RPWG
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REVIEW DRAFT
2/3/92

RESTORATION FRAMEWORK: OUTLINE

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I. Introduction

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1. Funds 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.
2. Definition of natural resources and services from MOA

B. Proposed Criteria

1. Sources of injury: NRDA is primary source; other sources are public or shoreline assessments
2. Standard of what constitutes injury used to determine the priorities for spending restoration funds.
3. Questions which frame restoration criteria

C. Injury to Natural Resources

1. Discussion on "demonstrable loss"

D. Recovery

1. Full recovery achieved when pre-spill faunal and floral constituents are again, present, healthy, and productive and there is a full complement of age classes.
2. A fully recovered ecosystem provides the same functions and services as undamaged systems.
3. Scientific determination of recovery

E. Restoration of Services and Intrinsic Values

1. Most services will be restored if the natural resource is restored.
2. Restoration of natural resources may not fully restore services those resources provide
3. Intrinsic values of wilderness and pristine areas
4. Avoid double recovery [NOTE: Is this an issue or

just information?]

V. Background

A. Life Histories
1. Sea otter
2. Harbor Seal
3. Common murre
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6. Dolly varden
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8. Pink salmon
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10. Killer whale
11. Brown bear
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13. Bald eagle
14. Black oystercatcher
15. Sockeye salmon
16. Pacific herring
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18. Spot shrimp

B. Discussion of Other Resources/Services

1. Archaeology
2. Subsistence
3. Recreation
4. Wilderness

(Format for each section is 1) a summary of injury, 2) users, use patterns, and use statistics, 3) resource values, and 4) various laws which recognize the special values and guide and direct protection and restoration)

VI. Proposed Criteria for Selecting Restoration Options

A. Settlement Guidance

1. Restoration funds are to be used to "restore, replace, enhance, rehabilitate or acquire the equivalent" of injured natural resources, natural resources services, and archaeological sites and artifacts.
2. Goal of restoration is "recovery"--to return a resource or service to its pre-spill condition.
3. Types of restoration
4. Habitat protection measures are in some cases a way

to maintain and enhance prospects for the recovery of an injured resource and, as such, is direct restoration. In other cases it or can be categorized as acquisition of equivalent resources and services.

B. Proposed Criteria

1. Throughout the process, the public has been requested to and has submitted suggestions for restoring the injured natural resources and services.
2. In order to assist the Trustees and public in determining which approaches and options are preferable to others, the restoration work group has developed criteria. These have been used to guide the Trustee's decision to date.

VII. Approaches and Options

A. Further Evaluation

1. Overview
2. Definitions
3. Approaches
4. Options (about 50)
   - Management of Human Uses (restore, rehabilitate)
   - Manipulation of Resources, including Species and Habitats (restore, rehabilitate, replace, enhance)
   - Habitat Protection and Acquisition (restore, rehabilitate, enhance, acquire the equivalent)
   - Other Resources/Services
4. Further evaluation

B. Recommended Approaches

1. Decision process/criteria
2. Approaches

C. Rejected Options

VIII. Implementation of Settlement

A. Post Settlement Administration

1. Introduction
2. Explanation of Criminal Fine and Settlement Funds

3. Organization

B. Technical evaluation of options through science studies, economic analysis, matrices, etc.

1. Introductory paragraph: this section addresses how we will use restoration science studies and monitoring to specify for a given injured resource which candidate restoration option or suite of options are the most appropriate to implement, and when they should be implemented.
2. Restoration Science Information Studies: this section will describe how the existing science database can be used to estimate the extent of restoration that will be required spill-wide. This section will also indicate that, for many resources, the database is insufficient and additional field work will be required in 1992 and in some cases 1993.

3. Recovery monitoring
4. Evaluation of options for identifying and protecting marine and upland habitats

C. Public Participation

1. Settlement guidance
2. Goals and objectives
3. History of Public Participation
   (refer to Section II -- Restoration Planning)
4. Information Availability (the NRDA issue)
5. Community Planning Meetings
6. Product Review and Comment Process
7. Public Advisory Group
8. Other Public Outreach

D. Compliance with NEPA

E. Restoration Plan

APPENDICES: MOA and Consent Decree
Tear Sheets for Public Comment

RPWG
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Restoration Planning
Following the
Exxon Valdez Oil Spill
Restoration

dont worry about cover Jim will do that

Volume
Restoration Framework

DRAFT

CONFIDENTIAL

Prepared by:
Exxon Valdez Oil Spill Trustees
645 "G" Street
Anchorage, AK 99501
(907) 278-8012

March, 1992

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

RPWG
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Following the
Exxon Valdez Oil Spill
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Volume I:
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March 1992

Dear Reviewer:

On December 9, 1991 the United States and the State of Alaska settled their claims against the Exxon Corporation and Exxon Shipping Company for the *Exxon Valdez* oil spill. Money provided by the settlement will be used to restore the environment of Prince William Sound, lower Cook Inlet, and the Gulf of Alaska. The court has entrusted this task to the undersigned six State and Federal Trustees, who in consultation with the public are responsible for determining how restoration funds are to be spent.

Restoration Planning Following the *Exxon Valdez* Oil Spill is a key step in shaping the decision-making process. It is divided into two volumes, outlined below, which are presented for your review and comment. Volume 1: Restoration Framework provides background information and proposes guidelines for the future. Volume II: 1992 ~~Annual~~ Work Plan proposes activities that are important to undertake in 1992 prior to the final development of the Restoration Plan. We expect that a work plan will be developed annually, describing the activities the Trustees intend to conduct in that year.

These documents are intended to elicit comments and suggestions from you and to begin public "scoping" for environmental analysis under the National Environmental Policy Act. We want to know how you view this process and receive suggestions concerning restoration of the resources and services injured by the oil spill. This planning effort will culminate in the development of ~~an~~ overall Restoration Plan, which will be the restoration program's blueprint for the next decade.

We invite your comments on both Volumes I and II of ~~Restoration Planning~~ Following the *Exxon Valdez* Oil Spill. The issues identified on the tear sheets ~~at the back of the Restoration Framework~~ are intended to facilitate but not limit your comments and suggestions. In order to be considered during the development of the draft Restoration Plan, written comments must be received by _____, at the following address:

Exxon Valdez Oil Spill Trustee Council
645 "G" Street
Anchorage, Alaska 99501

Questions concerning this document or its distribution should be directed to Mary McGee, Oil Spill Public Information Center, 645 G Street, Anchorage, Alaska 99501, or you may call (907) 278-8008.

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

Sincerely,

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

Charles E. Cole
Attorney General
State of Alaska

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

Steven Pennoyer
Director
Alaska Region
National Marine Fisheries Service

Carl L. Rosier
Commissioner
Alaska Department of
Fish and Game

John H. Sandor
Commissioner
Alaska Department of
Environmental Conservation

Restoration Framework
Table of Contents

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EXECUTIVE SUMMARY

In ~~Restoration Planning Following the~~ *Exxon Valdez* Oil Spill, Volume I: Restoration Framework, the Trustees propose a process and structure to guide the restoration of the ~~injured~~ resources and services injured by the *Exxon Valdez* oil spill. The Restoration Framework also serves as a "scoping" document as required by the National Environmental Policy Act.

On December 9, 1991 the State and Federal governments and Exxon agreed to settlement terms under which Exxon will pay $1 billion dollars in criminal restitution and civil damages to the governments. This settlement provides an extraordinary opportunity to address the restoration of injuries resulting from the largest oil spill in United States history.

Post Settlement Administration (Chapter I)

The State and Federal Trustees will ~~receive~~ recover $900 million dollars from Exxon for civil claims over the next 10 years. These funds will be deposited into a Federal interest bearing account in Houston and then into a Joint Use Fund in Alaska. Subject to court approval, the Trustees will draw from that fund for restoration and for certain reimbursements.

All decisions about restoration and uses of restoration funds must have the unanimous agreement of six Trustees, three Federal and three State. The Federal Trustees have delegated authority to their representatives on an Alaska-based Trustee Council. The Trustee Council has appointed a Restoration Team to administer and manage the restoration process. An Administrative Director will be hired to chair the Restoration Team. The Trustee Council has approved creation of a number of working groups to address specific needs, such as budget, public participation, and habitat evaluation and protection.

The State Trustees, unlike their Federal counterparts, serve on the Trustee Council.

Public Participation (Chapter II)

The settlement terms specify that the Trustees shall:

- establish procedures providing for meaningful public participation in the injury assessment and restoration process; and
- establish a public advisory group to advise the Trustees.

The Trustees intend to establish a public advisory group and have held a series of public meetings to solicit comments on the role, responsibility and membership of that group. Public comment will be sought as the ~~draft~~ Restoration Framework, 1992 ~~Annual~~ Work Plan, and draft and final restoration plans are developed in the next year.

Restoration Planning Before the Settlement (Chapter III)

The Trustees and the Environmental Protection Agency laid the foundation for restoration through the work of the Restoration Planning Work Group ~~(RPWG)~~ from late 1989 until December 1991. This group carried out several scoping activities, ~~such as holding~~ a series public meetings and consulting with technical experts. The restoration group also developed draft criteria for evaluating restoration options, and began ~~the process of~~ analyzing the many restoration options suggested by the public, resource managers, and scientists.

Summary of Injury (Chapter IV)

Immediately after the *Exxon Valdez* oil spill, the Trustees began a series of studies--the Natural Resource Damage Assessment--to determine the effects of the oil spill on the environment and the many resources and services administered by the Trustee agencies (e.g., marine and terrestrial mammals, birds, fish and shellfish, archaeological ~~sites and artifacts~~, subsistence). These studies, most of ~~which~~ were concluded in 1991, provide an assessment of a wide range of injuries, some immediate and acute, some subtle and persistent. Major results of the studies to date are discussed.

Criteria for Injuries and Restoration Options (Chapter V) (Chapter VI)

The settlement specifies that restoration funds must be spent to restore resources and services injured by the *Exxon Valdez* oil spill. The Trustees propose that "evidence of consequential injury" and "the adequacy and rate of natural recovery" must be considered in deciding whether it is appropriate to spend restoration dollars on a given resource or service. ~~These two criteria are amplified with respect to different types of injuries.~~ Once it has been established that a resource or service warrants restoration action, there may be a number of effective restoration options. The Trustees also propose criteria to help evaluate such options, including technical feasibility, cost effectiveness, and the potential for additional injury resulting from the proposed restoration option.

Restoration Alternatives and Options (Chapter VII)

The restoration planning process to date has yielded a variety of ~~restoration~~ ideas, ~~submitted by the public, the resource managers and others. These ideas~~ which are presented for comment as restoration options in Appendix ~~D~~ B.

These restoration options, and others identified by the public, will be considered by the Trustee Council as possible components of several restoration alternatives.

ital

For purposes of this scoping document, six possible alternatives have been identified. These are:

- a no-action alternative;
- human use management;
- resource manipulation;
- habitat protection and acquisition;
- a combination alternative; and
- ~~and an acquisition~~ equivalent resource alternative.

An Analysis of ~~these~~ a proposed action and various alternatives will be presented in a draft restoration plan and environmental impact statement. for public comment

Appendices A and B

~~Four~~ Two appendices are attached: ~~supplying reference material concerning the Consent Decree and Memorandum of Agreement~~, life histories ~~of selected~~ and backgrounds on injured resources and services and a ~~summary~~ series of the restoration options that have been suggested by the public ~~and~~/or peer reviewers.

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CHAPTER I
INTRODUCTION

Restoration Framework

The intent of Restoration Planning Following the *Exxon Valdez* Oil Spill, Volume I: Restoration Framework (Restoration Framework) is to propose a process to guide the Trustees in the restoration of the environment injured by the *Exxon Valdez* oil spill.

The document contains information on past *Exxon Valdez* oil spill restoration activities, background information on the legal settlement that provides funding for restoration, and a description of the Trustees' structure for administration of the restoration program. Information is also provided on the spill-related injuries, draft criteria for determining when injury is sufficient to warrant restoration actions, draft criteria and procedures for evaluating specific options, and an initial description of possible restoration alternatives.

The Restoration Framework also serves the Trustees as a "scoping" document as required by the National Environmental Policy Act 42 U.S.C. 4321-4370c. As such, the document presents the proposed action, discusses the decisions to be made and presents the main issues and concerns known at this time. The Trustees will, as part of a planned draft Restoration Plan, issue a draft environmental impact statement to ensure that the environmental process is integrated with restoration planning.

Proposed Action

The Trustees propose to restore the environment of the areas affected by the *Exxon Valdez* oil spill to their pre-spill condition. This includes the restoration of "...[a]ny natural resource injured, lost or destroyed and the services provided by that resource or which replaces or substitutes for the injured, lost or destroyed resource and affected services." (Memorandum of Agreement and Consent Decree, Appendix B) (Memorandum of Agreement).

Decisions to be Made

The Trustees are addressing a number of issues as they develop the *Exxon Valdez* oil spill restoration program. Among the issues covered in the Restoration Framework are the following:

- establishing a final administrative structure that enables the maximum amount of settlement funds to be spent on effective restoration (Chapter I);

- providing meaningful public involvement and establishing a public advisory group (Chapter II);
- determining when injuries are sufficient to warrant restoration actions (Chapter V);
- evaluating potential restoration options, including the use of objective criteria (Chapter VI);
- developing a reasonable range of alternative sets of restoration options and establishing priorities for use of settlement funds (Chapter VII, Appendix D); and
- soliciting and evaluating proposals for restoration studies and projects from the public and government agencies (Chapter VI and VII, Appendix D).

Background

Shortly after midnight on March 24, 1989 the T/V *Exxon Valdez* ran aground on Bligh Reef in Prince William Sound 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 slick lengthened and widened, but stayed in the waters of the Sound and did not go ashore. Even with these favorable conditions 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 in the Gulf of Alaska on April 11, nineteen days after the spill. By May 18, oil had moved some 470 miles and had contaminated shorelines of Prince William Sound, the Kenai Peninsula, lower Cook Inlet, the Kodiak Archipelago, and the Alaska Peninsula. Portions of 1,200 miles of coastline were oiled, including segments 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 (See Figure 1).

The magnitude of the efforts of the State and Federal governments, the public, and Exxon to contain and clean up the oil, rescue oiled birds and sea otters, and study the effects of the spill was unprecedented. During 1989, efforts focussed on containing and cleaning up the spill and rescuing oiled wildlife. Skimmer

Proposed ACTION

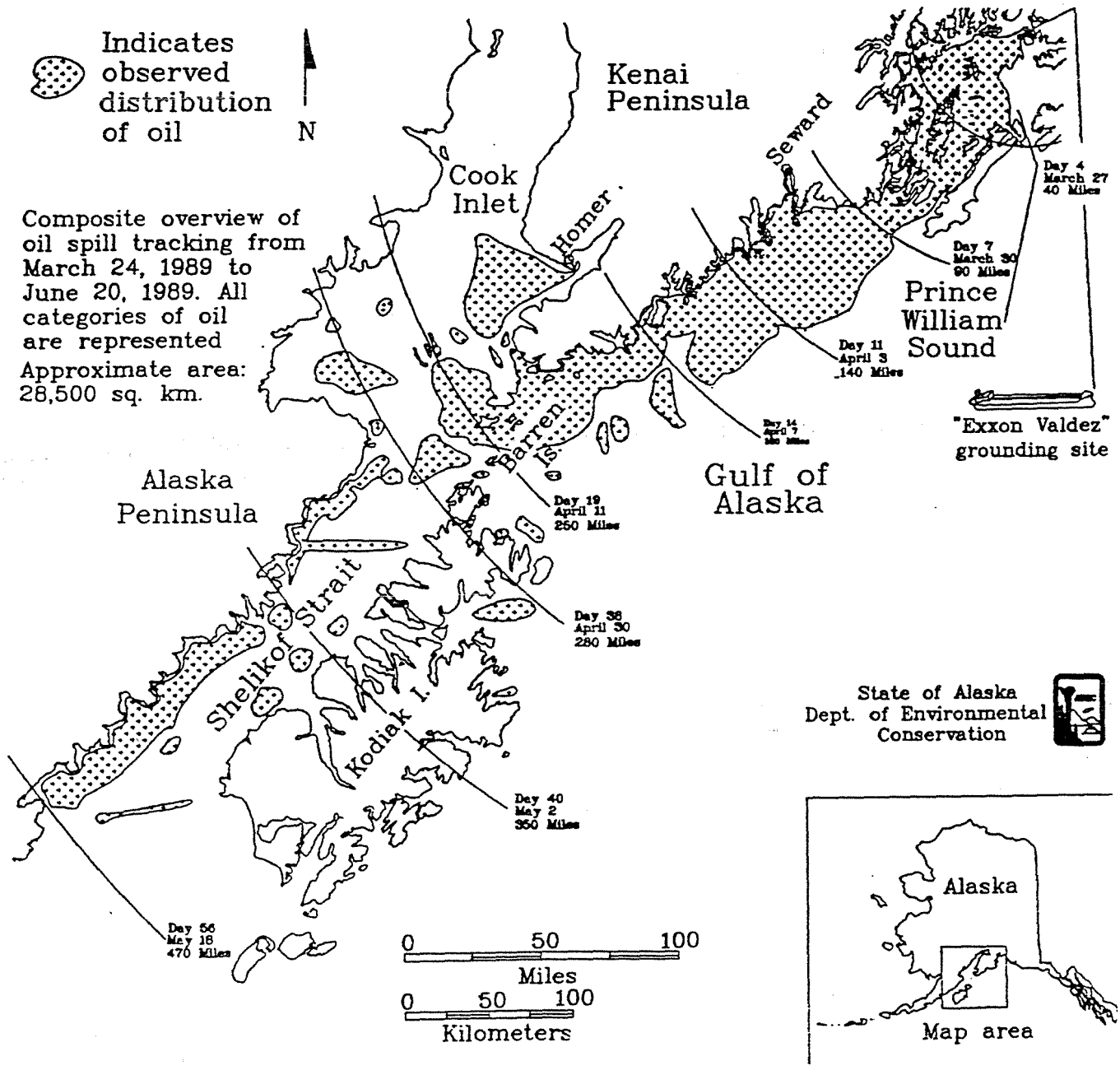
The Trustees propose to restore the environment of the areas affected by the Exxon Valdez oil spill to its pre-spill condition. This includes the restoration of any natural resource injured, lost or destroyed and the services provided by that resource or which replaces or substitutes for the injured, lost or destroyed resource and affected services. The Trustees will develop a restoration plan considering restoration options ~~identified by the public or proposed~~ described in Appendix B ~~of this document~~. The restoration plan will establish management direction in a programmatic manner and guide all ~~natural resource restoration~~ activities. Specific restoration activities will be developed annually and may be implemented if consistent with the restoration plan.

and others identified subsequently

and services

to restore injured natural resources and services

Figure 1


Indicates observed distribution of oil
N
Composite overview of oil spill tracking from March 24, 1989 to June 20, 1989. All categories of oil are represented
Approximate area: 28,500 sq. km.
Kenai Peninsula
Cook Inlet
Homer
Seward
Prince William Sound
Day 4 March 27 40 Miles
Day 7 March 30 90 Miles
Day 11 April 3 140 Miles
"Exxon Valdez" grounding site
Barren Is.
Gulf of Alaska
Alaska Peninsula
Day 19 April 11 250 Miles
Day 36 April 30 280 Miles
Shelikof Strait
Kodiak I.
Day 40 May 2 350 Miles
Day 56 May 18 470 Miles
0 50 100
Miles
0 50 100
Kilometers
State of Alaska
Dept. of Environmental Conservation
Alaska
Map area

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. Exxon began a beach cleanup under the direction of the U.S. Coast Guard with input from Federal and State agencies and local communities on the areas that should receive priority for clean up. Several thousand 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 the anticipation of deteriorating weather brought an end to clean-up 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 clean-up work took place during 1991, and another shoreline survey will be conducted in 1992 to determine if further cleanup is needed.

During the first summer after the spill, the State and Federal Trustee agencies planned and mobilized the Natural Resource Damage Assessment (damage assessment) field studies to determine the nature and extent of the injuries that were 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 scarcity of 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 laboratory data analyses are still underway. In the latter part of 1989, the Trustee agencies, with the assistance of the Environmental Protection Agency, initiated restoration planning activities to identify restoration alternatives and procedures and to implement restoration technical and feasibility studies and projects during 1990 and 1991.

Summary of the Settlement

On December 9, 1991 the United States and the State of Alaska settled their claims against Exxon Corporation and Exxon Shipping Company for various criminal violations and for recovery of damages resulting from the oil spill.

Exxon and Exxon Shipping entered guilty pleas to criminal charges filed in the United States District Court. The companies admitted violating provisions of the Federal Water Pollution Control Act (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 to the State and Federal governments. This was the largest sum ever recovered in the United States ~~for~~ environmental ~~damages.~~

Thousands of private individuals and other litigants are still pursuing claims in Federal and State courts 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.

The terms of the settlement can be found in the Agreement and Consent Decree. This document details the agreement among the United States, the State of Alaska, Exxon Corporation, Exxon Shipping Company, Exxon Pipeline Company, and the T/V *Exxon Valdez* that settled 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 December 9, 1991 ~~(Appendix A)~~.

Exxon and Exxon Shipping were fined $150 million; of this amount, the sum of $125 million was remitted (i.e., forgiven) due to their cooperation with the governments during the cleanup, timely payment of many private claims, and environmental precautions taken since the spill, and $25 million was paid as follows:

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

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. The State and Federal governments will ~~each~~ control the $50 million payment that each has received. These criminal restitution funds 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."

The Civil Settlement and ~~Restitution~~ Restoration Fund

The spending guidelines for the civil settlement monies ($900 million) are set forth in the Memorandum of Agreement and Consent Decree. Through these documents the United States and the State of Alaska resolved their claims against each other and agreed 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, 1991. ~~(Appendix B).~~ The Exxon companies agreed to pay the United States and the State of Alaska $900 million over a period of 10 years, according to the following schedule:

SCHEDULED DATE	AMOUNT
December 1991	$90 Million
December 1992[1]	$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
September 2001	$70 Million

These monies will be deposited in the registry account of the United States District Court for the District of Alaska and then transferred to the Federal Court Registry Investment System in Houston. As funds are needed for restoration, the Trustees will apply to the Court for disbursement of these funds. The money deposited in the Houston account will be invested and accrue interest for the restoration fund. The Trustees plan to apply to the Court each year as the annual work plan and restoration budget are approved.

[1] Exxon's cleanup costs for the 1991 field season will be deducted from this payment.

The civil spending guidelines provide 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 Trustees may also use the money to reimburse expenses they have incurred regarding the oil spill, including costs of litigation, response and damage assessment. The following table summarizes the major points of the Memorandum of Agreement:

MEMORANDUM OF AGREEMENT GUIDELINES

- All decisions shall be made by the unanimous agreement of the Trustees.
- A joint trust fund will be established.
- The Trustees shall agree to an organizational structure for decision making within 90 days of receipt of funds.
- Procedures for meaningful public participation, including a public advisory group shall be established within 90 days of receipt of funds.
- The Trustees have elected not to be bound by the Federal Natural Resource Damage Assessment regulations (43 CFR Part II).
- The Trustees shall jointly use all natural resource damage recoveries for purposes of restoring, replacing, enhancing, rehabilitating, or acquiring the equivalent of natural resources injured as a result of the oil spill and the reduced or lost services provided by such resources, except for allowable reimbursements to the governments. "Natural resources" means land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources of the State or the United States.
- All natural resource damage recoveries will be expended on restoration of natural resources in Alaska unless the Trustees unanimously agree that spending funds outside of the state is necessary.

The settlement with Exxon also has a reopener provision, that allows the governments to claim up to an additional $100 million between September 1, 2002 and September 1, 2006 to restore one or more populations habitats or species that suffered a substantial loss or decline as a result of the spill. Any restoration projects funded with this money must have costs that are not grossly disproportionate to the magnitude of the benefits anticipated, and the injury to the affected population, habitat, or species could not reasonably have been known or anticipated from information available at the time of settlement.

Organization

The post-settlement organization is largely guided by the Memorandum of Agreement. In addition to resolving the legal claims between the State of Alaska and the United States governments, the Memorandum of Agreement also states that the governments will maximize the funds available for restoration and sets forth terms for fulfilling their obligations to assess injuries and to restore the natural resources or services. Under the Memorandum of Agreement, the natural resource Trustees are responsible for making all decisions regarding funding, injury assessment and restoration.

The State of Alaska Trustees are:

- Commissioner of the Department of Environmental Conservation;
- Commissioner of the Departments of Fish and Game; and,
- Alaska Attorney General.

The Federal Trustees are:

- U.S. Secretary of the Interior;
- U.S. Secretary of Agriculture; and,
- Administrator of the National Oceanic and Atmospheric Administration.

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, unlike their Federal counterparts, serve on the Trustee Council.

The Trustee Council appointed an interim Administrative Director and a Restoration Team to take on the day-to-day 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 will hire a permanent full time Administrative Director to chair the Restoration Team. The Trustee Council has formed various subgroups from agency staff to work on components of the restoration program, such as finance, public participation, and habitat

protection. The organization chart approved by the Trustee Council on February 5, 1992 is shown below (See Figure 2).

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; and
- establish procedures for meaningful public participation in the injury assessment and the restoration process which shall include establishment of 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.

