Kure/Humboldt Bay Oil Spill

Final Damage Assessment and Restoration Plan/
Environmental Assessment



JULY 2008

Prepared by:
California Department of Fish and Game
United States Fish and Wildlife Service

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Executive Summary

In the early hours of 5 November 1997, the *M/V Kure* punctured a fuel tank and spilled approximately 4,500 gallons of Intermediate Fuel Oil 180 (IFO-180) while docked in Humboldt Bay, California. The federal Oil Pollution Act of 1990 (OPA) (33 U.S.C. §§ 2701, et seq.) and California's Lempert-Keene-Seastrand Oil Spill Prevention and Response Act (the "California Act") (Gov. Code §§ 8670.1, et seq.) establish liability for natural resource damages, requiring responsible parties to make the environment and the public whole for the injury, destruction and loss of natural resources and services resulting from oil spills into navigable and/or marine waters. The following agencies are designated natural resource trustees (the "Trustees") under OPA and/or State law, for natural resources injured by the Kure oil spill: the California Department of Fish and Game (CDFG); the California State Lands Commission (CSLC); and the United States Fish and Wildlife Service (USFWS). As a designated Trustee, each agency is authorized to: (1) act on behalf of the public under State and/or federal law to assess and recover natural resource damages; and (2) plan and implement actions to restore, rehabilitate, replace, or acquire the equivalent of the affected natural resources injured as a result of a discharge of oil.

Damage Assessment and Restoration Plan (DARP)/Environmental Assessment (EA)

The Trustees[1] have prepared this final DARP/EA, describing the injuries resulting from the Spill and the selected restoration projects. Prior to releasing this final DARP/EA, the Trustees released a draft DARP/EA for public review and comment. This final DARP/EA is an amended version of the draft DARP/EA after consideration of public comments. This plan reflects consideration of input from representatives of Kure Shipping S.A. and Patt Manfield & Co. (collectively "Kure" or the "Responsible Party"), work conducted in cooperation with the Responsible Party, technical experts hired by the Trustees, and comments provided by the public.

This document serves, in part, as the Trustee agencies' compliance with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). It describes potential adverse environmental impacts as well as cumulative impacts that may result from the restoration alternatives. Additional environmental compliance may be required prior to actual implementation of some of the restoration projects.

What was injured?

Studies conducted by the Trustees and other experts identified the following injuries to natural resources and lost or diminished recreational services from the spill:

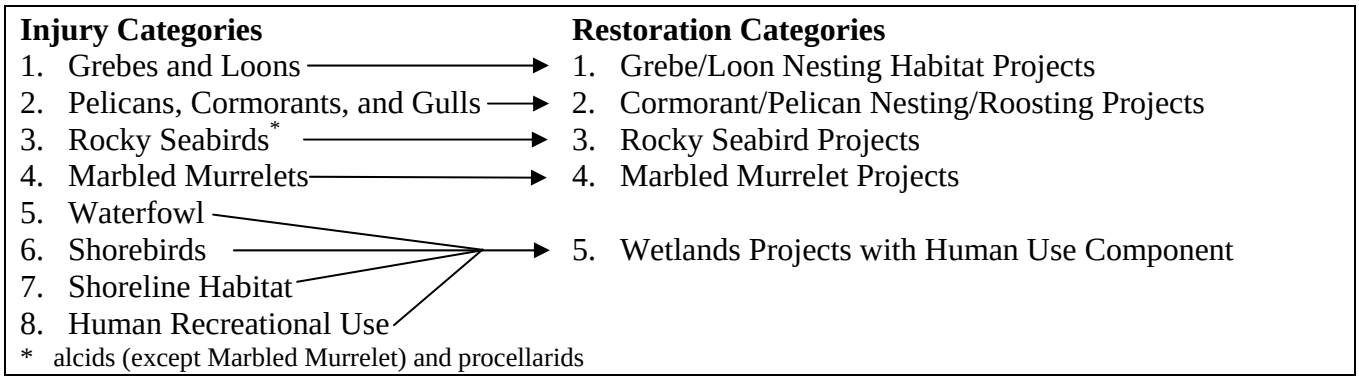
- Marbled Murrelets— 130 estimated dead
- Common Murres, Other Alcids, and Procellarids—910 estimated dead
- Pelicans, Cormorants, and Gulls — 220 estimated dead (31 Brown Pelicans)

[1] The CSLC has deferred restoration planning (i.e., preparation of the DARP/EA) and implementation activities associated with the Kure oil spill to the CDFG on behalf of the State of California. Accordingly, this final DARP/EA was prepared by the USFWS and the CDFG on behalf of the Trustees.

- Loons and Grebes – 243 estimated dead
- Waterfowl—414 estimated dead
- Shorebirds—2,033 estimated dead
- Shoreline habitat—6,200 acres of mudflat, wetland, beach, and riprap habitat exposed to oil
- Recreational services—estimated 767 lost user days of surfing, camping, and sea kayaking activity

What restoration projects will compensate for these injuries?

The Trustees grouped the injuries into categories and identified restoration projects that would address each injury category. The figure below provides a conceptual guide to the injury categories and the restoration categories that would address each injury.



After evaluating a number of restoration project proposals and considering public comments on the preferred restoration projects presented in the draft DARP/EA, the Trustees have selected the following six restoration projects.

Protection of Western/Clark's Grebe Nesting Colonies at Northern California Lakes
This project will fund some of the recommendations from a recent study of the status and management needs of Western and Clark's Grebes at their breeding grounds in California (Ivey 2004). These recommendations are designed to protect Western and Clark's Grebe nesting colonies from human disturbance. These recommendations include public education and outreach, as well as the establishment of small seasonal buffers around grebe nesting colonies.

Brown Pelican Roost Site Protection
This project will provide protection to Brown Pelican roost sites from human disturbance. In the Humboldt area, pelicans are most common in the fall and have limited roosting sites available at high tide. This project will be flexible and respond to disturbance issues as they arise or are anticipated. Potential project elements include public outreach and education; protective fencing, signs and/or buoys; and monitoring and adaptive management.

Restoration of Common Murre Nesting Colony
This project will restore a murre colony on Redding Rock, off Humboldt County. This colony once contained over 1,000 Common Murre pairs, but has greatly declined as a result of human disturbance and possibly oil spills, including the *Kure* spill. This project would combine public education to reduce disturbance with social attraction techniques that have proven successful in attracting murres to former nesting sites.

Protection of Marbled Murrelet Nesting Habitat
This project will protect good occupied nesting habitat from logging and other development pressures and manage it for Marbled Murrelets. Good nesting habitat is defined as residual or old growth redwood forest with characteristics conducive to murrelet nesting. "Occupied" implies that murrelets currently nest there. This project will seek to protect such stands that are currently at risk of logging and/or other human disturbance and manage them for Marbled Murrelets. The Trustees' selected restoration project is the protection and management of old growth redwood parcels located in Del Norte County through purchase of a conservation easement from a willing seller, in this case, Green Diamond Resource Company. Under this proposal, the easement would be held in perpetuity by a non-profit entity and managed on behalf of the Trustees for the protection and enhancement of Marbled Murrelet habitat. The Trustees will have a right to enforce the terms of the conservation easement.

Protection of Marbled Murrelet Nesting Success through Corvid Management
This project will improve Murrelet nest success by contributing to on-going corvid (i.e., ravens, jays, crows) management projects in Redwood National Park and vicinity. Corvid populations are artificially high in areas where human food waste is readily accessible. This, in turn, leads to increased predation of Murrelet nests by corvids. Management efforts may include, among other actions, education of park campers and visitors regarding control of food waste, improved garbage facilities, and outreach to nearby communities where food waste may support artificially high corvid numbers.

Restoration of Salt Marsh Wetlands
This project will contribute funds toward the McDaniel Slough Wetland Enhancement Project. This project primarily consists of removing the tide gates at McDaniel Slough, constructing new levees around the project perimeter, and breaching the bay-front levee. The project is anticipated to restore approximately 200 acres of tidal wetlands and 20–27 acres of marsh plain, and also will include new hiking trails and educational opportunities for the public.

