



IN REPLY REFER TO:

SOL.AK.0029

# United States Department of the Interior

OFFICE OF THE SOLICITOR  
ALASKA REGION

222 West 8th Avenue, #34  
Anchorage, Alaska 99513-7584

March 23, 1992



RPWG  
I

TO: Stan Senner  
Restoration Planning Subgroup

FROM: Regina L. Sleater, Attorney *Regina Sleater*  
Office of the Regional Solicitor - Alaska Region

SUBJECT: EVOS-Restoration Framework

The following are my comments on the draft Restoration Framework document, both substantive and editorial:

- Since this is an official published document, the vessel which caused the oil spill should be referred to as T/V Exxon Valdez, except in direct quotations from other sources. Then no one can fault us for either hyping or castigating Exxon.
- Refer to this document as the Restoration Framework and the companion volume as the 1992 Work Proposals. There is no need for the Volume I and II designations since the documents stand on their own and are not dependent upon each other. 1992 Work Plans should be changed to Proposals because of the NEPA implications of plans. Further, this is very early in the exercise to pre-empt the title Exxon Valdez Oil Spill Restoration or we will eventually end up with volume ML.
- Suggest eliminating paragraph specifying OSPIC since too many contacts lead to confusion.
- Check with the Post Office to ascertain if a half page fold will be delivered with one regular stamp.
- P.i, chapter V Proposed Injury Criteria  
appendix B Potential Restoration Options
- P.iii, 4, and 7, there is still confusion about the date of the settlement. Please state that on October 8, 1991 the [Exxon] settlement agreement was approved by the U.S. District Court requiring that the Exxon companies pay approximately one billion dollars in criminal restitution and civil damages to the governments. [The Modern Language Association allows either writing a number in words or if the number is larger than ninety-nine using numerals but not combining the two. If there is a need the numerals in parentheses may follow the words. The method adopted "\$1 billion dollars" is also redundant. This comment applies to all figures used.]

◦ P.iii, paragraph 3: The State and Federal Trustees will receive \$900,000,000 from the Exxon companies in settlement of the civil claims over the next ten years. These funds will be deposited in the Court Registry Investment Account. Subject to Court approval, the Trustees will draw from that fund to finance restoration

◦ P.iii, paragraph 4, 2d sentence: The Federal Trustees have appointed representatives to an Alaska-based Trustee Council.

◦ P. 13 PAG

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 included the role, responsibilities and membership of the public advisory group. The Trustees have identified the following interests and constituencies to be represented on the fifteen seat public advisory group ...scientific/academic. Single seats will be reserved for local governments and Native Interests as defined by the settlement of Chenega Bay v. United States and State of Alaska, Civil Action No. 91-454. A member of the Alaska House of Representatives and a member of the Alaska Senate will serve as ex officio members of the public advisory group.

The members of the advisory group will be nominated by the public and various organizations and be appointed with the unanimous consent of the Trustees. The Trustees will be formally soliciting nominations for membership on the public advisory group through the Federal Register and local newspapers. If you are interested in receiving an announcement, please contact.

◦ Delete p.14 listing is unnecessary and dates are subject to change. Just giving the disgruntled something to complain about later.

◦ P. 38 Wilderness: The State and Federal have designated "wilderness areas" in KBSP....In Addition, lands in KFNP and the CNF are being studied for potential designation. 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...."

Portions of these areas were oiled by the T/V Exxon Valdez spill. 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 injury.... These clean-up activities disrupted the uses of the wilderness....

◦ As an editorial comment, modern English usage does not utilize a comma before a conjunctive or disjunctive. I have

tried to mark these unnecessary commas for deletion.

I am providing my marked up version of the draft Restoration Framework, please call if you do not understand the comments marked therein or the comments which I made this morning.

DRAFT

CONFIDENTIAL

April 1992

Dear Reviewer:

*for natural resource damages*

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.~~

*report states too*

*This*

~~Restoration Framework~~ 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 I: 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~~.

*presented with the 1992 Work Proposal*

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.

*maybe change*

*the Restoration Framework and the 1992 Work Proposal*

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: 645 G Street, Anchorage, Alaska 99501

*Sincerely,*

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

*EVOs Trustees*

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.

*Proposals*

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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.

*7 Have you checked size with PO?*

Return Address:

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Place  
Stamp  
Here

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

Attn: Restoration Framework

-----(fold here)-----  
Additional Comments:

# Restoration Framework

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# EXECUTIVE SUMMARY

*The*  
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. *intended to serve approximately approved*

On October 9, 1991 a settlement agreement was ~~filed~~ *approved* 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. *Court approval date*

## Post Settlement Administration (Chapter I)

The State and Federal Trustees will ~~recover~~ *receive* \$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. *in settlement of the funds deposited in court registry account*

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. *Texas have appointed representatives to T.C.*

## 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. *> a post currently filled by an Interim Executive Director*

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~~. *the PAC have approved a charter* 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. *have approved charter*

*Proposals* Additional public comments will be solicited

### Restoration Planning Before the Settlement (Chapter III)

The Trustees <sup>with the assistance of</sup> and the Environmental Protection Agency <sup>begin preliminary restoration planning</sup> 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. <sup>These proposed criteria & options are presented for public review & comment in consultation with technical experts.</sup>

*Although the litigation required confidentiality,*

### Summary of Injury (Chapter IV)

Immediately after the ~~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 <sup>to the</sup> 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.