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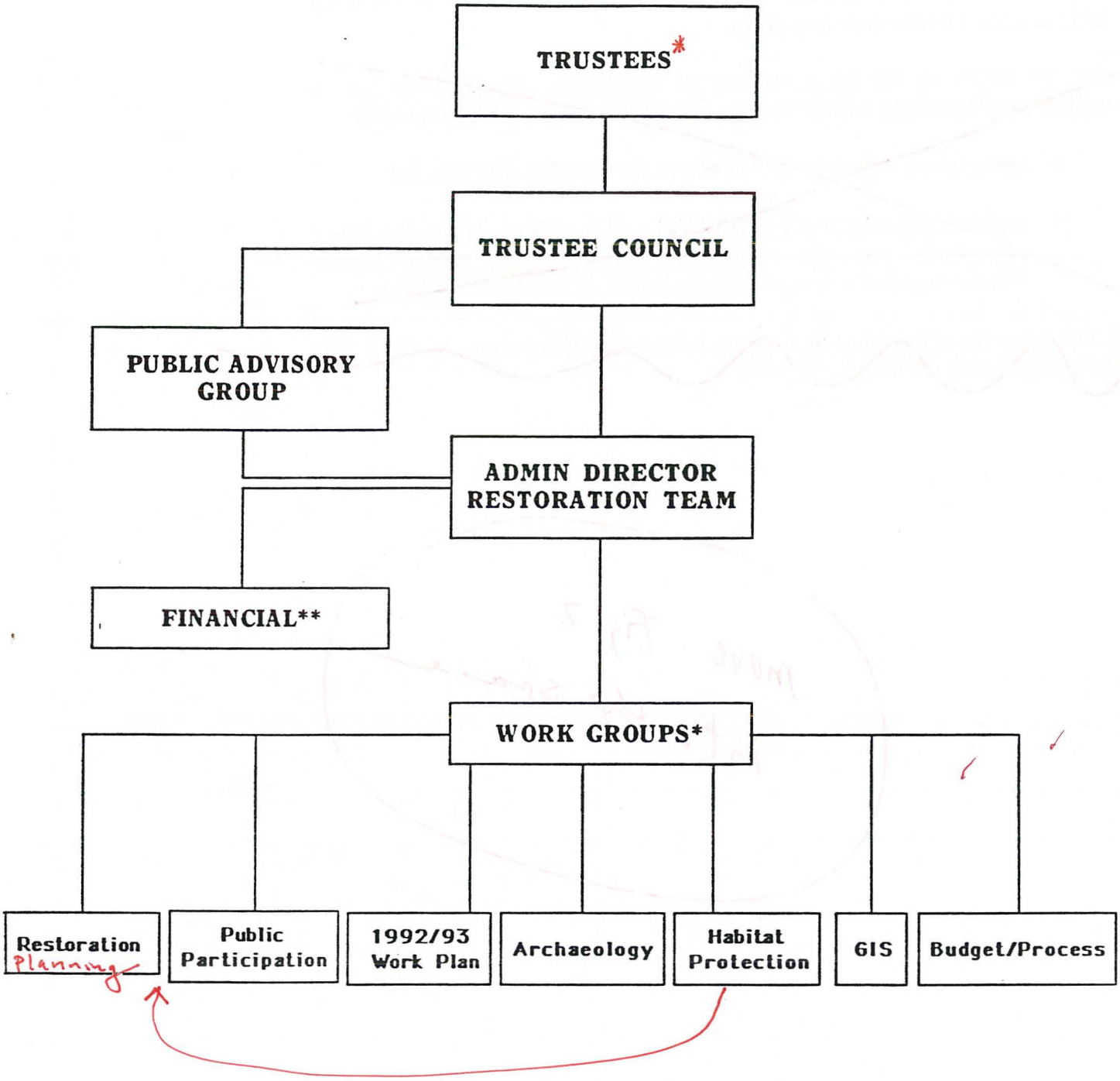
Figure 2



* The State Trustees also serve on the Trustee Council; the Federal Trustees have designated representatives to the Trustee Council.

Groups will be formed and disband as appropriate.

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

CHAPTER III
RESTORATION PLANNING TO DATE

The approach and need for restoration depends on the nature, extent and persistence of injuries to natural resources and natural resources services and the rate and adequacy of natural recovery. Restoration planning, therefore, is a dynamic process that incorporates new findings on injuries and natural recovery, as well as evaluations of restoration options and the availability of funds. The damage assessment studies are the primary sources of information on injuries. Other sources include data gathered during the oil spill clean up, public comments, and studies conducted outside of the damage assessment program.

Scoping Activities

Public Participation

Late in 1989 the Trustees and the Environmental Protection Agency established a Restoration Planning Work Group. This group began the process of determining the issues to be addressed in the restoration program.

In March 1990 a public symposium was held in Anchorage (Restoration Following the *Exxon Valdez* Oil Spill, Proceedings of the Public Symposium, July 1990). In April and May public meetings were held in Cordova, Valdez, Whittier, Homer, Kodiak, Seward, Anchorage and Kenai-Soldotna. People were invited to ask questions and put forward their ideas about restoration needs and priorities. In August the work group issued a report that describes the planning activities to date, summarized the public comments and presented ideas for restoration (Restoration Planning Following the *Exxon Valdez* Oil Spill: August 1990 Progress Report). Opportunities for public participation prior to the settlement, however, were limited due to pending litigation with the parties responsible for the oil spill and the need for the results of damage assessment studies to remain confidential.

Technical Workshop

In April 1990 a three-day technical workshop was held in Anchorage, providing the first opportunity for an organized exchange of ideas on restoration among Federal and State resource managers and selected scientists and technical experts under contract to the governments. This workshop was closed to the public because confidential damage assessment information was discussed.

Guided by an overview of preliminary results from the damage assessment studies, these experts explored a broad range of restoration options that could help restore injured ~~ecological, archaeological, and recreational~~ resources and services in the oil-spill area.

Potential restoration options were identified and evaluated and feasibility studies were suggested. Participants also identified other information required to aid restoration planning.

Issues and Concerns Identified

The restoration planning and scoping process has generated a wide array of issues and concerns regarding the restoration of resources and services in the oil spill area. The following list summarizes these issues and concerns:

- The use of restoration monies for prevention of future spills;
- Determining what cleanup activities should continue to occur;
- The need for continued natural resource damage assessment;
- The need for continued research on injuries;
- The need for long term monitoring;
- How much reliance should be placed on ~~the process of~~ natural ~~recovery as the primary means~~ to ~~affect~~ ensure recovery of injured natural resources and services processes;
- What management practices ~~could~~ can be taken by the governments to ~~affect a speedier~~ recovery;
- The need to support educational efforts so the general public can understand what happened and what they can do;
- The affect restoration activities have on the local economy of the spill area;
- The need to protect habitat as direct means of restoration;
- The idea of removing other (not *Exxon Valdez* oil) sources of contamination from the affected area as a means of aiding restoration;
- How to determine the most effective use of restoration monies; ~~and~~
- How to provide for meaningful public involvement; and

- How to establish and operate a public advisory group to the Trustees.

Peer Review

In addition to the technical workshop described above, there have been ongoing consultations with selected nationally recognized scientists and technical experts, who are knowledgeable about Alaskan resources. These experts continue to provide advice for the restoration planning and damage assessment process, identify information needs and review study proposals.

Habitat Protection

Resource experts and the public have identified the protection of fish and wildlife habitats and recreation sites 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. Accordingly, the restoration planning staff conducted special projects concerning the protection of marine and upland habitats.

First, a workshop was held in August 1991 to evaluate State and Federal marine habitat protection designations and their potential usefulness in the restoration program. The designations reviewed included national marine sanctuaries, estuarine research reserves, and Alaska State marine parks. The workshop participants included managers and administrators of various protected areas who provided first-hand information on the areas for which they are responsible. Each type of designation and specific unit has a different purpose, management approach, historical funding level, and track record. Participants suggested that marine habitat protection designations help maintain ecosystem integrity by controlling activities that disrupt ecological processes or that physically damage the environment, thereby minimizing further stress on recovering resources. These designations accommodate conservation objectives as well as other pre-existing uses.

Second, The Nature Conservancy was invited to provide technical assistance in identifying key upland habitats that are linked to the recovery of injured resources and services and evaluating potential protection strategies. The Nature Conservancy is a non-profit organization, and works with private landowners, government agencies, and other organizations to identify and protect ecological resources throughout the Western Hemisphere. In cooperation with the restoration planning staff, The Nature Conservancy prepared a handbook entitled, Options for Identifying and Protecting Strategic Fish and Wildlife Habitats and Recreation Sites (December 1991). The handbook provides 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.

Review of Recovery Literature

The rate and adequacy of natural recovery are considered when evaluating restoration measures. In some cases it may be most appropriate to allow natural recovery to proceed without further human intervention.

To supplement damage assessment data on natural recovery, the Trustee agencies and Environmental Protection Agency initiated in 1991 a review and critical synthesis of the scientific literature on the recovery of marine mammals, marine birds, commercially important fish and shellfish, and invertebrates following environmental perturbations, including other oil spills. The reviews are being conducted under contract by the Point Reyes Bird Observatory (marine birds), University of Washington Fisheries Research Institute (fish and commercially important shellfish), and Hubbs-Sea World Research Institute and the Pacific Estuarine Research Laboratory at San Diego State University (marine mammals and intertidal and subtidal invertebrate communities). These syntheses will be completed in 1992.

Field Studies

As damage assessment results were reviewed in 1990 and 1991, the restoration planning staff consulted with scientists who were conducting the damage assessment studies, Federal and State resource managers, and outside experts to identify and evaluate potential restoration options. In some cases lack of information prevented the evaluation or implementation of a restoration option, and field studies were proposed to provide needed information. Thus, the Trustees approved a series of small-scale restoration studies in 1990 and 1991.

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.

The studies conducted were described in the 1990 and 1991 versions of the State/Federal Natural Resource Damage Assessment and Restoration Plan for the *Exxon Valdez* Oil Spill and in three Federal Register notices (55 Fed. Reg. 8160, November 19, 1990, 56 Fed. Reg. 8898, March 1, 1991, and 56 Fed. Reg. 36160, July 31, 1991.)

Note: no underlines for Fed. Reg.

In 1991 the Restoration Planning Work Group began to develop an integrated longterm monitoring strategy to assess the recovery of injured natural resources in the oil-spill area. If the Trustees implement such a program, it would determine if and when injured resources have been restored to their pre-spill baseline conditions. The program also could monitor the effectiveness of restoration activities. A monitoring program also would detect latent injuries and reveal long-term trends in the environmental health of ecosystems affected by the oil spill. The duration of the monitoring program would depend on the severity and duration of effects resulting from the spill and the time necessary to establish a trend for recovery.

Some limited monitoring studies are proposed to be conducted in the field in 1992 (see draft 1992 ~~Annual~~ Work Plan). At the same time, efforts will continue to develop a comprehensive and integrated monitoring program as part of the draft Restoration Plan ~~for consideration by the Trustees~~. This is presented as Restoration Option No. 32 in Appendix B of this document. ~~The first step is to~~ development of a ~~conceptual design for a recovery~~ monitoring plan ~~that addresses~~ requires the identification of goals, objectives ~~and other basic elements. With approval by the Trustees, this preliminary effort will be followed by more detailed planning to develop a~~ and then technical design and costs for monitoring target resources and services.

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CHAPTER V
INJURY CRITERIA

Settlement Guidance

The settlement documents specify that 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." The services provided by natural resources include such activities as subsistence hunting and fishing and recreation. Restoration funds also may be used for archaeological resources--"sites and artifacts"--that were injured, lost, or destroyed as a result of the oil spill. (The quotations above were taken from the Agreement and Consent Decree and the Memorandum of Agreement; appendices A and B.)

"Other such resources" includes archaeological resources.

Proposed Criteria

How do we determine which natural resources and natural resource services, and archaeological resources warrant further restoration activities? The following criteria are proposed to assist the Trustees in these determinations:

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

The concepts underlying these criteria are described below.

Injury to Natural Resources

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:

- significant direct mortality;
- significant declines in populations or productivity;
- significant sublethal and chronic effects to adults or any 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 restricted scope or duration of the damage assessment studies. The killer whale is one example. In these cases, judgments concerning injuries to natural resources as a result of the oil spill will have to be determined by the weight of the evidence or best professional judgment.

Injury to Natural Resource Services

A natural resource service has experienced "consequential injury" if the *Exxon Valdez* oil spill or clean up:

- has resulted in the continued presence of oil on or adjacent to special-purpose lands[1];
- has significantly reduced the physical or biological functions performed by injured natural resources, including loss of human uses; or

[1] "Special-purpose" lands have been designated by the State of Alaska or the United States for the protection and conservation of natural resources and services.

- has significantly reduced aesthetic, intrinsic or other indirect uses provided by injured natural resources.

This definition covers a wide range of injured natural resources services. Examples are commercial fishing, subsistence hunting, fishing, and gathering; wildlife viewing; sport fishing; and recreation, which includes a variety of activities, such as kayaking and backcountry camping.

Indirect uses, such as aesthetics or appreciation of wilderness qualities, were also affected by the spill. This is a particular concern ~~since many of~~ those areas have been designated as wilderness areas by the United States or the State of Alaska.

Archaeology

Important archaeological sites and artifacts, protected by both Federal and State laws, were oiled. Inherent values could be irretrievably lost as oil continues to contaminate additional artifacts at some sites. Increased public knowledge of exact archaeological site locations, also continues to foster looting and vandalism.

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Recovery Concepts

To maximize the benefits of restoration expenditures, the Trustees will consider the effects of natural recovery before investing restoration dollars. 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 were provided by the pre-spill, ~~undamaged~~ system.

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, an estimation of the rate of natural recovery will be considered based on the best information available from the damage assessment and restoration studies, the scientific literature and other sources. If it appears that recovery will be nearly complete before the benefits of a restoration study or project can be realized, then the Trustees may suggest 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. ~~The concept of recovery has limited application in this context.~~

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CHAPTER VI
OPTIONS CRITERIA AND EVALUATION OF RESTORATION OPTIONS

Members of the public, resource managers, principal investigators and scientific advisors have suggested hundreds of ways to restore injured natural resources and services. To aid the Trustees and the public in determining which of the many restoration alternatives, approaches and specific options are appropriate and most beneficial under the terms of the settlement, objective criteria ~~have been proposed to assist in the selection of potential restoration projects and~~ are now presented 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 the restoration option?

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

Will implementation of the 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 restoration option in the environment of the oil-spill area?

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:

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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 [including lost uses] and the primary and secondary benefits associated with implementation of the restoration option.)

F. Cost effectiveness:

Does the 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 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 or nontarget resources or 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 preliminary screening and are presented in Appendix ~~D~~. Following public comment on the Restoration Framework, including any suggestions of additional options, there will be more detailed evaluations of all potential options. The draft Restoration Plan will present the results of these evaluations, including alternative ~~sets of options~~, for further public comment.

Database Review and Evaluation

To determine which options are most appropriate to implement at any given site, the restoration planning staff will review existing databases for each injured resource or service. Data relevant to this evaluation may be found in the scientific literature, geographic information systems, and the reports of damage assessment and restoration studies. The database for each injured resource and service should be screened to consider:

- the nature and severity of injury;
- the rate of natural recovery;
- life history requirements;
- factors limiting recovery;
- persistence of contaminants;
- opportunities to accelerate the rate of recovery;
- costs to accelerate recovery; and
- legal status and existing management practices.

Many of these evaluations are underway. With this information, the Trustees will decide 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 also will 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 determine the costs of implementing specific restoration options or sets of options at one or more sites throughout the oil-spill area.

For some injured resources and services, much of the above information is in hand; in other cases there are substantial deficiencies in the databases that will impede the evaluation and timely implementation of restoration options. To remedy this, additional field work is being recommended to provide the needed information. Detailed study plans for work considered in 1992 are found in the 1992 Annual Work Plan. These study plans were developed in consultation with scientists representing the Trustee agencies, outside peer reviewers, and the Chief Scientist.

Evaluation of Options for Identifying and Protecting Marine and Upland Habitats

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 equivalents 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 identified and used 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. Inventory: The first step 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. Rank: 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. Plan Protection: Once habitats or sites are ranked, the next major step is to develop a plan and strategy to protect 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 also should 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 also is 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 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 marine park and national marine sanctuary) have been evaluated for their applicability to restoration goals (see Chapter II).

D. Manage: 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 implement the management plan are essential parts of fulfilling protection objectives.

Recovery Monitoring

Monitoring plays a role in the evaluation of restoration options. First, "recovery monitoring" of injured resources and services indicates whether restoration actions are necessary or whether the "no action/natural recovery" alternative is the most appropriate choice. Several recovery monitoring studies are proposed in the 1992 Annual Work Plan. Second, there is need to monitor the effectiveness of restoration options, once implemented, and to identify whether additional restoration actions may be necessary.

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Evaluation of Options for Identifying and Protecting Marine and Upland Habitats

All restoration options, including habitat protection and acquisition options, will be evaluated using the basic criteria outlined in the first section of this chapter (VI). By necessity, however, there are additional steps needed to properly evaluate habitat protection and acquisition options.

In its draft 1991 Restoration Work Plan (56 Fed. Reg. 8902-8903, March 1, 1991), the Trustees developed a preliminary sequence of steps for use in identifying and protecting strategic fish and wildlife habitats and recreation sites. While the Trustees develop a final process for evaluating habitat protection and acquisition options, they again invite public comment on the steps that were published in the March 1, 1991 Federal Register notice:

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Need and Objectives:

The marine and intertidal habitats where most oil spill injuries occurred are ecologically linked to adjacent uplands. 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 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.

During the public scoping process the governments received many restoration suggestions that involved the protection and prime fish and wildlife habitats, recreation sites, and adjacent uplands. Suggested approaches to this protection included land acquisition and changes in management practices.

Land-use activities may occur in the oil spill area in 1991 or 1992. These activities may impact important habitats and recreation sites or slow the recovery of spill-injured resources.

The objective of this project is to identify and protect strategic wildlife and fisheries habitats and recreation sites and to prevent further potential environmental damages to resources injured by the *Exxon Valdez* oil spill. This project will be preceded by a technical support project to identify and evaluate potential properties which if publicly owned will contribute to this objective. Where acquisition of property rights is determined to be appropriate, they will be acquired on a willing buyer/willing seller basis. Primary considerations in deciding which properties should be acquired during this project will include (1) the nature and immediacy of changes in use that may further affect resources injured by the oil spill and (2) the prospect that failure to act will foreclose restoration opportunities.

The Trustees have developed the following preliminary sequence of steps for use in identifying and protecting strategic fish and wildlife habitats and recreation sites:

1. Identification of key upland habitats that are linked to the recovery of injured resources or services by scientific data or other relevant information.

2. Characterization and evaluation of potential impacts from changed land use in relation to their effects on recovery of the ecosystem and its components; comparative evaluation of recovery strategies not involving acquisition of property rights (e.g., redesignation of land use classification), including an assessment of protection afforded by existing law, regulations, and other alternatives.

3. Evaluation of cost-effective strategies to achieve restoration objectives for key upland habitats, identified through steps one and two above. This would include evaluation of other restoration alternatives for these resource injuries.

4. Willing seller/buyer negotiations with private landowners for property rights.

5. Incorporation of acquired property rights into public management.

Habitat and recreation site acquisition proposals that meet the appropriate evaluation factors for restoration (see section 2) will be identified and assigned by priority for implementation in accordance with this preliminary five-step process and applicable State and Federal laws and regulations.

The geographic scope of the 1991 project will be the oil spill area. Subsequent to this initial effort, the Trustees will continue to survey potential acquisitions, including acquisitions outside the spill area.

Estimated Cost: To be determined

C. Funding for the 1991 Restoration Work Plan

Although it is expected that the responsible parties will pay for the costs of the damage assessment and restoration program, there is no certainty about the final amount and when such funds will be forthcoming. It is possible, therefore, that funds to carry out the 1991 Restoration Work Plan, including the proposed planning and implementation activities, will have to be advanced by the State and Federal governments. To date, those funds have not been committed or secured by either government.

D. References

The documents listed below provide additional information on damage assessment and restoration. They are available from the Oil Spill Public Information Center, The Simpson Building, 645 G Street, Anchorage, Alaska, 99501.

1. "The 1990 State/Federal Natural Resource Damage Assessment and Restoration Plan for the *Exxon Valdez* Oil Spill, Volume I Assessment and Restoration Plan Appendices A, B, C."

2. "State/Federal Natural Resource Damage Assessment Plan for the *Exxon Valdez* Oil Spill," August 1989.

3. "Restoration Planning following the *Exxon Valdez* Oil Spill: August 1990 Progress Report."

4. "Restoration following the *Exxon Valdez* Oil Spill: Proceedings of the Public Symposium," July 1990.

Dated: February 26, 1991.

LaJuana S. Wilcher,

Assistant Administrator, Office of Water, U.S. Environmental Protection Agency.

Dated: February 25, 1991.

Charles E. Cole,

Attorney General, State of Alaska.

[FR Doc. 91-5014 Filed 2-28-91; 8:45 am]

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CHAPTER II
PUBLIC PARTICIPATION

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 among Exxon and the State and Federal governments. The Memorandum of Agreement (MOA) 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...."

This chapter outlines the goals of the public participation program, the type of information available to the public, and provides a brief description of possible criteria for membership on a public advisory group.

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Goals and Objectives

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

- invite and encourage public review and comment to guide development and implementation of restoration programs;
- provide the public with information and resources to independently understand and evaluate proposals and programs; and
- involve relevant constituencies;
- disseminate information concerning the restoration process in a timely manner;
- establish legitimacy and ensure public acceptance of the restoration process and structure;
- determine the scope of issues to be addressed in the draft environmental impact statement and the significant issues related to restoration; 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 (as of 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;
- 1991 restoration study plans; and
- restoration progress reports and bibliographies.

These documents, as well as an extensive collection of other information on the *Exxon Valdez* oil spill, are available 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 (Facsimile)

Information is also available through public meetings and mailings. Mailing lists will be maintained and updated on a regular basis. Mailings to the people and

organizations on these lists will be used along with community meetings and the public advisory group as major components of the public participation program. In addition, the following information will be made routinely available to the public for review ~~and comment~~:

- meeting agendas;
- transcripts of Trustee Council meetings;
- informational packets; and,

- planning and other documents, such as study and implementation project plans.

Community Meetings

The Trustee Council directed the Restoration Team to conduct public meetings and solicit written comments on a public participation program. This process began in January 1992 with meetings held in spill ~~affected~~ communities as well as Juneau, Anchorage, and Fairbanks. ~~These~~ comments received are being evaluated for recommendations to the Trustee Council regarding the role, structure, and operating procedures for a public advisory group.

A second series 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. Thereafter, it is anticipated that annual work plans will be developed to implement the Restoration Plan ~~and~~ each year's draft work plan will be the subject of additional public participation and comment. ~~Minutes of each meeting are available at the Oil Spill Public Information Center.~~

Public Advisory Group

As noted above, public meetings were 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. The Trustees have tentatively identified the following interests and constituencies to be represented on the public advisory group. This list is preliminary and not meant to be inclusive. These include: aquaculture, commercial fishing, commercial tourism, environment, forest products, local government, native landowners, recreations users, sport fishing and fishing, subsistence, and scientific/academic.

It is anticipated that the members of the advisory group will 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 and constituencies;
- 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 expertise.

Restoration Plan ~~Schedule~~

In this first year following settlement, the Trustees will develop a draft Restoration Plan. The draft plan will present in detail the options and alternative sets 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.

April ~~March~~ 1992: Restoration Framework to public for review

Draft 1992 ~~Annual~~ Work Plan to public for review

May ~~April~~ 1992: Public comments due on Restoration Framework

Public comments due on 1992 ~~Annual~~ Work Plan

May 1992: Request for proposals for 1993 ~~Annual~~ Work Plan to public and agencies

August 1992: Proposals for 1993 ~~Annual~~ Work Plan due from public and agencies

September 1992: Draft Restoration Plan and environmental impact statement to public for review

Draft proposals for 1993 ~~Annual~~ Work Plan to public for review

October 1992: Public comments due on draft Restoration Plan and environmental impact statement

Public comments due on proposals for 1993 ~~Annual~~ Work Plan

February 1993: ~~Publication of~~ final Restoration Plan and environmental impact statement to public

~~Publication of~~ 1993 ~~Annual~~ Work Plan to public

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organizations on these lists will be used along with community meetings and the public advisory group as major components of the public participation program. In addition, the following information will be made routinely available to the public for review and comment:

- meeting agendas;
- informational packets; and,
- planning and other documents, such as study and implementation project plans.

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Public Advisory Group

insert 13A

Was approved for initial use and for public comment in the February 27-28, 1992 T.C. meeting.

As noted above, public meetings were 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. The Trustees have tentatively identified the following interests and constituencies to be represented on the public advisory group. This list ~~is preliminary~~ and ~~not~~ is not meant to be final at this time. ~~inclusive. These include: aquaculture, commercial fishing, commercial tourism, environment, forest products, local government, native landowners, recreations users, sport fishing and fishing, subsistence, and scientific/academic~~.

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

It is anticipated that at least these interests would be represented. ~~Single~~ Seats would be reserved for Native village council or corporation local government and one for the Alaska House and one for the Alaska ~~Senate~~ Senate. various organizations and the

The group will offer non-binding advice to the Trustees. The charter of the public advisory groups is reproduced in Appendix A.

At this time, the Trustees are formally soliciting nominations for membership on the ~~PAG~~. If you are interested in applying please contact the Administrative Director to Trustee Council at 645 G St. Anch AK. 99501 for further information.

Public Advisory Group

- 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 and constituencies;
- 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 expertise.

Restoration Plan Schedule

In this first year following settlement, the Trustees will develop a draft Restoration Plan. The draft plan will present in detail the options and alternative sets 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 to public for review

Draft 1992 Annual Work Plan to public for review

April 1992: Public comments due on Restoration Framework

Public comments due on 1992 Annual Work Plan

May 1992: Request for proposals for 1993 Annual Work Plan to public and agencies

August 1992: Proposals for 1993 Annual Work Plan due from public and agencies

Insert 13A

Acquaculture
Commercial Fishing
Commercial Tourism
Environmental
Conservation
Forest Products
Local Government
Native Landowners[1]
Recreational Users
Sport Hunting & Fishing
Subsistence
Scientific/Academic
[redacted]
The Alaska House of Representatives (EX-OFFICIO)
The Alaska Senate (EX-OFFICIO)

~~1 This group would represent the seat provided to "Native Interest" as required by the Chenega Bay agreement~~

~~[need correct citation~~

September 1992:	Draft Restoration Plan to public for review
	Draft proposals for 1993 Annual Work Plan to public for review
October 1992:	Public comments due on draft Restoration Plan
	Public comments due on proposals for 1993 Annual Work Plan
February 1993:	Publication of final Restoration Plan
	Publication of 1993 Annual Work Plan

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RPWG
H

March 1992

Dear Reviewer:

On December 9, 1991 the United States and [illegible] their claims against the Exxon Corporation and E[illegible]r the *Exxon Valdez* oil spill. Money provided by the [illegible]store the environment of Prince William Sound, lo[illegible]lf of Alaska. The court has entrusted this task to the [illegible]deral Trustees, who in consultation with the public ar[illegible] how restoration funds are to be spent.

QCd revisions New one Changes in Red

Exxon Valdez Oil Spill

Restoration is a key step in shaping the decisi[illegible]ided into two volumes, outlined below, which are [illegible] and comment. Volume 1: Restoration Framework [illegible]ation and proposes guidelines for the future. Volu[illegible]oses activities that are important to undertake in 19[illegible]ment of the Restoration Plan. We expect that a work [illegible]ally, describing the activities the Trustees intend to [illegible]

These documents are intended to elicit comments and suggestions from you and to begin the public "scoping" process for environmental analysis under the National Environmental Policy Act. We want to know how you view this process and receive suggestions concerning restoration of the resources and services injured by the oil spill. This planning effort will culminate in the development of the overall Restoration Plan, which will be the restoration program's blueprint for the next decade.

Exxon Valdez Oil Spill

We invite your comments on both Volumes I and II of Restoration. The issues identified on the tear sheets in each document are intended to facilitate but not limit your comments and suggestions. In order to be considered during the development of the final 1992 Work Plan and draft Restoration Plan, written comments must be received by _____, at the following address:

Exxon Valdez Oil Spill Trustee Council
645 "G" Street
Anchorage, Alaska 99501

Questions concerning this document or its distribution should be directed to Mary McGee, Oil Spill Public Information Center, 645 G Street, Anchorage, Alaska 99501, or you may call (907) 278-8008.