ACRONYMNS

BLM	Bureau of Land Management
CCC	California Coastal Commission
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CSLC	California State Lands Commission
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DARP	Damage Assessment and Restoration Plan
EA	Environmental Assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESH	Essential Fish Habitat
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
FWCA	Fish and Wildlife Coordination Act
HEA	Habitat Equivalency Analysis
IFO	Intermediate Fuel Oil
LP	Louisiana Pacific
MBTA	Migratory Bird Treaty Act
MMCA	Marbled Murrelet Conservation Area
MMPA	Marine Mammal Protection Act
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NMFA	National Marine Fisheries Service
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NPS	National Park Service
NRDA	Natural Resource Damage Assessment
OPA	Oil Pollution Act of 1990
PSRPA	Park System Resource Protections Act
REA	Resource Equivalency Analysis
RP	Responsible Party
SCAT	Shoreline Cleanup and Assessment Team
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service

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1.0 Introduction and Purpose

This final Damage Assessment and Restoration Plan (DARP)/Environmental Assessment (EA) was prepared by State and federal natural resource trustees (the "Trustees") responsible for restoring natural resources[2] and resource services[3] injured by the November 5, 1997 oil spill from the *Kure* at the Samoa dock in Humboldt Bay, California (the "Spill"). Consistent with the Oil Pollution Act (OPA) and the National Environmental Policy Act (NEPA), the purpose of restoration planning is to identify and evaluate restoration alternatives and to provide the public with an opportunity for review and comment on the proposed restoration alternatives. Restoration planning provides the link between injury and restoration. The purpose of restoration, as outlined in this final DARP/EA, is to make the environment and the public whole for injuries resulting from the Spill by implementing restoration actions that return injured natural resources and services to baseline conditions and compensate for interim losses. Baseline conditions are the conditions that would exist if the Spill had not occurred.

The USFWS, the CDFG, and the CSLC, are the Trustees for the natural resources injured by the Spill (Trustees). As a designated Trustee, each agency is authorized to act on behalf of the public under State and/or federal law to assess and recover natural resource damages and to plan and implement actions to restore, rehabilitate, replace, or acquire the equivalent of the affected natural resources injured as a result of a discharge of oil.

At the time of the Spill, the *Kure* was owned by Kure Shipping, S.A. and operated by Patt Manfield & Co. Both are Responsible Parties (RPs) under OPA and the California Act. Under OPA and the California Act, the RPs are liable for the costs of conducting a natural resource damage assessment, as well as the costs of implementing restoration projects to restore the injured resources.

The Trustees have prepared this final DARP/EA to inform the public about the natural resource damage assessment and restoration planning efforts that have been conducted following the Spill. The Trustees received and considered public comments on the restoration alternatives presented in the draft DARP/EA (see Appendices M and N). The Trustees have settled with the RPs and anticipate that funds from the settlement will be sufficient to implement the selected projects in the final DARP/EA.

[2] Natural resources are defined under the Oil Pollution Act (OPA) as "land, fish, wildlife, biota, air, water, groundwater, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States, any State or local government or Indian tribe, or any foreign government.

[3] Services (or natural resources services) means the functions performed by a natural resource for the benefit of another natural resource and/or the public.

1.1 Overview of the Incident

On November 5, 1997, the *Kure* spilled approximately 4500 gallons of Intermediate Fuel Oil 180 (IFO-180) inside Humboldt Bay. The incident began at approximately 5:00 am at the Louisiana Pacific (LP) Export Dock in Samoa, California. The *Kure* was tied to the dock and in the process of being repositioned for loading when its starboard hull struck a mooring "dolphin" that punctured the #3 fuel tank. Approximately 150 feet of sorbent boom was deployed on site to contain the spill, but oil escaped the boom and spread with the tide.

The LP Export Dock is located 4.5 miles north of the mouth of Humboldt Bay on the interior side of the North Spit. It is across the Bay from the City of Eureka. Oil was carried into the northern finger of the Humboldt Bay complex with the flooding tide and out towards the Pacific Ocean with the ebbing tide. Trajectory analysis shows that the oil went to the ocean on the first day of the Spill (French *et al.* 2000). Personnel on the first overflights on November 6 identified black oil product as far as 17.5 miles north of the bay mouth (Figure 1-1). On subsequent overflights on November 7 and 8, observers detected black oil product offshore and oil sheen at the mouth of the Bay. Wildlife overflights documented oily "mousse" just outside the surf zone as far north as Trinidad Head.

The United States Coast Guard (USCG), the CDFG Office of Spill Prevention and Response, and representatives of the responsible party established a unified command within four hours of the initial release. Multiple federal, State, and local agencies joined the incident command and participated in the response efforts. As part of these activities, response teams (and members of the public) collected 961 dead or injured birds, of which 928 were determined to be spill-related. Most of these birds were visibly oiled. Shoreline Cleanup and Assessment Teams (SCAT) conducted surveys through November 12, wildlife observers searched the shoreline through November 17, and on-water surveys were conducted through December 5.

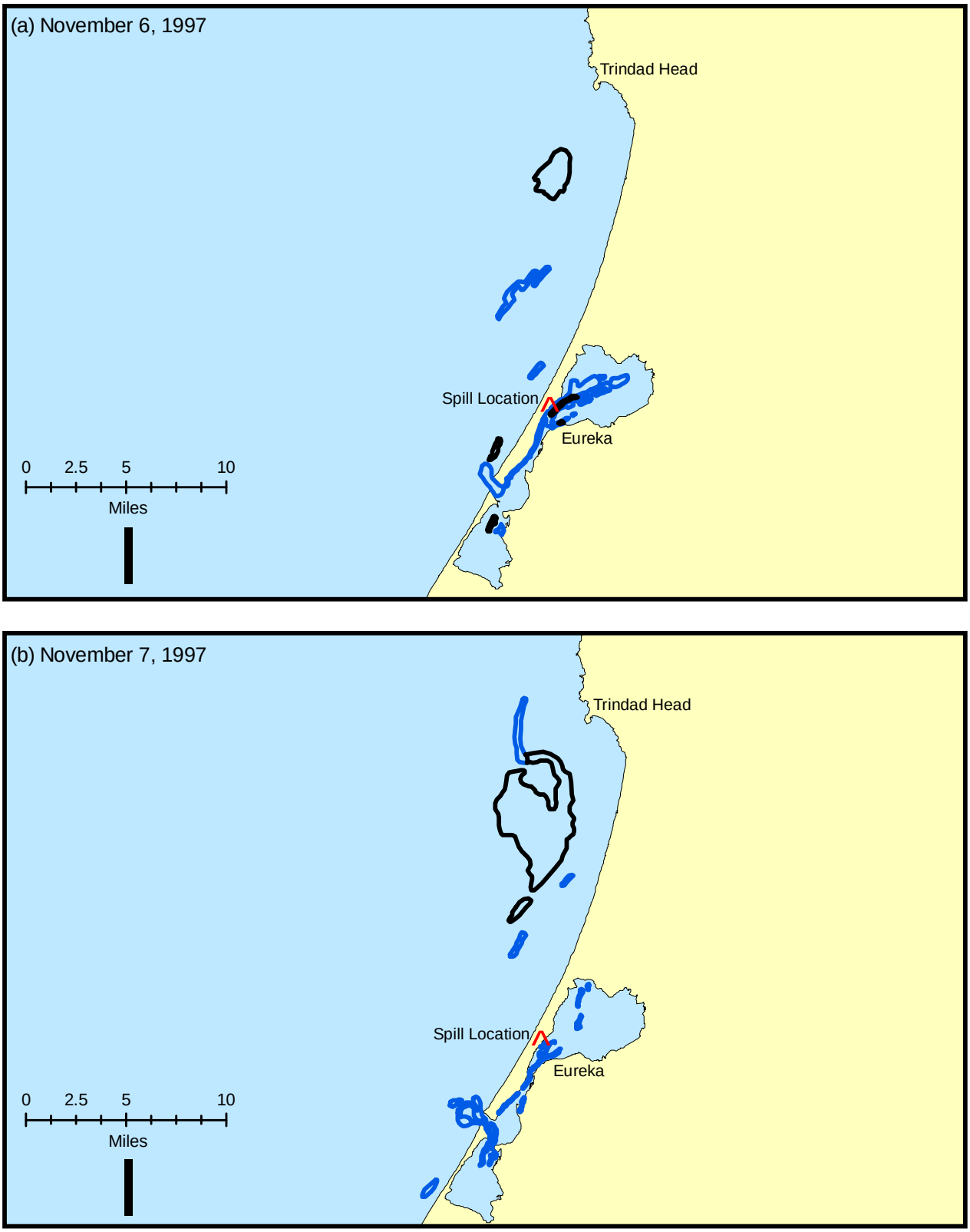
1.2 Natural Resource Damage Assessment

The Trustees commenced the Pre-assessment Phase of the natural resource damage assessment (NRDA) in accordance with the OPA NRDA regulations (the "OPA regulations") (15 C.F.R. § 990.40), to determine if they had jurisdiction to pursue restoration under OPA and, if so, whether it was appropriate to do so.