*More than just those done by TCS*

*when why high 1992 costs Proposed*

### 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 ~~the~~ Exxon Valdez oil spill. The Trustees propose that <sup>potential</sup> "evidence of consequential injury" and <sup>potential</sup> "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 <sup>as possible components of several restoration alternatives</sup> in a draft restoration plan.

*Consider components of alternatives*

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

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## Restoration Framework

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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

<sup>may</sup>  
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:

better on next page

- establishing a <sup>final</sup> 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).

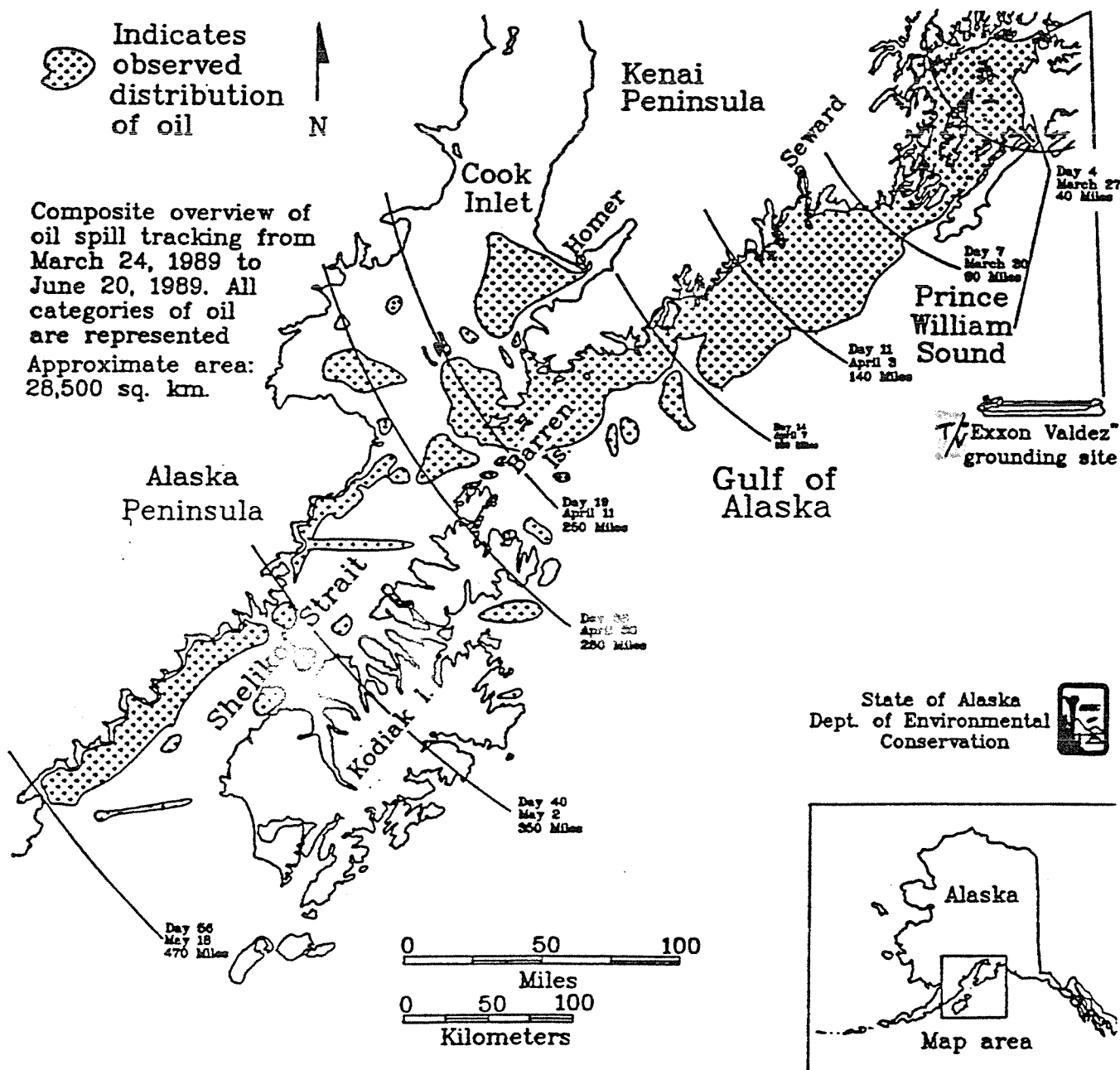
## Background

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

These details of days appear to be different than version of NOAA used in Apr 1990. Don't use official use restoration info or not at all.

Figure 1





ships were sent throughout the spill zone to <sup>remove</sup> 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.

*field* 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

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*approved by the*  
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). *up to*

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. *companies and others*

### 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: *The remaining*

- \$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." *agreed that*

### 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 *filed*

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~~ <sup>approved</sup> 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.

<sup>up to</sup> 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 <sup>1</sup>	\$150 Million <sup>1</sup>
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

<sup>1</sup> Exxon's cleanup costs for the 1991 and 1992 field seasons will be deducted from this payment.