RPWG
H

March 1992

Dear Reviewer:

On December 9, 1991 the United States and the State of Alaska settled their claims against the Exxon Corporation and Exxon Shipping Company for the *Exxon Valdez* oil spill. Money provided by the settlement will be used to restore the environment of Prince William Sound, lower Cook Inlet, and the Gulf of Alaska. The court has entrusted this task to the undersigned six State and Federal Trustees, who in consultation with the public are responsible for determining how restoration funds are to be spent.

Exxon Valdez Oil Spill
Restoration is a key step in shaping the decision-making process. It is divided into two volumes, outlined below, which are presented for your review and comment. Volume 1: Restoration Framework provides background information and proposes guidelines for the future. Volume II: 1992 Work Plan proposes activities that are important to undertake in 1992 prior to the final development of the Restoration Plan. We expect that a work plan will be developed annually, describing the activities the Trustees intend to conduct in that year.

These documents are intended to elicit comments and suggestions from you and to begin the public "scoping" process for environmental analysis under the National Environmental Policy Act. We want to know how you view this process and receive suggestions concerning restoration of the resources and services injured by the oil spill. This planning effort will culminate in the development of the overall Restoration Plan, which will be the restoration program's blueprint for the next decade.

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

Sincerely,

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

Charles E. Cole
Attorney General
State of Alaska

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

Steven Pennoyer
Director
Alaska Region
National Marine Fisheries Service

Carl L. Rosier
Commissioner
Alaska Department of Fish and Game

John A. Sandor
Commissioner
Alaska Department of Environmental Conservation

Restoration Framework
Table of Contents

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EXECUTIVE SUMMARY

Exxon Valdez oil spill

In Restoration, Volume I: Restoration Framework, the Trustees propose a process and structure to guide the restoration of the resources and services injured by the *Exxon Valdez* oil spill. The Restoration Framework also serves as a "scoping" document as required by the National Environmental Policy Act.

On December 9, 1991 the State and Federal governments and Exxon agreed to settlement terms under which Exxon will pay $1 billion dollars in criminal restitution and civil damages to the governments. This settlement provides an extraordinary opportunity to address the restoration of injuries resulting from the largest oil spill in United States history.

Post Settlement Administration (Chapter I)

The State and Federal Trustees will recover $900 million dollars from Exxon for civil claims over the next 10 years. These funds will be deposited into a Federal interest bearing account in Houston and then into a Joint Use Fund in Alaska. Subject to court approval, the Trustees will draw from that fund for restoration and for certain reimbursements.

All decisions about restoration and uses of restoration funds must have the unanimous agreement of six Trustees, three Federal and three State. The Federal Trustees have delegated authority to their representatives on an Alaska-based Trustee Council. The State Trustees, unlike their Federal counterparts, serve on the Trustee Council. The Trustee Council has appointed a Restoration Team to administer and manage the restoration process. An Administrative Director will be hired to chair the Restoration Team. The Trustee Council has approved creation of a number of working groups to address specific needs, such as budget, public participation, and habitat evaluation and protection.

Public Participation (Chapter II)

The settlement terms specify that the Trustees 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 Trustees intend to establish a public advisory group and have held a series of public meetings to solicit comments on the role, responsibility and membership of that group. Additional public comment will be sought as the Restoration Framework, and the draft 1992 Work Plan, and draft and final restoration plans are developed in the next year.

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Restoration Planning Before the Settlement (Chapter III)

The Trustees and the Environmental Protection Agency laid the foundation for restoration through the work of the Restoration Planning Work Group from late 1989 until December 1991. This group carried out several scoping activities, including a series of public meetings and consultations with technical experts. The restoration group also developed draft criteria for evaluating restoration options, and began analyzing the many restoration options suggested by the public, resource managers and scientists.

Summary of Injury (Chapter IV)

Immediately after the *Exxon Valdez* oil spill, the Trustees began a series of studies--the Natural Resource Damage Assessment--to determine the effects of the oil spill on the environment and the many resources and services administered by the Trustee agencies (e.g., marine and terrestrial mammals, birds, fish and shellfish, archaeological resources, subsistence). Most of these studies were concluded in 1991. They provide an assessment of a wide range of injuries, some immediate and acute, some subtle and persistent. Major results of the studies to date are discussed.

Criteria for Injuries (Chapter V) and Restoration Options (Chapter VI)

The settlement specifies that restoration funds must be spent to restore natural resources and services injured by the *Exxon Valdez* oil spill. The Trustees propose that "evidence of consequential injury" and "the adequacy and rate of natural recovery" must be considered in deciding whether it is appropriate to spend restoration dollars on a given resource or service. Once it has been established that a resource or service warrants restoration action, there may be a number of effective restoration options. The Trustees also propose criteria to help evaluate such options, including technical feasibility, cost effectiveness, and the potential for additional injury resulting from the proposed restoration option.

Restoration Alternatives and Options (Chapter VII)

The restoration planning process to date has yielded a variety of ideas, which are presented for comment as restoration options in Appendix B. These restoration options, and others identified by the public, will be considered by the Trustee Council as possible components of several restoration alternatives.

For purposes of this scoping document, six possible alternatives have been identified. These are:

- no-action alternative;
- human use management;
- resource manipulation;
- habitat protection and acquisition;
- combination alternative; and
- equivalent resource alternative.

An analysis of a proposed action and various alternatives will be presented for public comment in a draft restoration plan and environmental impact statement.

Appendices A and B

Two appendices are attached: life histories and backgrounds on injured resources and services and a series of restoration options that have been suggested by the public or peer reviewers.

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CHAPTER I
INTRODUCTION

Restoration Framework

The intent of Restoration, Volume I: Restoration Framework (Restoration Framework) is to propose a process to guide the Trustees and the public in the restoration of the environment injured by the *Exxon Valdez* oil spill. This document contains information on *Exxon Valdez* oil spill restoration activities to date, background information on the legal settlement that provides funding for restoration, and a description of the Trustees' structure for administration of the restoration program. Information is also provided on the injuries to natural resources and services, proposed criteria for determining when injury is sufficient to warrant restoration actions, proposed criteria and procedures for evaluating specific restoration options, and an initial description of possible restoration alternatives.

The Restoration Framework also serves the Trustees as a "scoping" document pursuant to the National Environmental Policy Act 42 U.S.C. 4321-4370c. As such, the document presents and discusses the proposed action, the decisions to be made and the main issues known at this time. The document also invites public comment on these issues and any additional issues related to the proposed action. The Trustees will, as part of a planned draft Restoration Plan, issue a draft environmental impact statement to ensure that environmental effects are considered as part of restoration planning.

Proposed Action

The Trustees propose to restore the environment of the areas affected by the *Exxon Valdez* oil spill to its pre-spill condition. This includes the restoration of any natural resource injured, lost or destroyed and the services provided by that resource or which replaces or substitutes for the injured, lost or destroyed resource and affected services.

Identification of Issues

The Trustees are addressing a number of issues as they develop the *Exxon Valdez* oil spill restoration program. Among the issues identified in the Restoration Framework are the following:

- establishing a final administrative structure that enables the maximum amount of settlement funds to be spent on effective restoration (Chapter I);

- providing meaningful public involvement and establishing a public

advisory group (Chapter II);

- determining when injuries are sufficient to warrant restoration actions (Chapter V);

- evaluating potential restoration options, including the use of objective criteria (Chapter VI); and

- developing a reasonable range of alternatives for restoration options and establishing priorities for use of settlement funds (Chapter VII, Appendix B).

Background

Shortly after midnight on March 24, 1989 the T/V *Exxon Valdez* ran aground on Bligh Reef in Prince William Sound 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 slick lengthened and widened, but stayed in the waters of the Sound and did not go ashore. Even with these favorable conditions 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. Seven 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 in the Gulf of Alaska on April 11, nineteen days after the spill. By May 18, oil had moved some 470 miles and had contaminated shorelines of Prince William Sound, the Kenai Peninsula, lower Cook Inlet, the Kodiak Archipelago, and the Alaska Peninsula. Portions of 1,200 miles of coastline were oiled, including segments 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, nearly 600 miles from Bligh Reef (See Figure 1).

The magnitude of the efforts of the State and Federal governments, the public and Exxon to contain and clean up the oil, rescue oiled birds and sea otters, and study the effects of the spill was unprecedented. During 1989, efforts focused on containing and cleaning up the spill and rescuing oiled wildlife. Skimmer

Figure 1

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. Exxon began a beach cleanup under the direction of the U.S. Coast Guard with input from Federal and State agencies and local communities on the areas that should receive priority for clean up. Several thousand 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 the anticipation of deteriorating weather brought an end to clean-up 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. A shoreline survey and limited clean-up work took place during 1991, and another shoreline survey will be conducted in 1992 to determine if further cleanup is needed.

During the first summer after the spill, the State and Federal Trustee agencies planned and mobilized the Natural Resource Damage Assessment (damage assessment) field studies to determine the nature and extent of the injuries that were 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 scarcity of 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 laboratory data analyses are still underway. In the latter part of 1989, the Trustee agencies, with the assistance of the Environmental Protection Agency, initiated restoration planning activities to identify restoration alternatives and procedures and to implement restoration technical and feasibility studies and projects during 1990 and 1991.

Summary of the Settlement

On December 9, 1991 the United States and the State of Alaska settled their claims against Exxon Corporation and Exxon Shipping Company for various criminal violations and for recovery of civil damages resulting from the oil spill.

Exxon and Exxon Shipping entered guilty pleas to criminal charges filed in the United States District Court. The companies admitted violating provisions of the

Federal Water Pollution Control Act (Clean Water Act), the Migratory Bird Treaty Act, and the Refuse Act. The sentences entered by United States District Judge H. Russel Holland included the largest fine ever imposed for an environmental crime--$150 million.

Exxon Corporation and its subsidiary companies also entered into a 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 to the State and Federal governments. This was the largest sum ever recovered in the United States in an environmental enforcement action (civil).

Thousands of private individuals and other litigants are still pursuing claims in Federal and State courts 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.

Criminal Plea Agreement

Exxon and Exxon Shipping were fined $150 million; of this amount, the sum of $125 million was remitted (i.e., forgiven) due to their cooperation with the governments during the cleanup, timely payment of many private claims, and environmental precautions taken since the spill, and $25 million was paid as follows:

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

- $13 million deposited into the Victims of Crime Act Account

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. The State and Federal governments will independently control the $50 million payment that each has received. These criminal restitution funds 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."

The Civil Settlement and Restoration Fund

The terms of the civil settlement can be found in the Agreement and Consent Decree (Memorandum of Agreement). This document details the agreement among the United States, the State of Alaska, Exxon Corporation, Exxon

Shipping Company, Exxon Pipeline Company, and the T/V *Exxon Valdez* that settled 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 December 9, 1991.

The Exxon companies agreed to pay the United States and the State of Alaska $900 million over a period of 10 years, according to the following schedule:

SCHEDULED DATE	AMOUNT
December 1991	$90 Million
December 1992[1]	$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
September 2001	$70 Million

These monies will be deposited in the registry account of the United States District Court for the District of Alaska and then transferred to the Federal Court Registry Investment System in Houston. As funds are needed for restoration, the Trustees will apply to the Court for disbursement of these funds. The money deposited in the Houston account will be invested and accrue interest for the restoration fund. The Trustees plan to apply to the Court each year as the annual work plan and restoration budget are approved.

The settlement with Exxon also has a reopener provision, that allows the governments to claim up to an additional $100 million between September 1, 2002 and September 1, 2006 to restore one or more populations habitats or species that suffered a substantial loss or decline as a result of the spill. Any

[1] Exxon's cleanup costs for the 1991 and 1992 field seasons will be deducted from this payment.

restoration projects funded with this money must have costs that are not grossly disproportionate to the magnitude of the benefits anticipated, and the injury to the affected population, habitat or species could not reasonably have been known or anticipated from information available at the time of settlement.

The spending guidelines for the civil settlement monies ($900 million) are set forth in the Memorandum of Agreement and Consent Decree (Memorandum of Agreement). Through these documents the United States and the State of Alaska resolved their claims against each other and agreed 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, 1991.

The Memorandum of Agreement provides 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 Trustees also may use the money to reimburse expenses the governments have incurred regarding the oil spill, including costs of litigation, response and damage assessment. The following table summarizes the major points of the Memorandum of Agreement:

MEMORANDUM OF AGREEMENT GUIDELINES

- All decisions shall be made by the unanimous agreement of the Trustees.
- A joint trust fund will be established.
- Within 90 days after the receipt of funds, the Trustees shall agree to an organizational structure for decision making.
- Within 90 days after the receipt of funds, the Trustees shall establish procedures for meaningful public participation, which shall include a public advisory group.
- The Trustees shall jointly use all natural resource damage recoveries for purposes of restoring, replacing, enhancing, rehabilitating, or acquiring the equivalent of natural resources injured as a result of the oil spill and the reduced or lost services provided by such resources, except for the reimbursement of certain expenses to the governments.
- All natural resource damage recoveries will be expended on restoration of natural resources in Alaska unless the Trustees

unanimously agree that spending funds outside of the state is necessary for effective restoration.

Organization

The post-settlement organization is largely guided by the Memorandum of Agreement. In addition to resolving the legal claims between the State of Alaska and the United States governments, the Memorandum of Agreement also states that the governments will maximize the funds available for restoration and sets forth terms for fulfilling their obligations to assess injuries and to restore the natural resources or services. Under the Memorandum of Agreement, the natural resource Trustees are responsible for making all decisions regarding funding, injury assessment and restoration.

The State of Alaska Trustees are:

- Commissioner of the Department of Environmental Conservation;
- Commissioner of the Departments of Fish and Game; and
- Alaska Attorney General.

The Federal Trustees are:

- U.S. Secretary of the Interior;
- U.S. Secretary of Agriculture; and
- Administrator of the National Oceanic and Atmospheric Administration.

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. The State Trustees, unlike their Federal counterparts, serve on the Trustee Council.

The Trustee Council appointed an interim Administrative Director and a Restoration Team to take on the day-to-day management and administrative functions for implementation of the restoration program. Each Trustee has appointed one representative to the Restoration Team. The Attorney General of Alaska appointed a representative from the Department of Natural Resources. The Trustee Council will hire a permanent full-time Administrative Director to chair the Restoration Team. The Trustee Council has formed various subgroups from agency staff to work on components of the restoration program, such as finance, public participation, and habitat protection. The organization chart

approved by the Trustee Council on February 5, 1992 is shown below (See Figure 2).

Figure 2

CHAPTER II
PUBLIC PARTICIPATION

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 among Exxon and the State and Federal governments. The Memorandum of Agreement (MOA) 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...."

This chapter outlines the goals of the public participation program, the type of information available to the public, and provides a brief description of possible criteria for membership on a public advisory group.

Goals and Objectives

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

- invite and encourage public review and comment to guide development and implementation of restoration programs;
- provide the public with information and resources to evaluate proposals and programs independently;
- involve relevant constituencies;
- disseminate information concerning the restoration process in a timely manner;
- establish legitimacy and ensure public acceptance of the restoration process and structure;
- determine the scope of issues to be addressed in the draft environmental impact statement and the significant issues related to restoration; 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 (as of 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;
- 1991 restoration study plans; and
- restoration progress reports and bibliographies.

These documents, as well as an extensive collection of other information on the *Exxon Valdez* oil spill, are available 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 (Facsimile)

Information is also available through public meetings and mailings. Mailing lists will be maintained and updated on a regular basis. Mailings to the people and organizations on these lists will be used along with community meetings and the public advisory group as major components of the public participation program. In addition, the following information will be made available routinely to the public for review:

- meeting agendas;
- transcripts of Trustee Council meetings;
- informational packets; and
- planning and other documents, such as study and implementation project plans.

Community Meetings

The Trustee Council directed the Restoration Team to conduct public meetings and solicit written comments on a public participation program. This process began in January 1992 with meetings held in oil-spill communities as well as Juneau, Anchorage, and Fairbanks. Comments received are being evaluated for

recommendations to the Trustee Council regarding the role, structure, and operating procedures for a public advisory group.

A second series 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 and draft environmental impact statement. Thereafter, it is anticipated that annual work plans will be developed to implement the Restoration Plan. Each year's draft work plan will be the subject of additional public participation and comment.

Public Advisory Group

As noted above, public meetings were 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. The Trustees have tentatively identified the following interests and constituencies to be represented on the public advisory group. This list is preliminary and not meant to be inclusive. These include: aquaculture, commercial fishing, commercial tourism, environment, forest products, local government, native landowners, recreations users, sport fishing and fishing, subsistence, and scientific/academic.

It is anticipated that the members of the advisory group will 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 and constituencies;
- 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 expertise.

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In this first year following settlement, the Trustees will develop a draft Restoration Plan and draft environmental impact statement. The draft plan will present in detail the options and alternative sets 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.

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August 1992:	Proposals for 1993 Work Plan due from public and agencies

September 1992: Draft Restoration Plan and draft environmental impact statement to public for review

Draft proposals for 1993 Work Plan to public for review

October 1992: Public comments due on draft Restoration Plan and draft environmental impact statement

Public comments due on proposals for 1993 Work Plan

February 1993: Final Restoration Plan and environmental impact statement to public

1993 Work Plan to public

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CHAPTER II
PUBLIC PARTICIPATION

Public Participation Plan

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These documents, as well as an extensive collection of other information on the *Exxon Valdez* oil spill, are available 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 (Facsimile)

Information is also available through public meetings and mailings. Mailing lists will be maintained and updated on a regular basis. Mailings to the people and organizations on these lists will be used along with community meetings and the public advisory group as major components of the public participation program. In addition, the following information will be made available routinely to the public for review:

- meeting agendas;
- transcripts of Trustee Council meetings;
- informational packets; and
- planning and other documents, such as study and implementation project plans.

Community Meetings

The Trustee Council directed the Restoration Team to conduct public meetings and solicit written comments on a public participation program. This process began in January 1992 with meetings held in oil-spill communities as well as Juneau, Anchorage, and Fairbanks. Comments received are being evaluated for

recommendations to the Trustee Council regarding the role, structure, and operating procedures for a public advisory group.

A second series 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 and draft environmental impact statement. Thereafter, it is anticipated that annual work plans will be developed to implement the Restoration Plan. Each year's draft work plan will be the subject of additional public participation and comment.

Public Advisory Group

As noted above, public meetings were 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. The Trustees have tentatively identified the following interests and constituencies to be represented on the public advisory group: Aquaculture, Commercial Fishing, Commercial Tourism, Environmental, Conservation, Forest Products, Local Government, Native Landowners, Recreation Users, Sport Hunting and Fishing, Subsistence, Scientific/Academic, The Alaska House of Representatives (ex-officio), The Alaska Senate (ex-officio). This list was approved for initial use and for public comment in the February 27-28, 1992 Trustee Council meeting. It is anticipated that at least these interests would be represented. Single seats would be reserved for Native village council or corporation, local government and one for the Alaska House and one for the Alaska Senate and is not meant to be final at this time.

It is anticipated that the members of the advisory group will be nominated by various organizations and the public and be appointed by unanimous consent of the Trustees. The group will offer non-binding advice to the Trustees. The charter of the public advisory group is reproduced in Appendix A. At this time, the Trustees are formally soliciting nominations for membership on the public advisory group. If you are interested in applying, please contact the Administrative Director c/o Trustee Council at 645 G Street, Anchorage, Alaska, 99501 for further information.

Restoration Plan

In this first year following settlement, the Trustees will develop a draft Restoration Plan and draft environmental impact statement. The draft plan will present in detail the options and alternative sets 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.

April 1992: Restoration Framework to public for review

Draft 1992 Work Plan to public for review

May 1992: Public comments due on Restoration Framework

Public comments due on 1992 Work Plan

May 1992: Request for proposals for 1993 Work Plan to public and agencies

August 1992: Proposals for 1993 Work Plan due from public and agencies

September 1992: Draft Restoration Plan and draft environmental impact statement to public for review

Draft proposals for 1993 Work Plan to public for review

October 1992: Public comments due on draft Restoration Plan and draft environmental impact statement

Public comments due on proposals for 1993 Work Plan

February 1993: Final Restoration Plan and environmental impact statement to public

1993 Work Plan to public

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CHAPTER III
RESTORATION PLANNING TO DATE

The approach to and need for restoration depends on the nature, extent and persistence of injuries to natural resources and natural resources services and the rate and adequacy of natural recovery. Restoration planning, therefore, is a dynamic process that incorporates new findings on injuries and natural recovery, as well as evaluations of restoration options and the availability of funds. The damage assessment studies are the primary sources of information on injuries. Other sources include data gathered during the oil-spill cleanup, public comments and studies conducted outside of the damage assessment program.

Scoping Activities

Public Participation

Late in 1989 the Trustees and the Environmental Protection Agency established a Restoration Planning Work Group. This group began the process of determining the issues to be addressed in the restoration program.

In March 1990 a public symposium was held in Anchorage (Restoration Following the *Exxon Valdez* Oil Spill, Proceedings of the Public Symposium, July 1990). In April and May public meetings were held in Cordova, Valdez, Whittier, Homer, Kodiak, Seward, Anchorage and Kenai-Soldotna. People were invited to ask questions and put forward their ideas about restoration needs and priorities. In August the work group issued a report that described the planning activities to date, summarized the public comments and presented ideas for restoration (Restoration Planning Following the *Exxon Valdez* Oil Spill: August 1990 Progress Report). Opportunities for public participation prior to the settlement, however, were limited due to pending litigation with the parties responsible for the oil spill and the need for the results of damage assessment studies to remain confidential.

Technical Workshop

In April 1990 a three-day technical workshop was held in Anchorage, providing the first opportunity for an organized exchange of ideas on restoration among Federal and State resource managers and selected scientists and technical experts under contract to the governments. This workshop was closed to the public because confidential damage assessment information was discussed.

Guided by an overview of preliminary results from the damage assessment studies, these experts explored a broad range of restoration options that could help restore injured resources and services in the oil-spill area.

Potential restoration options were identified and evaluated and feasibility studies were suggested. Participants also identified other information required to aid restoration planning.

Issues and Concerns Identified

The restoration planning and scoping process has generated a wide array of issues and concerns regarding the restoration of resources and services in the oil-spill area. The following list summarizes these issues and concerns:

- The use of restoration monies for prevention of future spills;
- Determining what clean-up activities should continue to occur;
- The need for continued natural resource damage assessment;
- The need for continued research on injuries;
- The need for long-term monitoring;
- How much reliance should be placed on natural processes to ensure recovery of injured natural resources and services;
- What management practices can be taken by the governments to speed recovery;
- The need to support educational efforts so the general public can understand what happened and what they can do;
- The effect restoration activities have on the local economy of the spill area;
- The need to protect habitat as a direct means of restoration;
- The idea of removing other (not *Exxon Valdez* oil) sources of contamination from the affected area as a means of aiding restoration;
- How to determine the most effective use of restoration monies;
- How to provide for meaningful public involvement; and
- How to establish and operate a public advisory group to the Trustees.

Peer Review

In addition to the technical workshop described above, there have been ongoing consultations with selected nationally recognized scientists and technical experts, who are knowledgeable about Alaskan resources. These experts continue to provide advice for the restoration planning and damage assessment process, identify information needs and review study proposals.

Habitat Protection

Resource experts and the public have identified the protection of fish and wildlife habitats and recreation sites 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. Accordingly, the restoration planning staff conducted special projects concerning the protection of marine and upland habitats.

First, a workshop was held in August 1991 to evaluate State and Federal marine habitat protection designations and their potential usefulness in the restoration program. The designations reviewed included national marine sanctuaries, estuarine research reserve, and Alaska State marine parks. The workshop participants included managers and administrators of various protected areas who provided first-hand information on the areas for which they are responsible. Each type of designation and specific unit has a different purpose, management approach, historical funding level, and track record. Participants suggested that marine habitat protection designations help maintain ecosystem integrity by controlling activities that disrupt ecological processes or that physically damage the environment, thereby minimizing further stress on recovering resources. These designations accommodate conservation objectives as well as other pre-existing uses.

Second, The Nature Conservancy was invited to provide technical assistance in identifying key upland habitats that are linked to the recovery of injured resources and services and evaluating potential protection strategies. The Nature Conservancy is a non-profit organization, and works with private landowners, government agencies, and other organizations to identify and protect ecological resources throughout the Western Hemisphere. In cooperation with the restoration planning staff, The Nature Conservancy prepared a handbook entitled, Options for Identifying and Protecting Strategic Fish and Wildlife Habitats and Recreation Sites (December 1991). The handbook provides 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.

Review of Recovery Literature

The rate and adequacy of natural recovery are considered when evaluating restoration measures. In some cases it may be most appropriate to allow natural recovery to proceed without further human intervention.

To supplement damage assessment data on natural recovery, the Trustee agencies and Environmental Protection Agency initiated in 1991 a review and critical synthesis of the scientific literature on the recovery of marine mammals, marine birds, commercially important fish and shellfish, and invertebrates following environmental perturbations, including other oil spills. The reviews are being conducted under contract by the Point Reyes Bird Observatory (marine birds), University of Washington Fisheries Research Institute (fish and commercially important shellfish), and Hubbs-Sea World Research Institute and the Pacific Estuarine Research Laboratory at San Diego State University (marine mammals and intertidal and subtidal invertebrate communities). These syntheses will be completed in 1992.

Field Studies

As damage assessment results were reviewed in 1990 and 1991, the restoration planning staff consulted with scientists who were conducting the damage assessment studies, Federal and State resource managers, and outside experts to identify and evaluate potential restoration options. In some cases lack of information prevented the evaluation or implementation of a restoration option, and field studies were proposed to provide needed information. Thus, the Trustees approved a series of small-scale restoration studies in 1990 and 1991.

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.

The studies conducted were described in the 1990 and 1991 versions of the State/Federal Natural Resource Damage Assessment and Restoration Plan for the *Exxon Valdez* Oil Spill and in three Federal Register notices (55 Fed. Reg. 8160, [November 19, 1990], 56 Fed. Reg. 8898, [March 1, 1991], and 56 Fed. Reg. 36160, [July 31, 1991]).

In 1991 the Restoration Planning Work Group began to develop an integrated longterm monitoring strategy to assess the recovery of injured natural resources in the oil-spill area. If the Trustees implement such a program, it would determine if and when injured resources have been restored to their pre-spill baseline conditions. The program also could monitor the effectiveness of restoration activities. A monitoring program also would detect latent injuries and reveal long-term trends in the environmental health of ecosystems affected by the oil spill. The duration of the monitoring program would depend on the severity and duration of effects resulting from the spill and the time necessary to establish a trend for recovery.