Based on their analyses of initial data collected during the response and the Pre-assessment Phase, the Trustees found that they had jurisdiction to pursue restoration under the Oil Pollution Act. The Trustees further determined that response actions had not adequately addressed the injuries resulting from the incident, and that feasible primary and/or compensatory restoration actions existed to address the potential injuries. These determinations were memorialized in a Notice of Intent to Conduct Restoration Planning (Federal Register Vol. 70, No. 51, pages 13043-13045, March 17, 2005).

Figure 1-1: MV Kure Oil Spill Incident

A Composite From Selected NOAA Overflight & Ground Observations Maps



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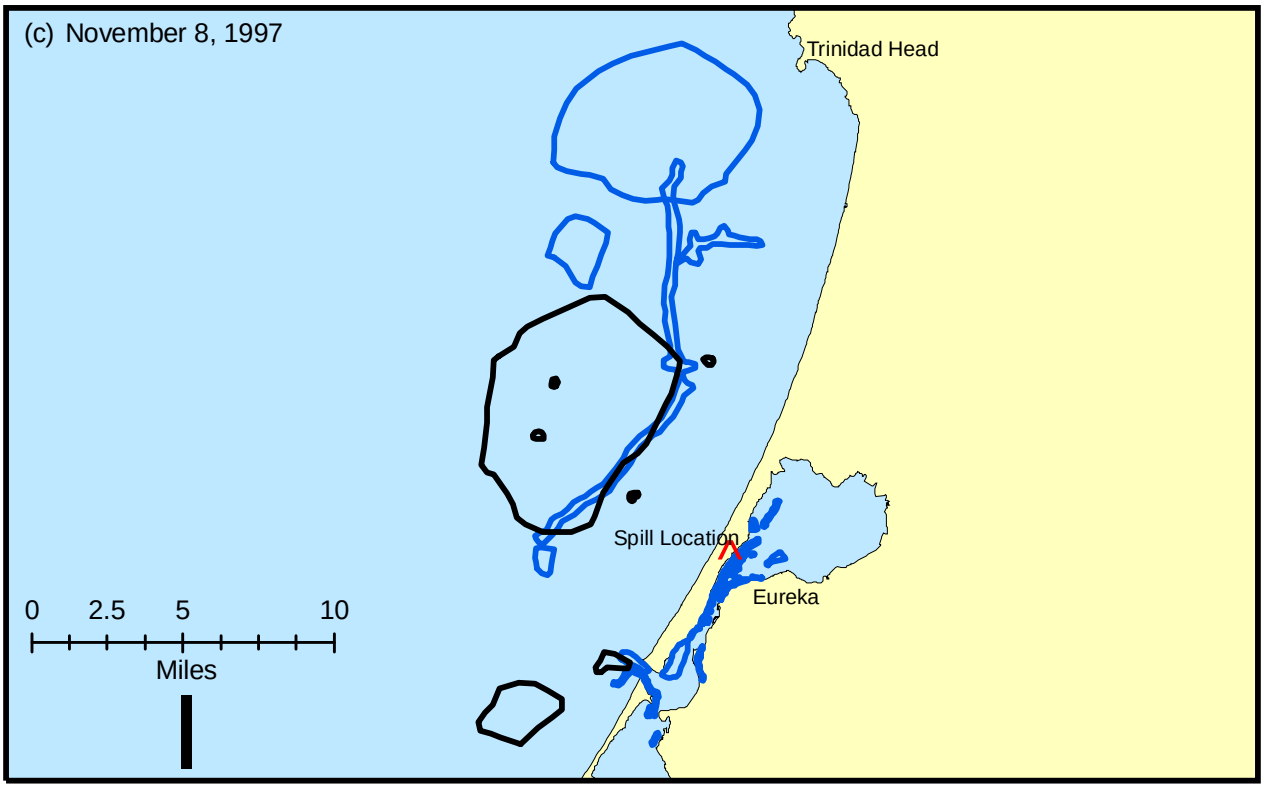
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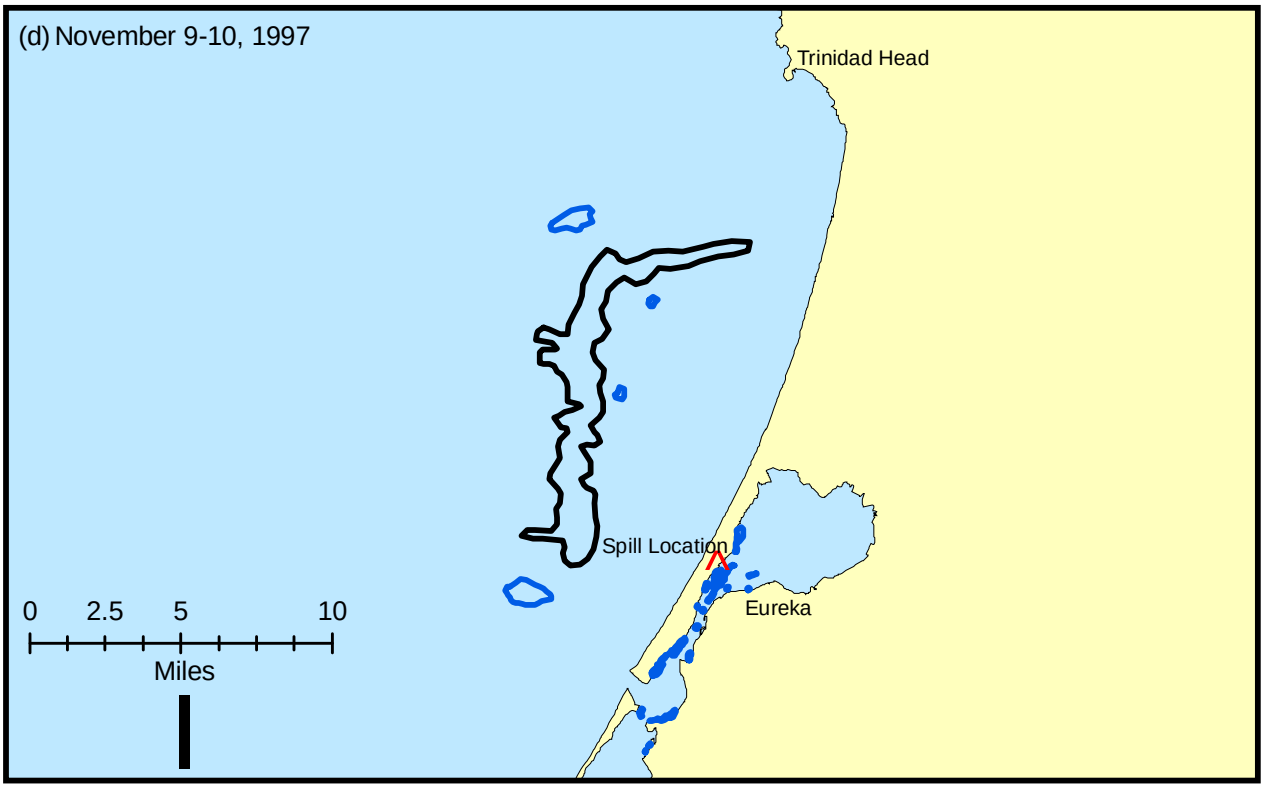
Observations with Tarballs/Tar patties/Black streamers

Other Oil Observations

Figure 1-1 (cont): MV Kure Oil Spill Incident

A Composite From Selected NOAA Overflight & Ground Observations Maps





Legend

Department of Fish and Game - OSPR

Observations with Tarballs/Tar patties/Black streamers

Other Oil Observations

Consequently, the Trustees initiated the Restoration Planning Phase of the NRDA, in accordance with 15 C.F.R. Section 990.50, which includes evaluating and quantifying potential injuries (injury assessment) and using that information to determine the need for and scale (or size) of restoration actions (restoration selection). The RPs entered into a cooperative NRDA agreement with the Trustees and were participants in these efforts.