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May be  
1/4 by*

*less certain  
allowable  
reimbursement*

*1/4 year  
interest*

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.

*that could not reason*

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 <sup>due to</sup> 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

*met*

6

*check - use quote*

- 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.

*Sloppy repetition  
Delete  
50*

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, *U.S. Dept. of Commerce*

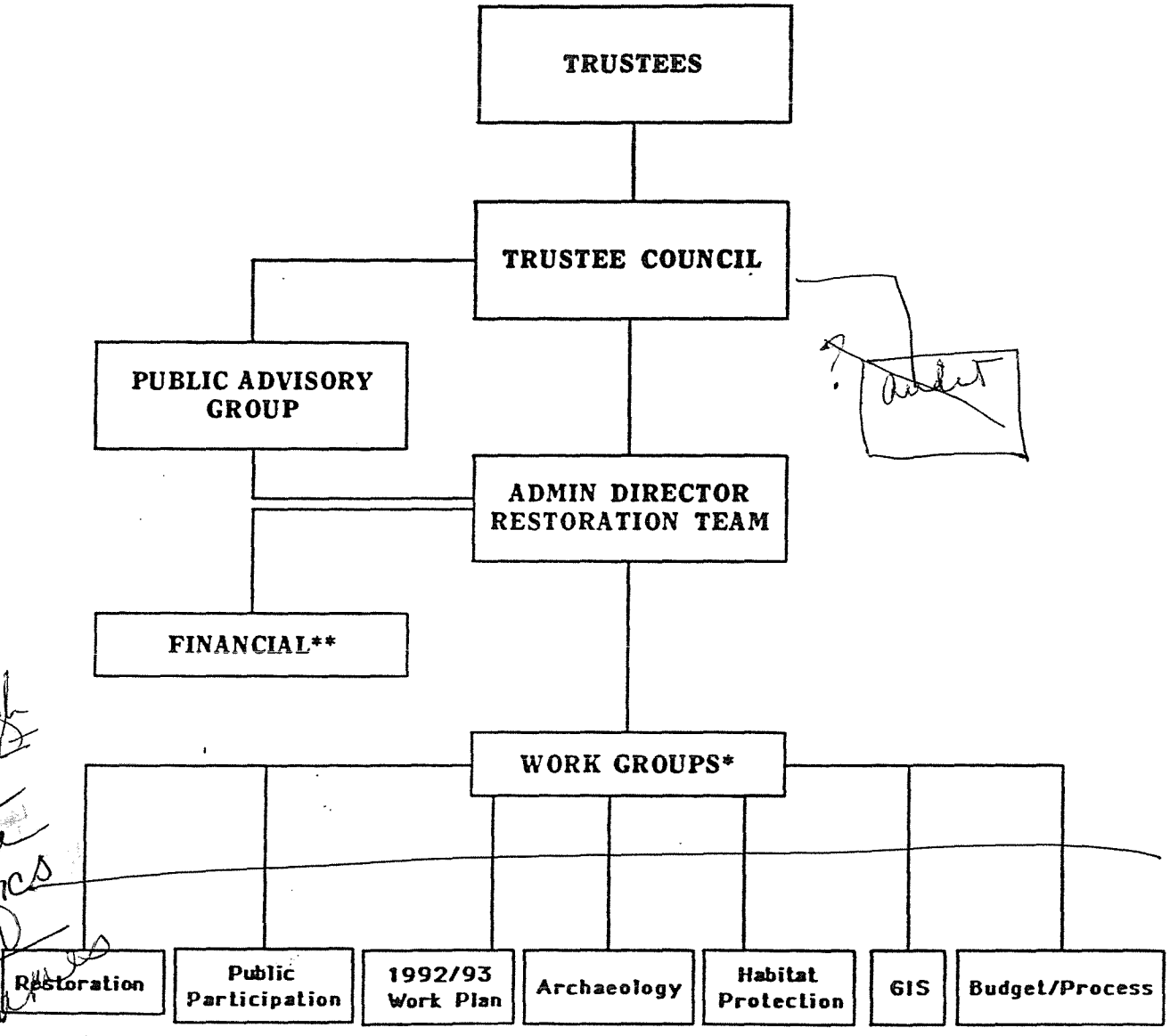
The Federal Trustees do not participate directly in most restoration decisions, but have <sup>appointed</sup> ~~delegated authority to do so to their designated~~ representatives <sup>Trustee Council deliberations</sup> on the Alaska-based Trustee Council. These representatives are the Alaska Regional 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

*provide admin support +*

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



Even though approved  
Delete Specifics since #s + names change

audit

maybe OMP

\* Groups will be formed and disband as appropriate.  
 \*\* Does not include audit function. Restoration Team will develop a proposal for combined state/federal audit.  
 Proposal for this function will be developed.

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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: *still approved in*

*No meet. Exx in doct.*

"... 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~~ the 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; *on*
- provide the public with information and resources ~~to evaluate~~ proposals and programs *on restoration* independently;
- involve relevant constituencies;
- disseminate information *to public* concerning the restoration process in a timely manner;
- ~~establish legitimacy and ensure public acceptance of the restoration process and structure;~~ *to* ensure public *understanding* 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.~~

*impartial acceptance comes from understanding*



Information Availability

Although <sup>the</sup> ~~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.

