding Ecology and Reproductive Success of Black Oystercatchers in PWS	USFWS		200000.	Defer to NRDA	Progress report 1991 #6 included - need to review together
18A	Murre Recovery Modeling					Proposal not received
19A	Control/Eliminate Human Disturbance near Murre Colonies	USFWS		88000.	Not reviewed	
20A	Identification and Protection of Important Bald Eagle Habitats	USFWS		267000.	Not recommended	Already have enough information on nest locations, also governments are mandated to protect nest sites with buffer zones
21A	Develop Bald Eagle Population Model and Understanding of Survival Rates	USFWS		154000.	Rec. w/mod.	Combine with #23 to reduce capture effort
22A	Monitor Productivity of Bald Eagles within the EVOS area	USFWS		60000.	Recommend	

Proposed Project Overview
Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

Projid	Title	Sponsor	PI	FY92 Cost	RPWG Recommendation	Comments
23A	Monitor Contamination of Bald Eagles by Residual Hydrocarbons/blood analyses	USFWS		128000.	Rec. w/mod.	Combine with #21. Collect blood during radio attachment
24A	Monitor contamination of Bald Eagle eggs by Residual Hydrocarbons	USFWS		128000.	Not Recommended	
250	Determine Food Habits for Adult and Subadult Bald Eagles	USFWS		146000.	Consider 1993	Agency suggested deferring until 1993+
260	Assessment of Marbled Murrelet Foraging Habitat Requirements during breeding	USFWS			Consider 1993	Agency suggested deferring until 1993+
270	Censuses of Seabird Nesting Colonies in the EVOS Zone	USFWS			Consider 1993	Agency suggested deferring until 1993+
280	Control, Translocation or Removal of Specific Avian Predators	USFWS			Consider 1993	Agency suggested deferring until 1993+
290	Removal of Introduced Foxes on Selected Colonial Seabird Nesting Islands	USFWS			Consider 1993	Agency suggested deferring until 1993+
300	Test Feasibility of Tape Recordings, Decoys, Habitat Modification	USFWS			Consider 1993	Agency suggested deferring until 1993+
310	Identify Post-breeding Concentrations of Murre Chicks with Accompanying Male	USFWS			Consider 1993	Agency suggested deferring until 1993+
32C	Injury and Recovery of Deep Benthic Macrofaunal Communities	AK Fish/Game	Howard M. Feder	273000.	Defer to NRDA	Coordinate/integrate with proposals #51, 74, 77, and 83. Support in principle
33H	Injured Species Habitat Identification	US Forest Serv.	Susan Borchers	1049800.	Split Recommendation	Ability to extrapolate and data quality are pluses; costs and timing are concerns
34A	Food Habitats of Staging Waterfowl on the Intertidal Habitats	USFS et al.	Mary Anne Bishop	45000.	Not recommended	Weak link to injury

Proposed Project Overview

Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

Projid	Title	Sponsor	PI	FY92 Cost	RPWG Recommendation	Comments
35A	Migratory Shorebirds Staging in Rocky Intertidal Habitats of PWS	USFS et al	Mary Anne Bishop	80000.	Not recommended	Need policy called on "inferred" injury to species not investigated during NRDA
36A	Surveys to Determine Distribution and Abundance of Migratory Waterfowl	USFS et al	Mary Anne Bishop	91000.	Not recommended	Weak link to injury
37N	Paulson Creek Fish Ladder Modification	Chugach NF	Kate Wedemeyer	12500.	Not reviewed	Implementation Proposal
38A	Migratory Shorebirds: Temporal and Spatial Use	USFS et al	Mary Anne Bishop	95000.	Not recommended	Weak link to injury
39E	Fish Limiting Habitat Factors Analysis	USFS	Robert Olson	125000.	Defer to NRDA	Consider with 40 and 42 and the restoration progress reports
40E	PWS Wild Fish Stock Information Assessment	USFS	Robert Olson	50000.	Defer to NRDA	Consider with 39 and 42, and restoration progress reports
41N	Otter Creek Fish Pass	US Forest Serv.	Kate Wedemeyer	72900.	Not reviewed	Implementation Proposal
42E	W. PWS Restoration Survey and Project Planning	US Forest Serv.	Kate Wedemeyer	92200.	Defer to NRDA	Consider with 39 and 40 and restoration progress reports
43N	Coghill Lake Sockeye Salmon Habitat Rehabilitation	USFS et al	Kate Wedemeyer	118000.	Not reviewed	Implementation proposal
44F	Anadromous Sport Fish Status and Evaluation	AK Fish/Game	K. Hepler	12000.	Defer to NRDA	Consider when existing Dolly varden/cutthroat study is reviewed (1991 #7)
45E	Montague Island Chum Salmon Restoration	US Forest Serv.	D. Schmid	26000.	Not reviewed	Also see Progress Report

Proposed Project Overview

Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

Projid	Title	Sponsor	PI	FY92 Cost	RPWG Recommendation	Comments
46E	Identification of Suitable Early-run Pink Salmon	AK Fish/Game	Mark Willette	80000.	Defer to NRDA	Question methodology and relationship to non-EVOS management agenda. Cost share?
47H	Stream Habitat Assessment	AK Fish/Game	Mark Kuwada	485365.	Split Recommendation	Timing and cost of projects are pluses; less information will be gathered than #33
48C	Bivalve Shellfish Restortion and Enhancement	AK Fish/Game	James O. Cochran	20000.	Consider 1993	If mariculture becomes a serious option RPWG would support needs more focus (e.g. lit.search)
49C	Intertidal\Subtidal Restoration Needs Assessment	AK Fish/Game	James O. Cochran	20000.	Not recommended	Mariculture is not currently being considered for general restoration
50C	Tanner Crab Population Monitoring and Restoration	AK Fish/Game	Charles Trowbridge	80000.	Not recommended	Lack of injury. Need policy call on "inferred" injury to species not investigated
51C	Natural Restoration/Shallow Subtidal Communities	AK Fish/Game	Stephen C. Jewett	391973.	Defer to NRDA	support in principle. Coordinate/integrate with proposals #32, 74, 77, and 83
52C	Development of a Restoration Plan for Groundfish	AK Fish/Game	William Bechtol	255000.	Split Recommendation	For those opposed: Non-EVOS agency management agenda is a concern
53E	Kenai River Sockeye Salmon Restoration	AK Fish/Game	Kenneth Tarbox	380000.	Defer to NRDA	Need comment on technique. Question purchasing new equipment
54C	Juvenile Spot Shrimp Habitat	AK Fish/Game	Charles Trowbridge	65000.	Defer to NRDA	Need discussion on degree of injury. If okay'd would support combined with #55
55C	Spot Shrimp Restoration	AK Fish/Game	Charles Trowbridge	65000.	Defer to NRDA	Need discussion on degree of injury to species not investicated. If okay'd combine with 54

Proposed Project Overview

Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

Projid	Title	Sponsor	PI	FY92 Cost	RPWG Recommendation	Comments
56	Butter Clam and Pacific Littleneck Clam Restoration and Enhancement					deleted; combined with #48
57F	Herring Spawn Substrate/Egg Transplanting Studies	AK Fish/Game	Evelyn Biggs	70000.	Recommend	
58F	Herring Restoration and Monitoring	AK Fish/Game	Evelyn Biggs	210000.	Split Recommendation	Those opposed think costs are too high, want a review of various elements in the study
59E	Assessment of Genetic Stock Structure of Salmonids	AK Fish/Game	James Seeb	250000.	Recommend	Need assurance of the benefits of genetic stock separation
60E	Stock Identification/Population Monitoring	AK Fish/Game	Samuel Sharr	2130000.	Defer to NRDA	See combined damage assessment/restoration report
61E	Monitoring DNA Breakages of Fish and Shellfish	AK Fish/Game	James E. Seeb	150000.	Defer to NRDA	Could this be an alternative to population monitoring?
62E	Salmon Stock Separation Using Otolith Patterns	AK Fish/Game	Mark Willette	500000.	Defer to NRDA	Could this techniqued be refined with costs reduced? Likelihood of success? Cost share?
63E	Evaluation of Wild-Hatchery Salmon Stock	AK Fish/Game	Mark Willette	600000.	Defer to NRDA	Would this provide the forage fish information needed to further ecological assessment of forage fish prey base?
64M	PWS Mines and Canneries Hazardous Site Assessment	Chugach NF	Carol Huber	100000.	Not recommended	Weak link to injuries and endpoint
65B	Coastal Habitat Comprehensive Intertidal Program	USFS et al	Raymond Highsmith	2117448.	Defer to NRDA	Coordinate with other studies and HAZMAT. Support in principle.

Proposed Project Overview

Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

Projid	Title	Sponsor	PI	FY92 Cost	RPWG Recommendation	Comments
66N	PWS Resource and Oil Spill Interpretation	Chugach NF	Steve Hennig	198000.	Not reviewed	Implementation proposal
67B	High Intertidal Fucus Recovery and Restoration	possibly EPA	Andrew De Vogelaere	109175.	Defer to NRDA	
68K	Evaluation of Sea Otter Population Recovery Rates	PWS Science Ctr	Lisa Rotterman	1250000.	Defer to NRDA	
69K	Identification/Prioritization of Critical Habitat	PWS Science Ctr	Charles Monnett	450000.	Defer to NRDA	
70B	Stable Carbon Isotopic Analyses of EVOS Carbon	USFS	Raymond Highsmith	48600.	Defer to NRDA	
71A	Preliminary Progress Report of Harlequin Duck	AK Fish/Game	Samuel Patten	275000.		Progress Report (1991 #5)
72G	State Archaeological Restoration Project	DNR	Douglas R. Reger	350000.	Defer to NRDA	RPWG discussion included considering in 1993+ or Re-examine 1991 proposals - integrate with current studies.
73J	Harbor Seal Progress Report Restoration Study	AK Fish/Game	Kathryn J. Frost			Progress Report (1991 #1)
74C	Recovery Monitoring of Contaminated Resources	AB Lab et al	Charles O'Clair	480000.	Defer to NRDA	Support in principle. coordinate/integrate with proposals #32, 51, 77, 83 or 65
75C	Natural Recovery of Subtidal Species in PWS	NOAA	Usha Varanasi	230000.	Defer to NRDA	

Proposed Project Overview

Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

Projid	Title	Sponsor	PI	FY92 Cost	RPWG Recommendation	Comments
76D	Recovery Monitoring of Intertidal Oiled Mussel	NOAA	Stanley Rice	500000.	Defer to NRDA	Possibly coordinate with other subtidal studies
77C	Monitoring Recovery of Intertidal/Nearshore Subtidal specis in PWS	NOAA	Usha Varanasi	300000.	Deferred	Coordinate/integrate with proposals #32, 51, 74, and 83. Support in principle
78C	Mussel Tissue/Sediment Hydrocarbon Data Synthesis	NOAA	Stanley Rice	100000.	Recommend	
79B	Recovery Monitoring of Intertidal/Nearshore Subtidal Communities Impacted	NOAA	Alan Mearns	850000.	Defer to NRDA	
80	Pre and Post-spill Concentrations of Hydrocarbons in Sediments and Mussels	NOAA	Malin M. Babcock			Progress Report(1991 #11)
81D	Hydrocarbon Analyses of Mussels and Substrates/ Sediments Collected from PWS	NOAA	Malin M. Babcock			Informal study-Progress Report
82I	Killer Whale Monitoring and Habitat Studies	NOAA	Marilyn Dahlheim			Progress Report included
83C	Monitoring Microbial Populations in Marine Sediment as Indicators	UAF	Joan F. Braddock	80000.		Coordinate/integrate with proposals #32, 51, 74, 77 and 83. support in principle
84B	Herring Bay Experimental and Monitoring Studies	UAF	Raymond C. Highsmith		Not reviewed	
85F	Technical Support Study for the Restoration of Dolly Varden/Cutthroat Trout	AK Fish/Game	Andrew G. Hoffman			Progress Report(1991 #7)
86	Survey/Evaluation of Instream Habitat and Stock Restoration Techniques	AK Fish/Game	Mark Willette			Progress Report (1991 #13)