1.3 Summary of Natural Resource Injuries

The Trustees have dedicated considerable time and effort to assessing the nature and extent of natural resource injuries and lost services resulting from this Spill. The Trustees have used available information, focused studies, and expert scientific judgments to arrive at the best estimate of the injuries caused by the Spill. Principal investigators included State and federal scientists, consultants with damage assessment experience, and local experts. There is, however, some uncertainty inherent in the assessment of oil spill impacts. The Trustees have sought to balance the desire for more information with the reality that further research would delay the implementation of the restoration projects, at the expense of the local environment, the citizens of California, and others who use and enjoy the area's natural resources. While collecting more data may increase the precision of the estimate of the impacts, the Trustees believe that the type and scale of restoration actions would not substantially change as a result of more research.

Based on the assessment activities, the Trustees believe that the Spill caused injuries to natural resources at sea and along the Humboldt County coast, including birds and habitat. The Spill also impacted recreational use.

It is the intent of the Trustees to address all injuries. However, rather than develop separate restoration projects for each species and habitat type impacted, the Trustees have grouped the injuries into categories, sometimes combining impacts to similar species or habitats. In this way, one larger restoration project, benefiting a suite of species or one primary species or habitat type, serves as the compensation for all injuries within that category. Table 1.1 summarizes the Trustees' injury quantification results.

Table 1-1: Summary of Injuries and Selected Restoration Projects

Injury Category	Injury Estimate	Restoration Project
Loons and Grebes	243 estimated dead	Protection of grebe nesting colonies on northern California lakes
Pelicans, Cormorants, and Large Gulls	220 estimated dead	Protection of Brown Pelican roost sites through education, potential access restrictions, and potential roost site creation.
Alcids (except Marbled Murrelet) and Procellarids	910 estimated dead (over 77% Common Murres)	Contribution to Redding Rock project to benefit Common Murre nesting colony
Marbled Murrelets	130 estimated dead	Protection and enhancement of occupied habitat. Corvid management program

Table 1-1: Continued

Injury Category	Injury Estimate	Restoration Project
Waterfowl	414 estimated dead	Restoration of 11.6 acres of wetland habitat (McDaniel Slough)
Shorebirds	2,033 estimated dead	Restoration of 3.8 acres of wetland habitat (McDaniel Slough)
Shoreline Habitat Injury	6,200 acres of mudflat, riprap, beach, and wetland habitats exposed to oil	Restoration of 7.5 acres of wetland habitat (McDaniel Slough)
Human Recreational Use Losses	767 lost user-days	Contribution towards projects that benefit recreational use (McDaniel Slough).

1.4 Summary of Selected Restoration Projects

The Trustees' responsibility under the OPA (see, 33 U.S.C. 2706(b)) is to attempt to make the environment and the public whole for injuries to natural resources and natural resource services resulting from the discharge of oil. This purpose must be achieved through the restoration, rehabilitation, replacement or acquisition of equivalent natural resources and/or services. Thus, for a project to be considered there must be a connection between natural resource injuries and proposed restoration actions.

Restoration actions under OPA are termed primary or compensatory. Primary restoration is any action taken to accelerate the return of injured natural resources and services to their baseline condition. Trustees may elect to rely on natural recovery rather than primary restoration actions where feasible or cost-effective primary restoration actions are not available, or where the injured resources will recover relatively quickly without human intervention.

Compensatory restoration is any action taken to compensate for interim losses of natural resources and services pending recovery. The scale of the required compensatory restoration will depend on the extent and severity of the initial resource injury and how quickly each resource and associated service returns to baseline. Primary restoration actions that speed resource recovery will reduce the amount of compensatory restoration.

For all of the biological injury categories, the Trustees assumed that natural processes would eventually lead to full recovery of the injured resources (i.e., return to projected baseline condition). Thus, the Trustees focused on restoration projects that would provide compensatory restoration for interim losses. To the extent that restoration projects are implemented prior to the completion of natural recovery, there is an element of primary restoration. This factor is taken into account in the scaling of the restoration project sizes.

The Trustees considered approximately 50 restoration concepts and alternatives with the potential to provide compensatory restoration. These were evaluated based on selection criteria developed by the Trustees consistent with the guidelines provided in the OPA regulations (15

C.F.R. § 990.54(a)). Section 4.2.4 of this final Plan presents OPA-based selection criteria developed by the Trustees for this Spill. Based on the Trustees' evaluation, a total of six restoration projects have been selected. These are included in Table 1-1. Note that some of these selected restoration projects were identified in part because they were amenable to the scaling process (i.e., the projects were relatively easy to compare regarding the benefits of restoration and the losses from the *Kure* Spill).

Note that there are two projects to address the Marbled Murrelet (*Brachyramphus marmoratus*) injury and one combined wetland project to address injuries to waterfowl, shorebirds, and shoreline habitat.

2.0 Affected Environment

This chapter presents a brief description of the physical and biological environment affected by the *Kure* oil spill, and potentially affected by the preferred projects, as required by NEPA (40 U.S.C. Section 4321, et. seq.). The affected environment includes various habitats occurring in Humboldt Bay and along over 28 miles of shoreline from the outer coast of southern Humboldt Bay to Trinidad Head. The biological environment includes a wide variety of birds, fish, mammals, shellfish, and other organisms. Several State and federally-recognized threatened or endangered species are also found within the spill zone. One species, the Marbled Murrelet, occurs primarily within the oiled area at sea. To the extent that selected projects are located within this area, this chapter provides information on the affected environment as required by NEPA (42 U.S.C. Section 4321, et. seq.). For selected projects located outside this area, additional information on the affected environment is provided along with the project descriptions in Section 4.3.

2.1 Physical Environment

Humboldt Bay is centered geographically on the west coast of Humboldt County. The coast in the vicinity of the bay consists of low-lying river deltas that end in wide sandy beaches, while farther to the north and south are steep cliffs, ridges, and bluffs.

The outer coast of Humboldt Bay contains approximately 1,600 acres of dune forest, vegetated dunes, and open sand. It is home to the Western Snowy Plover (*Charadrius alexandrinus nivosus*). The North and South Spit areas are recognized as the most complete and least disturbed dune ecosystem on the west coast of the United States. The Humboldt Bay complex includes the northern Arcata Bay and the southern Humboldt Bay. It is the fifth largest estuary on the west coast and second largest in California. Because of the relatively limited amount of freshwater input to the bay, it has been described as a large, tidally-driven, coastal lagoon (Lesh 1998).

2.2 Biological Environment

Humboldt Bay includes an extensive system of tidal mudflats and eelgrass beds that provide diverse fish and macroinvertebrate communities, as well as highly productive year-round foraging habitats for wading birds and shorebirds. Intertidal wetlands are a critical part of the Humboldt Bay ecosystem, providing much of the primary productivity, nutrients, and invertebrate biomass that support the large numbers of birds that use the bay as a wintering area and migratory staging area. Humboldt Bay is very important as a link in the coastal flyway for waterfowl, shorebirds, and other birds, supporting a total of 250 different species (Monroe 1973). It has recently been declared a Western Hemisphere Shorebird Reserve Network site. Eelgrass *(Zostera marina)* thrives in the bay, due to the brackish to saline conditions that occur. Eelgrass meadows provide food, cover, spawning areas, or attachment surfaces for a variety of marine invertebrates, fish, shorebirds, waterfowl, and marine mammals. Eelgrass also stabilizes substrate, controls turbidity, and, to a lesser degree, controls shoreline erosion (Helvie and Lowe 1985).