Some limited monitoring studies are proposed to be conducted in the field in 1992 (see draft 1992 Work Plan). At the same time, efforts will continue to develop a comprehensive and integrated monitoring program as part of the draft Restoration Plan. This is presented as Restoration Option No. 31 in Appendix B of this document. Development of a monitoring plan requires the identification of goals and objectives, and then technical designs and costs for monitoring target resources and services.

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CHAPTER V
INJURY CRITERIA

Settlement Guidance

The settlement documents specify that 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. "Other such resources" includes archaeological resources. The services provided by natural resources include such activities as subsistence hunting and fishing and recreation.

Proposed Criteria

How do we determine which natural resources and natural resource services warrant further restoration activities? The following criteria are proposed to assist the Trustees in these determinations:

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

The concepts underlying these criteria are described below.

Injury to Natural Resources

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:

- significant direct mortality;
- significant declines in populations or productivity;
- significant sublethal and chronic effects to adults or any 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 potential natural resources injuries. Consequential loss is most certain where there was significant direct mortality (e.g., bald eagles 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.

Important archaeological sites and artifacts, protected by both Federal and State laws, were oiled. Inherent values could be irretrievably lost as oil continues to contaminate additional artifacts at some sites. Archaeological sites and artifacts are not living, renewable resources and have no capacity to heal themselves. Increased public knowledge of exact archaeological site locations, also continues to foster looting and vandalism.

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 restricted scope or duration of the damage assessment studies. The killer whale is one example. In these cases, judgments concerning injuries to natural resources as a result of the oil spill will have to be determined by the weight of the evidence or best professional judgment.

Injury to Natural Resource Services

A natural resource service has experienced "consequential injury" if the *Exxon Valdez* oil spill or clean up:

- has resulted in the continued presence of oil on or adjacent to special

purpose lands[1];

- has significantly reduced the physical or biological functions performed by injured natural resources, including loss of human uses; or

- has significantly reduced aesthetic, intrinsic or other indirect uses provided by injured natural resources.

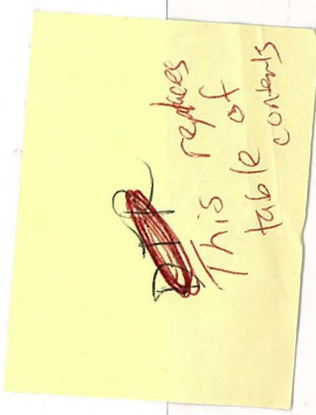
This definition covers a wide range of potentially injured natural resources services. Examples are commercial fishing, subsistence hunting, fishing, and gathering; wildlife viewing; sport fishing; and recreation, which includes a variety of activities, such as kayaking and backcountry camping.

Indirect uses, such as aesthetics or appreciation of wilderness qualities, were also affected by the spill. This is a particular concern for those areas which formally have been designated as wilderness areas by the United States or the State of Alaska.

Recovery Concepts

To maximize the benefits of restoration expenditures, the Trustees will consider the effects of natural recovery before investing restoration dollars. 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 were provided by the pre-spill, uninjured system.

Our ability to determine scientifically if recovery has occurred or when it will occur may be limited, due to such problems as the quality and quantity of information on pre-spill, "baseline" conditions. For each injured resource and service, however, an estimation of the rate of natural recovery will be considered based on the best information available from the damage assessment and restoration studies, the scientific literature and other sources. If it appears that recovery will be nearly complete before the benefits of a restoration study or project can be realized, then the Trustees may suggest 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.



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[1]"Special-purpose" lands have been designated by the State of Alaska or the United States for the protection and conservation of natural resources and services.

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RPWG
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April 1992

Dear Reviewer:

In the autumn of 1991 the United States and the State of Alaska settled their claims against the Exxon Corporation and Exxon Shipping Company for the *Exxon Valdez* oil spill. Money provided by the settlement will be used to restore the environment of Prince William Sound, lower Cook Inlet, and the Gulf of Alaska. The court has entrusted this task to the undersigned six State and Federal Trustees, who in consultation with the public are responsible for determining how restoration funds are to be spent.

Exxon Valdez Oil Spill Restoration is a key step in shaping the decision-making process. It is divided into two volumes, which are presented for your review and comment. Volume 1: Restoration Framework provides background information and proposes guidelines for the future. Volume II: 1992 Work Plan proposes activities that are important to undertake in 1992 prior to the final development of the Restoration Plan. We expect that a work plan will be developed annually, describing the activities the Trustees intend to conduct in that year.

These documents are intended to elicit comments and suggestions from you and to begin the public "scoping" process for environmental analysis under the National Environmental Policy Act. We want to know how you view this process and receive suggestions concerning restoration of the resources and services injured by the oil spill. This planning effort will culminate in the development of the overall Restoration Plan, which will be the restoration program's blueprint for the next decade.

We invite your comments on both Volumes I and II of *Exxon Valdez* Oil Spill Restoration. The issues identified on the tear sheets in each document are intended to facilitate but not limit your comments and suggestions. In order to be considered during the development of the final 1992 Work Plan and draft Restoration Plan, written comments must be received by _____, at the following address:

Exxon Valdez Oil Spill Trustee Council
645 "G" Street
Anchorage, Alaska 99501

Questions concerning this document or its distribution should be directed to Mary McGee, Oil Spill Public Information Center, 645 G Street, Anchorage, Alaska 99501, or you may call (907) 278-8008.

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

Sincerely,

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

Charles E. Cole
Attorney General
State of Alaska

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

Steven Pennoyer
Director
Alaska Region
National Marine Fisheries Service

Carl L. Rosier
Commissioner
Alaska Department of
Fish and Game

John A. Sandor
Commissioner
Alaska Department of
Environmental Conservation

COMMENTS

You are invited to share your ideas and comments with the Trustee Council. Please use this tear sheet to present your views on the Restoration Framework. You may send additional comments by letter or participate in a public meeting on the 1992 Work Plan and Restoration Framework.

If needed, use the space on the back or attach additional sheets.
Please fold, staple, and add a postage stamp. Thank you for your interest and participation.

Return Address:

_____

_____

_____

Place
Stamp
Here

Exxon Valdez Oil Spill Trustee Council
645 "G" Street
Anchorage, AK 99501

Attn: Restoration Framework

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Additional Comments:

Restoration Framework
Table of Contents

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EXECUTIVE SUMMARY

In *Exxon Valdez* Oil Spill Restoration, Volume I: Restoration Framework, the Trustees propose a process and structure to guide the restoration of the resources and services injured by the *Exxon Valdez* oil spill. The Restoration Framework also serves as a "scoping" document as required by the National Environmental Policy Act.

On October 9, 1991 a settlment agreement was filed in United States District Court that required Exxon to pay $1 billion dollars in criminal restitution and civil damages to the governments. This settlement provides an extraordinary opportunity to address the restoration of injuries resulting from the largest oil spill in United States history.

Post Settlement Administration (Chapter I)

The State and Federal Trustees will recover $900 million dollars from Exxon for civil claims over the next 10 years. These funds will be deposited into a Federal interest bearing account in Houston and then into a Joint Use Fund in Alaska. Subject to court approval, the Trustees will draw from that fund for restoration and for certain reimbursements.

All decisions about restoration and uses of restoration funds must have the unanimous agreement of six Trustees, three Federal and three State. The Federal Trustees have delegated authority to their representatives on an Alaska-based Trustee Council. The State Trustees, unlike their Federal counterparts, serve on the Trustee Council. The Trustee Council has appointed a Restoration Team to administer and manage the restoration process. An Administrative Director will be hired to chair the Restoration Team. The Trustee Council has approved creation of a number of working groups to address specific needs, such as budget, public participation, and habitat evaluation and protection.

Public Participation (Chapter II)

The settlement terms specify that the Trustees 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 Trustees intend to establish a public advisory group and have held a series of public meetings to solicit comments on the role, responsibility and membership of that group. Additional public comment will be sought on the Restoration Framework and the draft 1992 Work Plan, as draft and final restoration plans are developed in the balance of this year.

Restoration Planning Before the Settlement (Chapter III)

The Trustees and the Environmental Protection Agency laid the foundation for restoration through the work of the Restoration Planning Work Group from late 1989 until December 1991. This group carried out several scoping activities, including a series of public meetings and consultations with technical experts. The restoration group also developed draft criteria for evaluating restoration options, and began analyzing the many restoration options suggested by the public, resource managers and scientists.

Summary of Injury (Chapter IV)

Immediately after the *Exxon Valdez* oil spill, the Trustees began a series of studies--the Natural Resource Damage Assessment--to determine the effects of the oil spill on the environment and the many resources and services administered by the Trustee agencies (e.g., marine and terrestrial mammals, birds, fish and shellfish, archaeological resources, subsistence). Most of these studies were concluded in 1991. They provide an assessment of a wide range of injuries, some immediate and acute, some subtle and persistent. Major results of the studies to date are discussed.

Criteria for Injuries (Chapter V) and Restoration Options (Chapter VI)

The settlement specifies that restoration funds must be spent to restore natural resources and services injured by the *Exxon Valdez* oil spill. The Trustees propose that "evidence of consequential injury" and "the adequacy and rate of natural recovery" must be considered in deciding whether it is appropriate to spend restoration dollars on a given resource or service. Once it has been established that a resource or service warrants restoration action, there may be a number of effective restoration options. The Trustees also propose criteria to help evaluate such options, including technical feasibility, cost effectiveness, and the potential for additional injury resulting from the proposed restoration option.

Restoration Alternatives and Options (Chapter VII)

The restoration planning process to date has yielded a variety of ideas, which are presented for comment as restoration options in Appendix B. These restoration options, and others identified by the public, will be considered by the Trustee Council as possible components of several restoration alternatives in a draft restoration plan.

For purposes of this scoping document, six possible alternatives have been identified. These are:

- no-action;
- management of human uses;

- manipulation of resource;
- habitat protection and acquisition;
- acquisition of equivalent resources; and
- combination.

An analysis of a proposed action and various alternatives will be presented for public comment in a draft restoration plan and environmental impact statement.

Appendices A and B

Two appendices are attached: life histories and backgrounds on injured resources and services and a series of restoration options that have been suggested by the public, resource managers and technical experts.

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CHAPTER I
INTRODUCTION

The intent of *Exxon Valdez* Oil Spill Restoration, Volume I: Restoration Framework (Restoration Framework) is to propose a process to guide the Trustees and the public in the restoration of the environment injured by the *Exxon Valdez* oil spill. This document contains information on *Exxon Valdez* oil spill restoration activities to date, background information on the legal settlement that provides funding for restoration, and a description of the Trustees' structure for administration of the restoration program. Information is also provided on the injuries to natural resources and services, proposed criteria for determining when injury is sufficient to warrant restoration actions, proposed criteria and procedures for evaluating specific restoration options, and an initial description of possible restoration alternatives. Life history and background on injured natural resources and services are presented in Appendix A.

The Restoration Framework also serves the Trustees as a "scoping" document pursuant to the National Environmental Policy Act 42 U.S.C. 4321-4370c. As such, the document presents and discusses the proposed action, the decisions to be made and the main issues known at this time. The document also invites public comment on these issues and any additional issues related to the proposed action. The Trustees will, as part of a planned draft restoration plan, issue a draft environmental impact statement to ensure that environmental effects are considered as part of restoration planning.

Proposed Action

The Trustees propose to restore the environment of the areas affected by the *Exxon Valdez* oil spill to its pre-spill condition. This includes the restoration of any natural resource injured, lost or destroyed and the services provided by that resource or which replaces or substitutes for the injured, lost or destroyed resource and affected services. The Trustees will develop a restoration plan considering restoration options described in Appendix B and others identified subsequently. The Restoration Plan will establish management direction in a programmatic manner and guide all activities to restore injured natural resources and services. Specific restoration activities will be developed annually and may be implemented if consistent with the Restoration Plan.

Identification of Issues

The Trustees are addressing a number of issues as they develop the *Exxon Valdez* oil spill restoration program. Among the issues identified in the Restoration Framework are the following:

- establishing a final administrative structure that enables the maximum amount of settlement funds to be spent on effective restoration (Chapter I);

- providing meaningful public involvement and establishing a public advisory group (Chapter II);

- determining when injuries are sufficient to warrant restoration actions (Chapter V);

- evaluating potential restoration options, including the use of objective criteria (Chapter VI); and

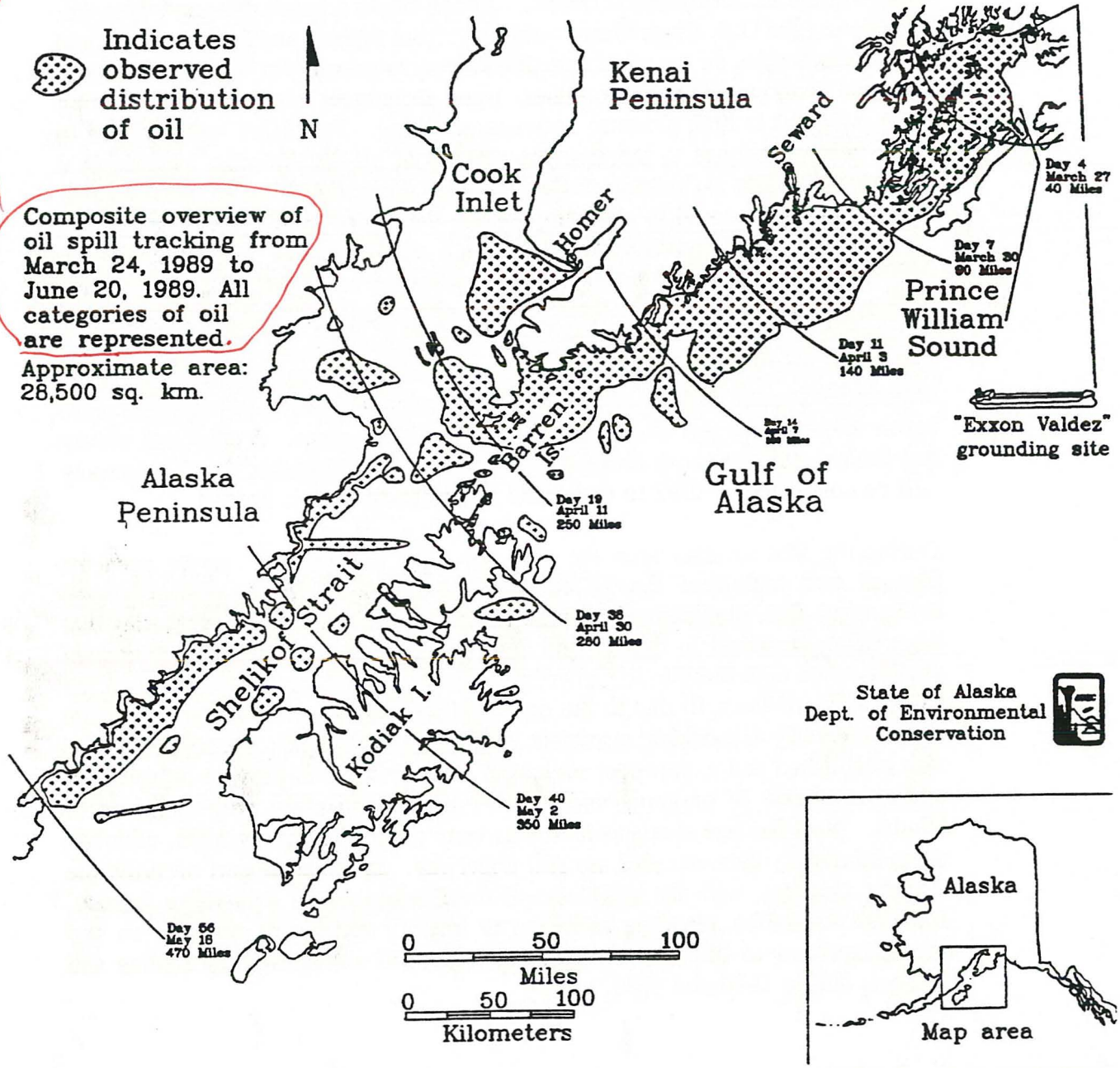
- developing a reasonable range of alternatives for restoration options and establishing priorities for use of settlement funds (Chapter VII, Appendix B).

Background

Shortly after midnight on March 24, 1989 the T/V *Exxon Valdez* ran aground on Bligh Reef in Prince William Sound 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 slick lengthened and widened, but stayed in the waters of the Sound and did not go ashore. Even with these favorable conditions 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. Seven 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 in the Gulf of Alaska on April 11, nineteen days after the spill. By May 18, oil had moved some 470 miles and had contaminated shorelines of Prince William Sound, the Kenai Peninsula, lower Cook Inlet, the Kodiak Archipelago, and the Alaska Peninsula. Portions of 1,200 miles of coastline were oiled, including segments 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, nearly 600 miles from Bligh Reef (See Figure 1).

The magnitude of the efforts of the State and Federal governments, the public and Exxon to contain and clean up the oil, rescue oiled birds and sea otters, and study the effects of the spill was unprecedented. During 1989, efforts focused on containing and cleaning up the spill and rescuing oiled wildlife. Skimmer

Figure 1


Indicates observed distribution of oil
N
Composite overview of oil spill tracking from March 24, 1989 to June 20, 1989. All categories of oil are represented.
Approximate area: 28,500 sq. km.
Kenai Peninsula
Cook Inlet
Homer
Seward
Prince William Sound
Day 4 March 27 40 Miles
Day 7 March 30 90 Miles
Day 11 April 3 140 Miles
"Exxon Valdez" grounding site
Barren Is.
Gulf of Alaska
Alaska Peninsula
Day 19 April 11 250 Miles
Day 36 April 30 280 Miles
Shelikof Strait
Kodiak I.
Day 40 May 2 350 Miles
Day 56 May 18 470 Miles
0 50 100
Miles
0 50 100
Kilometers
State of Alaska Dept. of Environmental Conservation
Alaska
Map area

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. Exxon began a beach cleanup under the direction of the U.S. Coast Guard with input from Federal and State agencies and local communities on the areas that should receive priority for clean up. Several thousand 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 the anticipation of deteriorating weather brought an end to clean-up 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. A shoreline survey and limited clean-up work took place during 1991, and another shoreline survey will be conducted in 1992 to determine if further cleanup is needed.

During the first summer after the spill, the State and Federal Trustee agencies planned and mobilized the Natural Resource Damage Assessment (damage assessment) field studies to determine the nature and extent of the injuries that were 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 scarcity of 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 laboratory data analyses are still underway. In the latter part of 1989, the Trustee agencies, with the assistance of the Environmental Protection Agency, initiated restoration planning activities to identify restoration alternatives and procedures and to implement restoration technical and feasibility studies and projects during 1990 and 1991.

Summary of the Settlement

On October 9, 1991 an agreement was filed in United States District Court that settled the claims of the United States and the State of Alaska settled their claims against Exxon Corporation and Exxon Shipping Company for various criminal violations and for recovery of civil damages resulting from the oil spill.

Exxon and Exxon Shipping entered guilty pleas to criminal charges filed in the

United States District Court. The companies admitted violating provisions of the Federal Water Pollution Control Act (Clean Water Act), the Migratory Bird Treaty Act, and the Refuse Act. The sentences entered by United States District Judge H. Russel Holland included the largest fine ever imposed for an environmental crime--$150 million.

Exxon Corporation and its subsidiary companies also entered into a 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 to the State and Federal governments. This was the largest sum ever recovered in the United States in an environmental enforcement action (civil).

Thousands of private individuals and other litigants are still pursuing claims in Federal and State courts 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.

Criminal Plea Agreement

Exxon and Exxon Shipping were fined $150 million; of this amount, the sum of $125 million was remitted (i.e., forgiven) due to their cooperation with the governments during the cleanup, timely payment of many private claims, and environmental precautions taken since the spill, and $25 million was paid as follows:

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

- $13 million deposited into the Victims of Crime Act Account

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. The State and Federal governments will independently control the $50 million payment that each has received. These criminal restitution funds 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."

The Civil Settlement and Restoration Fund

The terms of the civil settlement can be found in the Agreement and Consent Decree (Memorandum of Agreement). This document details the agreement

among the United States, the State of Alaska, Exxon Corporation, Exxon Shipping Company, Exxon Pipeline Company, and the T/V *Exxon Valdez* that settled 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.) by United States District Judge H. Russel Holland on October 9, 1991. The period for consideration of appeals ended on December 9, 1991.

The Exxon companies agreed to pay the United States and the State of Alaska $900 million over a period of 10 years, according to the following schedule:

SCHEDULED DATE	AMOUNT
December 1991	$90 Million
December 1992[1]	$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
September 2001	$70 Million

These monies will be deposited in the registry account of the United States District Court for the District of Alaska and then transferred to the Federal Court Registry Investment System in Houston. As funds are needed for restoration, the Trustees will apply to the Court for disbursement of these funds. The money deposited in the Houston account will be invested and accrue interest for the restoration fund. The Trustees plan to apply to the Court each year as the annual work plan and restoration budget are approved.

The settlement with Exxon also has a reopener provision, that allows the governments to claim up to an additional $100 million between September 1, 2002 and September 1, 2006 to restore one or more populations habitats or

[1] Exxon's cleanup costs for the 1991 and 1992 field seasons will be deducted from this payment.

species that suffered a substantial loss or decline as a result of the spill. Any restoration projects funded with this money must have costs that are not grossly disproportionate to the magnitude of the benefits anticipated, and the injury to the affected population, habitat or species could not reasonably have been known or anticipated from information available at the time of settlement.

The spending guidelines for the civil settlement monies ($900 million) are set forth in the Memorandum of Agreement and Consent Decree (Memorandum of Agreement). Through these documents the United States and the State of Alaska resolved their claims against each other and agreed 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, 1991.

The Memorandum of Agreement provides 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 Trustees also may use the money to reimburse expenses the governments have incurred regarding the oil spill, including costs of litigation, response and damage assessment. The following table summarizes the major points of the Memorandum of Agreement:

MEMORANDUM OF AGREEMENT GUIDELINES

- all decisions shall be made by the unanimous agreement of the Trustees;
- a joint trust fund will be established;
- within 90 days after the receipt of funds, the Trustees shall agree to an organizational structure for decision making;
- within 90 days after the receipt of funds, the Trustees shall establish procedures for meaningful public participation, which shall include a public advisory group;
- the Trustees shall jointly use all natural resource damage recoveries for purposes of restoring, replacing, enhancing, rehabilitating, or acquiring the equivalent of natural resources injured as a result of the oil spill and the reduced or lost services provided by such resources, except for the reimbursement of certain expenses to the governments; and

- all natural resource damage recoveries will be expended on restoration of natural resources in Alaska unless the Trustees unanimously agree that spending funds outside of the state is necessary for effective restoration.

Organization

The post-settlement organization is largely guided by the Memorandum of Agreement. In addition to resolving the legal claims between the State of Alaska and the United States governments, the Memorandum of Agreement also states that the governments will maximize the funds available for restoration and sets forth terms for fulfilling their obligations to assess injuries and to restore the natural resources or services. Under the Memorandum of Agreement, the natural resource Trustees are responsible for making all decisions regarding funding, injury assessment and restoration.

The State of Alaska Trustees are:

- Commissioner of the Department of Environmental Conservation;
- Commissioner of the Departments of Fish and Game; and
- Alaska Attorney General.

The Federal Trustees are:

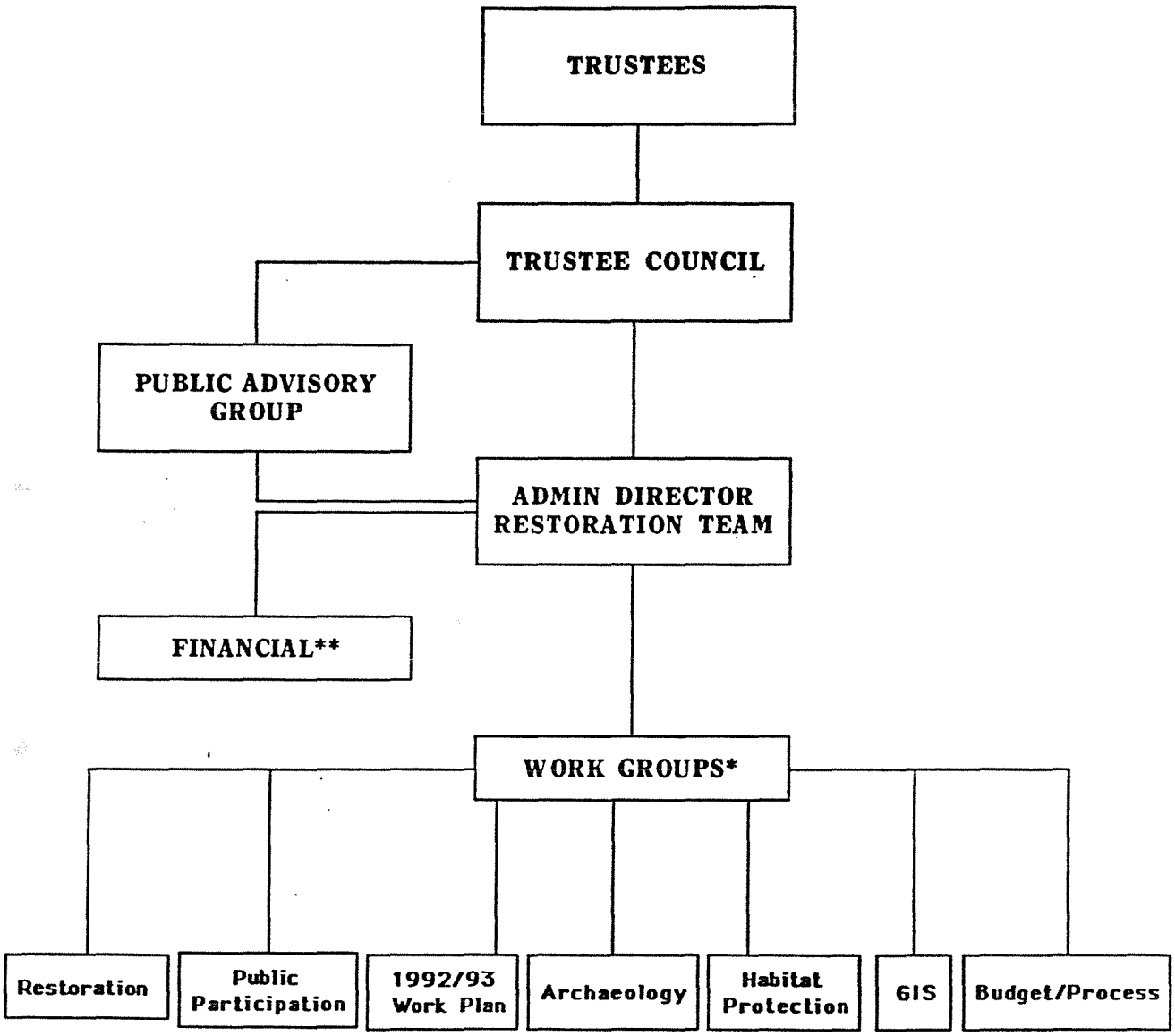
- Secretary of the U.S Department of Interior;
- Secretary of the U.S. Department of Agriculture; and
- Administrator of the National Oceanic and Atmospheric Administration.