*e*

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 <sup>on the restoration process</sup> for review:

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

*Handwritten notes:*  
 No meeting  
 info packet  
 No  
 Plans  
 Resto Plan

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

*Handwritten note:* specify what

*Handwritten notes:* were  
were

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 <sup>will be</sup> are scheduled for April and May 1992. <sup>Notice to public will be given through federal register and newspaper notices.</sup>

~~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.~~ <sup>Additional</sup> <sup>proposals</sup> <sup>proposals</sup>

### 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 included its role, responsibilities and membership. <sup>etc.</sup> 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 <sup>will</sup> be reserved for representatives of each of the following: <sup>local govt + Native</sup> Native village council or corporation, local government, the Alaska House and the Alaska Senate <sup>would serve as ex officio members of the P.A.G.</sup>

~~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.~~ <sup>traditional</sup> <sup>Interests as defined or of Representative</sup> <sup>a member of 1</sup> <sup>receiving an announcement</sup>

### Restoration Plan

In this first year following settlement, the Trustees <sup>proposed</sup> will develop a draft restoration plan and draft environmental impact statement. <sup>on the plan</sup> 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 judgment 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.

*Don't think all this was approved - just suggested by 1993 Work Proposal out of sync*

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

*Asking for  
trouble*

*This*  
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 *Symposium* Involvement

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~~ *refining* the issues to be addressed in the restoration program. *with EPA providing support*

In March 1990 a public symposium was held in Anchorage. *See* 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~~ *for litigation* 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. <sup>were replaced</sup>

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

*Per Review*

### Issues and Concerns Identified

*process*  
The ~~restoration planning and scoping~~ <sup>restoration</sup> 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 <sup>the</sup> 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.

Move

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 <sup>may</sup> continue to provide advice for the restoration planning and damage assessment process, identify information needs and review study proposals.

Same as

Habitat Protection

← Put at end since after specific federal

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.

sometimes makes look like done deal  
T.C. [unclear]

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.

establishing a methodology for [unclear]  
why promote

## Review of Recovery Literature

The rate and adequacy of natural recovery <sup>maybe</sup> 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, <sup>was initiated in 1991</sup> 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]).

*incorp  
p 46*

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.

*of this type*

*Proposals*

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.

*ment of*

*Habitat Protection*



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# CHAPTER IV SUMMARY OF INJURY

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

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.