Rocky shores mark the coastline as one moves further to the north and the south of the Bay. These areas support intertidal communities (including crabs, mussels, and other macro-invertebrates), as well as marine mammals. Offshore rocks provide habitat for large colonies of Common Murres (*Uria aalge californica*) and other seabirds**.**

Inland from the Bay are ancient redwood (*Sequoia sempervirens*) forests that include some of the largest trees in the world and oldest trees in the Pacific Northwest. Large old growth trees provide critical nesting habitat for the Marbled Murrelet, a pelagic seabird that nests inland only in old growth forest stands.

2.2.1 Species of Concern

There are several species in the Spill area that are of special concern due to their population status. These include the California Brown Pelican (*Pelecanus occidentalis californicus*), Western Snowy Plover (*Charadrius alexandrinus nivosus*), Marbled Murrelet (*Brachyramphus marmoratus*), and Coho Salmon (*Oncorhynchus kisutch*). Brown Pelicans and Marbled Murrelets suffered direct impacts from the Spill and are discussed in Chapter 4. Coho Salmon, which would have been at sea at the time of the Spill, are not suspected of suffering any direct impacts from the Spill. Likewise, Snowy Plovers occupy areas which were not suspected to be affected by the spill (LeValley *et al.* 2001).

3.0 Coordination and Compliance

3.1 Authorities and Legal Requirements

The USFWS, the CDFG, and the CSLC, collectively, are the Trustees for the natural resources injured by the Spill (Trustees). The USFWS is a designated Trustee for natural resources pursuant to subpart G of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 C.F.R. § 300.600 et seq.) and Executive Order 12580 (3 C.F.R., 1987 Comp. p. 193, 52 Fed. Reg. 2923 (January 23, 1987) as amended by Executive Order

12777 (56 Fed. Reg. 54757 (October 19, 1991)). The CDFG is a designated Trustee pursuant to OPA for resources within its purview and has State natural resource trustee authority pursuant to Fish and Game Code Sections 711.7 and 1802 and the Lempert-Keene-Seastrand Oil Spill Prevention and Response Act (Gov. Code §§ 8670.1, et seq.). The CSLC has State natural resource trustee authority pursuant to Public Resources Code Sections 6201, et seq. The CSLC has deferred restoration planning (i.e., preparation of the DARP/EA) and implementation activities associated with the Kure oil spill to the CDFG on behalf of the State of California. As a designated Trustee, each agency is authorized to act on behalf of the public under State and/or federal law to assess and recover damages for those natural resources under its authority and to plan and implement actions to restore, rehabilitate, replace, or acquire the equivalent of the natural resources injured as a result of a discharge of oil. The USFWS is serving as the lead federal Trustee for the Kure spill for purposes of coordination and compliance with OPA and NEPA.

3.1.1 Overview of the Oil Pollution Act

The OPA (33 U.S.C. § 2706(b)) establishes a liability regime for oil spills which injure natural resources and/or the services that those resources provide to the ecosystem or humans. Federal and State agencies and Indian tribes act as trustees on behalf of the public to assess the injuries, plan restoration to compensate for those injuries, and implement restoration. This final DARP/EA has been prepared jointly by CDFG and USFWS. OPA defines "natural resources" to include land, fish, wildlife, water sources, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States, any State or local government or Indian tribe, or any foreign government. Assessments are intended to provide the basis for restoring, replacing, rehabilitating, and acquiring the equivalent of injured natural resources and services. OPA provides that the Trustees may assess damages for natural resources injured under their trusteeship. OPA further authorizes the Trustees to develop and implement a plan for the restoration, rehabilitation, replacement, or acquisition of the equivalent of the natural resources under their trusteeship. The process emphasizes both public involvement and participation by the RPs.

3.1.1.1 Coordination among the Trustees

The OPA NRDA regulations provide that where an oil spill affects the interests of multiple trustees, they should act jointly to ensure that full restoration is achieved without double recovery (15 C.F.R. § 990.14(a)). The Trustees in this matter have worked together from the day of the Spill in a shared effort to fully restore the resources that were injured. The National Oceanic and Atmospheric Administration (NOAA) initially participated in the NRDA process. Thereafter, NOAA decided to withdraw from the process and defer to the remaining Trustees' determinations regarding natural resource injuries and restoration.

3.1.1.2 Coordination with the Responsible Parties

The OPA NRDA regulations encourage the Trustees to invite RPs to participate in the NRDA and enter into agreements with them to promote cost-effectiveness and cooperation (15 C.F.R, § 990.14(c)). The Trustees extended such an invitation and entered into a Cooperative Natural

Resource Damage Assessment Agreement (the "Agreement") with Kure for this Oil Spill. The Agreement established a process by which representatives of Kure and the Trustees would coordinate their studies and other technical activities in the injury determination and quantification stages of the assessment.

Under the Agreement, biologists, toxicologists, and other specialists representing Kure and the Trustees formed a technical working group that cooperated in developing scopes of work for the various injury studies, and in gathering and analyzing data and other information regarding injuries to various species and habitats. These technical specialists also discussed and gathered information regarding potential actions that would restore, or compensate for, injured species and habitats. Consultants were employed to assist with certain issues requiring specialized expertise not possessed by representatives of Kure or the Trustees.

The Administrative Record contains information and reports prepared by both Kure and the Trustees. This final DARP/EA, prepared solely by the Trustees, reflects consideration of the input provided by technical representatives of all parties.

3.1.1.3 Coordination with the Public

Public review of the draft DARP/EA was an integral component of the restoration planning process. The Trustees held a 45-day public review and comment period, from September 14 until October 29, 2007 for the draft DARP/EA. The Trustees also presented a brief overview of the draft DARP/EA and accepted public comments at a public meeting in Arcata, California on September 19, 2007. Comments received are summarized, along with Trustee responses, in Appendix M; written comments are presented in Appendix N.

The Trustees continue to maintain a website that provides information on the Kure case and on-going restoration at http://www.dfg.ca.gov/ospr/spill/nrda/nrda_kure.html.

3.1.1.4 Administrative Record

The Trustees have opened an Administrative Record (Record) in compliance with 15 C.F.R. § 990.45. The Record includes documents relied upon or considered thus far by the Trustees during the assessment and restoration planning performed in connection with the Spill. The Record is on file at the U.S. Fish and Wildlife Service, 2800 Cottage Way, Rm W-2605, Sacramento, CA 95825, and the California Department of Fish and Game, 619 Second Street, Eureka, CA 95501. Arrangements may be made to review the Record by contacting Carolyn Marn via email at Carolyn_Marn@fws.gov or 916-414-6602, or Kris Wiese (for Eureka) at Kwiese@ospr.dfg.ca.gov or 707-441-5762. The Record Index may be viewed at http://www.dfg.ca.gov/ospr/spill/nrda/nrda_kure.html.

3.1.2 Compliance with Potentially Applicable Laws and Regulations

3.1.2.1 Federal Statutes

Oil Pollution Act of 1990 (33 U.S.C. §§ 2701, et seq.; 15 C.F.R. Part 990)

The Oil Pollution Act, 33 U.S.C. 2706(b), establishes a liability regime for oil spills which injure or are likely to injure natural resources and/or the services that those resources provide to the ecosystem or humans. Federal and State agencies and Indian tribes act as Trustees on behalf of the public to assess the injuries, scale restoration to compensate for those injuries and implement restoration. This final DARP/EA has been prepared jointly by CDFG and USFWS. Each agency is a designated natural resource Trustee under OPA and/or State law, for natural resources injured by the Kure Spill. OPA defines "natural resources" to include land, fish, wildlife, water sources and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States, any State or local government or Indian tribe, or any foreign government. Assessments are intended to provide the basis for restoring, replacing, rehabilitating, and acquiring the equivalent of injured natural resources and services. OPA provides that the Trustees may assess damage for natural resources under their trusteeship. OPA further authorizes the designated Trustees to develop and implement a plan for the restoration, rehabilitation, replacement, or acquisition of the equivalent of the natural resources under their trusteeship. The process emphasizes both public involvement and participation by the Responsible Party(ies). The regulations for natural resource damage assessments under OPA are found at 15 C.F.R., Part 990.