Proposed Project Overview

Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

Projid	Title	Sponsor	PI	FY92 Cost	RPWG Recommendation	Comments
87A	Interim Summary of the 1991 Marbled Murrelet Restoration	USFWS	Kathy Kuletz			Progress Report (1991 #4)
88	Stream Carrying Capacity for Evaluating Restoration in PWS	NMFS	Dr. K.V. Koski	175000.		Late submission on 12/2/91; not reviewed

PROPOSED PROJECTS RECEIVED BY RPWG
NOVEMBER 1991

1. Mile 18 Resident Sport Fish Pond
   PI/Lead Agency: D. Schmid/USFS
   Cost: 1992 - $25K, 1993 and 1994 - $16K, monitoring - $8K annually

2. Cultural Resource Protection
   PI/Lead Agency: Steve Hennig/Chugach National Forest
   Cost: 1992 - $480K, 1993 and subsequent years - $120K

3. Public Information and Education
   PI/Lead Agency: Valerie Payne/NPS
   Cost: 1992 - $100K, 1993 - $150K, 1994 - $25K, 1995 - $50K, 1996 - $25K, 1997 - $50K, 1998 - $25K, 1999 - $50K, 2000 - $25K, 2001 - $50K

4. Monitoring the Fate and Persistence of Oil in National Parks Affected by the Exxon Valdez Oil Spill: A Restoration Science Study Proposal
   PI/Lead Agency: Dr. Gail Irvine/NPS
   Cost: 1992 - $165K, 1994 - $170K, 1996 - $175K, 1998 - $180K, 2000 - $185K

5. Trophic Investigation of Intertidal Use by Birds and Mammals in NPS Areas Affected by the Exxon Valdez Oil Spill: A Restoration Science Study Proposal
   PI/Lead Agency: Dr. Gail Irvine/NPS
   Cost: 1992 - $785K, 1993 - $775K, 1994 - $800K, 1995 - $820K, 1996 - $825K

6. Population Monitoring Component - Monitoring of Sea Otter Population Abundance, Distribution, Reproduction and Mortality in Areas Affected by the Exxon Valdez Oil Spill
   PI/Lead Agency: USFWS R8 & R7
   Cost: 1992 - $242K, 1993 - $242K, 1994 - $242K, 1995 to 2001 - $160K per year

7. Habitat Utilization by Sea Otters and Designation of Protected Areas
   PI/Lead Agency: USFWS
   Cost: 1992 - $160K, 1993 to 2001 - $121K per year

8. Sea Otter Recovery Model Validation Component - Survival, Reproduction, and Movements of Sea Otters Associated with the Exxon Valdez Oil Spill
   PI/Lead Agency: USFWS
   Cost: 1992 - $138K, 1993 - $347K, 1994 - $400K, 1995 to 1998 - $290K per year

9. Pathology and Toxicology Monitoring Component - Monitoring

Blood Parameters and Hydrocarbon Contamination of Sea Otters and their Prey Species Within the Oil Spill Zone
PI/Lead Agency: USFWS
Cost: 1992 - $44K, 1993 - $330K, 1994 - $100K, 1995-97-99 - $220K, 1996-98-2000 - $44K, 2001 - $165K

10. Management Strategies for Restoring and Protecting Migratory Bird and Sea Otter Populations and their Habitats in the <u>Exxon Valdez</u> Spill Zone
PI/Lead Agency: USFWS
Cost: Marine Mammal - $66K, Migratory Bird - $39K

11. Monitoring Rate of Recovery or Continuing Changes of Murre Numbers and Productivity in Seabird Colonies in or Downstream from the <u>Exxon</u> <u>Valdez</u> Oil Spill
PI/Lead Agency: USFWS
Cost: 1992 - $533K, 1993 to 2001 - $490K per year

12. Aging of Alcid Carcasses from the <u>Exxon</u> <u>Valdez</u> Oil Spill: Obtaining Demographic Information for Restoration Efforts
PI/Lead Agency: USFWS
Cost: 1992 to 1994 - $220K per year

13. Surveys to Monitor Marine Bird and Sea Otter Populations in the area of the <u>Exxon</u> <u>Valdez</u> Oil Spill
PI/Lead Agency: USFWS
Cost: 1992 - $275K, 1993 to 2001 - Option A - $550K, Option B - $825K

14. Pigeon Guillemot Recovery Enhancement and Monitoring
PI/Lead Agency: USFWS
Cost: 1992 - $303K, 1993 to 1997 - $578K per year

15. Surveys to Identify Upland Use by Murrelets in the EVOS Zone
PI/Lead Agency: USFWS
Cost: 1992 - $180K, 1993 - $176K, 1994 - $176K

16. Identification of Nesting Habitat Criteria and Reproductive Success for the Marbled Murrelet
PI/Lead Agency: USFWS
Cost: 1992 - $240K, 1993 to 2001 - $250K

17. Feeding Ecology and Reproductive Success of Black Oystercatchers in Prince William Sound
PI/Lead Agency: USFWS
Cost: 1992 - $200K, 1993 - $200K

18. Murre Recovery Modeling
Note: a more complete proposal will be submitted after checking the status of Dr. Heinemann's effort

19. Control or Eliminate Human Disturbance near Murre Colones

Showing Decreased Numbers, Delayed Chronology, and Decreased Production from Past Estimates
PI/Lead Agency: USFWS
Cost: 1992 to 1994 - $88K per year

20. Identification and Protection of Important Bald Eagle Habitats
PI/Lead Agency: USFWS
Cost: 1992 to 1994 - $267K, 1995 - $170K

21. Develop Bald Eagle Population Model and Understanding of Age-specific Survival Rates
PI/Lead Agency: USFWS
Cost: 1992 - $154K, 1993 to 2001 - $187K

22. Monitor Productivity of Bald Eagles within the EVOS area
PI/Lead Agency: USFWS
Cost: 1992 to 2001 - $60K per year

23. Monitor Contamination of Bald Eagles by Residual Hydrocarbons Through Blood Analyses
PI/Lead Agency: USFWS
Cost: 1992 - $128K, 1993 - $128K, 1994 to 1996 - $47K

24. Monitor Contamination of Bald Eagle Eggs by Residual Hydrocarbons
PI/Lead Agency: USFWS
Cost: 1992 - $128K

25. *Determine Food Habits for Adult and Subadult Bald Eagles
PI/Lead Agency: USFWS
Cost: 1992 - $146K, 1993 to 1994 - $113K

26. *Assessment of Marbled Murrelet Foraging Habitat Requirements During the Breeding Season
PI/Lead Agency: USFWS
Cost: To be determined

27. *Censuses of Seabird Nesting Colonies (Except Murre and PWS Guillemot Colonies) in the <u>Exxon</u> <u>Valdez</u> Oil Spill Zone
PI/Lead Agency: USFWS
Cost: To be determined

28. *Control, Translocation, or Removal of Specific Avian Predators (Eagles, Glaucous-winged Gulls, Ravens) of Murre Breeding Adults, Eggs, and Chicks so as to Improve Murre Reproductive Success
PI/Lead Agency: USFWS
Cost: To be determined

29. *Removal of Introduced Foxes on Selected Colonial Seabird Nesting Islands
PI/Lead Agency: USFWS

Cost: To be determined

30. *Test Feasibility of Tape Recordings, Decoys, Habitat Modification, and Other Methods to Facilitate Breeding Synchrony and Higher Reproductive Synchrony and Higher Reproductive Success for Murres at a Selected Site in Alaska
PI/Lead Agency: USFWS
Cost: To be determined

31. *Identify Post-breeding Concentrations of Murre Chicks with Accompanying Males and Winter Concentrations and Evaluate Other Questions About Winter Distribution and Whether Regional Murre Populations Intermix
PI/Lead Agency: USFWS
Cost: To be determined

*** The above projects are not recommended for implementation in 1992; however, they were considered for 1992 and will likely be considered for subsequent years. They are provided for planning purposes only.**

32. Injury and Recovery of Deep Benthic Macrofaunal Communities
PI/Lead Agency: Howard M. Feder/AK Fish and Game and UAF
Cost: $273K per year (5 years)

33. Injured Species Habitat Identification
PI/Lead Agency: Susan Borchers/US Forest Service
Cost: 1992 - $1,049,800, 1993 - $893.5K, 1994 - $893.5K

34. Food Habitats of Staging Waterfowl on the Intertidal Habitats of the Western Copper River Delta
PI/Lead Agency: Mary Anne Bishop/Copper River Delta Institute, U.S. Forest Service, Chugach National Forest
Cost: 1992 - $45K, 1993 - $35K, 1994 - $15K

35. Migratory Shorebirds Staging in Rocky Intertidal Habitats of Prince William Sound
PI/Lead Agency: Mary Anne Bishop/Copper River Delta Institute, U.S. Forest Service, Chugach National Forest
Cost: 1992 - $80K, 1993 - $65K, 1994 - $70K

36. Surveys to Determine Distribution and Abundance of Migratory Waterfowl Staging in Intertidal Habitats of the Western Copper River Delta During Spring and Fall
PI/Lead Agency: Mary Anne Bishop/Copper River Delta Institute, U.S. Forest Service, Chugach National Forest
Cost: 1992 - $91K, 1993 - $78K, 1994 - $15K

37. Paulson Creek Fish Ladder Modification
PI/Lead Agency: Kate Wedemeyer/Chugach National Forest
Cost: 1992 - $12.5K, 1993 - $20K, 1994 - ?, 1995 - $5K, 1996

- $6K, 1997 - $7K

38. Migratory Shorebirds: Temporal and Spatial Use Patterns on the Western Copper River Delta
PI/Lead Agency: Mary Anne Bishop/Copper River Delta Institute, U.S. Forest Service
Cost: 1992 - $95K, 1993 - $88K, 1994 - $17K

39. Fish Limiting Habit Factors Analysis
PI/Lead Agency: Robert Olson/Chugach National Forest
Cost: years one and two - $125K per year, year three - $30K

40. Prince William Sound Wild Fish Stock Information Assessment
PI/Lead Agency: Robert Olson/Chugach National Forest
Cost: $50K per year (two years)

41. Otter Creek Fish Pass
PI/Lead Agency: Kate Wedemeyer/US Forest Service
Cost: 1991 - $6K, 1992 - $72.9K, 1993 - ?, 1994 - $9K, 1995 $10K, 1996 - $11K

42. Western Prince William Sound Restoration Survey and Project Planning
PI/Lead Agency: Kate Wedemeyer/US Forest Service
Cost: one year - $92.2K

43. Coghill Lake Sockeye Salmon Habitat Rehabilitation
PI/Lead Agency: Kate Wedemeyer/US Forest Service
Cost: first year - $118K, succeeding years - $100K

44. Anadromous Sport Fish Status and Evaluation
PI/Lead Agency: K. Hepler/AK Fish and Game
Cost: $12K annually for three years

45. Montague Island Chum Salmon Restoration and Re-introduction
PI/Lead Agency: D. Schmid/U.S. Forest Service
Cost: 1992 - $26K, 1993 to 1996 - $30K, 1997 to 2001 - $16K

46. Identification of Suitable Early-run Pink Salmon Stocks for Development as Broodstock at Prince William Sound Hatcheries
PI/Lead Agency: Mark Willette/AK Fish and Game
Greg Carpenter
Cost: $80K

47. Stream Habitat Assessment
PI/Lead Agency: Mark Kuwada/AK Fish and Game
Cost: three year total - $1,456.095

48. Bivalve Shellfish Restoration and Enhancement
PI/Lead Agency: James O. Cochran/AK Fish and Game
Cost: year one - $20K, year two - $35K, year three - $35K

49. Intertidal and Subtidal Restoration Needs Assessment Survey
PI/Lead Agency: James O. Cochran/AK Fish and Game
Cost: year one - $20K

50. Tanner Crab Population Monitoring and Restoration
PI/Lead Agency: Charles Trowbridge/AK Fish and Game
Ivan Vining
Cost: $80K per year