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. The State Trustees, unlike their Federal counterparts, serve on the Trustee Council.

The Trustee Council appointed an interim Administrative Director and a Restoration Team to take on the day-to-day management and administrative functions for implementation of the restoration program. Each Trustee has appointed one representative to the Restoration Team. The Attorney General of Alaska appointed a representative from the Department of Natural Resources. The Trustee Council will hire a permanent full-time Administrative Director to chair the Restoration Team. The Trustee Council has formed various subgroups

from agency staff to work on components of the restoration program, such as finance, public participation, and habitat protection. The organization chart approved by the Trustee Council on February 5, 1992 is shown below (See Figure 2).

Figure 2



* Groups will be formed and disband as appropriate.

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

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CHAPTER II
PUBLIC PARTICIPATION

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 among Exxon and the State and Federal governments. The Memorandum of Agreement (MOA) 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...."

This chapter outlines the goals of the public participation program, the type of information available to the public, and provides a brief description of possible criteria for membership on a public advisory group.

Goals and Objectives

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

- invite and encourage public review and comment to guide development and implementation of restoration programs;
- provide the public with information and resources to evaluate proposals and programs independently;
- involve relevant constituencies;
- disseminate information concerning the restoration process in a timely manner;
- establish legitimacy and ensure public acceptance of the restoration process and structure;
- determine the scope of issues to be addressed in the draft environmental impact statement and the significant issues related to restoration; 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 (as of 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;
- 1991 restoration study plans; and
- restoration progress reports and bibliographies.

These documents, as well as an extensive collection of other information on the *Exxon Valdez* oil spill, are available 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 (Facsimile)

Information is also available through public meetings and mailings. Mailing lists will be maintained and updated on a regular basis. Mailings to the people and organizations on these lists will be used along with community meetings and the public advisory group as major components of the public participation program. In addition, the following information will be made available routinely to the public for review:

- meeting agendas;
- transcripts of Trustee Council meetings;
- informational packets; and
- planning and other documents, such as study and implementation project plans.

Community Meetings

The Trustee Council directed the Restoration Team to conduct public meetings and solicit written comments on a public participation program. This process began in January 1992 with meetings held in oil-spill communities as well as Juneau, Anchorage, and Fairbanks. Comments received are being evaluated for

recommendations to the Trustee Council regarding the role, structure, and operating procedures for a public advisory group.

A second series 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 and draft environmental impact statement. Thereafter, it is anticipated that annual work plans will be developed to implement the restoration plan. Each year's draft work plan will be the subject of additional public participation and comment.

Public Advisory Group

As noted above, public meetings were 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. The Trustees have tentatively identified the following interests and constituencies to be represented on the public advisory group: aquaculture, commercial fishing, commercial tourism, environmental, conservation, forest products, local government, Native landowners, recreation users, sport hunting and fishing, subsistence, scientific/academic, The Alaska House of Representatives (ex-officio), the Alaska Senate (ex-officio). This list was approved for initial use and for public comment in the February 27-28, 1992 Trustee Council meeting and is not meant to be final at this time. It is anticipated that at least these interests would be represented. Single seats would be reserved for representatives of each of the following: Native village council or corporation, local government, the Alaska House and the Alaska Senate.

It is anticipated that the members of the advisory group will be nominated by various organizations and the public and be appointed by unanimous consent of the Trustees. The group will offer non-binding advice to the Trustees. At this time, the Trustees are formally soliciting nominations for membership on the public advisory group. If you are interested in applying, please contact the Administrative Director at 645 "G" Street, Anchorage, Alaska, 99501 for further information.

Restoration Plan

In this first year following settlement, the Trustees will develop a draft restoration plan and draft environmental impact statement. The draft plan will present in detail the options and alternative sets 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.

April 1992:	Restoration Framework to public for review
	Draft 1992 Work Plan to public for review
May 1992:	Public comments due on Restoration Framework
	Public comments due on 1992 Work Plan
May 1992:	Request for proposals for 1993 Work Plan to public and agencies
August 1992:	Proposals for 1993 Work Plan due from public and agencies
September 1992:	Draft Restoration Plan and draft environmental impact statement to public for review
	Draft proposals for 1993 Work Plan to public for review
October 1992:	Public comments due on draft Restoration Plan and draft environmental impact statement
	Public comments due on proposals for 1993 Work Plan
February 1993:	Final Restoration Plan and environmental impact statement to public
	1993 Work Plan to public

CHAPTER III
RESTORATION PLANNING TO DATE

The approach to and need for restoration depends on the nature, extent and persistence of injuries to natural resources and natural resources services and the rate and adequacy of natural recovery. Restoration planning, therefore, is a dynamic process that incorporates new findings on injuries and natural recovery, as well as evaluations of restoration options and the availability of funds. The damage assessment studies are the primary sources of information on injuries. Other sources include data gathered during the oil-spill cleanup, public comments and studies conducted outside of the damage assessment program.

Scoping Activities

Public Participation

Late in 1989 the Trustees and the Environmental Protection Agency established a staff-level Restoration Planning Work Group. This group began the process of determining the issues to be addressed in the restoration program.

In March 1990 a public symposium was held in Anchorage (Restoration Following the *Exxon Valdez* Oil Spill, Proceedings of the Public Symposium, July 1990). In April and May public meetings were held in Cordova, Valdez, Whittier, Homer, Kodiak, Seward, Anchorage and Kenai-Soldotna. People were invited to ask questions and put forward their ideas about restoration needs and priorities. In August the work group issued a report that described the planning activities to date, summarized the public comments and presented ideas for restoration (Restoration Planning Following the *Exxon Valdez* Oil Spill: August 1990 Progress Report). Opportunities for public participation prior to the settlement, however, were limited due to pending litigation with the parties responsible for the oil spill and the need for the results of damage assessment studies to remain confidential.

Technical Workshop

In April 1990 a three-day technical workshop was held in Anchorage, providing the first opportunity for an organized exchange of ideas on restoration among Federal and State resource managers and selected scientists and technical experts under contract to the governments. This workshop was closed to the public because confidential damage assessment information was discussed.

Guided by an overview of preliminary results from the damage assessment studies, these experts explored a broad range of restoration options that could help restore injured resources and services in the oil-spill area.

Potential restoration options were identified and evaluated and feasibility studies were suggested. Participants also identified other information required to aid restoration planning.

Issues and Concerns Identified

The restoration planning and scoping process has generated a wide array of issues and concerns regarding the restoration of resources and services in the oil-spill area. The following list summarizes these issues and concerns:

- the use of restoration monies for prevention of future spills;
- determining what clean-up activities should continue to occur;
- the need for continued natural resource damage assessment;
- the need for continued research on injuries;
- the need for long-term monitoring;
- how much reliance should be placed on natural processes to ensure recovery of injured natural resources and services;
- what management practices can be taken by the governments to speed recovery;
- the need to support educational efforts so the general public can understand what happened and what they can do;
- the effect restoration activities have on the local economy of the spill area;
- the need to protect habitat as a direct means of restoration;
- the idea of removing other (not *Exxon Valdez* oil) sources of contamination from the affected area as a means of aiding restoration;
- how to determine the most effective use of restoration monies;
- how to provide for meaningful public involvement; and
- how to establish and operate a public advisory group to the Trustees.

Peer Review

In addition to the technical workshop described above, there have been ongoing consultations with selected nationally recognized scientists and technical experts, who are knowledgeable about Alaskan resources. These experts continue to provide advice for the restoration planning and damage assessment process, identify information needs and review study proposals.

Habitat Protection

Resource experts and the public have identified the protection of fish and wildlife habitats and recreation sites 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. Accordingly, the restoration planning staff conducted special projects concerning the protection of marine and upland habitats.

First, a workshop was held in August 1991 to evaluate State and Federal marine habitat protection designations and their potential usefulness in the restoration program. The designations reviewed included national marine sanctuaries, estuarine research reserves and Alaska State marine parks. The workshop participants included managers and administrators of various protected areas who provided first-hand information on the areas for which they are responsible. Each type of designation and specific unit has a different purpose, management approach, historical funding level, and track record. Participants suggested that marine habitat protection designations help maintain ecosystem integrity by controlling activities that disrupt ecological processes or that physically damage the environment, thereby minimizing further stress on recovering resources. These designations accommodate conservation objectives as well as other pre-existing uses.

Second, The Nature Conservancy was invited to provide technical assistance in identifying key upland habitats that are linked to the recovery of injured resources and services and evaluating potential protection strategies. The Nature Conservancy is a non-profit organization, and works with private landowners, government agencies, and other organizations to identify and protect ecological resources throughout the Western Hemisphere. In cooperation with the restoration planning staff, The Nature Conservancy prepared a handbook entitled, Options for Identifying and Protecting Strategic Fish and Wildlife Habitats and Recreation Sites (December 1991). The handbook provides 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.

Review of Recovery Literature

The rate and adequacy of natural recovery are considered when evaluating restoration measures. In some cases it may be most appropriate to allow natural recovery to proceed without further human intervention.

To supplement damage assessment data on natural recovery, the Trustee agencies and Environmental Protection Agency initiated in 1991 a review and critical synthesis of the scientific literature on the recovery of marine mammals, marine birds, commercially important fish and shellfish, and invertebrates following environmental perturbations, including other oil spills. The reviews are being conducted under contract by the Point Reyes Bird Observatory (marine birds), University of Washington Fisheries Research Institute (fish and commercially important shellfish), and Hubbs-Sea World Research Institute and the Pacific Estuarine Research Laboratory at San Diego State University (marine mammals and intertidal and subtidal invertebrate communities). These syntheses will be completed in 1992.

Field Studies

As damage assessment results were reviewed in 1990 and 1991, the restoration planning staff consulted with scientists who were conducting the damage assessment studies, Federal and State resource managers, and outside experts to identify and evaluate potential restoration options. In some cases lack of information prevented the evaluation or implementation of a restoration option, and field studies were proposed to provide needed information. Thus, the Trustees approved a series of small-scale restoration studies in 1990 and 1991.

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.

The studies conducted were described in the 1990 and 1991 versions of the State/Federal Natural Resource Damage Assessment and Restoration Plan for the *Exxon Valdez* Oil Spill and in three Federal Register notices (55 Fed. Reg. 8160, [November 19, 1990], 56 Fed. Reg. 8898, [March 1, 1991], and 56 Fed. Reg. 36160, [July 31, 1991]).

In 1991 the Restoration Planning Work Group began to develop an integrated longterm monitoring strategy to assess the recovery of injured natural resources in the oil-spill area. If the Trustees implement such a program, it would determine if and when injured resources have been restored to their pre-spill baseline conditions. The program also could monitor the effectiveness of restoration activities. A monitoring program also would detect latent injuries and reveal long-term trends in the environmental health of ecosystems affected by the oil spill. The duration of the monitoring program would depend on the severity and duration of effects resulting from the spill and the time necessary to establish a trend for recovery.

Some limited monitoring studies are proposed to be conducted in the field in 1992 (see draft 1992 Work Plan). At the same time, efforts will continue to develop a comprehensive and integrated monitoring program as part of the draft Restoration Plan. This is presented as Restoration Option No. 31 in Appendix B of this document. Development of a monitoring plan requires the identification of goals and objectives and then technical designs and costs for monitoring target resources and services.

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NOTE: This version incorporates Spies' comments on the Gertler draft. It does not incorporate agency comments on the Spies comments.

CHAPTER IV 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 four 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 transported to the subtidal zone in some areas.

Marine Mammals

Following the spill, humpback whales, Steller sea lions, sea otters, harbor seals, and killer whales were studied. The field work on the Steller sea lions and the humpback whales was completed in 1990 . Humpback whale studies included photo identification of individual whales, estimation of reproductive success, and possible displacement of whales from their preferred habitat. Exposure of this species to oil was not observed nor were tissues sampled and analyzed for hydrocarbons. The data do not indicate an effect of the spill on mortality or reproduction of Humpback whales in Prince William Sound, however humpback whales were displaced from Lower Knight Island Passage in 1989.

Results from the sea lion study were inconclusive. Several sea lions were observed with oiled pelts and petroleum hydrocarbons were found in some tissues. Determining if there was an effect of the spill on the sea lion population was complicated by seasonal movements in and out of the spill area, an ongoing population decline in the Gulf of Alaska, and a pre-existing problem with premature pupping.

Based on several photo-identification censuses a significant number of killer whales are missing from at least one and possibly two pods in Prince William Sound. Changes have also been observed in killer whale distribution and social structure. Some male whales have drooping dorsal fins. The cause of the mortalities and fin problems is uncertain. Injuries to harbor seals and sea otters have been more 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 may have 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.

Heavy initial and continuing long-term exposure to petroleum hydrocarbons may be resulting in a chronic effect on sea otters. Preliminary findings of the Coastal Habitat and Shellfish studies identified significantly elevated concentrations of petroleum hydrocarbons in intertidal and subtidal sediment samples within the spill zone as well as in intertidal mussels and benthic marine invertebrates identified as sea otter prey in western Prince William Sound. Analyses of blood taken from sea otters in 1990 and 1991 indicated significant differences in several blood measures 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 measures between east and west female sea otters, some changes in blood chemistry were present which were consistent with changes observed in the males. The changes observed in both sexes are not sufficient to indicate that the individuals that were sampled have health problems likely to result in death.

Abnormal patterns of mortality are continuing in 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 individuals . A high proportion of prime-age sea otter carcasses were found during 1990 and 1991, indicating a chronic effect of the spill.

Results of boat surveys indicate continued declines in sea otter abundance within oiled habitats in Prince William Sound. Pre-spill estimates of sea otter abundance in Prince William Sound were carried out in 1984 and 1985. Comparisons of pre- and post-spill estimates of sea otter abundance, based on boat surveys nearshore,

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.

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 Weaned sea otter pups with radio tags died at a faster rate in western Prince William Sound than in 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 (See Figure 3).

Sea otters released from rehabilitation centers had higher mortality and significantly lower pupping rates than those measured in the wild population before the spill. 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 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 and potentially 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 were abnormally lethargic and unwary. Petroleum hydrocarbon concentrations in bile were 5 to 6 times higher in seals from oiled areas than oiled areas one year after the spill. This indicates that seals were still encountering oil in the environment, were mobilizing fat reserves containing petroleum hydrocarbons, or both.

There was not a complete census of harbor seals in Prince William Sound before the spill. However, trend locations have been intermittently surveyed since the 1970s. Counts at the trend sites 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. Censuses in 1989 through 1991 provided data indicating differential rates of decline at oiled versus

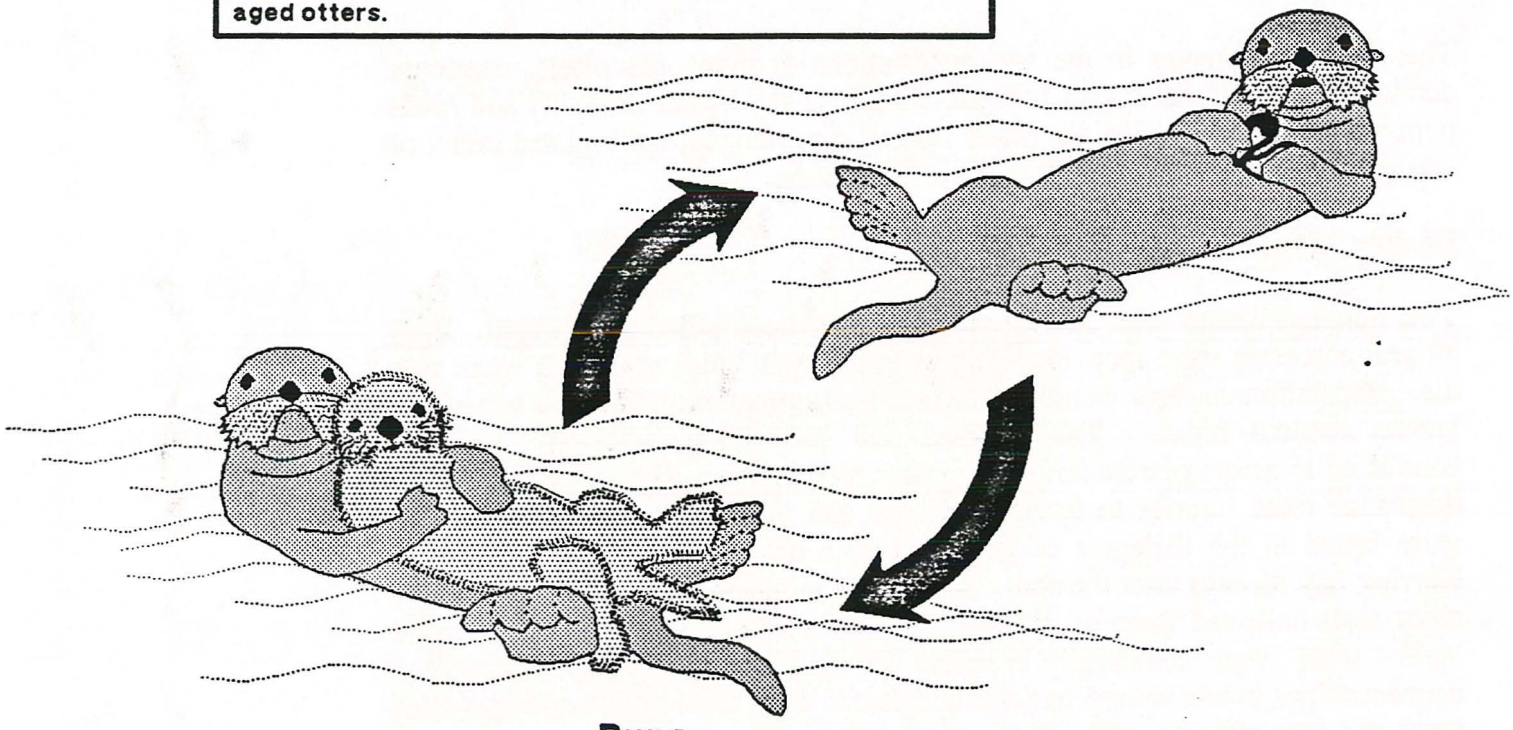
Figure 3. Summary of the major injuries in relation to the life history of ~~the~~ sea otters.

Sea Otters

Adults

Sea otters prefer shallow coastal waters with abundant molluscs and crustaceans for prey. Intertidal rocks and exposed beaches are used for haulout sites. Otters become sexually mature in 4 - 7 years. Most otters in Prince William Sound mate from September through October, but they are capable of breeding throughout the year.

INJURY: Heavy direct mortality of all age classes during the Exxon Valdez oil spill; continuing high mortality of prime aged otters.



Pups

Within Prince William Sound, most sea otter pups are born May through June. The single pup is dependent on its mother for 5 - 7 months. High quality, shallow habitats are used by female-pup pairs.

INJURY: High post-weaning mortality within the Exxon Valdez oil spill area.

unoiled trend sites, with oiled sites having a higher rate of decline of harbor seals than unoiled sites between 1988 and 1989.

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 similar differences between oiled and unoiled areas.

Killer Whales

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, but a calf was also born into the pod 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. This is a transient pod and it may be possible that the missing whales left the pod.

Several of the missing whales from AB pod 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. Very little is understood about the likely mechanisms of death from the spill, so other explanations for the missing whales continue to be explored. During the mid-1980s photographic evidence was obtained of bullet wounds in individuals in AB pod, though more recent evidence of shootings has not been obtained.

Terrestrial mammals that may have been exposed to oil through foraging in intertidal habitats were studied. 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. High concentrations of petroleum hydrocarbon metabolites were found in bile from a yearling brown bear found dead in 1989. The rate of mortality in yearling cubs is close to 50% for the first two years, so it is uncertain if this death was due to oil or other causes. Two radio-collared female brown bears with petroleum hydrocarbons found in their feces have since failed to reproduce.

Mink and other small mammals may feed and spend part or all of their time in the intertidal zone. When they are sick or injured, they are known to crawl into inaccessible burrows or the brush, making it difficult to determine if there was an effect of the spill on their populations. Also, information on pre-spill populations of these animals is minimal. In order to determine if their reproduction may been affected by oil in their diet, a laboratory exposure study of ranch-bred mink was done. They were fed food mixed with small, non-lethal amounts of weathered oil. No changes in reproductive rates or success resulted from this exposure, however 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.

Black bears forage in the intertidal zone in the spill area, but no field studies were carried out due to the difficulty of finding, collaring, or otherwise investigating these animals in the dense underbrush.

Intensive searches of beaches revealed no deer mortality attributable to the spill. However, deer taken for purposes of testing for human consumption (not part of the damage assessment process) were found to have slightly elevated concentrations of petroleum hydrocarbons in tissues of some individuals that fed on kelp in intertidal areas. 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 continues to be elevated in river otters from 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 dietary diversity were lower in oiled areas.

Among the most conspicuous victims of the Exxon Valdez oil spill were birds. Seabirds are particularly vulnerable to oil, as they spend much of their time on the sea surface while foraging. Oiled plumage insulates poorly, -loses buoyancy and birds die from hypothermia or drowning. Birds surviving initial acute exposure may 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. The results of the analyses by computer models that account for some of these variables suggest 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 do 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. Most of the pre-spill data on murre abundance in the Gulf of Alaska colonies affected by the spill were gathered in the mid-1970s to the early 1980s. 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 fewer individuals than before 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. There are some indications of the start of normal breeding in isolated areas of the Barren island colonies in 1991, but it is uncertain when the colony will start to produce significant numbers of viable chicks. Murre colonies in unoiled areas displayed none of these injuries and have 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. If it is accepted that this pattern of carcass deposition is representative of what happened following the oil spill then as many as 550 bald eagles may have been killed directly by the spill. However, eagles dying of natural causes and those that died after acute exposure to oil may have behaved differently, so the number of eagles killed is very uncertain but probably between 200 and 500 . 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 from 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 (See Figure 4).

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.

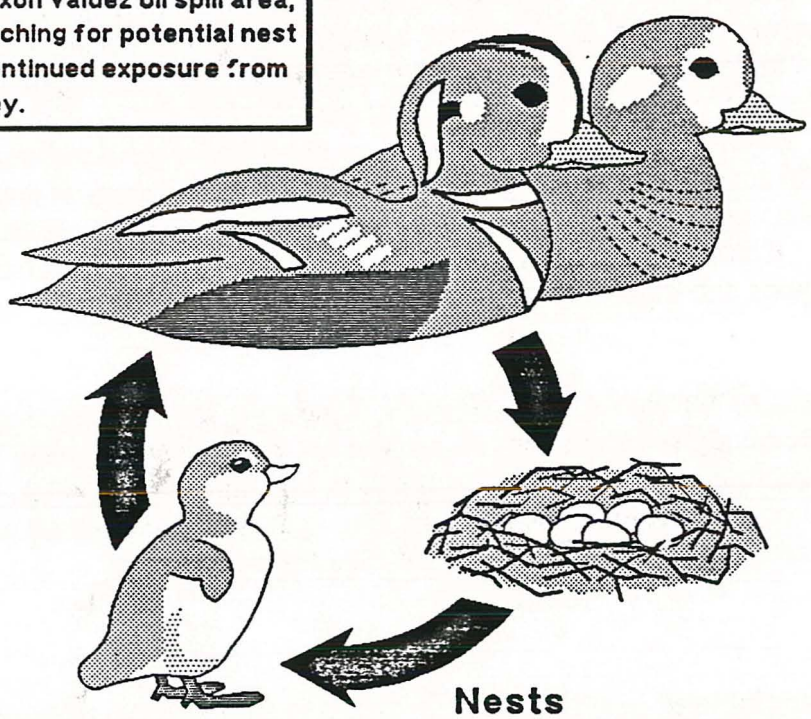
Figure 4. Summary of the major injuries in relation to the life history of ~~the~~ harlequin ducks.

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 intertidal waters.

INJURY: Pairs are not congregating at streams in the Exxon Valdez oil spill area, nor are they searching for potential nest sites. Possible continued exposure from contaminated prey.



Broods

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

INJURY: No broods observed within the Exxon Valdez oil spill area in 1990, and only one brood found in 1991, indicating reproductive failure at nesting and/or poor brood survival.

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 the Exxon Valdez oil spill area.

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.

No massive die-offs of adult fish were found following the spill, and adult salmon, for example, were 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, data was gathered that will enable scientists 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) and shallow subtidal zone (herring) or forage in the shallow water (Dolly Varden and Cutthroat trout). Five 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 of continuing exposure to petroleum hydrocarbons over a large geographic area but significant injury has not been 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 concentrations of hydrocarbon metabolites in bile and activities of mono-oxygenases in liver tissue. (very speculative--generally unsupported by the scientific literature--R. Spies)

Pink Salmon

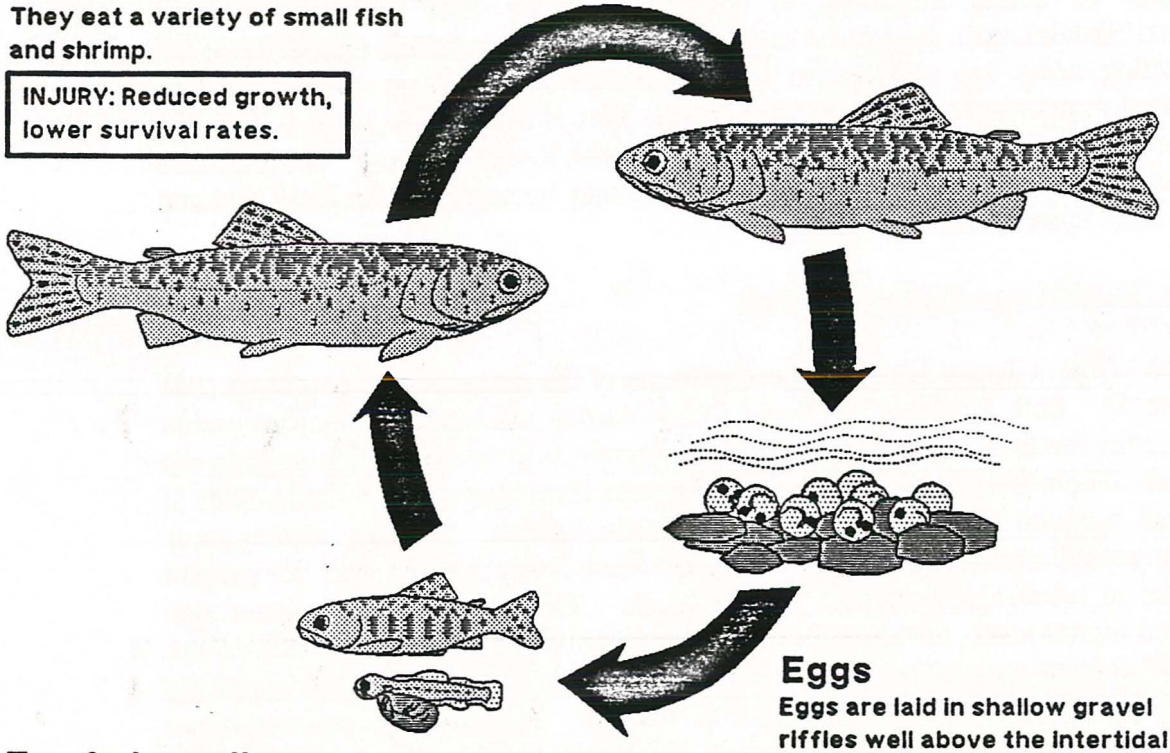
The full extent of short term injury to pink salmon cannot be assessed until after the 1991 run returns have been enumerated. Although the overall catch of pink salmon in Prince William Sound during 1990 was an all-time record (as predicted before the spill), this was primarily due to strong runs of 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.