*Local records about spill are not available because of general*

## 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

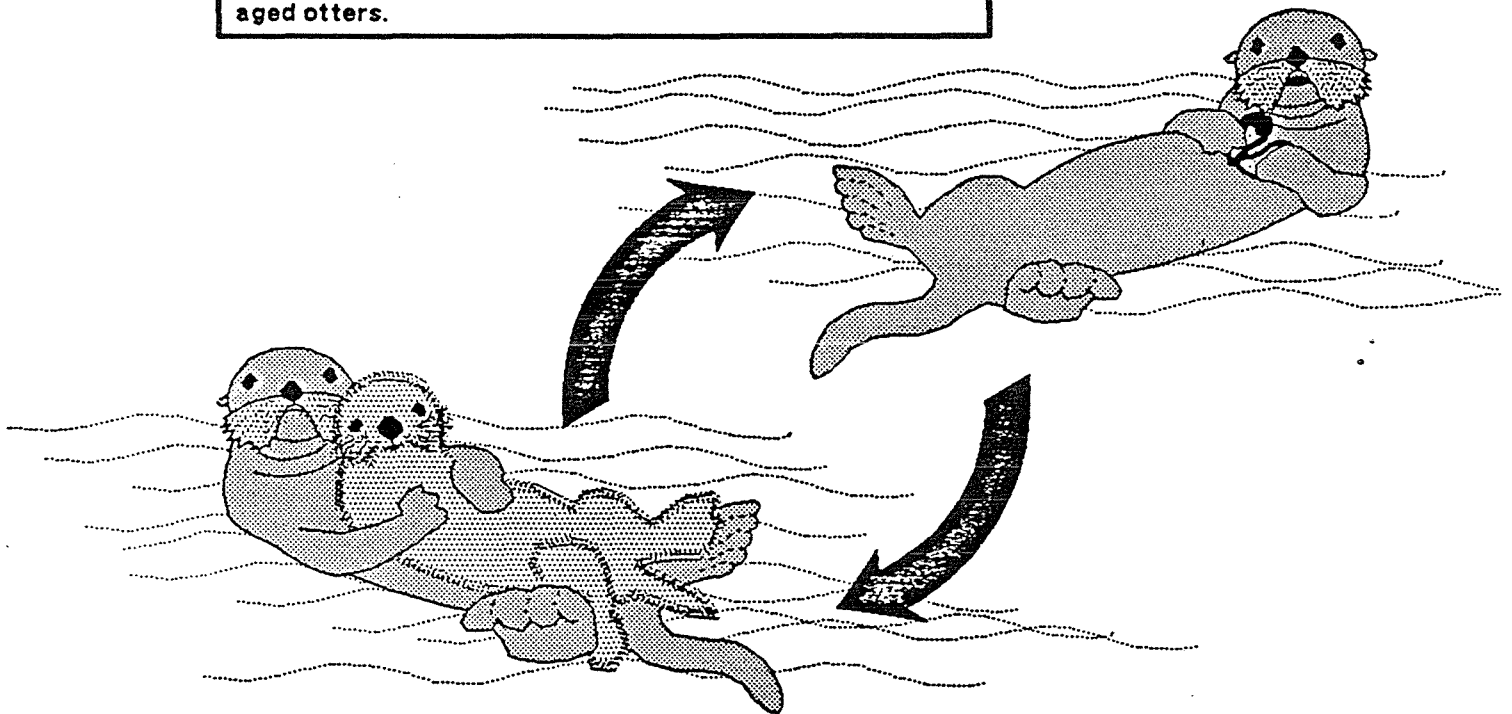
Figure 3

# 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 be 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 murren 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. Murren exhibit strong fidelity to traditional breeding sites and infrequently immigrate to new colonies.

Normally, murren 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 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.

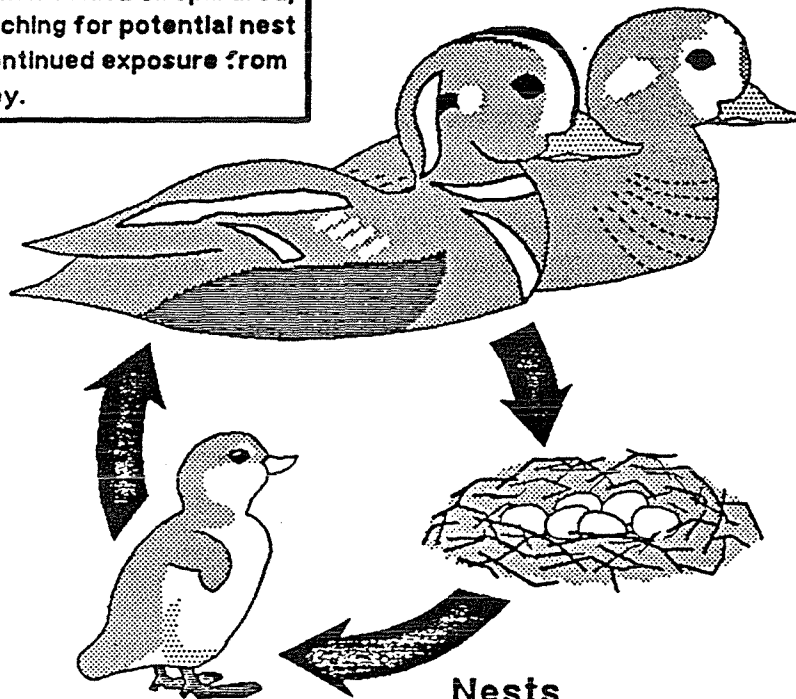
Figure 4

# 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, 81,000 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 effects 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

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 unoled 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

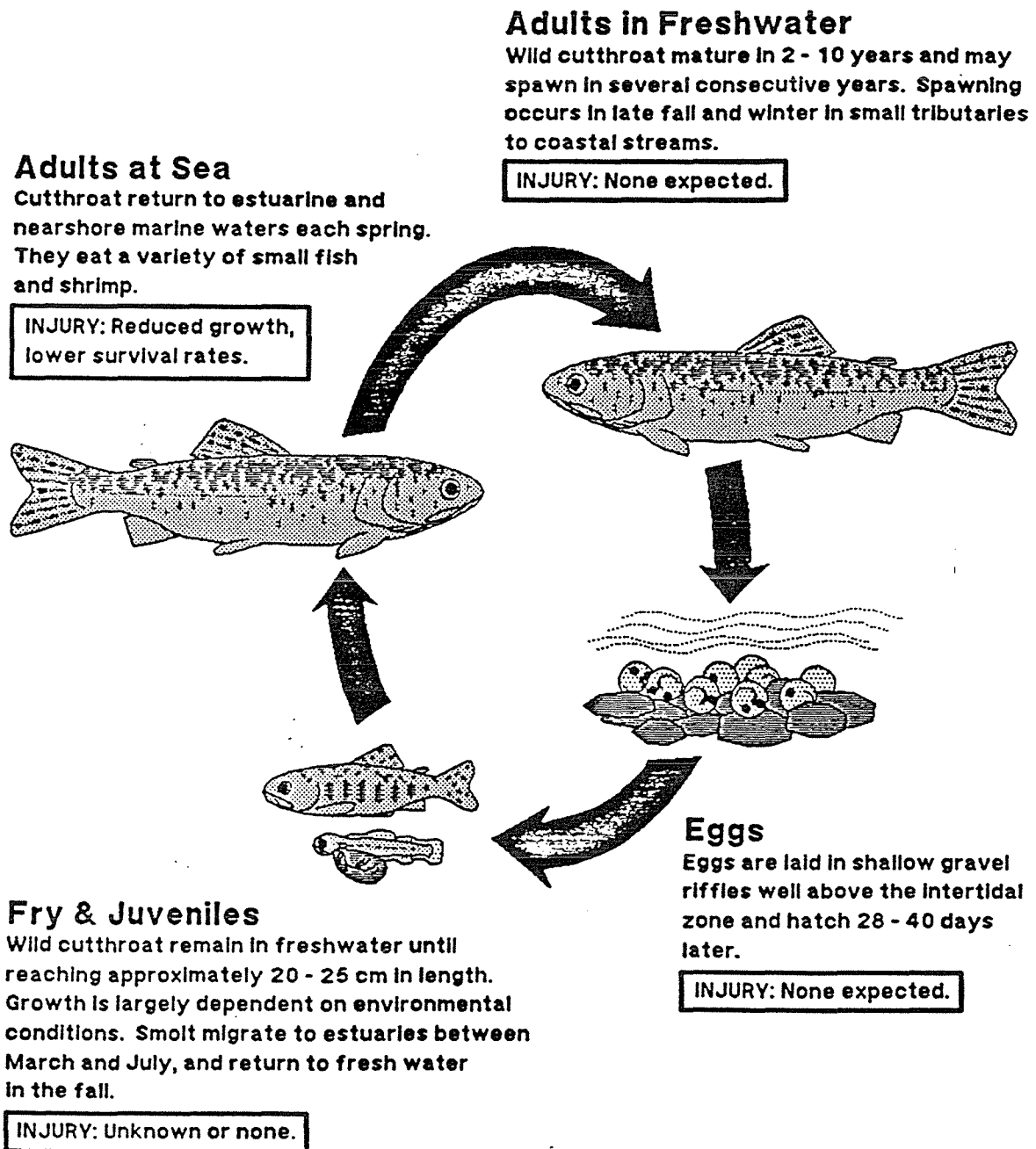
Prince William Sound is the northern extreme of the range of cutthroat trout (See Figure 5). Both cutthroat trout and Dolly Varden use nearshore and estuarine habitat for feeding throughout their lives (in contrast to salmon which migrate out to sea). The highest concentrations of bile petroleum hydrocarbon 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 unoled areas. The larger cutthroat trout also showed higher levels of mortality in oiled and unoled 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 unoled 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 unoled 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