National Environmental Policy Act (42 U.S.C. §§ 4321, et seq.; 40 C.F.R. Parts 1500-1508)

The National Environmental Policy Act sets forth a process of environmental impact analysis and public review. NEPA is the basic national charter for the protection of the environment. Its purpose is to “encourage productive and enjoyable harmony between man and the environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; and to enrich the understanding of the ecological systems and natural resources important to the Nation.” (42 U.S.C. § 4321) The law requires the government to consider the consequences of major federal actions on human and natural aspects of the environment in order to minimize, where possible, adverse impacts. Equally important, NEPA established a process of environmental review and public notification for federal planning and decision making.

Generally, when it is uncertain whether an action will have a significant effect, federal agencies will begin the NEPA planning process by preparing an environmental assessment (EA). The EA may undergo a public review and comment period. Federal agencies may then review the comments and make a determination as to the significance of the impacts. If the impacts are considered significant, an environmental impact statement (EIS) will be prepared. If the Federal Agencies determine the action will not result in significant impacts on the environment, a finding of no significant impact (FONSI) will be issued.

The Trustees have integrated the OPA restoration planning process with the NEPA process to comply, in part, with those requirements. Accordingly, this final DARP is also a NEPA EA.

This integrated process allows the Trustees to meet the public involvement steps of OPA and NEPA concurrently. The Trustees believe this process fully meets the NEPA requirements for most of the selected restoration projects described herein. However, additional NEPA analysis may be, or is being, conducted prior to implementation of some of the selected projects that are presently at the planning and/or are conceptual stage (e.g., McDaniel Slough, Pelican Roost Site Protection, and Redding Rock).

The Clean Water Act (33 U.S.C. §§ 1251, et seq.)

The Clean Water Act (CWA or the "Act") is the principle federal statute governing water quality. The Act's goal is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. The CWA regulates both the direct and indirect discharge of pollutants into the Nation's waters. Section 301 of the Act prohibits the discharge into navigable waters of any pollutant by any person from a point source unless it is in compliance with a National Pollution Discharge Elimination System (NPDES) permit.

Section 311 of the CWA regulates the discharge of oil and other hazardous substances into navigable waters and waters of the contiguous zone, as well as onto adjoining shorelines. The Act allows the federal government to remove the substance and assess the removal costs against the responsible party. The CWA defines removal costs to include costs for the restoration or replacement of natural resources damaged or destroyed as a result of a discharge of oil or a hazardous substance.

Section 404 of the Act authorizes the U.S. Army Corps of Engineers (the "Corps") to issue permits, after notice and opportunity for public hearings, for the disposal of dredged material into navigable waters. Generally, projects which move material in or out of waters or wetlands require Section 404 permits. Section 401 of the Act provides that projects that involve discharge or fill to wetlands or navigable waters must obtain certification of compliance with State water quality standards.

The McDaniel Slough restoration project is subject to CWA permitting requirements and has obtained a permit for Phase I of the project. The Trustees do not anticipate that any of the remaining selected restoration actions described herein will trigger CWA permitting requirements. However, the implementing entity for each project will be required to apply for any necessary permits prior to project implementation, including any required CWA permit.

Coastal Zone Management Act (16 U.S.C. §§ 1451, et seq.)

The goal of the Coastal Zone Management Act (CZMA) is to encourage and assist states to preserve, protect, develop and, where possible, restore and enhance valuable natural coastal resources. Participation by states is voluntary. California developed the California Coastal Management Program pursuant to the requirements of the federal CZMA. The California Coastal Act of 1976 made permanent the California Coastal Management Program. The enforceable policies of the CZMA are found in Chapter 3 of the California Coastal Act. NOAA approved the California Coastal Management Program in 1977.

Section 1456 of the CZMA requires that any federal action inside or outside of the coastal zone that affects any land or water use or natural resources of the coastal zone shall be consistent to the maximum extent practicable with the enforceable policies of approved state management programs. It states that no federal license or permit may be granted without giving the State the opportunity to concur that the project is consistent with the state's coastal policies. The regulations implementing the CZMA outline the consistency procedures. (15 C.F.R. Part 930) For the entire California coast, except San Francisco Bay, the California Coastal Commission (CCC) has federal consistency review authority under the CZMA (in the San Francisco Bay area, the San Francisco Bay Conservation and Development Commission has federal consistency review authority under the CZMA).

The Trustees believe that all of the selected restoration projects described herein can be implemented in a manner that will either have no effect on the coastal zone resources or uses or are consistent to the maximum extent practicable with the CZMA and the California Coastal Management Program. The USFWS determined that 5 of the selected projects (addressed previously in the *M/V Stuyvesant* case) will have no effect or only a positive effect, on coastal zone resources and/or uses. The CCC concurred with the USFWS's negative determination for those projects. The CCC has agreed that a separate determination and concurrence process for those same projects in this matter is not required. The remaining selected project will be evaluated under the CZMA on a project specific basis. Specifically, McDaniel Slough is being undertaken pursuant to a coastal development permit issued by the CCC to the City of Arcata.

Endangered Species Act (16 U.S.C. §§ 1531, et seq.)

The purpose of the Endangered Species Act (ESA) is to conserve endangered and threatened species and the ecosystems upon which they depend. The ESA directs all federal agencies to utilize their authorities to further these purposes. Pursuant to Section 7 of the ESA, federal agencies shall, in consultation with the Secretary of the Department of the Interior and/or Commerce, ensure that any action that they authorize, fund or carry out is not likely to jeopardize the continued existence of any endangered or threatened species, or result in the destruction or adverse modification of designated critical habitat.

Under the ESA, the NOAA Fisheries Service (formerly the National Marine Fisheries Service, or NMFS) and the USFWS publish lists of endangered and threatened species. Before initiating an action, the federal action agency, or its non-federal permit applicant, must ask the USFWS and/or NOAA Fisheries Service to provide a list of threatened, endangered, proposed and candidate species and designated critical habitat that may be present in the project area. If no species or critical habitats are known to occur in the action area[4], the federal action agency has no further ESA obligations under Section 7. If the federal action agency determines that a project may affect a listed species or designated critical habitat, consultation is required.

[4] Action Area: All areas that may be affected directly or indirectly by the proposed action and not merely the immediate area involved in the action.

If the federal action agency concludes that the project will not adversely affect listed species or designated critical habitat, the agency submits a "not likely to adversely affect" determination to the USFWS and/or NOAA Fisheries Service. If the USFWS and/or NOAA Fisheries Service concur with the federal action agency determination of not likely to adversely affect, then the consultation (informal to this point) is concluded and the decision is put in writing.

If the federal action agency determines that the project is likely to adversely affect either a listed species or its critical habitat, then more formal consultation procedures are required. A project description and assessment of impacts of the proposed project would be prepared and submitted to the appropriate agency (USFWS and/or NOAA Fisheries Service depending on what species would be impacted by the project). Upon receipt of this information USFWS and NOAA Fisheries Service have 135 days to prepare a biological opinion. The biological opinion could include mandatory measures to minimize the impacts of the project on the listed species that would be adversely affected by the project. The determination of whether or not the proposed action would be likely to jeopardize the species or adversely modify its critical habitat is contained in the biological opinion. If a jeopardy or adverse modification determination is made, the biological opinion must identify any reasonable and prudent alternatives that could allow the project to move forward.

The Trustees have evaluated the potential effects of the selected restoration projects on listed species or designated critical habitat and have performed the appropriate level of consultation with the USFWS and/or NOAA Fisheries Service pursuant to the requirements of the ESA. Also, as a Trustee, the USFWS has conducted and completed an internal Section 7 consultation on the selected Restoration Projects. The consultation was conducted for these projects under a separate DARP/EA (Stuyvesant/Humboldt Coast Oil Spill). Further consultation with USFWS and NOAA Fisheries Service is required for the McDaniel Slough project and information on the potential project impacts is currently being collected. This consultation will be completed prior to implementation of this project. The Trustees do not believe any of the selected restoration projects described herein will adversely affect a listed species or critical habitat as the projects are designed to restore and benefit injured resources including the federally-listed species referred to above. If any selected projects in this final DARP/EA are changed, the Trustees will conduct a consultation pursuant to Section 7 of the ESA as necessary.