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 autumn of 1989, egg mortality in oiled streams averaged about 15%, compared to about 9% in unoiled streams. Surprisingly, egg mortality has generally increased and in 1991 there was 40 to 50 percent egg mortality in oiled, and about a 18% in unoiled streams. Fry growth was decreased in oiled streams as compared to unoiled streams. The role of the spill and other factors, including 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

Figure 5. Summary of the major injuries in relation to the life history of cutthroat trout.

Cutthroat Trout



Adults in Freshwater

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

INJURY: None expected.

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.

Eggs

Eggs are laid in shallow gravel riffles well above the intertidal zone and hatch 28 - 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.

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 some 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. 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 survival to the smolt stage. 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 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 (See Figure 5). 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 in 1989 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. Since concentrations of bile hydrocarbons were greatly reduced in 1990 and 1991, indicating much less exposure to oil, it is unclear why differences in survival rates between oiled and unoiled streams should persist.

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 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. The chances of measuring a change in the adult population, beyond the bounds of the natural variability, is very small.

There was evidence of oil contamination in adult fish in 1989 and 1990. In 1989, hydrocarbon metabolites occurred in the bile of adult fish. There were significant changes in incidence of histopthalogical lesions and 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

About 5 dead rock fish were found after the spill-the only species observed dying after the spill. Rockfish showed lethal and sublethal injuries, including tissue lesions, consistent with exposure to hydrocarbons. Other species that had measurable amounts of 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.

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.

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 oiled shorelines in Prince William Sound, on Kodiak Island and Cook Inlet and along the Alaskan Peninsula. 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 subsurface oil in beaches. 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 in 1990. Sediment traps collected significant concentrations of petroleum hydrocarbons during the winter of 1990-1991, indicating that oil removed from the beaches by cleaning and natural processes was still being mobilized to depths.

In 1991, relatively high concentrations 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.

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 was 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 a similar pattern. 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 exposed to oil actively bake up hydrocarbons, but 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 harlequin ducks, river otters, 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 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.

The effects of hydrocarbons on shallow and deep subtidal communities were investigated by comparison of oiled and unoiled areas. Unfortunately, no pre-spill data were available to determine more directly if the oil spill had altered these communities. In the shallow subtidal rocky areas (<20m) Laminaria communities were studied, both in bays and around points of land on the open coast. In shallow water sandy areas eelgrass beds and areas around them were studied. Data are available for 1990. The greatest differences have been observed between eelgrass and its associated habitat between oiled and unoiled areas. Within the beds themselves there lower densities of eelgrass, fewer Telemesus (a crab), fewer amphipods, but more small mussels and juvenile cod. The greatest differences were observed in the abundance of fauna at depths from 6-20 meters below the eelgrass beds, where there were far fewer individuals in oiled areas. In the Laminaria habitat fewer differences were noted--the most noticeable difference being the greater abundance of young Laminaria plants, but fewer large older plants.

Archaeological 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 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.

Wilderness and Intrinsic Values

State and Federal legislated "wilderness areas" are designated in Kachemak Bay State Wilderness Park, in Katmai National Park, and in Becharof National Wildlife Refuge. Additional Federal "wilderness study" lands are in Kenai Fjords National Park and the Chugach National Forest. Portions of these areas were oiled by the *Exxon Valdez* spill and in spite of clean-up efforts many of these areas still have oil present.

The Wilderness Act of 1964 requires that Federal wilderness areas be "administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired..." In the context of this Act, the presence of oil, most recently documented by the May Shoreline Assessment Program for 1991, may be perceived as an injury to these areas. In addition to the damage to these areas from the oil, hundreds of workers, motorized machinery and support equipment were used during the cleanup in the wilderness areas. These clean-up activities disrupted the traditional uses of the wilderness such as camping, fishing and kayaking, as well as the perceived pristine nature of the wilderness.

CHAPTER VI
EVALUATION OF RESTORATION OPTIONS

Members of the public, resource managers, principal investigators and scientific advisors have suggested hundreds of ways to restore injured natural resources and services. To aid the Trustees and the public in determining which of the many restoration alternatives and options are appropriate and most beneficial under the terms of the settlement, objective criteria are presented below 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 the restoration option?

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

   Will implementation of the 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 restoration option in the environment of the oil-spill area?

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 [including lost uses] and the primary and secondary benefits associated with implementation of the restoration option.)

F. Cost effectiveness:

Does the 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 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 or nontarget resources or services? Is the project of net environmental benefit?

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

Would the restoration option improve on or create additional natural 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 preliminary screening and are presented in Appendix B. Following public comment on the Restoration Framework, including any suggestions of additional options, there will be more detailed evaluations of all potential options. The draft Restoration Plan and draft environmental impact statement will present the results of these evaluations, including restoration alternatives, for further public comment.

Database Review and Evaluation

To develop the draft Restoration Plan and draft environmental impact statement, the restoration planning staff will review existing databases for each injured resource or service. Data relevant to this evaluation may be found in the scientific literature, geographic information systems and the reports of damage assessment and restoration studies. Subject areas include:

- the nature and severity of injury;
- the rate of natural recovery;
- life history requirements;
- factors limiting recovery;
- persistence of contaminants;
- opportunities to accelerate the rate of recovery;
- costs and environmental impacts of accelerating recovery; and
- legal status and existing management practices.

For some injured resources and services, much of the above information is in hand; in other cases there are substantial deficiencies in the databases that could impede the evaluation and timely implementation of restoration options. To remedy this, additional field work is being recommended to provide the needed information. Detailed study plans for work considered in 1992 are found in the 1992 Work Plan. These study plans were developed in consultation with scientists representing the Trustee agencies, outside peer reviewers and the Chief Scientist.

Evaluation of Options for Identifying and Protecting Marine and Upland Habitats

All restoration options, including habitat protection and acquisition options, will be evaluated using the basic criteria outlined in the first section of this chapter (VI). By necessity, however, there are additional steps needed to properly evaluate habitat protection and acquisition options.

In its draft 1991 Restoration Work Plan (56 Fed Reg. 8902-8903, [March 1, 1991]), the Trustees developed a preliminary sequence of steps for use in identifying and protecting strategic fish and wildlife habitats and recreation sites. While the Trustees develop a final process for evaluating habitat protection and acquisition options, they again invite public comment on the steps that were published in the March 1, 1991 Federal Register notice:

1. Identification of key upland habitats that are linked to the recovery of injured resources or services by scientific data or other relevant information.

2. Characterization and evaluation of potential impacts from changed land use in relation to their effects on recovery of the ecosystem and its components; comparative evaluation of recovery strategies not involving acquisition of property rights (e.g., redesignation of land use classification), including an assessment of protection afforded by existing law, regulations, and other alternatives.

3. Evaluation of cost-effective strategies to achieve restoration objectives for key upland habitats, identified through steps one and two above. This would include evaluation of other restoration alternatives for these resource injuries.

4. Willing seller/buyer negotiations with private landowners for property rights.

5. Incorporation of acquired property rights into public management.

Recovery Monitoring

Monitoring plays a role in the evaluation of restoration options. First, "recovery monitoring" of injured resources and services indicates whether restoration actions are necessary or whether the "no action" alternative is the most appropriate choice. Several recovery monitoring studies are proposed in the 1992 Work Plan. Second, there is need to monitor the effectiveness of restoration options, once implemented, and to identify whether additional restoration actions may be necessary.

CHAPTER VII
SCOPE OF POTENTIAL RESTORATION ALTERNATIVES

The goal of the Trustees is the total restoration of the environment and its resources and services provided before the spill. In order to reach the goal of total recovery, individual elements of the restoration program developed by the Trustees may be species- or resource-specific.

The restoration-related activities conducted by the Trustees and the Environmental Protection Agency to date have involved the public, technical experts, and resource managers from agencies in Alaska (See Chapters I and III). Through these preliminary scoping efforts, a broad array of ideas for restoration activities has been suggested. The ideas listed in Restoration Planning Following the *Exxon Valdez* Oil Spill: 1990 Progress Report (Chapters II and VI) were evaluated by the planning staff using the criteria outlined in Chapter VI of this document. The results of this evaluation, which incorporate what has been learned from the damage assessment and restoration studies, are presented as restoration options in Appendix B.

The draft Restoration Plan and draft environmental impact statement will contain a more detailed presentation of restoration alternatives and options after further technical review and consideration of the public comments received on this framework document. The restoration options presented in Appendix B will be considered by the Trustees in developing restoration alternatives, which will be presented for public comment.

Possible Restoration Alternatives

Paragraphs A-F identify possible conceptual restoration alternatives. These alternatives are provided for discussion purposes only and do not indicate any preference by the Trustees.

A. No Action

A possible alternative that could be addressed in the draft environmental impact statement is for the Trustees to rely upon the natural recovery process to restore the ecosystem. Monitoring would assess whether natural recovery is proceeding as anticipated.

B. Management of Human Uses

This approach uses Federal and State management authorities (statutes and regulations) to modify human uses of resources or habitats. The goal is to reduce mortality or stress on injured resources and to accelerate their recovery.

Examples:

- restrict or eliminate legal harvest of marine and terrestrial mammals and sea ducks; and
- intensify management of fish and shellfish.

C. Manipulation of Resources

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

Examples:

- improve or supplement stream and lake habitats for spawning and rearing of wild salmonids; and
- accelerate recovery of upper intertidal *Fucus* zone.

D. Habitat Protection and Acquisition

This approach includes changes in management practices on public or private lands and creation of "protected" areas on existing public lands in order to prevent further damage to resources injured by the *Exxon Valdez* oil spill. Going beyond land management practices, there are options that involve the acquisition of damaged habitats or property rights short of title, in order to protect strategic wildlife, fisheries habitat or recreation sites.

Examples:

- designate protected marine habitats; and
- acquire additional marine bird and mammal habitats.

E. Acquisition of Equivalent Resources.

"Acquisition of equivalent resources means to compensate for an injured, lost, or destroyed resource by substituting another resource that provides the same or substantially similar services as the injured resource" (56 Federal Register 8899 [March 1, 1991]). Restoration approaches, such as the manipulation of resources

and habitat protection and acquisition, can be implemented on an equivalent-resource basis.

Another possible alternative, therefore, would be to place primary emphasis upon the acquisition of equivalent resources as opposed to options that attempt to directly restore or rehabilitate specific injured resources or services.

Examples:

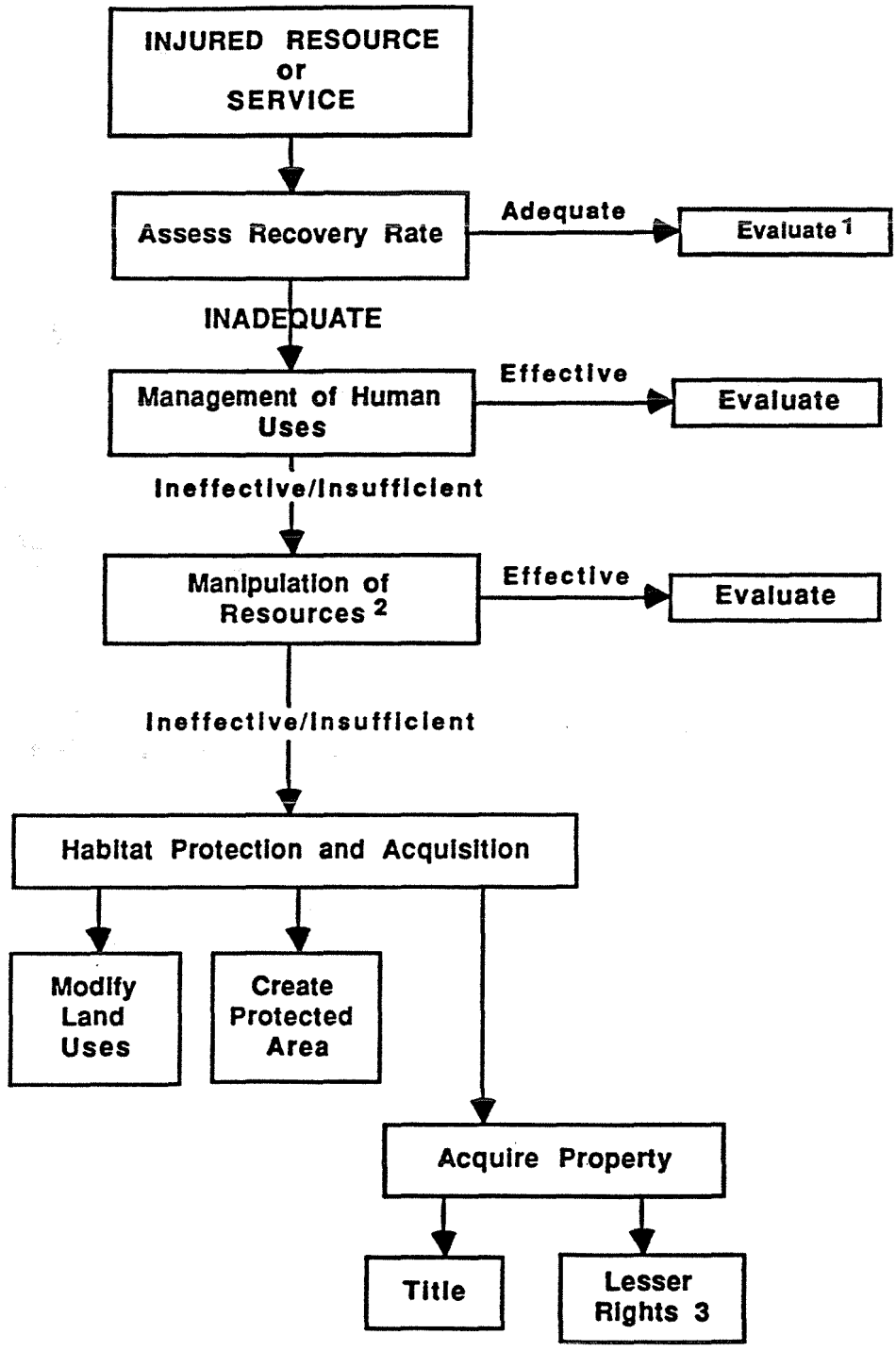
- creation of new recreation facilities; and
- acquire tidelands.

F. Combination Alternatives

Each of the alternatives above, A-E, may be considered strictly in its own right, or mixed in any number of ways, depending on priorities and methods. For example, Figure 6 depicts a hierarchical analysis, through which the Trustees would consider "habitat protection and acquisition" options only after considering whether options under "management of human uses" and "manipulation of resources" were inadequate. In the analysis illustrated in Figure 7, the Trustees would give equal weight to all approaches, proceeding to those restoration options deemed most desirable based on professional and scientific judgment and public comments.

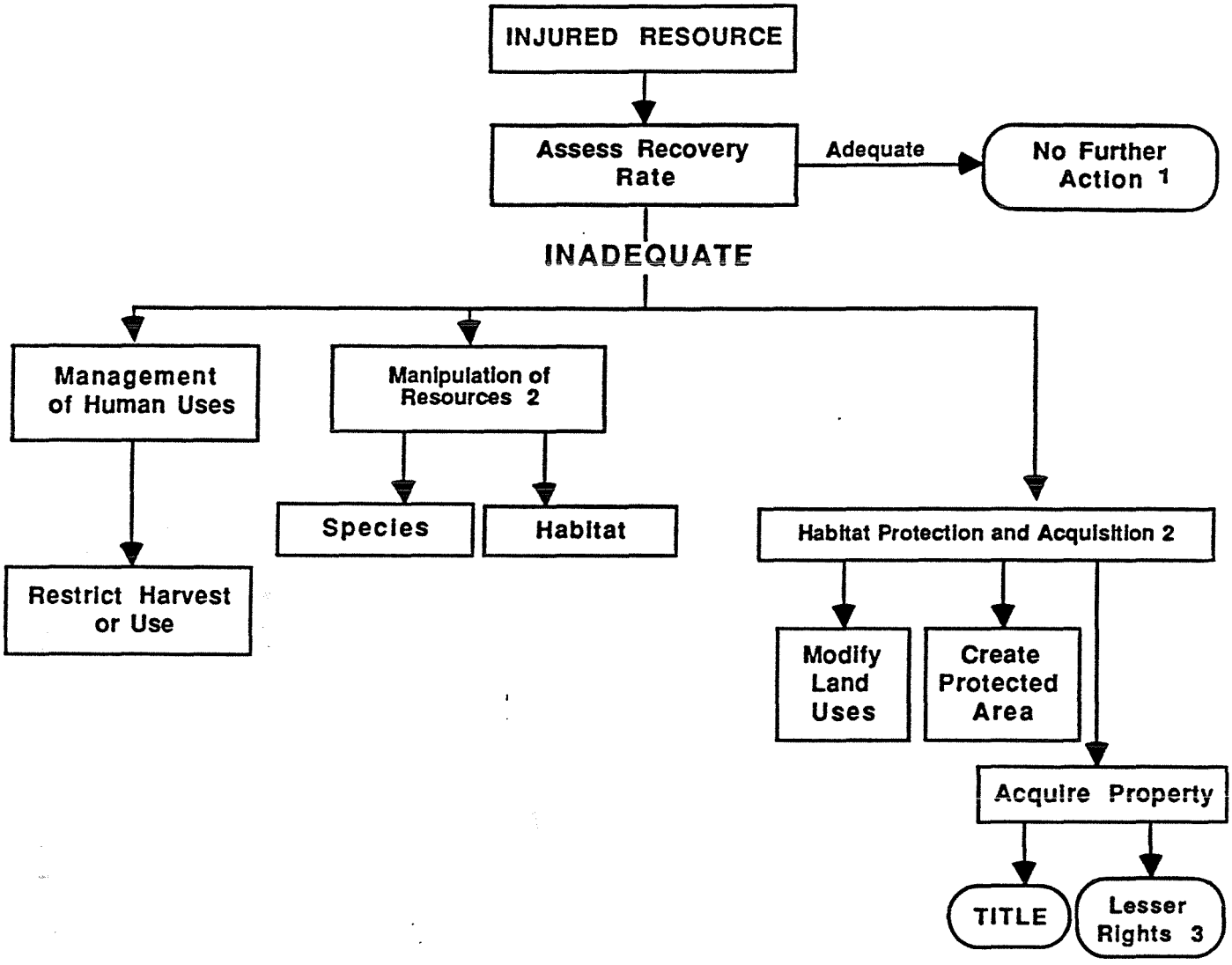
The Trustees seek comment about the likely feasibility and efficacy of these possible restoration alternatives, and any other alternatives and approaches that should be considered in a draft environmental impact statement.

Figure 6



1 All restoration actions will be evaluated to assess their effectiveness on the recovery rate of the target injured resource.
2 These approaches can be implemented on a direct-restoration or equivalent-resource basis.
3 Acquisition of full title or lesser rights exclusive of full ownership of title (partial interests), e.g., conservation easement, timber rights, access rights, etc.

Figure 7



1 All restoration actions will be evaluated to assess their effectiveness on the recovery rate of the target injured resource.
2 These approaches can be implemented on a direct-restoration or equivalent-resource basis.
3 Rights exclusive of full ownership of title (partial interests), e.g., conservation easement, timber rights, access rights, etc.

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APPENDIX A

BACKGROUND ON INJURY RESOURCES AND SERVICES

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APPENDIX A
BACKGROUND ON INJURED RESOURCES AND SERVICES

The success of developing and implementing restoration options depends, in large measure, on our understanding of the injured resources and services. This appendix 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 and Appendix B.

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. 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. The following life histories are included:

- Sea otter
- Harbor seal
- Brown bear
- River otter
- Killer whale
- Common murre
- Harlequin duck
- Black oystercatcher
- Marbled murrelet
- Pigeon guillemot
- Bald eagle
- Coastal cutthroat trout
- Pink salmon
- Pacific herring
- Rockfish
- Dolly Varden
- Sockeye salmon
- Spot Shrimp

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 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 is 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. Marine Mammal Science 5:159-172.

Reidman, M.L. and J.A. Estes. 1990. The sea otter (*Enhydra lutris*): behavior, ecology, and natural history. U.S. Fish and Wildlife Service, Biological Report 90(14). 126pp.

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 January during hibernation. Survival of cubs to yearlings (1.5 years old) ranges from 45%-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 32 km for females and 170 km 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 well drained moderately sloping mountain sides, leeward of the prevailing winds. Dens are seldom used in consecutive years. Brown bears enter their dens in late October and November and emerge between early April and late May.

Food Habits

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

Human Interactions

Brown/grizzly bears are harvested throughout their range on a limited basis. Habitat alterations and human disturbance near 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. Canadian Field Naturalist 96:1-3.

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Peterson, J. 1991. Swikshak coastal report. Unpublished report. Katmai National Park and Preserve.

Smith, R.B. and L.J. VanDoele. 1991. Final report on Brown Bear Studies (1982-1986) Terror Lake Hydroelectric Project, Kodiak Island, Alaska. Alaska Department of Fish and Game, Juneau, AK. 188 pp.

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. Ministry of Natural Resources, Ontario.

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

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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. Canadian Journal of Zoology 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 (approximately 15 years old). They give birth to a single calf after an estimated gestation period of 17 months. Cows will nurse the calf for 12 months and provide additional care for 2 years or longer. The interval between calves varies among individuals with a mean of about 5 years (range 2-12).

Social Structure and Habitat Use

Killer whales live in social groups called pods. Pods usually consist of less than 40 animals. There are two types of pods. Transient pods do not occupy a defined home range. They move in and out of areas occupied by resident pods and may cover great distances throughout the year. Resident pods have home ranges which may encompass several hundred square miles. In resident pods the whales form matrilineal subgroups. The matrilineal group consists of a female and her offspring. New matrilineal groups may form as a female calf matures and produces her own offspring, but the group remains within the original pod. Matrilineal groups of the same pod interact with each other on a regular basis.

Food Habits

Killer whales are opportunistic predators. Fish are the primary food source for whales in resident pods, but marine mammals and birds are also prey. Salmon, cod, Pacific herring, flatfish, blackcod, squid, pinnipeds, and other cetaceans have all been documented as food sources for killer whales. Transient pods may prey more on marine mammals than 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.

Primary References

Bigg, M.A, P.F. Olesiuk, G.M. Ellis, J.K.B. Ford and K.C. Balcomb III. 1990. Social organization and genealogy of resident killer whales (*Orcinus orca*) in the coastal waters of British Columbia and Washington State. Paper SC/ADD/ID39 In Individual recognition of cetaceans: Use of photo-identification and other techniques to estimate population parameters. Report International Whaling Commission (Special Issue 12). pp. 383-405.

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Heyning, J.E. and M.E. Dahlheim. 1988. *Orcinus orca.* pages. 1-9 in Mammalian Species. American Society of Mammologists.

Olesiuk, P.F., M.A. Bigg, and G.M. Ellis. 1990. Life history and population dynamics of resident killer whales *(Orcinus orca)* in the coastal waters of British Columbia and Washington State. Paper SC/A88/ID3 In Individual recognition of cetaceans: Use of photo-identification and other techniques to estimate population parameters. Report International Whale Commission (Special Issue 12). pp. 209-243.

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 and bald eagles, 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.

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

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

Hatch, S.A. and M.A. Hatch. 1989. Attendance patterns of murres at breeding sites: implications for monitoring. Journal of Wildlife Management 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. Department of Commerce, National Oceanic and Atmospheric Administration, OCSEAP Final Report 45:631-771.

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Williams, A.J. 1974. Site preferences and interspecific competition among guillemots *Uria aalge* (L) and *Uria lomvia* (L.) on Bear Island. Ornis Scandinavia. 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. Report to National Marine Fisheries Service. Saltwater Inc. Anch. Alaska. 72 pp.

Harlequin Duck (*Histrionicus*)

Range

In North America, the western population is found from the Seward Peninsula and the Alaska Range, 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 to late 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 20 and June 10. 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 but return to estuaries to feed. Typically nests are located along shallow rivers and streams with gravel or rocky substrates, and nest sites are located under dense vegetation on steep banks in mature forests. Harlequins may return to the same nest site in consecutive years. Slow stretches on lee sides of stream bends 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 and by molting females in late 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 harlequins in Alaska. 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.

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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 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.

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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 Prince William Sound 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 flats 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

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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.

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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 (e.g., The Chugach National Forest currently requires a 330 feet buffer zone around any bald eagle nest tree, with an additional 330 feet of restricted activity. The U.S. Fish and Wildlife Service proposes extending restrictions to 990 feet from bald eagle nests.) which has further helped the stability of populations.

Primary References

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Coastal Cutthroat Trout (*Onchorhynchus 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 2-3 years for males and between 3-6 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 eelgrass beds. Adults return to freshwater lakes to overwinter, and then spawn in small coastal streams or small tributaries to coastal streams and rivers.

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.

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Pink Salmon (*Oncorhynchus gorbuscha*)

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

Adults - 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.

Fry and Juveniles - 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

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

Fry and Juveniles - 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, other mammalian and avian predators eat spawning salmon.

Human Interactions

Wild and hatchery pink salmon are the basis for 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.

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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.

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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 Report No. 8. National Oceanic and Atmospheric Administration/NOS Strategic Environmental Assessments Division, Rockville, MD, 329 p.

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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.

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Dolly Varden (*Salvelinus malma*) - Anadromous populations

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

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

Primary References

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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 redds (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 - 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 Department 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 Report No. 8. National Oceanic and Atmospheric Administration/NOS Strategic Environmental Assessments Division, Rockville, MD, 329 p.

Spot Shrimp *(Pandalus platyceros)*

Range

North Pacific Ocean, from southern California to the Bering Strait, and to Japan and Korea.

Migration

Long range movement of spot shrimp are unlikely. However, daily movements bring the shrimp to shallow waters at dusk and to deeper waters during the day.

Life Cycle

Spot shrimp are hermaphroditic. They are juveniles for 1-2 years after hatching, then become functional males until 3-5 years of age. They reach a transitional phase from 6-7 and remain as females until they die between 7-10 years of age.