51. Natural Restoration of the Shallow Subtidal Communities in Prince William Sound
PI/Lead Agency: Stephen C. Jewett/AK Fish and Game
Thomas A. Dean
Cost: (3/1/92 to 2/28/93) - $391,973, (3/1/93 to 2/28/94) - $330K, (3/1/94 to 2/28/95) - $330K

52. Development of a Restoration Plan for Groundfish Stocks Affected by the Exxon Valdez Oil Spill
PI/Lead Agency: William Bechtol/AK Fish and Game
Andrew Hoffman
Lisa Seeb
Patricia Hansen
Ivan Vining
Cost: year 1 - $255K, year 2 - $180K, year 3 - $235K, year 4 - $195K, year 5 - $195K

53. Kenai River Sockeye Salmon Restoration
PI/Lead Agency: Kenneth Tarbox/AK Fish and Game
Linda Brannian
Cost: $380K per year

54. Juvenile Spot Shrimp Habitat
PI/Lead Agency: Charles Trowbridge/AK Fish and Game
Ivan Vining
A.J. Paul
Cost: $65K per year

55. Spot Shrimp Restoration
PI/Lead Agency: Charles Trowbridge/AK Fish and Game
Lisa Seeb
James Cochran
Ivan Vining
Cost: $65K per year

56. Butter Clam and Pacific Littleneck Clam Restoration and Enhancement
PI/Lead Agency: Charles Trowbridge/ AK Fish and Game
J. Johnson
Cost: $85K per year

57. Herring Spawn Substrate and Egg Transplanting Studies
PI/Lead Agency: Evelyn Biggs/AK Fish and Game

Tim Baker
Cost: $70K

58. Herring Restoration and Monitoring
PI/Lead Agency: Evelyn Biggs/AK Fish and Game
Lisa Seeb
Tim Baker
Cost: $1,125,000

59. Assessment of Genetic Stock Structure of Salmonids for Restoration Planning and Monitoring
PI/Lead Agency: James Seeb/AK Fish and Game
Lisa Seeb
Cost: year 1 - $250K, year 2 - $262K, year 3 - $275K, year 4 and beyond - as needed

60. Stock Identification and Population Monitoring of Wild Pink Salmon
PI/Lead Agency: Samuel Sharr/AK Fish and Game
Carol Peckham
Dan Sharp
David Evans
Cost: $2,130,000

61. Monitoring DNA Breakages of Fish and Shellfish Populations in Prince William Sound
PI/Lead Agency: James E. Seeb/AK Fish and Game
James J. Hasbrouck
Cost: year 1 - $150K, year 2 - $103.5K, year 3 - $110K, year 4 - $115.5K, year 5 - $121.6K, year 6 - $128.8K

62. Salmon Stock Separation Using Otolith Banding Patterns and Microchemistry
PI/Lead Agency: Mark Willette/AK Fish and Game
Kenneth Severin
James Hasbrouck
Cost: $500K

63. Evaluation of Wild-hatchery Salmon Stock Interactions During the Early Marine Period
PI/Lead Agency: Mark Willette/AK Fish and Game
James Hasbrouck
Cost: $600K

64. Prince William Sound Mines and Canneries Hazardous Site Assessment
PI/Lead Agency: Carol Huber/Chugach National Forest
Chris Roe
Cost: $100K per year

65. Coastal Habitat Comprehensive Intertidal Monitoring Program
PI/Lead Agency: Dr. Raymond C. Highsmith/USFS, UAF, NPS

Dr. Mike Stekoll
Dr. M. Dale Strickland
Dr. Lyman L. McDonald
Dr. Willard Barber
Cost: $2,117,448, West, Inc. - $74,376

66. Prince William Sound Resource and Oil Spill Interpretation
PI/Lead Agency: Steve Hennig/Chugach National Forest
Cost: 1992 - $198K, 1993 - $198K, 1994 - $153K, 1995 - $108K, 1996 - $83K, last 5 years - $83K annually

67. High Intertidal Fucus Recovery and Restoration Following the Exxon Valdez Oil Spill
PI/Lead Agency: Dr. Andrew P. De Vogelaere/possibly EPA
Michael S. Foster
Cost: year 1 - $109,175, year 2 - $87,690

68. Evaluation of Sea Otter Population Recovery Rates and Processes in Prince William Sound
PI/Lead Agency: Lisa Rotterman/PWS Science Center
Charles Monnett
Cost: $750K - toxicology, pathology and prey sampling
$500K - instrumentation, monitoring and recovery

69. Identification and Prioritization of Critical Habitat for Sea Otters in Prince William Sound
PI/Lead Agency: Charles Monnett/PWS Science Center
Lisa Rotterman
Cost: year 1 - $450K, year 2 - $350K

70. Stable Carbon Isotopic Analyses of EVOS Derived Carbon in Intertidal Organisms
PI/Lead Agency: Raymond C. Highsmith/USFS
Susan M. Saupe
Cost: $48.6K

71. Preliminary Progress Report of Harlequin Duck Restoration Project in Prince William Sound: Proposal for 1992
PI/Lead Agency: Dr. Samuel M. Patten/AK Fish and Game
Cost: $275K

72. State Archaeological Restoration Project
PI/Lead Agency: Dr. Douglas R. Reger/DNR
Cost: year one - $350K, year two - $300K

73. Harbor Seal Progress Report Restoration Study
PI/Lead Agency: Kathryn J. Frost/AK Fish and Game
Cost: ?

74. Recovery Monitoring of Hydrocarbon-contaminated Subtidal Marine Sediment Resources
PI/Lead Agency: Charles O'Clair and Stanley Rice/Auke Bay

Laboratory, NOAA, National Marine Fisheries Service
Cost: year 4 - $480K, year 5 - $530K, year 6 - $585K

75. Natural Recovery of Subtidal Species in Prince William Sound
PI/Lead Agency: Usha Varanasi
Cost: $230K

76. Recovery Monitoring of Intertidal Oiled Mussel Beds in Prince William Sound and the Gulf of Alaska Impacted by the Exxon Valdez Oil Spill
PI/Lead Agency: Stanley Rice/NOAA and NMFS
Cost: year 4 - $500K, year 5 - $500K, year 6 - $600K

77. Monitoring Recovery of Intertidal and Nearshore Subtidal Species in Prince William Sound
PI/Lead Agency: Usha Varanasi
Cost: $300K

78. Mussel Tissue and Sediment Hydrocarbon Data Synthesis
PI/Lead Agency: Stanley Rice and Jeffrey Short/Auke Bay Laboratory, National Marine Fisheries Service, NOAA
Cost: year 4 - $100K, year 5 - $110K, year 6 - $120K

79. Recovery Monitoring of Intertidal and Nearshore Subtidal Communities Impacted by the Exxon Valdez Oil Spill and Associated Clean-up
PI/Lead Agency: Alan Mearns, NOAA
Jonathan Houghton
Dennis Lees
Howard Teas
Jacqueline Michel
Charles Henry
Cost: $800 - $850K

80. Pre-spill and Post-spill Concentrations of Hydrocarbons in Sediments and Mussels at Intertidal Sites Within Prince William Sound and the Gulf of Alaska: Status Report 1991
PI/Lead Agency: Malin M. Babcock/NOAA
John Karinen
Cost: ?

81. Hydrocarbon Analyses of Mussels and Substrates/Sediments Collected From Prince William Sound, 1991: A Special Survey of Oiled Mussel Beds
PI/Lead Agency: Malin M. Babcock/NOAA
Cost: ?

82. Killer Whale Monitoring and Habitat Studies
PI/Lead Agency: Marilyn E. Dahlheim/NOAA and NMML
Thomas R. Loughlin
Cost: $219.5K

83. Monitoring Microbial Populations in Marine Sediment as Indicators of Environmental Disturbance and Restoration
PI/Lead Agency: Joan Forshaug Braddock/UAF
Cost: $80K per year, **Note: does not include cost of vessels or salaries of divers.**

84. Herring Bay Experimental and Monitoring Studies
PI/Lead Agency: Raymond C. Highsmith/UAF
Cost: cost included with #65

85. Technical Support Study for the Restoration of Dolly Varden and Cutthroat Trout Populations in Prince William Sound
PI/Lead Agency: Andrew G. Hoffman/AK Fish and Game
Cost: Progress Report

86. Survey and Evaluation of Instream Habitat and Stock Restoration Techniques for Wild Pink and Chum Salmon
PI/Lead Agency: Mark Willette/AK Fish and Game
Cost: Progress Report

87. Interim Summary of the 1991 Marbled Murrelet Restoration Project
PI/Lead Agency: Kathy Kuletz/USFWS
Cost: Progress Report

88. Stream Carrying Capacity for Evaluating Restoration in Prince William Sound
PI/Lead Agency: Dr. K.V. Koski/NMFS
Cost: $175K
Note: late submission on 12/2/91

89. River Otter Restoration Study
PI/Lead Agency: James B. Faro/AK Fish and Game
Cost: $63K if half of salaries are paid by NRDA budget
Note: late submission on 12/4/91

12/4/91 version

A
Birds
11
12
14
↓
24
34
35
36
38

K
Sea Otters
6
↓
9
68
69

E
Salmon
39
40
42
46
53
59
61
62
63
45

F
Herring/Dolly Varden
57
58
44

L
Boat Survey
10
13

D
mussel beds
76
81

H
Habitat
33
47

B
Coastal Habitat
67
5
65
70
79
84

C
Subtidal
4
32
48
49
50
51
52
54
55
74
75
77
78
83

N
Implementation
1
37
41
43
3
66

O
Deferred to 1993+
25
↓
31

G
Archaeology
2
72

M
Recreation
64

I
Killer Whale
82

J
Harbor Seals

~~Progress Reports~~

P
Database Managem

Q
Shellfish

R
Tech. Services

4
5
6

progress reports ∧

Proj. Id	Sponsor	P.I	Title	RPWG Rec. FY92	Comments
01	USFS	D. Schmid	18 mile restoration	Deferred	Implementation projects - not considered.
02					

Proposed Project Overview
Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

ProjID		Title	Sponsor	OY4 Cost	Recommendation
Birds					
1	A	An Assessment of Damage to Seabirds in PWS and the Western GOA from EVOS	FWS	0.	
11	A	Injury Assessment of Hydrocarbon Uptake by Sea Ducks in PWS	FWS	75000.	
12	A	Assessment of Injury to Shorebirds Staging and Nesting in PWS and Kenai Pen.	FWS	18000.	
2	A	Boat Surveys to Determine Distribution and Abundance of Migratory Birds	FWS	60000.	
3	A	Population Surveys of Seabird Colonies in the Spill Area (Murres)	FWS	125000.	
4	A	Assessing the Effects of EVOS on Bald Eagles	FWS	75000.	
6	A	Assessment of the Abundance of Marbled Murrelets at Sites along Kenai Penin.	FWS	18000.	
7	A	Assessment of the Effects of Petroleum Hydrocarbons on Petrel	FWS	5000.	
8	A	Assessment of Injuries to Reproductive Success of Blacklegged Kittiwakes-PWS	FWS	5000.	
9	A	Assessment of Injury to Waterbirds Based on Pop. and Breeding Pig. Guillemot	FWS	18000.	

Proposed Project Overview
Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

ProjID		Title	Sponsor	OY4 Cost	Recommendation
Coastal Habitat					
1B	B	Pre-spill and Post-spill Concentrations of Hydrocarbons in Mussels in PWS	NOAA	40000.	

Proposed Project Overview
Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

ProjID		Title	Sponsor	OY4 Cost	Recommendation
Subtidal					
1	C	Petroleum Hydrocarbon-induced Injury to Subtidal Marine Sediment Resources	NOAA/NMFS	100300.	
1	C	Hydrocarbon Mineralization Potentials and Microbial Pops. in Sediment	DEC	16000.	
2b	C	Deep Water Bethos	ADF&G	80000.	
3	C	Bioavailability and Transport of Hydrocarbons in the Near Shore Water Column	NOAA/NMFS/ADEC	29300.	
4	C	Fate and Toxicity of EVOS Oil	NOAA	160000.	
5	C	Injury to Shrimp	ADF&G	80000.	
6	C	Injury to Rockfish	ADF&G	25000.	
7	C	Injury to Demersal Fishes	NMFS	66000.	
7	C	Injury to Demersal Fish	NOAA/ADF&G	0.	
8	C	Mussel Tissue and Sediment Hydrocarbon Data Synthesis	NOAA/NMFS	90000.	