Appendix A contains the list of federally listed/proposed threatened and endangered species in Del Norte and Humboldt Counties, CA. Several federally-listed species occur in the affected area for this Restoration Plan. The federally endangered California Brown Pelican and Tidewater goby, and the federally threatened Marbled Murrelet and Western Snowy Plover may utilize habitats included in areas selected for implementing restoration projects. The California Brown Pelican and Marbled Murrelet are target beneficiaries of certain of the selected projects described herein. Marbled Murrelets nest near and around the proposed corvid control projects sites and nest within the conservation easement parcels. Field personnel will conduct corvid and murrelet surveys in a manner that will not disturb murrelets. The surveys are intended to be used to help increase nest success of murrelets. Several species of birds, including the California Brown Pelican and the Western Snowy Plover may utilize beaches near the selected recreational use projects, habitat restoration projects, and seabird restoration projects. These projects will be implemented in a manor that will avoid or minimize potential impacts to these species.

Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§ 1801, et seq.)

The federal Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) as amended and reauthorized by the Sustainable Fisheries Act (Public Law 104-297) establishes a program to promote the protection of essential fish habitat (EFH) in the review of projects conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. After EFH has been described and identified in fishery management plans by the regional fishery management councils, federal agencies are obligated to consult with the Secretary of Commerce with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any EFH.

The Trustees believe that the selected projects in the final DARP/EA will have no adverse effect on EFH and will promote the protection of fish resources and EFH.

Fish and Wildlife Coordination Act (16 U.S.C. §§ 661, et seq.)

The Fish and Wildlife Coordination Act (FWCA) provides the basic authority for the USFWS involvement in the evaluation of impacts to fish and wildlife from proposed water resource development projects. The FWCA requires that federal agencies consult with the USFWS (and/or NOAA Fisheries as may be appropriate) and state wildlife agencies for activities that affect, control or modify waters of any stream or bodies of water, in order to minimize the adverse impacts of such actions on fish and wildlife resources and habitat. This consultation is generally incorporated into the process of complying with Section 404 of the Clean Water Act, NEPA or other federal permit, license or review requirements.

As to those selected projects involving activities that affect, control, or modify water bodies, such as the McDaniel Slough project, the implementing entity will be required to consult with the appropriate wildlife agencies and comply with Section 404 of the Clean Water Act, NEPA and/or other federal permit, license or review requirements as appropriate.

Marine Mammal Protection Act (16 U.S.C. §§ 3371, et seq.)

The Marine Mammal Protection Act (MMPA) prohibits, with certain exceptions, the take of marine mammals by U.S. citizens on the high seas, or by any person in waters or on land subject to the jurisdiction of the U.S., and the importation of marine mammals and marine mammal products into the U.S. The Secretary of Commerce is responsible for the conservation and management of pinnipeds (other than walruses) and cetaceans. The Secretary of Commerce delegated MMPA authority to NMFS. The Secretary of the Interior (through the USFWS) is responsible for walruses, sea and marine otters, polar bears, manatees, and dugongs. Subchapter III, formerly known as Title II, of the MMPA established an independent Marine Mammal Commission (and its Advisory Committee) which provides independent oversight of the marine mammal conservation polices and programs being carried out by federal regulatory agencies. The Commission is charged with developing, reviewing and making recommendations on domestic and international actions and policies of all federal agencies with respect to marine mammal protection and conservation and with carrying out a research program.

The MMPA provides for several exceptions to the moratorium on taking and importation of marine mammals and marine mammal products. The Secretary may issue permits for take or importation for purposes of scientific research, public display, photography for educational or commercial purposes, enhancing the survival or recovery of a species or stock, importation of certain polar bear parts taken in sports hunting in Canada, and incidental taking in the course of commercial fishing operations.

The Trustees do not believe that any of the selected restoration projects have the potential to result in the take, injury, or harassment of any species protected under the MMPA, with one possible exception (restoration of Common Murres on Redding Rock). If work on Redding Rock is deemed to have disturbance effects on California Sea Lions (*Zalophus californianus*), an MMPA permit from NOAA Fisheries will be required.

Migratory Bird Treaty Act of 1918 (16 U.S.C. §§ 703, et seq.)

The Migratory Bird Treaty Act (MBTA) implements four international treaties involving protection of migratory birds, including all marine birds, and is one of the earliest statutes to provide for avian protection by the federal government. The MBTA generally prohibits actions to "pursue, hunt, take, capture, kill, attempt to take, kill, possess, offer for sale, sell, offer to purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird...or any part, nest, or egg of such bird." Exceptions to these prohibitions are only allowed under regulations or permits issued by USFWS.

Hunting of migratory game birds is regulated annually through a process in which the USFWS sets "framework regulations" and "special regulations" designed to maintain sustainable hunting levels. Framework regulations are the foundation of annual regulations and consist of the outside dates for opening and closing seasons, season length, daily bag and possession limits, and shooting hours. Special regulations consist of framework regulations that are applied on a small scale and consist of split seasons, zones and special seasons, state regulations conform to the federal regulations. All other actions prohibited by the MBTA are only allowed under specific permits issued by the USFWS Regional Bird Permit Offices. These permits include special use permits for collection and rehabilitation or preservation of oiled birds during spill response, which usually provides the primary data for determining extent of injury to marine birds and the need for restoration.

The selected projects in the final DARP/EA, in particular the corvid management project, will be conducted in full compliance with the MBTA.

National Marine Sanctuaries Act (16 U.S.C. §§ 1431, et seq.)

The National Marine Sanctuaries Act (NMSA) authorizes the Secretary of Commerce (Secretary) to designate and manage areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or esthetic qualities as national marine sanctuaries. Day-to-day

management of national marine sanctuaries has been delegated by the Secretary to the National Marine Sanctuary Program. The primary objective of the NMSA is to protect marine resources, such as coral reefs, sunken historical vessels or unique habitats.

The NMSA prohibits the destruction, loss of, or injury to any sanctuary resource. The Secretary is required to conduct such enforcement activities as are necessary and reasonable to carry out the Act. The Secretary may issue special use permits which authorize specific activities in a sanctuary to establish conditions of access to and use of any sanctuary resource or to promote public use and understanding of a sanctuary resource. The NMSA also establishes liability for response costs and natural resource damages for injury to sanctuary natural resources.

The Spill did not impact natural resources within a marine sanctuary. The Trustees do not believe that any of the selected restoration projects have the potential to affect resources within a marine sanctuary.

Park System Resource Protection Act (16 U.S.C. § 19(jj))

Public Law 101-337, the Park System Resource Protections Act (PSRPA; 16 U.S.C. 19jj), authorizes the Secretary of the Interior (Secretary) to assess and monitor injuries to the National Park Service (NPS) resources. A "park system resource" is defined by the PSRPA as "any living or nonliving resource that is located within the boundaries of a unit of the NPS…." except for resources owned by a non-federal entity. The Act specifically allows the Secretary to recover response costs and damages from the Responsible Party causing the destruction, loss of, or injury to park system resources. "Response costs" are defined by the Act to include the costs of actions taken by the Secretary to prevent, abate or minimize the destruction, loss or injury or imminent risk of such destruction, loss, or injury. The Act further provides that "response costs" include monitoring ongoing effects of incidents causing such destruction, loss, or injury. "Damages" include the cost of "replacing, restoring, or acquiring the equivalent of a park system resource" and the "value at any significant loss of use" of such resources.

The Trustees do not believe that any of the selected restoration projects, including the corvid management project, will injure park system resources.

Rivers and Harbors Act (33 U.S.C. §§ 401, et seq.)

The federal Rivers and Harbors Act regulates development and use of the Nation's navigable waterways. Section 10 of the Act prohibits unauthorized obstruction or alteration of navigable waters and vests the Army Corps of Engineers with authority to regulate discharges of fill and other materials into such waters. Restoration actions that require Section 404 Clean Water Act permits are likely also to require permits under Section 10 of the Rivers and Harbors Act. However, a single permit usually serves for both. Therefore, the Trustees can ensure compliance with the Rivers and Harbors Act through the same mechanisms.