Figure 5

# Cutthroat Trout



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 histopathological 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.

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## **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, but in 1991, toxicity was associated primarily with sediment samples from the shallow subtidal zone. There is evidence that animals living on or near the sea floor continue to be exposed to petroleum hydrocarbons. petroleum hydrocarbon metabolites and increased mono-oxygenase 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 from 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 take 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 Telemeus (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.

*Wilderness  
and*  
**Archaeological/Subsistence Resources**

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

**Archaeological Resources** +

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

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

## Subsistence Resources

Surveys undertaken by state researchers before the spill and in 1990 indicated that subsistence harvesters in the area affected by the oil spill significantly reduced their use of subsistence resources after the spill. 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 <sup>designated</sup> ~~legislated~~ "wilderness areas" are designated in Kachemak Bay State Wilderness Park, in Katmai National Park, and in Becharof National Wildlife Refuge. <sup>Additional Federal "wilderness study" lands are in Kenai Fjords National Park and the Chugach National Forest.</sup> 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..." <sup>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.</sup> 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.

*Proposed*  
**CHAPTER V  
INJURY CRITERIA**

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**Settlement Guidance**

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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.

*check doc*

**Proposed Criteria**

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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**

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The following definition of injury is proposed to 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<sup>1</sup>;
  - has significantly reduced the physical or biological functions performed by ~~injured~~ natural resources, including loss of human uses;
- or

<sup>1</sup> "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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- or*
- has significantly reduced aesthetic, intrinsic or other indirect uses provided by ~~injured~~ *the* 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

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To maximize the benefits of restoration expenditures, the Trustees ~~will~~ *may* 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.

*The* 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~~ *determine* that spending restoration dollars is not justified. On the other hand, if it appears that the time to recovery is prolonged, it ~~is~~ *may be* worth considering technically feasible, cost-effective restoration options.

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# CHAPTER VI EVALUATION OF RESTORATION OPTIONS

*many*  
~~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:~~

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(no priority, intended)*

*change*

*Use  
bullets  
instead  
of letters which  
suggest priority*

**(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.

*As an example of application of the above-criteria, some options for restoration activities have been identified & are presented in Appendix B.*

## 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:~~

*It will be necessary to*

*Do you like it? would you like other*

- 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

*different class of concern*

- legal status and existing management practices and available controls

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. *Proposals:* These study plans were developed in consultation with scientists representing the Trustee agencies, outside peer reviewers and the Chief Scientist.