Reproductive Period

Studies in Prince William Sound indicate that spot shrimp may lay multiple egg clutches before death. Conversely, studies from British Columbia have indicated a shorter life span and a single clutch of eggs per female.

Mating/Hatching

Mating occurs in the fall and females carry the eggs for 5-6 months. The eggs hatch from March-April.

Habitat Use and Requirements

Spot shrimp are found at depths ranging from 4 to 487 meters, but they are most common in shallower marine waters. The adults prefer areas with rocky bottoms and fairly steep slopes. Rock crevices, cracks and small caves are used as hiding places; shrimps will also use vegetation as cover against predators. The larvae are pelagic when they first hatch and become demersal as juveniles. Movements between depths and distance from shore occur daily as adults.

Food Web Interrelationships

Spot shrimp feed on detritus and worms (annelids and polychaetes), and on other crustaceans.

Predation - Spot shrimp are an important prey item for many other species. They are an important component in the diet of fish, e.g. salmon, rockfish, Pacific cod, and octopus as well as diving seabirds.

Human Interactions

Spot shrimp are of commercial and recreational importance. They are primarily caught in traps, but are incidentally caught in trawls. In the late 1980s, Alaska Department of Fish and Game reduced the allowable harvest in parts of Prince William Sound. This change was due to information from experimental fishery management areas which raised concerns about over-harvest.

Primary References

Donaldson, W. 1991. Prince William Sound management area 1990 shellfish annual management report. Alaska Department of Fish and Game. Regional Informational Report No. 2C91-04. 48 pp.

Holthuis, L. B. 1980. Shrimps and prawns of the world: An annotated catalogue of species of interest to fisheries. Food and Agriculture Organization species catalogue No. 125, Volume 1.

Kruse G. H. and M. C. Murphy. 1989. Review of biology and life history of shrimps. Alaska Department of Fish and Game, Regional Informational Report No. 5J89-05. 34 pp.

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

Archaeological Resources

Archaeological resources, including sites and the artifacts, constitute an important part of our national and state heritage. They 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 resources.

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 archaeological 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 archaeological 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. In 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.

These designated wilderness lands, thousands more acres of undesignated

wildlands and developed lands provide, in part, the basis for Alaska's tourist economy. 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, hiking, camping, skiing, sightseeing, power boating, kayaking and photography.

Beyond those who actively use these lands, many Americans benefit by knowing that in Alaska large areas of undeveloped lands provide habitat for natural, healthy populations of wildlife.

Subsistence Use

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 the public lands and by Alaska Natives on Native lands is essential to Native physical, economic, traditional, and cultural existence and to non-Native 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, 16 USC 1131 *et seq*.

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

Commercial Fisheries

The seafood industry is Alaska's largest private basic industry employer, both in terms of income and employment. The industry provides nearly 70,000 seasonal jobs which translates to 33,000 direct, indirect and induced year-round jobs.

The seafood industry is the second largest revenue generator in the state. Total current investment by the Alaska seafood industry is estimated at 4$ billion.

In Kodiak, one of the major fishing ports impacted by the oil spill, seafood landings ranked third in both cash value and volume in the United States from 1988 to 1990. Kenai landings (Cook Inlet) ranked 23rd in volume but 8th in value during the same time period. Cordova landings were 14th and 13th in value.

All five species of Pacific salmon, herring, bottomfish, including halibut, cod and several species of sole, and king, tanner and dungeness crab comprise the Kodiak fisheries. Herring support a food and bait and a sac roe fishery. Pink and sockeye salmon are of major ecological as well as economic importance.

In Cook Inlet all five species of Pacific salmon are caught as well as herring and shellfish, especially razor clams. Herring support 2 sac roe fisheries, the Kamishak and the Outer and Eastern Districts. Sockeye are the most abundant ecologically and economically.

Pacific herring are the most abundant species of ecological importance in Prince William Sound. These populations support a fall food and bait fishery, a purse seine and gill net sac roe fishery, and a wild and pound spawn-on-kelp fishery. Together they constitute to 2nd largest herring fishery in the state.

The pink salmon fishery, however, constitutes the major volume and value of the annual commercial harvest. Groundfish landings are increasing as that fishery develops. Shellfish, including tanner crab and spot shrimp are also important fisheries in the Sound.

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APPENDIX B

RESTORATION OPTIONS

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APPENDIX B
RESTORATION OPTIONS

NOTE: The following options are presented for the purpose of public comment and are not recommendations by the Trustees.

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I. Restoration Options for Consideration

<u>Management of Human Uses</u>

1. archaeological resource protection
2. intensify management of fish and shellfish
3. increase management for fish and shellfish that previously did not require intensive management
4. reduce disturbance at marine bird colonies and marine mammal haul out sites and rubbing beaches
5. reduce harvest by redirecting sport-fishing pressure
6. redesignate a portion of the Chugach National Forest as a National Recreation Area or Wilderness Area
7. increase management in parks and refuges
8. restrict or eliminate legal harvest of marine and terrestrial mammals and sea ducks
9. minimize incidental take of marine birds by commercial fisheries

<u>Manipulation of Resources</u>

10. preservation of archaeological sites and artifacts
11. improve or supplement stream and lake habitats for spawning and rearing of wild salmonids
12. creation of new recreation facilities

13. eliminate sources of persistent contamination of prey and spawning substrates

14. accelerate recovery of upper intertidal zone

15. supplement intertidal substrates for spawning herring

16. test feasibility of enhancing murre productivity

17. eliminate introduced foxes from islands important to nesting marine birds

18. replace fisheries harvest opportunities by establishing alternative salmon runs

Habitat Protection and Acquisition

19. update and expand the State's Anadromous Fish Stream Catalog

20. establish an *Exxon Valdez* oil spill "special management area"

21. acquire tidelands

22. designate protected marine areas

23. acquire additional marine bird habitats

24. acquire "inholdings" within parks and refuges

25. protect or acquire upland forests and watersheds

26. acquire extended buffer strips adjacent to anadromous fish streams

27. designate and protect "benchmark" monitoring sites

28. acquire access to sport-fishing streams

29. establish or extend buffer zones for nesting birds

Other Options

30. test subsistence foods for hydrocarbon contamination

31. develop comprehensive monitoring program

32. endow a fund to support restoration activities

33. develop integrated public information and education program

34. establish a marine environmental institute

35. replacement of archaeological artifacts

II. Restoration Options Rejected

1. sea otters and harbor seals

2. killer whales

3. river otters

4. common murres and marbled murrelets

5. marbled murrelets

6. harlequin ducks

7. harlequin ducks and black oystercatchers

8. bald eagles

9. pink salmon and sockeye salmon

10. rockfish

11. spot shrimp

12. coastal habitat

13. cultural resources

14. multiple resources

OPTION 1: Archaeological Resource Protection

APPROACH CATEGORY: Management of Human Uses

INJURED RESOURCES AND SERVICES: Archaeological sites and artifacts

BACKGROUND AND JUSTIFICATION:

Increased public knowledge of exact archaeological site locations, largely because of beach clean-up activities, has increased injury to these resources from vandals. Inherently, archaeological resources injured by the oil spill are not restorable and the remoteness of sites makes enforcement of archaeological protection laws difficult. A site steward program could be developed to establish a corp of local citizens to watch over threatened archaeological sites. Additionally, agency monitoring and public education efforts could be expanded to discourage vandalism. Additionally, the agencies could develop cooperative management plans for archaeological resources to better coordinate their activities in the oil-spill area.

ACTION:

- create an archaeological site stewardship program;
- increase number of public contact patrols in the oil-spill area; and
- expand public education efforts.

INFORMATION NEEDED TO IMPLEMENT OPTION:

No further information is needed to accomplish this work.

OPTION 2: Intensify Management of Fish and Shellfish

APPROACH CATEGORY: Management of Human Uses

INJURED RESOURCES AND SERVICES: Pink and sockeye salmon, Dolly Varden, coastal cutthroat trout, Pacific herring, rockfish, and spot shrimp

BACKGROUND AND JUSTIFICATION:

Managing the human uses of fisheries resources, both commercial and recreational, is fundamental to the restoration of oil-spill injuries. Intensive fisheries management could temporarily reduce human pressure on injured wild stocks or populations to speed their recovery. This can be done by restricting or redirecting existing fisheries, making every effort to minimize impacts on, or provide alternatives to, the affected fisheries. In the case of sockeye salmon, for example, one objective is to relieve pressure on what are anticipated to be small runs in the Kenai River system in the next several years, without shutting down other Upper Cook Inlet fisheries.

ACTION:

- develop and implement program to upgrade and intensify management of injured fisheries resources throughout oil-spill area.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Intensive management of injured fish and shellfish resources will be difficult, especially in mixed-stock fisheries. Improved population modeling, application of genetic and other techniques to separate stocks, and other research and monitoring are needed to support intensified fisheries management.

OPTION 3: Increase Management for Fish and Shellfish that Previously Did Not Require Intensive Management

APPROACH CATEGORY: Management of Human Uses

INJURED RESOURCES AND SERVICES: Rockfish, spot shrimp

BACKGROUND AND JUSTIFICATION:

Prior to the oil spill, commercial fishing did not require comprehensive management plans for some species. This was true for rockfish (various species) and spot shrimp, both of which were to some degree injured by the oil spill itself. The directed harvest and by-catch of rockfish increased significantly in 1990 and 1991, as fishing effort was shifted from salmon and herring to groundfish. Rockfish are of particular concern; they are long-lived and slow-growing and overharvest could greatly exacerbate oil-spill injuries. Development and implementation of management plans will aid the recovery of rockfish and spot shrimp by ensuring that human harvests are consistent with the status and productivity of post-oil-spill populations.

ACTION:

- develop and implement a fishery management plan for rockfish and spot shrimp. The management plans should establish harvest levels, times and areas that are appropriate for recovery from oil-spill injuries.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Considerable information is needed to develop management plans, including data on commercial and sport catches to describe age and size composition, natural mortality rates, general seasonal movements, stock abundance and recruitment. Separation of discrete stocks through genetic and other studies are also needed to enable management on a targeted rather than broad-scale basis.

OPTION 4: Reduce Disturbance at Marine Bird Colonies and Marine Mammal Haul-Out Sites and Rubbing Beaches

APPROACH CATEGORY: Management of Human Uses

INJURED RESOURCES AND SERVICES: Marine birds and marine mammals

BACKGROUND AND JUSTIFICATION:

Human disturbance can adversely affect the fitness or reproductive success of marine birds and mammals. Especially vulnerable are species that gather in large numbers and traditionally make use of small, discrete sites. Examples include colonies of common murres, which typically nest on cliffs, haul-out sites frequented by harbor seals, and rubbing beaches used by killer whales. In the case of common murres, recent reports have indicated specific problems in the Barren Islands with the shooting of halibut landed by charter-boat operators. The sound of the gunshots causes murres to flush in a panic from the nesting cliffs, kicking eggs off the cliffs and leaving eggs and chicks vulnerable to avian predators. Problems such as these are probably best approached through the education of tour- and charter-boat operators and the fishing industry. Designation of buffer zones around particularly sensitive areas and stricter enforcement of harassment provisions in the Marine Mammal Protection Act and the Migratory Bird Treaty Act also are possibilities.

ACTION:

- educate tour- and charter-boat operators about appropriate behavior near sensitive marine bird and mammal areas;
- increase the field presence of Trustee agencies at such areas;
- consider restrictive measures, such as the designation of buffer zones; and
- consider greater enforcement of Federal and State laws.

INFORMATION NEEDED TO IMPLEMENT OPTION:

There is need to determine the specific areas and times in which birds and mammals are sensitive to disturbance. No additional information is needed to implement the education component of this option.

OPTION 5: Reduce Harvest by Redirecting Sport-Fishing Pressure

APPROACH CATEGORY: Management of Human Uses

INJURED RESOURCES AND SERVICES: Dolly Varden and cutthroat trout

BACKGROUND AND JUSTIFICATION:

Spill-related injuries to cutthroat trout and Dolly Varden have resulted in a loss of sport fishing opportunities in Prince William Sound. Both of these species are important components of recreational fisheries in this area. Moreover, because the affected population of cutthroat trout is at the extreme northern limit of its geographic range, it is important to protect the genetic integrity of these populations. The proposed option is designed to manage this recreational fishery in a manner that would redirect pressure away from impacted populations, maintain sport fishing opportunities and, at the same time, conserve the unique gene pool of these wild stocks.

ACTION:

- Prepare a fisheries management plan that includes some or all of the following alternatives:
  - close oiled streams in Prince William Sound;
  - redirect recreational fishing to non-oiled streams and drainages; and
  - reduce creel limits in the affected area.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Results from recovery monitoring studies will provide timing data for management actions. Results of survey and inventory studies will provide locations for alternative sport-fishing opportunities. Stock status data on Dolly Varden and cutthroat trout populations will aid in the development of the management plan.

OPTION 6: Redesignate a Portion of the Chugach National Forest as a National Recreation Area or Wilderness Area

APPROACH CATEGORY: Management of Human Uses

INJURED RESOURCES AND SERVICES: recreation, fish including salmon, coastal cutthroat trout, and Dolly Varden

BACKGROUND AND JUSTIFICATION:

The waters of Prince William Sound are surrounded by the Chugach National Forest. The area is recognized as biologically rich and it provides a variety of resources, including significant opportunities for private and commercial recreation. The National Forest System contains several "national recreation areas" and designated "wilderness areas." Management of national recreation areas emphasizes recreational values and the habitats needed to sustain recreational opportunities. Management of wilderness areas emphasizes the preservation of pristine qualities and opportunities for nonmechanized recreation. Within the Chugach National Forest, Congress previously designated two "wilderness study areas"--Nellie Juan and College Fjords--but has never resolved their permanent status. Changing the designations of all or parts of the Chugach forest would alter management directions to favor recreational opportunities and wilderness qualities.

ACTION:

- Recommend that the Forest Service integrate consideration of national recreation area and wilderness area designations into its management planning process for the Chugach National Forest.

- If redesignation is determined to be appropriate, that recommendation must be forwarded to Congress for legislative approval.

INFORMATION NEEDED TO IMPLEMENT OPTION:

The Forest Service must gather some new resource data on the changes brought about by the oil spill on forest resources.

OPTION 7: Increase Management in Parks and Refuges

APPROACH CATEGORY: Management of Human Uses

INJURED RESOURCES AND SERVICES: Coastal habitat, wildlife, fisheries and recreation within State and Federal parks and refuges

BACKGROUND AND JUSTIFICATION:

There are many parks and refuges scattered throughout the oil-spill area. Because of the size and location of these areas, managing agencies are limited in their ability to provide an extensive field presence. It may be desirable to increase the staff capability and frequency of patrols to ensure that human use activities are conducted in a manner that safeguards the recovery potential of injured resources.

ACTION:

- hire and train additional staff to patrol and monitor spill-affected public lands; and

- provide interpretive services to educate the public about the spill and explain how they can minimize their chances of impeding resource recovery.

INFORMATION NEEDED TO IMPLEMENT OPTION:

This option needs no additional information to implement.

OPTION 8: Restrict or Eliminate Legal Harvest of Marine and Terrestrial Mammals and Sea Ducks

APPROACH CATEGORY: Management of Human Uses

INJURED RESOURCES AND SERVICES: Sea otter, harbor seal, brown bear, river otter, and harlequin duck

BACKGROUND AND JUSTIFICATION:

Continued harvest of several species could slow or negate recovery from oil-spill injuries. Legal hunting and trapping of these species represents a controllable source of mortality that can be considered in developing a restoration strategy. Brown bears are taken by sport hunters in the oil-spill area and river otters are trapped for their furs. Under the Marine Mammal Protection Act, subsistence users are allowed to take sea otters and harbor seals. Recently, some subsistence users have voluntarily reduced their take of marine mammals. Harlequin ducks are shot by both sport and subsistence users. In 1991 the Alaska Department of Fish and Game delayed the open season on harlequin ducks in Prince William Sound and along the outer Kenai Coast to protect the small resident breeding population prior to an influx of a much larger number of migrant and wintering ducks.

ACTION:

- if necessary, recommend that the Alaska Department of Fish and Game temporarily restrict or close harvests of brown bear, river otter, and harlequin ducks in the oil-spill area; and

- convey information to subsistence users about the status of injured species of marine mammals and other resources and, if appropriate, encourage voluntary reductions in harvest levels.

INFORMATION NEEDED TO IMPLEMENT THE OPTION:

Monitor population levels of injured species, establish harvest levels in oil-spill area and estimate the influence of annual harvests on the recovery of these species.

OPTION 9: Minimize Incidental Take of Marine Birds by Commercial Fisheries

APPROACH CATEGORY: Management of Human Resources

INJURED RESOURCES AND SERVICES: Marine birds

BACKGROUND AND JUSTIFICATION:

Large numbers of marine birds are susceptible to being tangled and drowned in commercial fishing gillnets. Local, nearshore fisheries can cause the death of significant numbers of marine birds as evidenced with common murres in a halibut/croaker fishery in California and with marbled murrelets in a salmon gillnet fishery in British Columbia. Research on marine bird mortalities due to commercial fisheries in Alaska has been limited. Data from the National Marine Fisheries Service's observer program in 1990 suggested that the annual mortality from Prince William Sound drift gillnets was 836-2100 marine birds, most of which were marbled murrelets. This mortality is not high relative to the overall size of the murrelet population, but on a local basis it could slow recovery from oil-spill related injuries. Management strategies, such as reducing hours of night-time fishing during critical times in discrete areas, may reduce the mortality.

ACTION:

- if necessary, develop and implement strategies to reduce the incidental mortality of marbled murrelets in drift gillnets.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Design and implement a sampling program throughout the spill area to obtain data on the significance, level and distribution of annual driftnet mortalities.

OPTION 10: Preservation of Archaeological Sites and Artifacts

APPROACH CATEGORY: Manipulation of Resources

INJURED RESOURCES AND SERVICES: Archaeological sites and artifacts

BACKGROUND AND JUSTIFICATION:

Important archaeological sites, protected by Federal and State laws, were oiled. At some sites oil continues to degrade artifacts, to spread further within sites and to contaminate additional artifacts. Erosion also may be a problem at some sites. The information within some sites could be totally lost, especially since petroleum residues interfere with Carbon[14] dating techniques. Additionally, increased public knowledge of exact archaeological sites locations is encouraging vandalism. Since these injured archaeological resources are not restorable, excavation may be the best option available to retrieve valuable information from some of the key sites and artifacts before they are rendered useless. It may be necessary to develop cleaning techniques so that standard radiocarbon dating procedures can be used to establish age of artifacts.

ACTION:

- excavate and document (e.g., photographic record) the most threatened and significant archaeology sites.[1]

INFORMATION NEEDED TO IMPLEMENT OPTION:

Completion of damage assessment studies will enable managers to more fully understand the effects of oiling on a site-specific basis. Thereafter, possible excavation sites can be ranked, based upon their value and ability to contribute knowledge.

[1] Artifacts collected during excavations will be curated, or distributed to appropriate museums, by the responsible agency.

OPTION 11: Improve or Supplement Stream and Lake Habitats for Spawning and Rearing of Wild Salmonids

APPROACH CATEGORY: Manipulation of Resources

INJURED RESOURCES AND SERVICES: Pink and sockeye salmon

BACKGROUND AND JUSTIFICATION:

There are a variety of established techniques for improving or supplementing spawning and rearing habitats to restore and enhance injured wild salmonids. These include construction of spawning channels and fish passes, removal of barriers impeding access to spawning habitats and addition of woody debris. Placement of egg boxes and use of net pens for rearing fry can improve in-stream productivity. Unlike pink and chum salmon, young sockeye salmon grow in lakes for 1-3 years before emigrating to sea. One restoration technique for sockeye is to add chemical fertilizers to lakes to temporarily supplement the natural nutrients needed to sustain prey on which the fry feed. Once a run is restored, the carcasses of spawned salmon are a natural source of the nutrients needed to sustain the food chain.

ACTION:

- construct or implement stream and lake improvements for the spawning and rearing of wild salmonids.

INFORMATION NEEDED TO IMPLEMENT THE OPTION:

Although stream and lake enhancement techniques are well established, there is need for site-specific analyses to determine which techniques are appropriate. An overall enhancement plan is needed to ensure an efficient, coordinated approach throughout the oil-spill area.

OPTION 12: Creation of New Recreation Facilities

APPROACH CATEGORY: Manipulation of Resources

INJURED RESOURCES AND SERVICES: Recreation

BACKGROUND AND JUSTIFICATION:

The oil-spill area contains an important assemblage of public lands dedicated, in part, to providing recreational services to the public. These lands include a national forest, several state and national parks and national wildlife refuges. A full range of private and commercial recreational activity occurs in these areas, supported by facilities like mooring buoys, boat ramps, recreational-use cabins, camping sites, and trails.

ACTION:

- replace or construct new recreational facilities within the oil-spill area.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Identify facilities and sites that have been damaged, destroyed or rendered unusable by the *Exxon Valdez* oil spill or clean up. The agencies then need to identify what actions may be taken to restore, replace or enhance recreation sites and opportunities.

OPTION 13: Eliminate Sources of Persistent Contamination of Prey and Spawning Substrates

APPROACH CATEGORY: Manipulation of Resources

INJURED RESOURCES AND SERVICES: Coastal habitat, blue mussels, harlequin ducks, sea otters, black oystercatchers, river otters, fisheries, subsistence

BACKGROUND AND JUSTIFICATION:

Continued oil contamination in substrate used for spawning may affect fish-egg deposition and survival. Mussel beds throughout the spill area were not cleaned during the oil spill cleanup because of the uncertainty of appropriate cleaning techniques. Mussels are an important food resource for a variety of injured species and the acute, chronic or sublethal effects of this continuing contamination are poorly understood. However, there is potential for movement into higher trophic levels, such as birds and mammals. This may cause chronic, sublethal effects at both the individual and population levels, further affecting the health and survival of injured resources.

ACTION:

- determine and implement, if necessary, the most effective and least destructive method of cleaning mussel beds and other critical oiled areas.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Conduct field surveys and sampling of oiled mussel beds and other areas throughout the spill area and chemical analyses of sediments and mussel tissue to determine the extent of the problem and the toxicity of the oil. Field tests to determine the most effective and least destructive method of cleaning oiled mussel beds must be conducted.

OPTION 14: Accelerate Recovery of Upper Intertidal Zone

APPROACH CATEGORY: Manipulation of Resources

INJURED RESOURCES AND SERVICES: Upper intertidal community of invertebrates and algae, especially the brown alga (*Fucus*)

BACKGROUND AND JUSTIFICATION:

Much of the upper intertidal zone within the oil-spill area was heavily oiled and subjected to intensive cleanup. This zone is dominated by the brown alga *Fucus gardneri* (popweed) which is not recovering rapidly. Moreover, many of the other life forms that use the upper intertidal are dependent upon this alga and associated invertebrate fauna for food and cover. The scientific literature indicates that *Fucus* is slow to recover and that its recovery is very important to that of the rest of the intertidal community. It is also important to evaluate the long-term effects of the various clean-up techniques that were used in the intertidal zone. Conclusions derived from the assessment of these techniques may have significant bearing on clean-up decisions for future spills.

ACTION:

- implement ways to expedite the recovery of the upper intertidal community, especially *Fucus*; and

- design and implement a monitoring program that will assess the effects of the various methods that were used to remove oil from the intertidal zone.

INFORMATION NEEDED TO IMPLEMENT OPTION:

There is need to conduct feasibility studies to test alternative methods of accelerating recovery of *Fucus* in the field.

OPTION 15: Supplement Intertidal Substrates for Spawning Herring

APPROACH CATEGORY: Manipulation of Resources

INJURED RESOURCES AND SERVICES: Pacific herring

BACKGROUND AND JUSTIFICATION:

Pacific herring spawn on a variety of intertidal and subtidal substrates, including *Fucus and Laminaria*. Herring eggs, larvae and spawning substrates were adversely impacted by the spill and cleanup. Attempts to supplement spawning habitat in the United States and abroad with both artificial and cultured macroalgal substrates have successfully increased herring egg survival and populations. In Russia, spawning habitat enhancement has been successful in substantially increasing herring egg survival.

ACTION:

- enhance and replace spawning substrates in areas used by spawning herring.

INFORMATION NEEDED TO IMPLEMENT OPTION:

It will be necessary to test the feasibility of implementing this option on a scale sufficient to benefit the herring population.

OPTION 16: Test Feasibility of Enhancing Murre Productivity

APPROACH CATEGORY: Manipulation of Resources

INJURED RESOURCES AND SERVICES: Common murres

BACKGROUND AND JUSTIFICATION:

Numerically, common murres suffered the greatest direct mortality from the oil spill of any vertebrate species. Although murre populations have been damaged by previous oil spills and other human-related perturbations, there have been no documented attempts at direct restoration of murre colonies. Based on restoration work with related species and an understanding of murre behavior, there are several techniques that hold some promise of increasing murre productivity. Methods that could be considered include enhancing social stimuli (e.g., use of decoys and recorded calls) to encourage nesting activity and improving the physical characteristics of nest sites (e.g., adding sills to ledges) to increase productivity. These techniques are experimental and possibly intrusive, but if effective, have the potential to reduce the recovery time of murres nesting in colonies in such places as the Barren Islands. Without intervention, the time to recovery is now estimated to be in the decades.

ACTION:

- conduct field study to determine the feasibility of techniques to enhance the productivity of common murres.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Prior to implementation of any technique proven to be feasible, it also would be necessary to evaluate whether there are any unintended, adverse effects on murres or other species. Lastly, it will also be important to consider the practicality of implementing successful techniques on a scale sufficient to reduce the recovery time of the murre population.

OPTION 17: Eliminate Introduced Foxes from Islands Important to Nesting Marine Birds

APPROACH CATEGORY: Manipulation of Resources

INJURED RESOURCES AND SERVICES: Marine birds

BACKGROUND AND PURPOSE:

Foxes are not indigenous to many of the islands of the Aleutian chain and Gulf of Alaska. Foxes were introduced to more than 400 islands to be raised and trapped for their furs. Introduced foxes reduced and eliminated populations of surface, burrow and in some cases cliff-nesting birds in a matter of years. More than 50 islands still have introduced foxes, and bird populations on these islands have never recovered. Where foxes have died out naturally or been eliminated through trapping and shooting, recovery of marine bird populations has been dramatic. Elimination of introduced foxes on selected islands may result in increased numbers and diversity of marine birds in Alaska and be viewed as "acquiring" resources equivalent to the estimated several hundred-thousand marine birds lost due to the oil spill. If selected as a restoration option, introduced foxes can be eliminated successfully on smaller islands using traps and guns. Most of the target islands would be west of the oil-spill area.

ACTION:

- eradicate red and arctic ("blue") foxes on islands in the western Gulf of Alaska and in the Aleutians where: such foxes are not indigenous; and the island is or was important to nesting marine birds in the alcid family (murres, puffins, auklets, murrelets), storm-petrels, gulls and terns, and waterfowl, such as eiders and Canada geese.