Proposed Project Overview
Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

ProjID		Title	Sponsor	OY4 Cost	Recommendation
Salmon					
1	E	Salmon Spawning Area Injury	ADF&G	0.	
2	E	Eggs/Pre-Emergent Fry Sampling	ADF&G	0.	
27	E	Sockeye Salmon Overescapement	ADF&G	0.	
28	E	Run Reconstruction	ADF&G	0.	
3	E	Coded-Wire Tag Recovery and Analysis	ADF&G	0.	
4	E	Early Marine Salmon Injury	ADF&G	0.	
7	E	Salmon Spawning Area Injury Outside PWS (LCI?)	ADF&G	0.	
8	E	Egg and Pre-Emergent Fry Sampling, Outside PWS (LCI?)	ADF&G	0.	
F/S-4	E	Effects of Oil Contamination on Juvenile Pink Salmon in PWS	NOAA/NMFS	188000.	

Proposed Project Overview

Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

ProjID		Title	Sponsor	OY4 Cost	Recommendation
Herring/Dolly Varden					
11	F	Herring Injury	ADF&G	0.	
5	F	Dolly Varden Injury	ADF&G	0.	
7	F	Technical Support Study for Restoration of Dolly Varden and Cutthroat Trout	ADF&G	280000.	

Proposed Project Overview
Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

ProjID		Title	Sponsor	OY4 Cost	Recommendation
Archeology					
Arch. 1	G	Archaeological Survey	USFS/DNR	247000.	

Proposed Project Overview

Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

ProjID		Title	Sponsor	OY4 Cost	Recommendation
Killer Whales					
1	I	Effects of EVOS on Distribution and Abundance of Humpback Whales in PWS	NOAA/NMFS/NMML	15000.	
2	I	Assessment of Injuries to Killer Whales in PWS, Kodiak Archipelago, SE AK	NOAA/NMFS/NMML	35000.	

Proposed Project Overview
Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

ProjID		Title	Sponsor	OY4 Cost	Recommendation
Harbor Seals					
5	J	Assessment of Injury to Harbor Seals	ADF&G/NOAA	0.	

Proposed Project Overview
Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

ProjID		Title	Sponsor	OY4 Cost	Recommendation
Sea Otters					
6	K	Assessment of Magnitude/Extent/Duration of Oil Spill Impacts on Sea Otters	FWS	200000.	
TM3	K	Assessment of the effects of the EVOS on River Otter and Mink in PWS	ADF&G	183.	

Proposed Project Overview
Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

ProjID		Title	Sponsor	OY4 Cost	Recommendation
30	P	Database Management	ADF&G	0.	

Proposed Project Overview

Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

ProjID		Title	Sponsor	OY4 Cost	Recommendation
13	Q	Clam Injury	ADF&G	77000.	
16	Q	Injury to Oysters	NOAA	6000.	

Proposed Project Overview

Project ID is defined by "Proposed Projects Recieved by RPWG Nov.1991"

ProjID		Title	Sponsor	OY4 Cost	Recommendation
1	R	Hydrocarbon Support Services and Analysis of Distribution/Weathering of Oil	NOAA	600000.	
1	R	Hydrocarbon Analytical Support Services	FWS	150000.	
3	R	GIS Mapping	DNR/USFWS	0.	
3	R	GIS Mapping and Analysis of Damage Assessment Data	FWS	100000.	

Contracts Database

Contract master

ID#	Title	Project Officer	Funding Type	Amount	Start Date	End Date	Products/Schedule	Reporting Req.	Draft Report	Final Report
DW15957003-01-1	Peer Review	Brian Ross	IAG	20000.	07/01/90	09/30/91	Provide peer review on request			
DW14957002-01-0	Forage Fish	Brian Ross	IAG	36500.	06/01/90	09/30/91	Complete report on the success of the pilot project by 9/30/90; complete report on the success of the creation of the databank by 9/30/90	None		
DW15957020-01-0	Office Space	Brian Ross	IAG	23760.	12/01/90	11/30/91	N/A	N/A		
DW12957033-01-0	Monitoring	Steve Bugbee	IAG	176085.	06/01/91	09/30/92				
DW14957030-01-0	Oystercatche	Steve Bugbee	IAG	60000.	05/25/91	05/31/92	draft report - 11/29/91; final report 2/29/92	None	11/29/91	02/29/92
68D00089:WA#9	Workshop Sum	Diane Boquist	procure	22727.	07/31/91	09/30/91	2 day workshop in Anchorage (8/1-2/91); draft workshop summary report - 8/26/91; final draft workshop summary report - 9/22/91; draft marine habitat synthesis report - 9/22/91	monthly progress reports	08/26/91	09/22/91
DW129570390101D	Habitat Prot	Steve Bugbee	IAG	41000.	08/01/91	12/31/91	The Nature Conservancy Final Habitat Protection Report due 12/91; Moss Landing Field Report on (Fucus) Herring Bay site visit due 12/91	None		12/31/91

Contracts Database

ID#	Title	Project Officer	Funding Type	Amount	Start Date	End Date	Products/Schedule	Reporting Req.	Draft Report	Final Report
DW15957003-01-1	Peer Review	Brian Ross	IAG	20000.	07/01/90	09/30/91	Provide peer review on request			
DW14957002-01-0	Forage Fish	Brian Ross	IAG	36500.	06/01/90	09/30/91	Complete report on the success of the pilot project by 9/30/90; complete report on the success of the creation of the databank by 9/30/90	None		
DW15957020-01-0	Office Space	Brian Ross	IAG	23760.	12/01/90	11/30/91	N/A	N/A		
DW12957033-01-0	Monitoring	Steve Bugbee	IAG	176885.	06/01/91	09/30/92				
DW14957030-01-0	Oystercatche	Steve Bugbee	IAG	60000.	05/25/91	05/31/92	draft report - 11/29/91; final report 2/29/92	None	11/29/91	02/29/92
68D00089:WA#9	Workshop Sum	Diane Boquist	procure	22727.	07/31/91	09/30/91	2 day workshop in Anchorage (8/1-2/91); draft workshop summary report - 8/26/91; final draft workshop summary report - 9/22/91; draft marine habitat synthesis report - 9/22/91	monthly progress reports	08/26/91	09/22/91
DW12957039010ID	Habitat Prot	Steve Bugbee	IAG	41000.	08/01/91	12/31/91	The Nature Conservancy Final Habitat Protection Report due 12/91; Moss Landing Field Report on (Fucus) Herring Bay site visit due 12/91	None		12/31/91

Contracts Database

ID#	Title	Project Officer	Funding Type	Amount	Start Date	End Date	Products/Schedule	Reporting Req.	Draft Report	Final Report
X817765-01-0	Assistance f	Janet Pawlukiewi	grant	15250.	09/30/90	09/30/91	Audio tapes due 10/91; tanker route map due 10/91; handouts due 10/91	Content/design report due 3/91; components report due 10/91; ann. rpt. on exhibition circ. on 10/91		
X000556-01-0	Lit. Synthes	John Armstrong	grant	54806.	06/04/91	12/31/91	Draft report due August 1991; final report due October 1991	None	08/31/91	10/31/91
X000554-01-0	Recovery of	John Armstrong	grant	44894.	05/31/91	11/15/91	Draft report due October 1991; final report due December 1991	None	10/31/91	12/31/91
68-C80006	Assessment	John Armstrong	contract	263300.			Survey of injured tidal marshes in PWS and Gulf of AK; recommendations on restoration measures for identified marshes; ecological site assessment work for PWS	Unk.		
DW12957003-01-2	Support Pers	Steve Bugbee	IAG	280000.	07/19/91	09/30/92	Support of ecologists positions for RPWG; peer review support for RPWG	Monthly reports to project officer		
DW15957020-01-1	Support	Steve Bugbee	IAG	134760.	07/15/91	09/30/92	Provide technical support personnel to RPWG; provide office space to RPWG	monthly reports to project officer		
DW14957043-01-0	Education	Steve Bugbee	IAG	20000.	09/01/91	09/30/92				
DW13957045-01-0	Monitoring	Steve Bugbee	IAG	61400.	09/01/91	09/30/92	Environmental consultant/comprehensive monitoring plan, mid-92; monitoring workshop and summary document early '92	Quarterly progress reports to project officer		

Contracts Database

ID#	Title	Project Officer	Funding Type	Amount	Start Date	End Date	Products/Schedule	Reporting Req.	Draft Report	Final Report
DW15957003-01-1	Peer Review	Steve Bugbee	IAG	100000.	07/01/90	09/30/91	Peer reviewers for RPWG	Monthly reports to project officer		
X-000554-01-0	Ecosystems	John Armstrong	sub-con.	21731.	06/01/91	11/01/91	Draft report due October 1991; final report due December 1991	Progress report - August 1991		
DW12957001-01-0	Fucus	Brian Ross	IAG	80000.	06/01/90	05/30/91	Draft report on 1st year results of field experiments on Fucus reestablishment; final report on 1st year results of field experiments on Fucus reestablishment	draft and final reports	11/30/90	12/31/91

EPA CONTRACTS

1. Restoration of <u>Fucus</u> Communities in Prince William Sound, Alaska

2. "Exxon Valdez Oil Spill: Peer Review for the Restoration Planning Efforts

3. Distribution and Abundance of Forage Fish in Relation to Marine Birds and Marine Mammals: Pilot Project and Development of a Beach Survey Database

4. Exxon Oil Spill: Leasing Office Space for the Restoration Planning Work Group

5. Exxon Valdez - Prince William Sound Shoreline Monitoring Program

6. Feeding Ecology and Reproductive Success of Black Oystercatchers in the Prince William Sound

7. Workshop and Workshop Summary Report for Oil Spill Restoration Scoping in Alaska National Environmental Policy Act

8. Fish and Wildlife Habitat Protection

9. Darkened Waters, a Traveling Exhibition, Outreach Assistance for the Environmental Protection Agency, Exxon Valdez Oil Spill Response and Restoration

10. Oil Spill Recovery: Review and Synthesis of Recovery Literature

11. Recovery of Marine Ecosystems from Natural and Man-induced Purturbations: Mammals, Subtidal and Intertidal Invertebrates, Macrophytes, Wetland Vegetation

12. Ecological Site Assessment Work for Prince William Sound

13. Exxon Valdez Oil Spill: Ecologist and Support Personnel for Restoration Planning Efforts

14. Exxon Valdez Oil Spill: Support to Restoration Planning Group

15. Exxon Valdez Oil Spill: Educate the Public on Ways to Help Induced Natural Resources

16. Comprehensive and Integrated Monitoring Plan for the Exxon Valdez Oil Spill Area

17. Exxon Valdez Oil Spill: Peer Review for the Restoration Planning Efforts

18. Recovery of Marine Ecosystems from Natural and Man-induced

Perturbations: Mammals, Subtidal and Intertidal Invertebrates, Macrophytes, Wetland Vegetation

ID #: DW12957001-01-0

PROJECT TITLE: RESTORATION OF <u>FUCUS</u> COMMUNITIES IN PRINCE WILLIAM SOUND, ALASKA

PROJECT OFFICER: BRIAN ROSS

TYPE FUNDING: IAG

AMOUNT: $80,000

OTHER AGENCY/PROJECT OFFICER: USFS/DAVE GIBBONS (907/871-8784)

BUDGET PERIOD: 6/1/90 - 5/30/91

PRODUCTS/SCHEDULE: DRAFT REPORT ON FIRST YEAR RESULTS OF FIELD EXPERIMENTS ON <u>FUCUS</u> REESTABLISHMENT. DUE 11/90.

FINAL REPORT ON FIRST YEAR RESULTS OF FIELD EXPERIMENTS ON <u>FUCUS</u> REESTABLISHMENT. DUE 12/91.