*1992 Work Proposal*  
*deal with in work Prop -*

## 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). *such as those* By necessity, ~~however, there are additional steps needed to properly evaluate habitat protection and acquisition options.~~ *it appears that criteria must be developed set forth* *some additional*

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:

*are developing*

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

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*Restoration* 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 *recovery* total recovery, individual elements of the restoration program developed by the Trustees may be species- or resource-specific. *overstates*

The restoration-related activities conducted by the Trustees *with assistance of* 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

<sup>alternative</sup> 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

<sup>strategic</sup> 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:

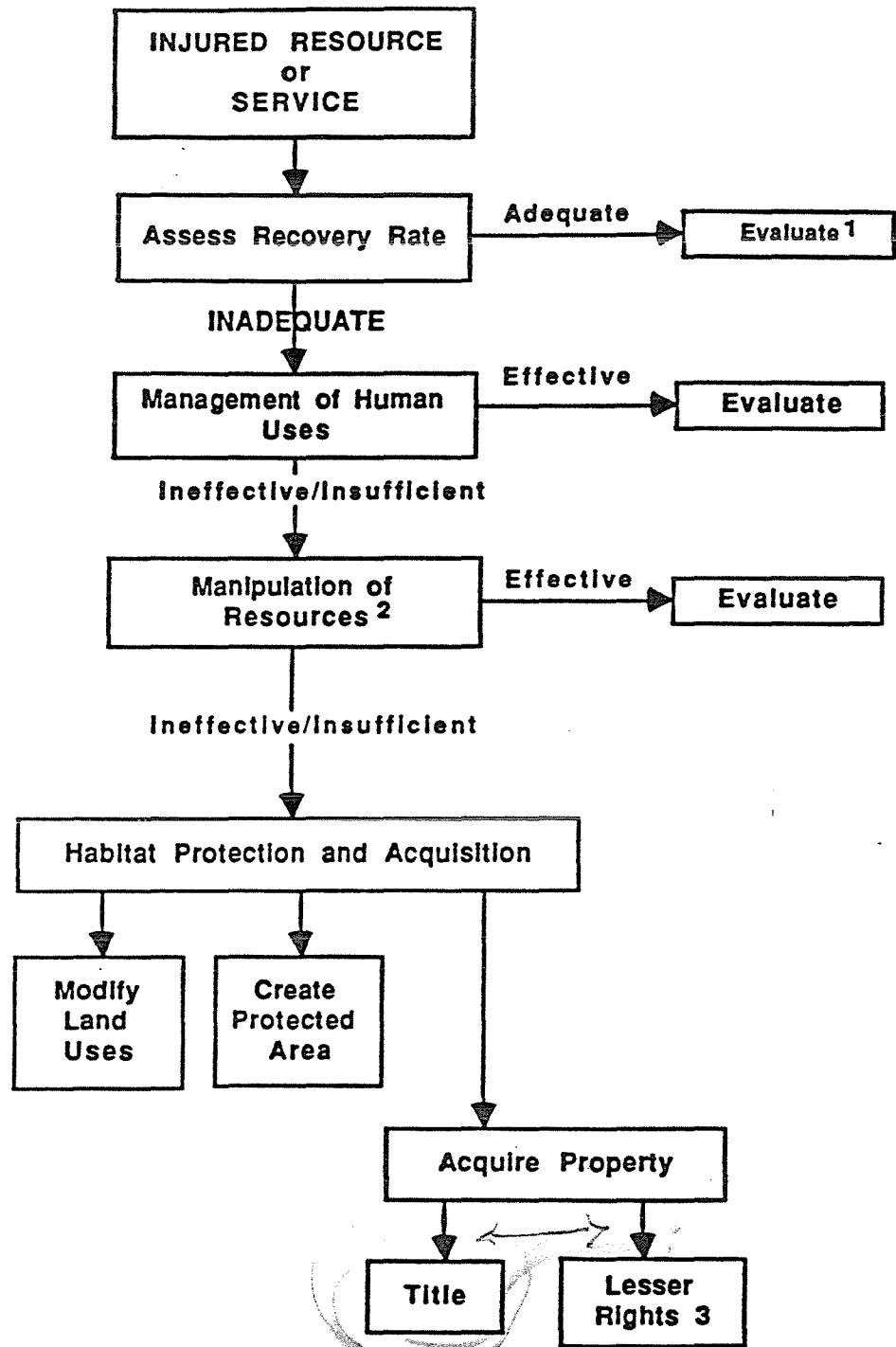
- creation of new recreation facilities; and
- acquire tidelands.