INFORMATION NEEDED TO IMPLEMENT OPTION:

No additional information is needed to implement this project other than to select target islands where successful, cost-effective programs can be instituted.

OPTION 18: Replace Fisheries Harvest Opportunities by Establishing Alternative Salmon Runs

APPROACH CATEGORY: Manipulation of Resources

INJURED RESOURCES AND SERVICES: Pink and sockeye salmon

BACKGROUND AND JUSTIFICATION:

Establishing alternative salmon runs can relieve pressure on injured wild stocks or replace harvest opportunities curtailed due to the restoration needs of injured wild stocks. For example, pink salmon produced in hatcheries are comprised largely of late-run stocks that return at the same time as most wild stocks of injured pink salmon in Prince William Sound. Harvest of the hatchery stocks in this mixed hatchery-wild stock fishery increases pressure on the wild stocks. Early runs of hatchery salmon could be established to alleviate pressure on the injured wild stocks without reducing harvest opportunities. Another example is to temporarily stock hatchery-reared smolts to replace loss of sockeye fishing opportunities resulting from overescapement when most Kodiak-area commercial salmon fishing was closed in 1989. This would only be appropriate in situations where injured wild stocks would not be affected by the replacement fishery.

ACTION:

- establish alternative salmon runs as appropriate and necessary to relieve pressure on injured wild stocks or to replace lost harvest opportunities during the recovery of wild stocks.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Establishing early-run hatchery salmon requires identification and development of the appropriate brood stock. In all cases, care must be taken to not further harm or complicate the management of injured wild stocks.

OPTION 19: Update and Expand the State's Anadromous Fish Stream Catalog

APPROACH CATEGORY: Habitat Protection and Acquisition

INJURED RESOURCES AND SERVICES: Anadromous fish, streams and intertidal spawning habitat

BACKGROUND AND JUSTIFICATION:

Numerous anadromous streams were affected by the spill and cleanup. Many of these streams are listed in the Anadromous Waters Catalog and Atlas maintained by the Alaska Department of Fish and Game. Additional streams were identified as part of the response survey effort following the oil spill and were added to the catalog. These new additions as well as a number of previously identified streams need to be surveyed as part of their evaluation as anadromous fish habitat. Evaluation of management or protection and acquisition options for restoring anadromous fish and their habitats will need the information acquired as part of these surveys. Under the State Forest Practices Act, streamside buffers are required bordering certain anadromous streams. This may be an important tool in the restoration of any stream-related species.

ACTION:

- survey and catalog anadromous streams located within the affected area.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Field surveys of anadromous streams within the affected area will provide the necessary information for documentation.

OPTION 20: Establish an *Exxon Valdez* Oil Spill "Special Management Area"

APPROACH CATEGORY: Habitat Protection and Acquisition

INJURED RESOURCES AND SERVICES: All

BACKGROUND AND JUSTIFICATION:

Restoration of injured resources and services may require special sensitivity or emphasis in making permit decisions on land uses and activities in the spill zone. This may be achieved by requiring that permits for such activities as anadromous stream crossings, log transfer sites, and mariculture projects be subject to a finding of compatibility with the recovery of injured resources and services. The duration of special management would be limited, depending upon the rate of recovery of the injured resources and services. A period of 5 to 15 years might be an appropriate time frame. Amendments to the State of Alaska's program under the Coastal Zone Management Act could be a vehicle for implementation of special management objectives. In all cases it would be essential to consider and minimize impacts on human uses of lands and resources.

ACTION:

- recommend creation of a Special Management Area within the oil-spill area. Activities requiring State permits within the zone will be regulated to assure compatibility with the recovery of injured resources and services.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Identify State and Federal permit decisions bearing directly on the recovery of injured resources and services, and evaluate the adequacy of the existing standards for issuing such permits. If a Special Management Area is warranted, the process for establishing a Special Management Area must be identified and initiated. Implementation would require action by the State legislature.

OPTION 21: Acquire Tidelands

APPROACH CATEGORY: Habitat Protection and Acquisition

INJURED RESOURCES AND SERVICES: Coastal habitat, including intertidal flora, fauna and various species of birds, mammals, fish and shellfish that use the intertidal areas

BACKGROUND AND JUSTIFICATION:

Tidelands and their associated flora and fauna were the habitat most injured by the spill. Most tidelands (below mean high water) are owned by the State or Federal governments. Some are owned privately or by municipalities, have high fish and wildlife values and are heavily used by the public for such activities as clam digging and wildlife viewing. Examples suggested by the public are Mud Bay at Homer and the Duck Flats at Valdez. Acquisition of such areas would preserve ecologically-important habitats and maintain the services such habitats provide for both consumptive and nonconsumptive public users. Services provided to the public could be enhanced by interpreting an area's natural history and providing additional access and viewing opportunities. Acquired areas could be designated as critical habitat areas, wildlife refuges or sanctuaries, or could be managed as part of State-owned, unclassified tidelands.

ACTION:

- acquire one or more tideland properties for public ownership and management to benefit wildlife resources.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Identify tidelands eligible for acquisition and subsequent "special" designation.

OPTION 22: Designate Protected Marine Areas

APPROACH CATEGORY: Habitat Protection and Acquisition

INJURED RESOURCES AND SERVICES: Coastal habitat, marine birds and mammals, seabirds, fisheries, invertebrates, algae and seagrasses, recreation

BACKGROUND AND JUSTIFICATION:

Virtually all species injured by the oil spill live in or use the nearshore and intertidal marine environment for feeding or reproduction. These marine habitats also provide many recreational and research opportunities. The recovery of injured marine resources and services may require long-term efforts and carefully coordinated management. The Trustees have recognized the importance of the marine environment and the potential value of increased, coordinated management for restoration purposes. In 1991, a two-day work shop exploring the subject was conducted. Possible designations include national marine sanctuaries, estuarine research reserves, marine parks, critical habitat areas, sanctuaries and refuges.

ACTION:

- if appropriate, recommend candidate areas for consideration and designation as marine protected areas by the Trustee agencies, the Alaska State Legislature and Congress.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Candidate areas must be identified and evaluated based on such factors as the habitat requirements of injured species and the type of designation needed to achieve restoration objectives.

OPTION 23: Acquire Additional Marine Bird Habitats

APPROACH CATEGORY: Habitat Protection and Acquisition

INJURED RESOURCES AND SERVICES: Marine birds, sea ducks, sea otters, harbor seals

BACKGROUND AND JUSTIFICATION:

There are a number of sites that are important to the recovery of marine species injured by the oil spill. These include various small rocky islands and cliffs used by colonies of nesting marine birds, riparian habitats used by nesting harlequin ducks and forested areas used by nesting marbled murrelets. Adjacent nearshore waters and tidelands are frequented by harbor seals and sea otters. The Alaska Maritime National Wildlife Refuge specifically was established for the conservation and management of marine birds, marine mammals, and other wildlife and fish. Examples of privately-owned islands with important marine bird and waterfowl habitats within refuge are Afognak, East Amatuli and Gull. Protecting key habitats in areas such as these would result in increased management, monitoring and research for the benefit of injured species. Bringing additional areas into public ownership could replace and enhance wildlife viewing services and public education opportunities.

ACTION:

- acquire and incorporate high-value marine bird and waterfowl habitats into public ownership.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Gather additional information on habitats relevant to injured species and integrate into the Trustees' overall effort to evaluate and acquire strategic fish and wildlife habitats.

OPTION 24: Acquire "Inholdings" Within Parks and Refuges

APPROACH CATEGORY: Habitat Protection and Acquisition

INJURED RESOURCES AND SERVICES: All

BACKGROUND AND JUSTIFICATION:

Several State and Federal conservation system units exist within the oil-spill area. These areas provide habitats for several injured species and various other resources or services. There have been many suggestions to acquire privately owned "inholdings" within existing conservation system units as a restoration action. For example, the Alaska Native Claims Settlement Act provided for several Native corporations to select lands inside the boundary of the Kenai Fjords National Parks. Those selections have been made (although not conveyed) and now overlay a significant portion of the park's coastline.

ACTION:

- acquire, on a willing seller basis, inholdings within existing parks and refuges to restore and enhance resources and services injured by the oil spill.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Gather additional information on habitats relevant to injured species and integrate into the Trustees' overall effort to evaluate and acquire strategic fish and wildlife habitats.

OPTION 25: Protect or Acquire Upland Forests and Watersheds

APPROACH CATEGORY: Habitat Protection and Acquisition

INJURED RESOURCES AND SERVICES: Harlequin ducks, marbled murrelets, river otters, anadromous fish, bald eagles, brown bears, recreation and wilderness and intrinsic uses

BACKGROUND AND JUSTIFICATION:

Although upland areas were not directly affected by the spill, they provide feeding and reproductive habitat for many of the injured species. Populations of salmonids and harlequin ducks are specifically dependent upon anadromous streams and their adjacent riparian lands. Undisturbed uplands and riparian lands provide important habitats and natural buffers that protect the quality of watersheds, streams and rivers. Uplands in the oil-spill area are also important recreation areas and contribute to the aesthetic experience enjoyed by recreational users throughout the spill area. Both recreation and tourism are dependent upon the pristine nature of these areas. By acquiring easements, property rights or fee-simple title to these strategic areas, injured species can be safeguarded during recovery and various resources and services can be restored and enhanced.

ACTION:

- acquire upland areas adjacent to anadromous streams, that are relied upon by injured species; and

- develop and implement a management plan for acquired or protected lands.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Gather additional information on habitats relevant to injured species and integrate into the Trustees' overall effort to evaluate and acquire strategic fish and wildlife habitats.

OPTION 26: Acquire Extended Buffer Strips Adjacent to Anadromous Streams

APPROACH CATEGORY: Habitat Protection and Acquisition

INJURED RESOURCES AND SERVICES: Anadromous fish, harlequin duck, river otter

BACKGROUND AND JUSTIFICATION:

Undisturbed riparian lands are important natural buffers that protect the water quality of streams and rivers and provide cover and food for wildlife. Injured populations of salmonids and harlequin ducks depend upon anadromous streams as feeding and reproductive habitat. Adverse human impacts to the lands adjacent to this habitat could retard the rate of their recovery. The State Forest Practices Act provides for 66-foot buffer strips along certain anadromous fish streams. One concept is to acquire wider buffer strips, as needed to maintain habitat for injured species.

ACTION:

- acquire title or property rights to riparian lands not currently protected under existing law.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Identify anadromous stream habitats important to injured species and evaluate degree of protection afforded under existing law.

OPTION 27: Designate and Protect Benchmark Monitoring Sites

APPROACH CATEGORY: Habitat Protection and Acquisition

INJURED RESOURCES AND SERVICES: All

BACKGROUND AND JUSTIFICATION:

A comprehensive monitoring plan has been suggested for consideration by the Trustees [Restoration Option No. 31]. Integral to the comprehensive monitoring plan is the designation of discrete and permanent monitoring sites within the oil-spill area. These sites could include oiled, representative habitat types and unoiled control sites, set aside untreated sites in 1989, damage assessment study sites, and Exxon study sites. There are several designations appropriate for monitoring sites, including "research natural areas" (U.S. Forest Service) and "estuarine research reserves" (National Oceanic and Atmospheric Administration). The Forest Service presently is considering several research natural areas in Prince William Sound, including one on Green Island. The National Science Foundation's program for long-term ecological research sites is also a possibility.

ACTION:

- recommend designation of permanent study sites and control areas for long-term monitoring of marine, intertidal and upland habitats and selected indicator parameters

INFORMATION NEEDED TO IMPLEMENT OPTION:

Establishment of monitoring sites should be integrated with development of a comprehensive monitoring plan. Ownership, management and other uses of potential sites must also be considered.

OPTION 28: Acquire Access to Sport Fishing Streams

APPROACH CATEGORY: Habitat Protection and Acquisition

INJURED RESOURCES AND SERVICES: Recreation, anadromous fish

BACKGROUND AND JUSTIFICATION:

Anadromous fish species, such as coastal cutthroat trout, and the recreation services provided by these fish were injured by the oil spill. Although most of the oil-spill area is in public ownership, some areas that provide important sport-fishing opportunities are not. Acquiring access to such areas can replace or enhance the injured services and also relieve pressure on streams with injured fish stocks. Acquisition of access for sport fishing might be achieved by various mechanisms, including fee-simple title, easements or other property rights. Candidate sites can be identified based on the knowledge of resource managers in the agencies, nominations from the public and proposals from interested landowners.

ACTION:

- acquire, on a willing-seller basis, access to strategic areas that provide significant sport-fishing opportunities.

INFORMATION NEEDED TO IMPLEMENT OPTION:

The identification and acquisition of access to such areas must be integrated into the Trustees' overall plan for identifying strategic fish and wildlife habitats and recreation sites. Management plans must be developed for any sites acquired.

OPTION 29: Establish or Extend Buffer Zones for Nesting Birds

APPROACH CATEGORY: Habitat protection and acquisition

INJURED RESOURCES AND SERVICES: Marine birds, sea ducks and bald eagles

BACKGROUND AND JUSTIFICATION:

Most bird species have specific nesting requirements. Actions that alter nesting habitat or disturb nesting birds may disrupt nesting birds, thus reducing productivity and slowing the recovery of injured species. Examples of nesting habitats for injured bird species are rocky cliffs and headlands for marine birds, large trees along coastlines or streams for bald eagles, upland stands of large trees for marbled murrelets, and upland wooded streamsides for harlequin ducks. During the period these injured species are recovering from spill injuries, it may be appropriate to adopt special management practices to ensure the integrity of nesting habitats and minimize disruption during breeding and rearing times. Extended buffer zones around nest sites or restrictions on certain activities at critical times could be considered. Implementation of this option is most easily accomplished on lands which are publicly managed, but, through cooperative agreements and other mechanisms, privately owned lands could be included as well.

ACTION:

- recommend implementation of special management practices, including buffer zones and time/area restrictions; and

- explore and negotiate cooperative mechanisms for achieving similar management practices on private lands.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Relate results from restoration studies now underway to current and proposed land uses and management directions on public and private lands.

OPTION 30: Test Subsistence Foods for Hydrocarbon Contamination

APPROACH CATEGORY: Other Options

INJURED RESOURCES AND SERVICES: Finfish, shellfish, sea ducks and marine mammals

BACKGROUND AND JUSTIFICATION:

People living within the oil-spill area use subsistence resources obtained from the intertidal zone and from nearshore waters. Finfish, shellfish, marine mammals, and sea ducks are a substantial part of the diet of these local residents. Damage assessment studies documented the contamination of certain of these resources by petroleum hydrocarbons. For example, mussel and sediment samples collected during the summer of 1991 revealed persistent contamination of mussels and mussel beds. An oil-spill health task force was formed in 1989 to oversee analyses of subsistence food resources. These studies tested for petroleum hydrocarbon contamination in seals, deer, salmon, ducks, clams and bottomfish. This option proposes to monitor subsistence foods for residual petroleum hydrocarbon contamination and to disseminate the results to the public.

ACTION:

- develop a program designed to monitor for the presence of petroleum hydrocarbons in subsistence foods; and

- disseminate the results of the monitoring project to subsistence users.

INFORMATION NEEDED TO IMPLEMENT OPTION:

The design and results of the previous food-testing program must be evaluated.

OPTION 31: Develop Comprehensive Monitoring Program

APPROACH CATEGORY: Other Options

INJURED RESOURCES AND SERVICES: All

BACKGROUND AND JUSTIFICATION:

Monitoring is necessary in order to assess the adequacy of natural recovery. Resources that are found to be recovering at an unacceptable rate may have to be reconsidered as candidates for restoration action. Likewise, resources which are recovering faster than anticipated may allow for the early completion of a restoration action. Monitoring of physical, chemical and biological parameters will establish a baseline for the affected area. This baseline can then be used as a reference standard to evaluate the effects of future disturbances to the oil-spill area, e.g., earthquakes and oil spills. This standard could also be used to assess the anticipated effects of human development and to guide management programs.

ACTION:

- design and implement a program that will monitor:
  - natural recovery of injured resources;
  - monitor recovery of restored resources; and
  - monitor selected parameters to establish an environmental baseline condition.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Initially, target resources and specific objectives of a monitoring program must be established. A determination must be made on the best and most cost-effective methods to be used for monitoring the selected resources.

OPTION 32: Endow a Fund to Support Restoration Activities

APPROACH CATEGORY: Other Options

INJURED RESOURCES/SERVICES: All

BACKGROUND AND JUSTIFICATION:

Ensuring that the spill-affected area will fully recover from the *Exxon Valdez* oil spill is a complex, long-term task that will involve many interests, significant funding and much initial uncertainty. There will be a continuing need to identify, protect and manage critical habitat areas in the future. Monitoring of natural recovery and the efficacy of restoration activities will be needed. Restoration activities will be implemented as injury and technical information indicate. Continued research into the effects of the spill will help the development of improved clean-up methods. In making a long-term commitment to the oil spill environment, it is important to recognize the need for continuing financial support. Contributions from Exxon for restoration activities terminate in 2001; the Trustees may consider spending mechanisms that will continue that support after 2001.

ACTION:

- establish a restoration endowment or trust fund using all of the available proceeds from Exxon. There are numerous spending alternatives available such as:

  - spending only the investment income;

  - spending principal at a given level for a number of years and then spending only the investment income after that; and

  - spending principal at a given level through the life of the settlement and reinvesting the balance annually.[2]

INFORMATION NEEDED TO IMPLEMENT OPTION:

Identify the process and institutional structure needed to implement and manage the fund.

[2] One scenario would allow expenditure of approximately $24 million a year for restoration through 2001, reimburse the governments for expenditures to date, and still have an endowment fund principal of approximately $600 million. By the year 2020 approximately $900 million would have been spent on restoration with a remaining endowment fund principle of over $1200 million.

OPTION 33: Develop Integrated Public Information and Education Program

APPROACH CATEGORY: Other Options

INJURED RESOURCES AND SERVICES: All

BACKGROUND AND JUSTIFICATION:

This project would design and develop information available from the damage assessment and restoration process to inform the public of ways they can help injured resources recover from the effects of the spill and the resulting clean-up efforts. Specifically, the information would explain changes to the ecosystem and how people can lessen their potential for creating additional harmful human disturbance. The information will be delivered through brochures, posters, video, enhancement of school curricula, and other informational media. The materials will be delivered to state and federal visitor centers, state ferries, and cooperating private businesses and organizations throughout the entire spill zone. The project would seek to recognize restoration within the context of the entire ecosystem, rather than through a species-specific approach.

ACTION:

- provide updated summaries of oil spill injuries and make available to the public;
- produce brochures, posters and other informational products for distribution to local, state and federal visitor facilities throughout the spill zone; and
- consider constructing or supplementing interpretive facilities in oil-spill communities.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Conduct feasibility study in regard to anticipated need, use and sites of any interpretive facilities.

OPTION 34: Establish a Marine Environmental Institute

APPROACH CATEGORY: Other Options

INJURED RESOURCES AND SERVICES: All

BACKGROUND AND JUSTIFICATION:

Restoration of the oil-spill area will require a long-term commitment by the Trustees. Establishing a marine environmental institute to conduct long-term research and monitoring activities could be a means to foster long-term restoration goals. Any information gained also will serve as an environmental baseline and help guide the use and management of the oil-spill area. The institute could be based in a field station in an oil-spill community. Funding for the institute could come either directly from the joint fund or from an endowment, as described in Restoration Option 32.

ACTION:

- establish and equip a marine environmental science institute.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Evaluation of this option requires consideration of a number of factors. The objectives of such an institute must be established and such questions as funding mechanisms and locations must be reviewed in light of those objectives. The relationships to established academic and research entities must be reviewed thoroughly.

OPTION 35: Replacement of Archaeological Artifacts

APPROACH CATEGORY: Other Options

INJURED RESOURCES AND SERVICES: Archaeological sites and artifacts

BACKGROUND AND JUSTIFICATION:

Important archaeological sites and artifacts, protected by Federal and State laws, were oiled. At some sites oil continues to degrade the resources, while at other sites increased looting and vandalism are occurring. Since archaeological resources are not inherently restorable, a direct replacement of artifacts may be a logical method to restore the injuries sustained. One method could be to purchase privately owned artifacts that originated in the region and put them into public collections. Another complementary approach would be to retrieve artifacts removed from the spill zone to public institutions and to actively track down other artifacts that were illegally collected during the spill and subsequent cleanup activity.

ACTION:

- seek out, in a systematic fashion, institutions and individuals who may have artifacts from the spill area and offer to purchase specific pieces for public institutions.

- investigate the incidence of looting and vandalism and strive to regain possession of publicly owned artifacts.

INFORMATION NEEDED TO IMPLEMENT OPTION:

Completion of damage assessment studies will enable managers to more fully understand the effects of looting and vandalism and may help lead to the recovery of illegally taken artifacts.

This section provides a brief description of the rationale for recommending the rejection of some options as follows:

Sea Otters and Harbor Seals:

Option: Supplementing winter foods

The technical feasibility of this option is questionable and the methodology is untested. Prey would have to be distributed over a large area in order to be effective and it would encourage unnatural dependence on the part of the predator. The cost of implementing this option would be extremely high, with only a marginal likelihood of success.

Option: Translocating sea otters or harbor seals to augment injured populations

Although translocating otters and seals is technically feasible, there is a risk of causing further damage to the populations by introducing disease and of impacting the donor population through lost individuals. In addition, there are source populations adjacent to the oil-spill area that will naturally expand as the habitat improves.

Option: Reduce incidental loss through buying back limited-entry gillnet permits

This would be extremely costly and may require legislative permission from the State of Alaska. It is unlikely to result in a population-level increase because the incidental take of sea otters or harbor seals is currently low.

Option: Establish international wildlife rehabilitation/public education center

Rehabilitation of oiled sea otters and harbor seals, while technically feasible, has been relatively ineffective. After heroic efforts to save the hundreds of otters brought to the Valdez rehabilitation center post release survival has been relatively low. There is question in the scientific community whether the additional stress related to capture, transportation and handling may contribute to the mortality in these situations. Costs of rehabilitation are very high, with an upper range of $80,000 per animal. To now create a rehabilitation center would do nothing to restore otter and seal populations impacted by the *Exxon Valdez* oil spill. Although use of restoration funds for education has merit, such efforts do not have to be linked to establishing a wildlife rehabilitation center.

Killer Whales:

Option: Reduce marine debris and expand stranding/entanglement rescue operations

Although this option has been used in other areas to benefit different whale species, it is unlikely to produce noticeable benefits to killer whales in the oil-spill area. Incidents of stranding and entanglement of killer whales in the oil-spill area are rare, and the opportunities to implement rescue operations are limited by the remoteness of the area.

River Otters:

Option: Translocating river otters to augment populations within and outside of the oil spill area.

Sufficient source populations exist for natural recolonization to occur. Translocating river otters may result in the introduction of disease into the injured population.

Common Murres and Marbled Murrelets:

Option: Augment natural reproduction through captive breeding, fostering and related techniques

The technical feasibility of this option is unknown because of the difficulty of introducing young murres and murrelets back into the wild. This would have to be done on a very large scale in order to have an effect on the populations. This option would require extensive research, at great cost, in order to determine its effectiveness.

Marbled Murrelets:

Option: Provide artificial nest sites to enhance productivity or redirect nest activities to alternative sites

Most marbled murrelets nest in large trees in old growth/mature forests. If sufficient mature forest remains available, nest sites will not be a limiting factor in recovery.

Harlequin Ducks:

Option: Augment natural reproduction through captive breeding, fostering and related techniques

Although this method has been used effectively for other species of waterfowl, it has not been tested for harlequins. Population problems

within the oil-spill area appear to be contaminant related and cannot be altered by augmenting the population of harlequins.

Harlequin Ducks and Black Oystercatchers:

Option: Mariculture of shellfish to supplement prey base

The cost:benefit ratio of this option is extremely poor. Mariculture operations would have to occur over an extremely large area to be effective, and the birds may still be exposed to oil from other food sources.

Bald Eagles:

Option: Augment natural reproduction through captive breeding, fostering and related techniques

Natural recovery is expected to be adequate when combined with habitat protection measures. Source populations for natural recovery exist near the oil-spill area.

Pink Salmon and Sockeye Salmon:

Option: Control predators on fish eggs and juveniles

This option would be difficult to implement over a large area. It also conflicts with the restoration of other injured species which may rely on salmon for food. Predator reduction may not be consistent with State and Federal laws.

Option: Buy back limited entry fishing permits to reduce pressure on resources

This would require a change in state law in order to implement. Identical results could be obtained through management practices.

Rockfish:

Option: Construct artificial habitat structures (e.g., artificial reefs)

Habitat does not appear to be a limiting factor in the recovery of rockfish.

Option: Buy back limited entry fishing permits to reduce pressure on resources

This would require a change in State law in order to implement. Identical results could be obtained through management practices.

Spot Shrimp:

Option: Mariculture and shore/intertidal habitat enhancements

The technical feasibility of this option for supplementing spot shrimp populations has not been demonstrated.

Coastal Habitat:

Option: Erosion control using rip-rap, revegetation and other methods

Shoreline assessment studies, and other observations in the field, indicate that erosion problems are minimal.

Cultural Resources:

Option: Inventory beach and upland sites for cultural resources

Potentially injured cultural resource sites are being surveyed under the damage assessment process.

Option: Encourage oral history and video tape projects concerning regional/local history and traditions

This option is not relevant to the restoration of archaeological resources as specified by the civil settlement.

Multiple Resources:

Option: Assist coastal communities and boat operators with environmentally-sound waste disposal and waste recycling programs

Option: Determine whether old community and military dump sites add to cumulative effects

Option: Reduce chronic oil pollution associated with boats, harbors, and transportation of petroleum

Option: Remove mining and logging debris to minimize cumulative effects of pollution

For any or all of the above options it would be extremely difficult to establish direct linkage to the recovery of injured resources. If such a linkage is established, these options may become appropriate. Meanwhile, public education may be an avenue for addressing chronic pollution problems.

Option: Initiate reforestation programs wherever logging has occurred (e.g. Afognak Island)

The injured species which utilize forested habitats rely primarily on mature forests. For this reason, reforestation practices will not help the near-term restoration of populations injured by the *Exxon Valdez* oil spill.

Option: Establish stronger regulations, improved planning, and better response in order to minimize additional effects from future oil spills

The criminal court settlement provisions allow for expenditures towards planning for and response to future oil spills. This option is beyond the scope of the civil settlement. In addition, the Oil Pollution Act of 1990 will require new regulations and contingency planning.

Option: Reduce energy consumption through improved efficiency and conservation

This is beyond the scope of the civil settlement.

Option: Buy back Bristol Bay oil leases

This does not apply to the restoration of resources injured by the *Exxon Valdez* oil spill.

Option: Buy "net operating losses" (NOLs) of timber sales or change laws to disallow NOLs

Legislative action has already disallowed "Net operating losses" of timber sales.

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