REPORTING REQUIREMENTS: DRAFT AND FINAL REPORTS

COMMENTS: USFS HAS GRANTED A NO COST EXTENSION FOR FINAL REPORT

ID #: DW15957003-01-1

PROJECT TITLE: "EXXON VALDEZ OIL SPILL: PEER REVIEW FOR THE RESTORATION PLANNING EFFORTS".

PROJECT OFFICER: BRIAN ROSS

TYPE FUNDING: IAG

AMOUNT: $20,000

OTHER AGENCY/PROJECT OFFICER: DOJ/GARY FISHER (202/514-3637)

BUDGET PERIOD: 7/1/90 - 9/30/91

PRODUCTS/SCHEDULE: PROVIDE PEER REVIEW ON REQUEST

REPORTING REQUIREMENTS:

COMMENTS:

ID #: DW14957002-01-0

PROJECT TITLE: DISTRIBUTION AND ABUNDANCE OF FORAGE FISH IN RELATION TO MARINE BIRDS AND MARINE MAMMALS: PILOT PROJECT AND DEVELOPMENT OF A BEACH SURVEY DATABASE.

PROJECT OFFICER: BRIAN ROSS

TYPE FUNDING: IAG

AMOUNT: $36,500

OTHER AGENCY/PROJECT OFFICER: USFWS/DAVE IRONS (907/786-3376)

BUDGET PERIOD: 6/1/90 - 9/30/91

PRODUCTS/SCHEDULE: COMPLETE REPORT ON THE SUCCESS OF THE PILOT PROJECT BY 9/30/90

COMPLETE REPORT ON THE SUCCESS OF THE CREATION OF THE DATABANK BY 9/30/90

REPORTING REQUIREMENTS: NONE

COMMENTS: RPWG HAS RECEIVED REPORTS

ID #: DW15957020-01-0

PROJECT TITLE: EXXON OIL SPILL: LEASING OFFICE SPACE FOR THE RESTORATION PLANNING WORK GROUP.

PROJECT OFFICER: BRIAN ROSS

TYPE FUNDING: IAG

AMOUNT: $23,760

OTHER AGENCY/PROJECT OFFICER: DOJ/LISA POLISAR (202/272-6259)

BUDGET PERIOD: 12/1/90 - 11/30/91

PRODUCTS/SCHEDULE: N/A

REPORTING REQUIREMENTS: N/A

COMMENTS: LEASE WILL NOT BE RENEWED, RPWG MOVING TO SIMPSON BLDG.

ID #: DW12957033-01-0

PROJECT TITLE: EXXON VALDEZ - PRINCE WILLIAM SOUND SHORELINE MONITORING PROGRAM

PROJECT OFFICER: STEVE BUGBEE

TYPE FUNDING: IAG

AMOUNT: $176,885

OTHER AGENCY/PROJECT OFFICER: NOAA/JEAN SNIDER (202/267-0418)

BUDGET PERIOD: 6/1/91 - 9/30/92

PRODUCTS/SCHEDULE:

REPORTING REQUIREMENTS:

COMMENTS: ORIGINAL IAG (6/91) FOR $100K, AMENDED (9/91) TO INCREASE OF $176,885.

ID #: DW14957030-01-0

PROJECT TITLE: FEEDING ECOLOGY AND REPRODUCTIVE SUCCESS OF BLACK OYSTERCATCHERS IN THE PRINCE WILLIAM SOUND

PROJECT OFFICER: STEVE BUGBEE

TYPE FUNDING: IAG

AMOUNT: $60,000

OTHER AGENCY/PROJECT OFFICER: USFWS/CAROL GORBICS (907/786-3494)

BUDGET PERIOD: 5/25/91 - 5/31/92

PRODUCTS/SCHEDULE: DRAFT REPORT - 11/29/91

FINAL REPORT - 2/29/92

REPORTING REQUIREMENTS: NONE

COMMENTS: PRINCIPAL INVESTIGATOR PRESENTED PRELIMINARY 1991 FIELD RESULTS TO RPWG 8/91.

ID #: 68D00089 : WA#9

PROJECT TITLE: WORKSHOP AND WORKSHOP SUMMARY REPORT FOR OIL SPILL RESTORATION SCOPING IN ALASKA NATIONAL ENVIRONMENTAL POLICY ACT

PROJECT OFFICER: DIANE BOQUIST (399-4011)

TYPE FUNDING: PROCUREMENT REQUEST/ORDER FOR EXTRAMURAL CONTRACT

AMOUNT: $22,727

OTHER AGENCY/PROJECT OFFICER: JONES AND STOKES ASSOCIATES/DAVE DESVOIGUE (206/822-1077)

BUDGET PERIOD: 7/91 - 9/91

PRODUCTS/SCHEDULE: 2 DAY WORKSHOP IN ANCHORAGE (8/1-2/91)

DRAFT WORKSHOP SUMMARY REPORT - 8/26/91

FINAL DRAFT WORKSHOP SUMMARY REPORT - 9/22/91

DRAFT MARINE HABITAT SYNTHSIS REPORT - 9/22/91

REPORTING REQUIREMENTS: MONTHLY PROGRESS REPORTS

COMMENTS: WA#9 AMENDED FOR ADDITIONAL FUNDS ($4,155) TO COMPLETE PROJECT.

WA#10 AMENDED FOR ADDITIONAL FUNDS ($3322) FOR PRINTING

ID#: DW12957039-01-0ID

PROJECT TITLE: FISH AND WILDLIFE HABITAT PROTECTION

PROJECT OFFICER: STEVE BUGBEE

TYPE FUNDING: IAG

AMOUNT: $41,000

OTHER AGENCY/PROJECT OFFICER: USFS/KEN RICE (907/278-8012)

BUDGET PERIOD: 8/1/91 - 12/31/91

PRODUCTS/SCHEDULE: THE NATURE CONSERVANCY FINAL HABITAT PROTECTION REPORT DUE 12/91

MOSS LANDING FIELD REPORT ON (FUCUS) HERRING BAY SITE VISIT DUE 12/91

REPORTING REQUIREMENTS: NONE

COMMENTS: FIELD REPORT WILL BE INCORPORATED IN FINAL REPORT UNDER IAG # DW1295700-01-0 (RESTORATION OF FUCUS COMMUNITIES IN PRINCE WILLIAM SOUND, ALASKA.

ID #: X817765-01-0

PROJECT TITLE: DARKENED WATERS, A TRAVELING EXHIBITION, OUTREACH ASSISTANCE FOR THE ENVIRONMENTAL PROTECTION AGENCY, EXXON VALDEZ OIL SPILL RESPONSE AND RESTORATION

PROJECT OFFICER: JANET PAWLUKIEWICZ

TYPE FUNDING: GRANT

AMOUNT: $15,250

OTHER AGENCY/PROJECT OFFICER: HOMER SOCIETY OF NATURAL HISTORY, PRATT MUSEUM/BETSY PITZMAN (907/235-8635)

BUDGET PERIOD: 9/30/90 - 9/30/91

PRODUCTS/SCHEDULE: AUDIO TAPES DUE 10/91

TANKER ROUTE MAP DUE 10/91

HANDOUTS DUE 10/91

REPORTING REQUIREMENTS: CONTENT AND DESIGN REPORT DUE 3/91

ADDITIONAL COMPONENTS REPORT DUE 10/91

ANNUAL REPORT ON EXHIBITION CIRCULATION BEGINNING 10/91

COMMENTS:

ID #: X000556-01-0

PROJECT TITLE: OIL SPILL RECOVERY: REVIEW AND SYNTHESIS OF RECOVERY LITERATURE

PROJECT OFFICER: JOHN ARMSTRONG

TYPE FUNDING: GRANT

AMOUNT: $54,806

OTHER AGENCY/ PROJECT OFFICER: UNIVERSITY OF WASHINGTON, FISHERIES RESEARCH INST./THOMAS SIBLEY (206/543-4257)

BUDGET PERIOD: 6/4/91 - 12/31/91

PRODUCTS/SCHEDULE: DRAFT REPORT DUE AUGUST 1991

FINAL REPORT DUE OCTOBER 1991

REPORTING REQUIREMENTS: NONE

COMMENTS: DUE TO LATE START, FINAL REPORT NOW DUE DECEMBER 1991

ID #: X000554-01-0

PROJECT TITLE: RECOVERY OF MARINE ECOSYSTEMS FROM NATURAL AND MAN-INDUCED PURTURBATIONS: MAMMALS, SUBTIDAL AND INTERTIDAL INVERTEBRATES, MACROPHYTES, WETLAND VEGETATION

PROJECT OFFICER: JOHN ARMSTRONG

TYPE FUNDING: GRANT

AMOUNT: $44,894

OTHER AGENCY/PROJECT OFFICER: HUBBS-SEA WORLD RESEARCH INSTITUTE/ JOE JEHL (619/226-3870)

BUDGET PERIOD: 5/31/91 - 11/15/91

PRODUCTS/SCHEDULE: DRAFT REPORT DUE OCTOBER 1991

FINAL REPORT DUE DECEMBER 1991

REPORTING REQUIREMENTS: NONE

COMMENTS: HSWRI SUBCONTRACTING WITH SAN DIEGO STATE UNIV. FOR INTERTEBRATE AND VEGETATION REPORTS

ID #: 68-C80006

PROJECT TITLE: ECOLOGICAL SITE ASSESSMENT WORK FOR PRINCE WILLIAM SOUND

PROJECT OFFICER: JOHN ARMSTRONG

TYPE FUNDING: INCREMENTAL TO EXTRAMURAL CONTRACT

AMOUNT: $263,300

OTHER AGENCY/PROJECT OFFICER: ORD/CORVALLIS/CHARLES FRANK (FTS 420-4651)

BUDGET PERIOD: UNK

PRODUCTS/SCHEDULE: SURVEY OF INJURED TIDAL MARSHES IN PRINCE WILLIAM SOUND AND GULF OF ALASKA

RECOMMENDATIONS ON RESTORATION MEASURES FOR IDENTIFIED MARSHES

ECOLOGICAL SITE ASSESSMENT WORK FOR PRINCE WILLIAM SOUND

REPORTING REQUIREMENTS: UNK

COMMENTS: NEED FOLLOWUP WORK WITH CORVALLIS TO DOCUMENT PRODUCTS, ETC.

ID #: DW12957003-01-2

PROJECT TITLE: EXXON VALDEZ OIL SPILL: ECOLOGIST AND SUPPORT PERSONNEL FOR RESTORATION PLANNING EFFORTS

PROJECT OFFICER: STEVE BUGBEE

TYPE FUNDING: IAG

AMOUNT: $280,000

OTHER AGENCY/PROJECT OFFICER: DOJ/LISA POLISAR (202/272-6759)

BUDGET PERIOD: 7/19 - 9/30/92

PRODUCTS/SCHEDULE: SUPPORT OF ECOLOGISTS POSITIONS FOR RPWG

PEER REVIEW SUPPORT FOR RPWG

REPORTING REQUIREMENTS: MONTHLY REPORTS TO PROJECT OFFICER

COMMENTS: PRIOR APPROVAL FROM PROJECT OFFICER REQUIRED FOR TRAVEL BY RPWG CONTRACT STAFF AND PEER REVIEWERS FOR RPWG.

ID #: DW15957020-01-1

PROJECT TITLE: EXXON VALDEZ OIL SPILL: SUPPORT TO RESTORATION PLANNING GROUP

PROJECT OFFICER: STEVE BUGBEE

TYPE FUNDING: IAG

AMOUNT: $134,760

OTHER AGENCY/PROJECT OFFICER: DOJ/LISA POLISAR (202/272-6259)

BUDGET PERIOD: 7/15/91 - 9/30/92

PRODUCTS/SCHEDULE: PROVIDE TECHNICAL SUPPORT PERSONNEL TO RPWG

PROVIDE OFFICE SPACE TO RPWG

REPORTING REQUIREMENTS: MONTHLY REPORTS TO PROJECT OFFICER

COMMENTS: PRIOR APPROVAL FROM PROJECT OFFICER REQUIRED FOR RPWG CONTACT TECHNICAL SUPPORT STAFF TRAVEL.