#### 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.

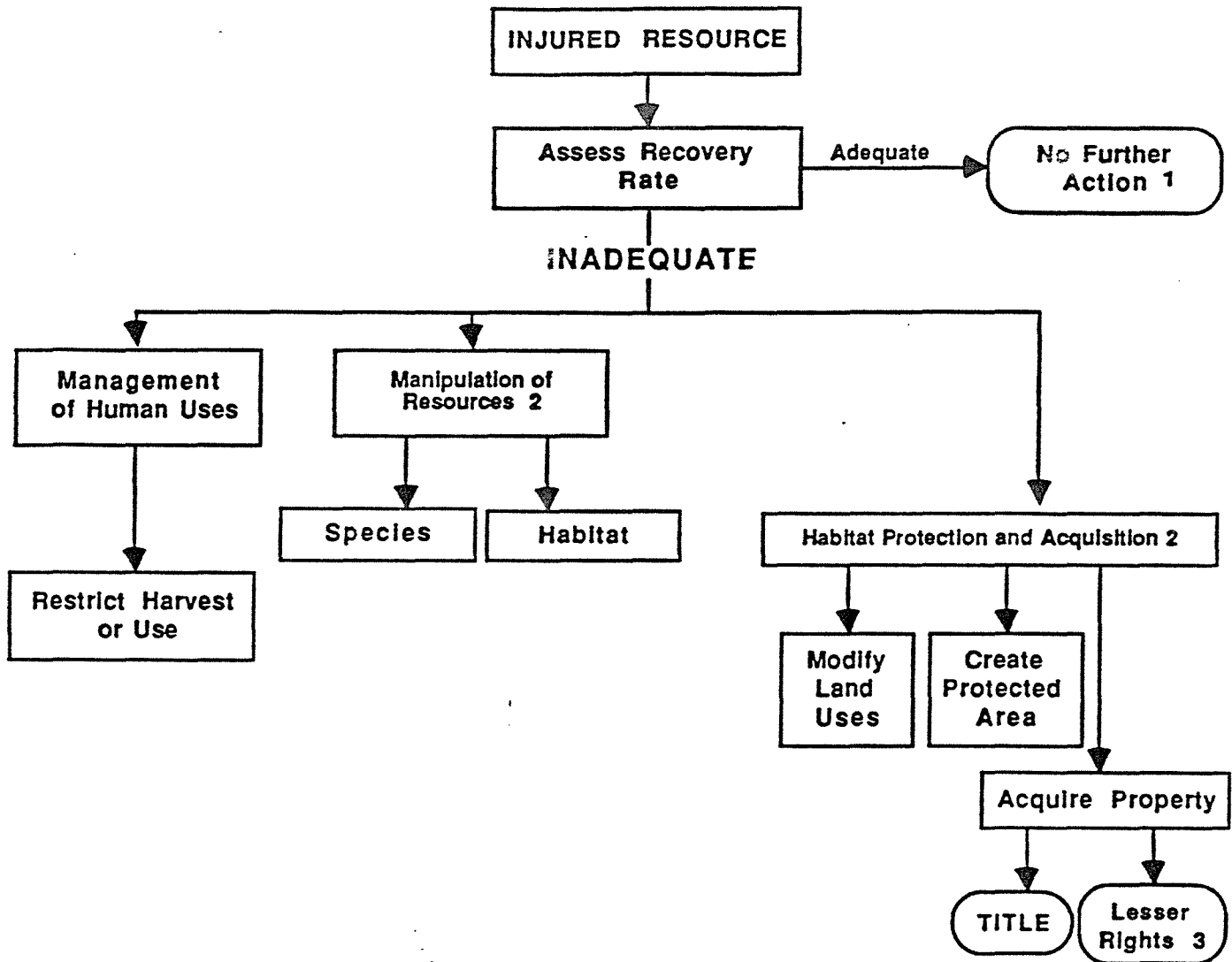
The Trustees seek comment about the likely feasibility and efficacy of these possible restoration alternatives, and any other alternatives and approaches that should be considered in a draft environmental impact statement.

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



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



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## Bird Study 11 Final Report

### Injury Assessment of Hydrocarbon Uptake by Sea Ducks in Prince William Sound and the Kodiak Archipelago, Alaska

Comments of D. Michael Fry

This report is important and provides a great deal of data to document oiled Harlequin Duck habitat, cleanup and disturbance.

This "final report" is not a summary or synthesis of data from B-11 89, B-11 90, B11 91, Patten or Crowley 91. Which of these are Patten 90a and Patten 90b is not obvious from the bibliography. This is primarily a chronicle of data on shoreline oiling, shoreline cleanup, bioremediation efforts and disturbance from cleanup and NRDA studies (principally helicopter trips). The data from other studies are presented in the introduction, some in the results, and in the conclusions, making it difficult to find the important data to assess results and conclusions.

Some data from previous reports are presented here in Tables 11-14 and page 26, with new data analysis. The "mixed effect" on adipose tissue is impossible to understand. Were there separate people doing the necropsies and scoring? Was there a sex difference in the distribution of fat? I don't know what to make of this data.

I would have liked to see the previous significant results from 1989, 1990 and 1991 all presented in this final report, so that one report would explain the injury and problems with recovery. The Harlequin Duck study makes such a good story that it is a shame to have it broken up into several different reports.

The organization of this report is confusing, with data on one subject presented in sections on another-see pages 31-32 for example where Harlequin Duck descriptions are presented under Oiling of offshore Rocks.

Much of the control information for this study is presented in Crowley 91, and no tabular comparisons of the data are presented.

In general, the data on seaducks presented are excellent and follows from the field work and from previous reports. The discussion of two separate "hypotheses" as to the causes of breeding failure seems to stretch reality, however, as it is quite clear that both oil ingestion and disturbance occurred, and either alone could have caused breeding problems. The combination almost certainly would have been injurious. No conclusions are drawn as to which "hypothesis" is responsible, I believe because Patten believes both contributed. If that is the case, it should be stated. I think a good editing of this report, and addition of data from previous reports will result in a

The five broods in the oil area or periphery in 1991- how peripheral were the 4 broods so listed? Two are listed as Montague, which is not in the oil spill zone. Three are listed as in the Bay of Isles, Whale Bay and Johnson Bay. Whale Bay is on the extreme west side- how far away from oil? Was Johnson Bay on Knight Island oiled or not?

Figures 2-5: What are the units? ng/g wet weight? Eliminate zeros and adjust units please. Figures 3 and 4 are not appropriate. A pie chart is supposed to show fractions of a whole. These are 3 independent samples.