ID #: DW14957043-01-0

PROJECT TITLE: EXXON VALDEZ OIL SPILL: EDUCATE THE PUBLIC ON WAYS TO HELP INJURED NATURAL RESOURCES

PROJECT OFFICER: STEVE BUGBEE

TYPE FUNDING: IAG

AMOUNT: $20,000

OTHER AGENCY/PROJECT OFFICER: USNPS/SANFORD RABINOWITCH (907/257-2653)

BUDGET PERIOD: 9/1/91 - 9/30/92

PRODUCTS/SCHEDULE:

REPORTING REQUIREMENTS:

COMMENTS: NEED TO CONTACT NPS FOR REVISED PRODUCTS/SCHEDULE

ID #: DW13957045-01-0

PROJECT TITLE: COMPREHENSIVE AND INTEGRATED MONITORING PALN FOR THE EXXON VALDEZ OIL SPILL AREA

PROJECT OFFICER: STEVE BUGBEE

TYPE FUNDING: IAG

AMOUNT: $61,400

OTHER AGENCY/PROJECT OFFICER: NOAA/JOHN STRAND (907/789-6601)

BUDGET PERIOD: 9/1/91 - 9/30/92

PRODUCTS/SCHEDULE: ENVIRONMENTAL CONSULTANT/COMPREHENSIVE MONITORING PLAN, MID-92

MONITORING WORKSHOP AND SUMMARY DOCUMENT, EARLY 92

REPORTING REQUIREMENTS: QUARTERLY PROGRESS REPORTS TO PROJECT OFFICER

COMMENTS:

ID #: DW15957003-01-1

PROJECT TITLE: EXXON VALDEZ OIL SPILL: PEER REVIEW FOR THE RESTORATION PLANNING EFFORTS

PROJECT OFFICER: STEVE BUGBEE

TYPE FUNDING: IAG

AMOUNT: $100,000

OTHER AGENCY/PROJECT OFFICER: DOJ/CHRISTINA GARDNER (202/272-6702)

BUDGET PERIOD: 7/1/90 - 9/30/91

PRODUCTS/SCHEDULE: PEER REVIEWERS FOR RPWG

REPORTING REQUIREMENTS: MONTHLY REPORTS TO PROJECT OFFICER

COMMENTS: PRIOR APPROVAL FROM PROJECT OFFICER REQUIRED FOR RPWG PEER REVIEW TRAVEL

ID #: X-000554-01-0

PROJECT TITLE: RECOVERY OF MARINE ECOSYSTEMS FROM NATURAL AND MAN-INDUCED PERTURBATIONS: MAMMALS, SUBTIDAL AND INTERTIDAL INVERTEBRATES, MACROPHYTES, WETLAND VEGETATION

PROJECT OFFICER: JOHN ARMSTRONG

TYPE FUNDING: SUBCONTRACT WITH HUBBS-SEAWORLD RESEARCH INSTITUTE

AMOUNT: $21,731

OTHER AGENCY/PROJECT OFFICER: SAN DIEGO STATE UNIV./JOHN BOLAND (619/594-7422)

BUDGET PERIOD: 6/1/91 - 11/1/91

PRODUCTS/SCHEDULE: DRAFT REPORT DUE OCTOBER 1991
FINAL REPORT DUE DECEMBER 1991

REPORTING REQUIREMENTS: PROGRESS REPORT AUGUST 1991

COMMENTS: SDSU WORKING UNDER NO COST EXTENSION TO REWORK FINAL REPORT

A
Birds

11
12
14
↓
24
34
35
36
38

K
Sea Otters

6
↓
9
68
69

E
Salmon

39
40
42
46
53
59
61
62
63
45

F
Herring/Dolly Varden

57
58
44

~~B~~ L
Boat Survey

K
13

D
mussel beds

76
81

~~H~~ H
Habitat

33
47

B
Coastal Habitat

67
5
65
70
79
84

C
Subtidal

4
32
48
49
50
51
52
54
55
~~*~~74
75
77
78
83

N
Implementation

1
37
41
43
3
66

O
Deferred to 1993+

25
↓
31

G
Archaeology

2
72

M
Recreation

64

I
Killer Whale

82

J
Harbor Seals

~~Progress Reports~~

4
5
6

progress reports A

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One) Cont	Cont/Mod	Discon
Marine Mammals	1	Effects of the EXXON-VALDEZ oil spill on the distribution and abundance of Humpback Whales in Prince William Sound, Southeast Alaska and the Kodiak Archipelago	NOAA/ NMFS/ NMML			

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$226.0K	$226.0K	$92.0K	$92.0K

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
Project Terminated		$15.0K

SUMMARY OF MAJOR MODIFICATIONS
No field work requested during 1992 under NRDA. The focus of the 1992 work will be to complete data analysis and produce a final report.

RELEVANCE TO RESTORATION
No restoration project is being considered.

JUSTIFICATION FOR RECOMMENDATION
A final report summarizing our two-year investigations on humpback whales under NRDA is warranted. This opportunity will permit us to evaluate all aspects of the study and have a final report readily available for distribution.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
Marine Mammals	2	Assessment of Injuries to Killer Whales in Prince William Sound, Kodiak Archipelago, and Southeast Alaska.	NOAA/ NMFS/ NMML			

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$200.0K	$200.0K	$255.8K	$255.8K

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$186.0K	$186.0K	Request $35.0K

SUMMARY OF MAJOR MODIFICATIONS
No field work requested during 1992 under NRDA. The focus of the 1992 work will be to complete data analysis and produce a final report.

RELEVANCE TO RESTORATION
A complete analysis and a final report summarizing our damage assessment work are required to enhance restoration investigations.

JUSTIFICATION FOR RECOMMENDATION
A final report summarizing our three-year investigations of killer whale damage assessment work is warranted. This opportunity will permit us to evaluate all aspects of the study.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One) Cont	Cont/Mod	Discont
Marine Mammals	5	Assessment of injury to Harbor Seals	ADF&G NOAA			X

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$245.0	$36.6	$159.3	*$134.4

* NOAA Contractual Problems; All State Funded

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$94,200	$85.9	-0-

SUMMARY OF MAJOR MODIFICATIONS
Essentially, assessment work is completed and a restoration field study has started. A final study report will be completed by February 1992 and no further funding for assessment work should be required for oil year 4.

RELEVANCE TO RESTORATION
Information and data from the assessment of Injured Harbor Seal Study have been formulated to make recommendations regarding restoration of lost use, populations, and habitat where injury is identified. The Harbor Seal Restoration Field Study has augmented these findings and techniques of radio collaring are being evaluated for monitoring feasibility.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
NRDA Marine Mammal	6	Assessment of Magnitude, Extent, and Duration of Oil Spill Impacts on Sea Otters	FWS			XX

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
MM6 - $ 163K MM7 - $ 108K	MM6 - $ 362K MM7 - $ 171K	MM6 - $1105K MM7 - $ 147K	MM6 - $1113K MM7 - $ 139K

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
MM6 - $ 911K MM7 added to MM6	MM6 - $780K	$200K -FWS Preliminary close-out Estimate

SUMMARY OF MAJOR MODIFICATIONS

Not Applicable.

RELEVANCE TO RESTORATION

The preparation of final reports will be essential for understanding the injuries the spill caused to sea otters. If this information is not clearly and completely available to those responsible for restoration, it will not be possible to adequately address the restoration needs of the resource.

JUSTIFICATION FOR RECOMMENDATION

It is recommended that this study be discontinued under NRDA and be funded for close-out. Close-out activities include final data analysis and final report preparation.

Certain elements of this study are recommended for continuation under the 1992 Restoration Program. If the sea otter restoration study is fully approved and funded under Restoration, close-out fund requirements would be reduced.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
Terrest. Mammal	TM 3	Assessment of the effects of the EVOS on River Otter and Mink in Prince William Sound	ADF&G		X	

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$287.7	$260.3	$347.6	$216.2

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$404.1	$428.0 *	$183.7

SUMMARY OF MAJOR MODIFICATIONS
This project will be live trap additional male otters during the breeding season in the Spring of 1992. Preliminary analysis has identified significant differences in body size and blood haptoglobin levels of river otters between oiled and un-oiled habitats. Analysis of 1991 field data is unfinished and needs to be completed in 1992.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
NRDA Bird Study	1	An Assessment of Damage to Seabirds in PWS and the Western GOA from EVOS	FWS			XXX

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$ 258K	$ 135K	$ 598K	$ 580K

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$ 210K	$ 69K	-0-

SUMMARY OF MAJOR MODIFICATIONS

This study is recommended to be discontinued. A final report was prepared in June 1991 by Environmental Consultants, Incorporated. DOJ has been advised that all deliverables have been received and are satisfactory. DOJ has been advised that FWS will no longer participate in this contract.

RELEVANCE TO RESTORATION

Not applicable.

JUSTIFICATION FOR RECOMMENDATION

Due to the end of litigation, there is no longer any need to continue the evaluation of total numbers of seabirds lost as a result of the spill. However, the disposition of the dead birds, otters and other mammals must be addressed by the Management Team and Trustee Council as soon as possible. It costs approximately $70,000 per year to maintain the freezer trailers and keep the specimens.

IMPACT OF REDUCED FUNDING ON CONTINUING PROJECTS

Not applicable.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
NRDA Bird Study	2	Boat Surveys to Determine Distribution and Abundance of Migratory Birds and Sea Otters in PWS	FWS			XXX

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
	$ 339K	$ 357K	$ 280K

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$ 220K	$ 184K	$60K - FWS Preliminary close-out Estimate

SUMMARY OF MAJOR MODIFICATIONS
Not applicable.

RELEVANCE TO RESTORATION
The preparation of final reports will be essential for understanding the injuries the spill caused to marine birds and sea otters. If this information is not clearly and completely available to those responsible for restoration, it will not be possible to adequately address the needs of the resource.

JUSTIFICATION FOR RECOMMENDATION
It is recommended that this study be discontinued under NRDA and be funded for close-out. Close-out activities include final data analysis and final report preparation. Portions of this study are recommended for continuation under the 1992 Restoration Program. If it is fully approved and funded under Restoration, close-out fund requirements would be reduced.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
NRDA Bird Study	3	Population Surveys of Seabird Colonies in the Spill Area (Murres)	FWS			XXX

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$ 440K	$ 236K	$ 251K	$ 265K

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$ 530K	$ 343K	$ 125K - FWS Preliminary close-out Estimate

SUMMARY OF MAJOR MODIFICATIONS

Not applicable.

RELEVANCE TO RESTORATION

The preparation of final reports will be essential for understanding the injuries the spill caused to murres and other colony breeders. If this information is not clearly and completely available to those responsible for restoration, it will not be possible to adequately address the restoration needs of the resource.

JUSTIFICATION FOR RECOMMENDATION

It is recommended that this study be discontinued under NRDA and be funded for close-out. Close-out activities include final data analysis and final report preparation.

Portions of this study are recommended for continuation under the 1992 Restoration Program. If it is fully approved and funded under Restoration, close-out fund requirements would be reduced.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
NRDA Bird Study	4	Assessing the Effects of EVOS on bald eagles	FWS			XXX

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$ 445K	$ 250K	$ 675K	$ 693K

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$ 255K	$ 185K	$ 75K - FWS Preliminary close-out Estimate

SUMMARY OF MAJOR MODIFICATIONS

Not applicable.

RELEVANCE TO RESTORATION

The preparation of final reports will be essential for understanding the injuries the spill caused to bald eagles. If this information is not clearly and completely available to those responsible for restoration, it will not be possible to adequately address the restoration needs of the resource.

JUSTIFICATION FOR RECOMMENDATION

It is recommended that this study be discontinued under NRDA and be funded for close-out. Close-out activities include final data analysis and final report preparation.

Certain elements of this study are recommended for continuation under the 1992 Restoration Program. If the bald eagle restoration study is fully approved and funded under Restoration, close-out fund requirements would be reduced.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
NRDA Bird Study	6	Assessment of the Abundance of Marbled Murrelets at Sites along the Kenai Peninsula and PWS	FWS			XXX

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$115.7K	$ 93K	-0-	-0-

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
-0-	-0-	$ 18K - FWS Preliminary close-out Estimate

SUMMARY OF MAJOR MODIFICATIONS
Not applicable.

RELEVANCE TO RESTORATION
The preparation of final reports will be essential for understanding the injuries the spill caused marbled murrelets. If this information is not clearly and completely available to those responsible for restoration, it will not be possible to adequately address the restoration needs of the resource.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One) Cont	Cont/Mod	Discont
NRDA Bird Study	7	Assessment of the Effects of Petroleum Hydrocarbons on Reproductive Success of the Fork-Tailed Storm Petrel	FWS			XXX

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$135K	$ 92K	-0-	-0-

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
-0-	-0-	$ 5K FWS Prelim. Estimate

SUMMARY OF MAJOR MODIFICATIONS
Not applicable.

RELEVANCE TO RESTORATION
The preparation of final reports will be essential for understanding the injuries the spill caused storm petrels. If this information is not clearly and completely available to those responsible for restoration, it will not be possible to adequately address the needs of the resource.

JUSTIFICATION FOR RECOMMENDATION
It is recommended that this study be discontinued under NRDA and be funded for close-out. Close-out activities include final data analysis and final report preparation.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
NRDA Bird Study	8	Assessment of Injuries to Reproductive Success of Black-legged Kittiwakes in PWS	FWS			XXX

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$190K	$299K	-0-	-0-

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
-0-	-0-	$ 5K- FWS Prelim. Estimate

SUMMARY OF MAJOR MODIFICATIONS

Not applicable.

RELEVANCE TO RESTORATION

The preparation of final reports will be essential for understanding the injuries the spill caused to black-legged kittiwakes. If this information is not clearly and completely available to those responsible for restoration, it will not be possible to adequately address the needs of the resource.

JUSTIFICATION FOR RECOMMENDATION

It is recommended that this study be funded for close-out. Close-out activities include final data analysis and final report preparation.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
NRDA Bird Study	9	Assessment of Injury to Waterbirds Based on the Population and Breeding Success of Pigeon Guillemots in PWS	FWS			XXX

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$ 109.5K	$ 49K	-0-	-0-

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
-0-	-0-	$ 18K - FWS Prelim. Estimate

SUMMARY OF MAJOR MODIFICATIONS
Not applicable.

RELEVANCE TO RESTORATION
The preparation of final reports will be essential for understanding the injuries the spill caused to pigeon guillemots. If this information is not clearly and completely available to those responsible for restoration, it will not be possible to adequately address the restoration needs of the resource.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One) Cont	Cont/Mod	Discont
NRDA Bird Study	11	Injury Assessment of Hydrocarbon Uptake by Sea Ducks in Prince William Sound	FWS			XXX

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$ 146K	$ 53.7K	$ 150K	$ 219.7K

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$ 177.2K	$ 100K	$ 75K- FWS Preliminary close-out Estimate (not coordinated with ADFG)

SUMMARY OF MAJOR MODIFICATIONS

Not applicable.

RELEVANCE TO RESTORATION

The preparation of final reports will be essential for understanding the injuries the spill caused to sea ducks including harlequin ducks. If this information is not clearly and completely available to those responsible for restoration, it will not be possible to adequately address the needs of the resource.

JUSTIFICATION FOR RECOMMENDATION

It is recommended that this study be discontinued under NRDA and be funded for close-out. Close-out activities include final data analysis and final report preparation.

Certain elements of this study are recommended for continuation under the 1992 Restoration Program. If the sea duck restoration study is fully approved and funded under Restoration, close-out fund requirements would be reduced.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One) Cont	Cont/Mod	Discont
NRDA Bird Study	12	Assessment of Injury to Shorebirds Staging and Nesting in PWS and the Kenai Peninsula	FWS			XXX

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$166K	$ 77K	-0-	-0-

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
-0-	-0-	$18 K - FWS Prelim. Estimate

SUMMARY OF MAJOR MODIFICATIONS
Not applicable.

RELEVANCE TO RESTORATION
The preparation of final reports will be essential for understanding the injuries the spill caused to shorebirds. If this information is not clearly and completely available to those responsible for restoration, it will not be possible to adequately address the restoration needs of the resource.

JUSTIFICATION FOR RECOMMENDATION
Close-out activities include final data analysis and final report preparation. Certain elements of this study are recommended for continuation under the 1992 Restoration Program. If the black oystercatcher restoration study is fully approved and funded under Restoration, close-out fund requirements would be reduced.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One) Cont	Cont/Mod	Discont
F/S	1	Salmon Spawning Area Injury	ADF&G		X	

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$144,800	$92,700	$391,500	

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$288,000		

SUMMARY OF MAJOR MODIFICATIONS

RELEVANCE TO RESTORATION

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
F/S	2	Eggs/Pre-Emergent Fry Sampling	ADF&G	X		

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$149,100	$72,200	$302,800	

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$259,000		

SUMMARY OF MAJOR MODIFICATIONS

RELEVANCE TO RESTORATION

JUSTIFICATION FOR RECOMMENDATION

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One) Cont	Cont/Mod	Discont
F/S	3	Coded-Wire Tag Recovery and Analysis	ADF&G		X	

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$1,943,400	$1,380,639	$1,990,000	

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$1,075,000		

SUMMARY OF MAJOR MODIFICATIONS

RELEVANCE TO RESTORATION

NOAA
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One): Cont	Cont/Mod	Discon
	F/S-4	Effects of oil contamination on juvenile pink salmon in Prince William Sound	NOAA/ NMFS		x	

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$238.5k project $ 50.0k vessel $288.5k total	212.5k 50.0k 262.5k	$250k project $150k vessel $400k total	$250k $150k $400k

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$172k	$172K	$ 78.0k continuation $110.0k new research $188.0k total

SUMMARY OF MAJOR MODIFICATIONS

(1) Continuation of on-going analyses:
Focus of this component is the completion and formal synthesis of results from field data collections, and the processing and analysis of samples generated from the 1991 ingestion experiment.

(2) New Research:
The OY-4 research would duplicate last year's work, using weathered oil instead of fresh oil for the 6 week exposure period. The oil would be "weathered" by removing the aromatics to a level consistent with weathered oil in PWS 4-6 weeks after the spill. The experiment would be streamlined by eliminating the holding of fish in isolation for gut evacuation as was done in 1991, thereby reducing weekly sample processing from 3 d to 2 d. The 4 week depuration phase would also be eliminated. The RNA/DNA assay would be dropped, and in its place we will consider ornithine decarboxylase (growth enzyme) as a measure of physiological response to exposure. The experiment would also include a short-term exposure to both fresh and weathered oil to determine the time lag for MFO induction; the preliminary read from the 1991 samples indicate that induction has occurred at 7 d, the shortest time interval sampled in 1991.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One) Cont	Cont/Mod	Discont
F/S	4	Early Marine Salmon Injury	ADF&G		X	

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$590,700	$209,700	$150,000	

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
ADF&G $136,400 NOAA $172,000		

SUMMARY OF MAJOR MODIFICATIONS

RELEVANCE TO RESTORATION

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One) Cont	Cont/Mod	Discont
F/S	5	Dolly Varden Injury	ADF&G	X		

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$437,400	$379,200	$290,000	

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$325,100		

SUMMARY OF MAJOR MODIFICATIONS

RELEVANCE TO RESTORATION

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One) Cont	Cont/Mod	Discont
F/S	7	Salmon Spawning Area Injury Outside PWS (LCI?)	ADF&G	X		

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$41,100(?)	$44,200(?)	$117,600(?)	

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$15,000*		

* This study is being funded for the completion of data analysis and final report preparation.

SUMMARY OF MAJOR MODIFICATIONS

RELEVANCE TO RESTORATION

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
F/S	8	Egg and Pre-Emergent Fry Sampling, Outside PWS (LCI?)	ADF&G		X	

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$15,700(?)	$31,400(?)	$71,000(?)	

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$15,000*		

* This study is being funded for the completion of data analysis and final report preparation.

SUMMARY OF MAJOR MODIFICATIONS

RELEVANCE TO RESTORATION

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
F/S	11	Herring Injury	ADF&G	X		

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$374,500	$466,300	$558,400	

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$558,000		

SUMMARY OF MAJOR MODIFICATIONS

RELEVANCE TO RESTORATION

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Disco
F/S	13	Clam Injury	ADF&G		X	

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$86,200	$57,600	$229,200	$200,100

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$147,000	$60,266	$77,000

SUMMARY OF MAJOR MODIFICATIONS

Discontinue field work in 1992. Continue aging portion of the study with IMS collecting length-at-age data from the 1991 transplant clams. Complete analysis of all length-at-age data (transect and transplant). Obtain assistance of TS1 personnel in interpreting hydrocarbon sample analyses completed to date. Continue analysis of histopathology samples for one additional group and analyze results. Cooperate with GIS study to develop final products depicting oiling, cleaning and sampling of beaches relevant to this study. Finish analyses and prepare a final report in Dec. 1992.

RELEVANCE TO RESTORATION

Will provide a final determination of damages which may influence the direction of or indicate the need for restoration activities.

NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One) Cont	Cont/Mod	Discont
F/S	16	Injury to Oysters	NOAA		xx	

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$ 30.3	$ 30.3	$ 0 K	$ 0 K

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$ 0 K	$ 0 K	$ 6 K

SUMMARY OF MAJOR MODIFICATIONS

N/A

RELEVANCE TO RESTORATION

N/A

JUSTIFICATION FOR RECOMMENDATION

The purpose of this proposal is to produce a Final Report. All samples have been analyzed for hydrocarbons. The data needs to be analyzed, interpreted and summarized. Oyster, like mussels, act as chemical surrogates in that they reflect what is present in the water column and available to other biota. The demonstration of hydrocarbon concentrations in oysters at 3 locations in PWS will assist in establishing a spatial and temporal pattern for the distribution of oil from *Exxon Valdez*.

IMPACT OF REDUCED FUNDING ON CONTINUING PROJECTS

N/A

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
F/S	27	Sockeye Salmon Overescapment	ADF&G	X		

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
N/A	N/A	$392,000	

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$334,300		

SUMMARY OF MAJOR MODIFICATIONS

RELEVANCE TO RESTORATION

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
F/S	28	Run Reconstruction	ADF&G	X		

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
N/A	N/A	$120,000	

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$175,100		

SUMMARY OF MAJOR MODIFICATIONS

RELEVANCE TO RESTORATION

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
F/S	30	Database Management	ADF&G	X		

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
N/A	N/A	$175,000	

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$175,800		

SUMMARY OF MAJOR MODIFICATIONS

RELEVANCE TO RESTORATION

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
Coastal Habitat	1B	Pre-spill and post-spill concentration of hydrocarbons in sediments and mussels in Prince William Sound and the Kenai Peninsula.	NOAA	xx		

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$ 128 K	$ 128 K	$ 160 K	$ 160 K

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$ 68 K	$ 68 K	$ 40 K

SUMMARY OF MAJOR MODIFICATIONS

This proposal is for only data analyses, data workup and interpretation and the production of a final report for the 3 years of the project. The field sampling and hydrocarbon analyses component of this study is being proposed for funding under the Restoration/Recovery Monitoring Phase.

RELEVANCE TO RESTORATION

This project has documented that levels of hydrocarbons in sediments and mussels in intertidal areas in Prince William Sound in 1989 but before impact of EVOS were similar to concentrations measured by an earlier NOAA/NMFS project (1977-1980) which established an hydrocarbon baseline for sediments and mussels for the same general geographical area. Subsequent sampling in 1989 and 1990 indicates some sites were impacted by Prudoe Bay crude oil. A final report for this study will provide data against which recovery and 'return to baseline levels' can be documented. This study does not directly measure injury but provides essential background data and is linked directly to other NRDA projects that are species oriented. This study also provides topographical continuity to sediment data generated by Subtidal Studies 1 and 3; and complements the large U.S.F.S. Coastal Habitat Study 1A.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
A/W	2b	Deep Water Benthos (UAF)	ADF&G		~~X~~	X

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
		$101.5	

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
Moved to Subtidal		80,000

SUMMARY OF MAJOR MODIFICATIONS

Finish analysis of 1991 field effort and prepare final report.

RELEVANCE TO RESTORATION

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
Subtidal	1	Hydrocarbon Mineralization Potentials and Microbial Populations in Sediment	DEC	X		

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
		16,000

SUMMARY OF MAJOR MODIFICATIONS
No major modifications are planned for the microbiology part of Air/Water Study #2 at this time. We are currently in the process of completing the data analysis and putting together the final report. These activities are proceeding on schedule for completion in June 1991.

RELEVANCE TO RESTORATION
The available data yield information on the impacts on microbial populations by the Exxon Valdez oil spill. This data will be an important baseline for comparison for monitoring recovery of sediments in restoration monitoring studies.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One) Cont	Cont/Mod	Discont
Subtidal	1	Petroleum Hydrocarbon-Induced Injury to Subtidal Marine Sediment Resources.	NOAA NMFS		X	

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$330K 0 vessel $330K total	$330K 0 vessel $330K total	$317K 150 vessel $467K total	$317K 150 vessel $467K total

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$155K 90 vessel $245K total	$155K 90 vessel $245K total	$100.3K 0 vessel $100.3K

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One) Cont	Cont/Mod	Discont
Subtidal	3	Bioavailability and Transport of Hydrocarbons in the Near Shore Water Column	NOAA/ NMFS ADEC		X	

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
NOAA 342.5K ADEC 210 K	NOAA 342.5K ADEC 210 K	NOAA 472.5K ADEC 47.5K	NOAA 472.5K ADEC 47.5K

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
NOAA 150 K ADEC 196.2K	NOAA 150 K ADEC 196.2K	NOAA 29.3K ADEC 46.7K

SUMMARY OF MAJOR MODIFICATIONS

1. The major emphasis for both agencies will be on data analysis and completion of a final report. ADEC will complete synthesis of the chemistry, grain size, and sediment cored data as soon as it is received from analytical labs; a final report is projected to be completed by July 1, 1992.

2. No further deployment of caged mussels and sediment traps are proposed in 1992. One joint cruise in mid March '92 will retrieve cages and traps from 6 overwinter exposure sites.

3. Selected samples from 1991 and 1991-1992 overwinter concurrent trap/cage deployments will be analyzed for hydrocarbons. Grain size and core stratigraphy will also be determined for trap samples.

4. Further synthesis of mussel data (all NRDA projects) will become part of a new project responsible for synthesis of both mussel and sediment hydrocarbon data in the NRDA database.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
Subtidal	4	Fate & Toxicity of EVOS Oil	NOAA	XX		

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
-0-	-0-	$620.0K (+ship @ 150)	$486.2K

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$125.0K	$102.6K	$160.0K

SUMMARY OF MAJOR MODIFICATIONS
Surveys of sediment toxicity in the spill zone (Objective A) were conducted during OY2 and 3. Results suggest significant toxicity associated with sites oiled by the spill, and a repeat survey is proposed for OY4. The field and laboratory work related to objectives B and C (an initial assessment of toxicity associated with polar, oxidized constituents or derivatives of petroleum) will be largely complete at the end of OY3. Continuing support is required during OY4 to complete the analysis of data, including the incorporation and interpretation of chemical data from Technical Services Project 1, and the presentation/publication of results. Objective D, which calls for the synthesis of available information on the distribution, composition, and transformation of the spilled oil from the actual time of the spill to the present, will also represent a major effort under this project during OY4.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
Subtidal	5	Injury to Shrimp	ADF&G	X		

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$60,500	$57,600	$65,000	$54,100

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$50,000	22,656	$80,000

SUMMARY OF MAJOR MODIFICATIONS

Analyze 1991 data, Continue survey in 1992. Discontinue analysis of hydrocarbon tissue samples. Begin cytogenetic analysis of determination of genetic damage. Complete analysis of 1989 histopathology samples and analyze 1991 samples. Identify crustacean larvae/juveniles in archived samples collected during the discontinued FS19 plankton trawl survey. A final report is expected March 1993.

RELEVANCE TO RESTORATION

Completion of damage assessment demonstrates the need for restoration projects (e.g. critically low stock levels may require intervention in order to effect recovery). This damage assessment project may evolve into a monitoring project in order to assess recovery of oil-affected stocks. Information gained would also allow more precise management of the fishery, directing effort away from depleted stocks, allowing them to recovery more quickly.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discon
Subtidal	6	Injury to Rockfish	ADF&G		X	

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$45,600	$17,900	$109,400	$73,800

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$120,000	$104,987	$25,000

SUMMARY OF MAJOR MODIFICATIONS

- No sampling is planned for oil year 4. A final report is planned for June 30, 1992.

- Sampling rockfish for histopathological evaluation could be conducted at two or three year intervals in order to monitor long-term injury and recovery.

RELEVANCE TO RESTORATION

Results of this study indicate that both lethal and sub-lethal injuries occurred to rockfish populations in Prince William Sound. This information, coupled with concerns of increasing harvest due to the redirection of effort resulting from the oil spill, indicates that major emphasis should be directed toward groundfish management. Therefore, we recommend implementation of the restoration proposal to develop a groundfish restoration management plan.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
Subtidal	7	Injury to Demersal Fish	NOAA ADF&G		X	

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$300.0 $1900.0 V $2200.0 T	$2371.6	$300.0 $150.0 V $450.0 T	

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
ADF&G $80,000 NOAA $235,000		

SUMMARY OF MAJOR MODIFICATIONS

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
Subtidal	7	Injury to Demersal Fishes	NMFS			

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$2200.0K	$2371.6K	$450.0K	$450.0K

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$235.0K	$235.0K	$66K Esimated

SUMMARY OF MAJOR MODIFICATIONS

This project is proposed to complete the assessment of injury to demersal fish species resulting from the EVOS. No field work is proposed, and the primary objectives under this proposal are to complete analyses of samples and data collected under F/S and ST 7, and to prepare a final report encomassing efforts under these projects for OY1 through OY3.

RELEVANCE TO RESTORATION

This final analysis of data is critical for determining the rate of natural recovery of the impacted species from oil exposure resulting from the EVOS. The results will also be necessary for determining whether active restoration efforts are needed, and for assessing the effectiveness of any restoration efforts on these species.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
NRDA Subtidal	8	Mussel Tissue and Sediment Hydrocarbon Data Synthesis	NOAA/ NMFS	X		

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
Salaries 35K Travel 3 Contract 20 Supplies 12 Equipment 15 TOTAL 85K		Salaries 53K Travel 5 Contract 20 Supplies 12 TOTAL 90K

LEAD AGENCY: NOAA
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discon
Tech. Ser.	#1	Hydrocarbon Support Services and Analysis of Distribution and Weathering of Spilled Oil	NOAA			

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$1,300,000	$550,000	$914,200	$1,648,187

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$2,000,000	$1,750,479 to date.	$600,000

SUMMARY OF MAJOR MODIFICATIONS

RELEVANCE TO RESTORATION
This project has built a single integrated dataset which supports all the NRDA projects and allows the development of synthesis products from data across all the projects. This was done through the required analysis of control materials, e.g. calibration and reference materials; the reporting of these data in association with the relevant sample data and the continued review of the control material data. The resultant dataset allows the comparison of analytical data across projects and through time. The dataset, as it presently stands, provides a comparative base for the Restoration projects; if it is continued, it would allow the comparative integration of the analytical data from both Damage Assessment and Restoration projects.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
Tech Services	1	Hydrocarbon Analytical Support Services	FWS			XX

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$1,000K	$ 200K	$1,100K	$1,300K

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$ 550K	$ 300K	$ 150K - FWS Prelim. Est.

SUMMARY OF MAJOR MODIFICATIONS
Not applicable.

RELEVANCE TO RESTORATION
This project will support Marine Mammal 6, Bird Study 3, Bird Study 7, Bird Study 11 and other FWS NRDA studies that have outstanding hydrocarbon analysis needs. The existing samples will be prioritized and only those which are necessary for final data analysis will be examined. This information will provide necessary data for the preparation of final reports. The preparation of final reports will be essential for understanding the injuries the spill caused to birds and otters. If this information is not clearly and completely available to those responsible for restoration, it will not be possible to adequately address the restoration needs of the resource.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
Tech Services	3	GIS Mapping	ADNR USFWS			X

* ADNR only; Missing D.O.I. - USFWS portion.

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
$488.0	$486.7	$616.1	$557.2

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$679.4	$379.4	0.0 ($587.9 for restoration)

SUMMARY OF MAJOR MODIFICATIONS

There have been no major modifications within Technical Services Study Number 3. TS#3 provides a resource database, with associated information management services and products, to support geographic analysis of scientific data relevant to the goals of the NRDA and restoration process.

RELEVANCE TO RESTORATION

TS#3 integrates information into an ecosystem injury picture. This integration of primary and thematic data will be increasingly used by restoration managers to process select restoration themes.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One) Cont	Cont/Mod	Discont
Tech Services	3	GIS Mapping and Analysis of Damage Assessment Data	FWS	XX Rest		

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
		$ 200K	$ 110K

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$ 300K	$ 194K	$100 K close-out (FWS Prelim Estim) $200 K restoration (Bird and Sea Otter projects)

SUMMARY OF MAJOR MODIFICATIONS
Not applicable.

RELEVANCE TO RESTORATION

This project will support Marine Mammal 6, Bird Study 2, Bird Study 3, Bird Study 4 and other FWS NRDA studies that have outstanding geographic components to their data. This information will provide necessary data analysis for the preparation of final reports which are essential for understanding the injuries the spill caused to birds and otters. If this information is not clearly and completely available to those responsible for restoration, it will not be possible to adequately address the restoration needs of the resource.

In addition, the restoration estimate provides for support to various bird restoration studies (murres, boat surveys, black oystercatchers, bald eagles, pigeon guillemots, harlequin duck, marbled murrelets) and sea otter restoration studies (population monitoring, habitat utilization, recovery model, and bioindicators).

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Discont
Archae-ology	Arch. 1	Archaeological Survey	USFS ADNR		X	

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
-0-	-0-	$1,000,000.	$313,600

* See budget details for agency breakout.

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
$791,600.	$1,138,400.	$247,000.

SUMMARY OF MAJOR MODIFICATIONS
Damage assessment studies are ongoing and the results will not be available until the spring of 1992. Preliminary results suggest injury may not be as extensive as feared but has occurred. Need for followup studies has to wait final results of current assessments. Compilation and analysis of results from the federally administered study and the smaller State study are necessary and are proposed for Oil Year 4. The second activity proposed is monitoring of injured sites to check heightened levels of Spill related injury through time. Additional damage assessment studies may be identified based on the 1991 study results.

LEAD AGENCY
NRDA PROJECT RECOMMENDATION FOR
OIL YEAR 4 (3/1/92 - 2/28/93)

Study Category	Study Number	Study Title	Agency	Recommendation (Check One)		
				Cont	Cont/Mod	Disco
RS7	7	Technical Support Study for the Restoration of Dolly Varden and Cutthroat trout Populations in Prince William Sound	ADF&G	X		

25 copies

BUDGETS			
Oil Year 1		Oil Year 2	
Allocated	Expended	Allocated	Expended
0	0	0	0

BUDGETS		
Oil Year 3		Oil Year 4
Allocated	Expended	Request
147,000		280,000

SUMMARY OF MAJOR MODIFICATIONS
No major modifications.

RELEVANCE TO RESTORATION
Injury to both Dolly Varden and cutthroat trout populations has been documented by NRDA Fish/Shellfish study # 5. These injuries have resulted in an overall loss of opportunities for recreational anglers. This project will provide information for the development of a management plan for these two species in PWS. This plan will provide for responsible management of these fisheries through modification of human use.