The Trustees do not believe that any of the selected restoration projects have the potential to obstruct or adversely alter navigable waters.

Executive Order (EO) 11988 – Construction in Flood Plains

This 1977 Executive Order directs federal agencies to avoid, to the extent possible, the long-and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct or indirect support of development in flood plains wherever there is a practicable alternative. Each agency is responsible for evaluating the potential effects of any action it may take in a flood plain. Before taking an action, the federal agency should determine whether the proposed action would occur in a flood plain. For any major federal action significantly affecting the quality of the human environment, the evaluation would be included in the agency's NEPA compliance document(s). The agency should consider alternatives to avoid adverse effects and incompatible development in flood plains. If the only practicable alternative requires siting in a flood plain, the agency should: (1) design or modify the action to minimize potential harm, and (2) prepare and circulate a notice containing an explanation of why the action is proposed to be located in the flood plain.

None of the selected restoration projects involve construction that will adversely affect, or be incompatible with, a floodplain.

Executive Order 13112 - Invasive Species

The 1999 Executive Order 13112 applies to all federal agencies whose actions may affect the status of invasive species. The Order requires such agencies, to the extent practicable and permitted by law, to: (1) identify such actions; and (2) take actions specified in the Order to address the problem consistent with their authorities and budgetary resources; and (3) not authorize, fund, or carry out actions that they believe are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, "pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions."

The Trustees do not believe that any of the selected restoration projects have the potential to cause or promote the introduction or spread of invasive species.

Executive Order (EO) 12898 - Environmental Justice

On February 11, 1994, President Clinton issued Executive Order 12898, requiring each federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority and low income populations. In the memorandum to heads of departments and agencies that accompanied executive Order 12898, the President specifically recognized the importance of procedures under NEPA for identifying and addressing environmental justice concerns. The memorandum states that "each Federal agency shall analyze the environmental effects, including human health, economic and social effects, of Federal actions, including effects on minority communities and low-income communities, when such analysis is required by [NEPA]." The memorandum particularly emphasizes the importance of NEPA's public participation process, directing that

"each Federal agency shall provide opportunities for community input in the NEPA process." Agencies are further directed to "identify potential effects and mitigation measures in consultation with affected communities, and improve the accessibility of meetings, crucial documents, and notices." The Council on Environmental Quality (CEQ) has oversight of the federal government's compliance with Executive Order 12898 and NEPA.

The Trustees have concluded that there is no low income or ethnic minority community that would be adversely or disproportionately affected by the selected projects in the final DARP/EA. The Trustees involved the public by providing notice and seeking public comments on the draft DARP/EA, holding a public meeting to present and receive comments on the draft DARP/EA, and by providing public access to the Administrative Record.

Information Quality Law (Public Law 106-554, Section 515)

Information disseminated by federal agencies to the public after October 1, 2002, is subject to information quality guidelines developed by each agency pursuant to Section 515 of Public Law 106-554 that are intended to ensure and maximize the quality of the objectivity, utility and integrity of such information. This final DARP/EA is an information product covered by information quality guidelines established by USFWS and DOI for this purpose. The quality of the information contained herein is consistent with these guidelines, as applicable.

3.1.2.2 State Statutes

California Environmental Quality Act (Pub. Res. Code §§ 21000-21178.1)

The California Environmental Quality Act (CEQA) was adopted in 1970 and applies to most public agency decisions to carry out, authorize or approve projects that may have adverse environmental impacts. Its basic purposes are to inform California governmental agencies and the public about the potentially significant effects of proposed activities, to identify ways that environmental damage can be avoided or significantly reduced, to prevent significant avoidable damage to the environment through adoption of feasible alternatives or mitigation measures, and to disclose the reasons for agency approval of a project resulting in significant environmental effects.

The CEQA process begins with a preliminary review as to whether CEQA applies to the project in question. Generally, a project is subject to CEQA if it involves discretionary action that is carried out, funded, or authorized by a public agency that has the potential to impact the environment. Once the agency determines that the "project" is subject to CEQA, the lead agency must then determine whether the action is exempt under either a statutory or categorical exemption.

If the lead agency determines that the project is not exempt then an initial study must be prepared to determine whether the project may have a potentially significant effect on the environment. Based upon the results of the initial study, the lead agency determines whether to prepare a Negative Determination (i.e., the project will not result in significant adverse effects to the environment) or an Environmental Impact Report (EIR) in cases where it is determined that the

project may cause a significant environmental effect. The test for determining whether an environmental impact report (EIR) or negative declaration must be prepared is whether a fair argument can be made based on substantial evidence that the project may have a significant effect on the environment.

In cases where a project will require compliance with both CEQA and the National Environmental Policy Act (NEPA), CEQA encourages the use of the NEPA Finding of No Significant Impact (FONSI) or Environmental Impact Statement (EIS) when such documents are available, or the preparation of joint State/federal documents, in lieu of preparing a separate Negative Declaration or EIR under CEQA. Accordingly, this DARP/EA and subsequent FONSI, if issued, may be relied upon or adopted by the State trustee agencies or the lead agency for the project(s) towards compliance with CEQA where appropriate. To this end, the State Trustees are coordinating with the federal Trustees to ensure the DARP/EA complies with the provisions of CEQA Guidelines including State public review requirements (Title 14 CCR, Chapter 3, § 15220 et seq.).

The State Trustee (CDFG) anticipates that many of the projects described herein are categorically exempt pursuant to: (1) "Minor alterations to land, water, or vegetation"; (2) "Actions by regulatory agencies for protection of natural resources", and (3) "Actions by regulatory agencies for the protection of the environment." However, as noted above, the Trustees intend to undertake further environmental review under NEPA/CEQA.

Additional CEQA compliance may be required for some of the projects described herein prior to actual implementation. This will be determined once detailed engineering design work or operational plans are developed for the selected projects. The lead agency for such projects will be required to carry out any additional CEQA compliance, as appropriate.

California Lempert-Keene-Seastrand Oil Spill Prevention and Response Act (Gov. Code §§ 8670.1, et seq.)

The Lempert-Keene-Seastrand Oil Spill Prevention and Response Act, commencing with Government Code Section 8670.1, became effective on September 24, 1990. This legislation is the key State compensatory mechanism for subsequent spills. It establishes a comprehensive liability scheme for damages resulting from marine oil spills. Recoverable damages include injury to natural resources, the cost of rehabilitating wildlife, habitat, and other resources, and loss of use and enjoyment of natural resources, public beaches, and other public resources. Responsible parties are required to fully mitigate adverse impacts to wildlife, fisheries, and wildlife and fisheries habitat by successfully carrying out environmental restoration projects or funding the activities of CDFG to carry out environmental restoration projects.

The California Act requires the CDFG Office of Spill Prevention and Response to assess natural resource damages following a significant oil spill. Additionally, the Administrator of the Office of Spill Prevention and Response is required to coordinate all actions required by State or local agencies to assess injury to, and provide full mitigation for injury to, or to restore, rehabilitate, or replace, natural resources, including wildlife, fisheries, wildlife or fisheries habitat, and beaches

and other coastal areas, that are damaged by an oil spill. Such actions include, but are not limited to, actions required by State trustees under Section 1006 of the OPA.

California Coastal Act (Pub. Res. Code §§ 30000, et seq.)

The California Coastal Act was enacted by the State Legislature in 1976 to provide long-term protection of California's 1100-mile coastline for the benefit of current and future generations. The Coastal Act created a partnership between the State (acting through the California Coastal Commission) and local government (15 coastal counties and 58 cities) to manage the conservation and development of coastal resources through a comprehensive planning and regulatory program. The Commission reviews and approves Local Coastal Programs, which are the basic planning tools used by local governments to guide development in the Coastal Zone. New development in the Coastal Zone may require a permit from the Commission or the appropriate local government agency.

The Trustees do not believe that the selected restoration projects will adversely affect the State's coastal zone and are coordinating with the California Coastal Commission. Please see Section 3.1.2.1 in regard to the Coastal Zone Management Act for specific information.

California Endangered Species Act (Fish and G. Code §§ 2050 et seq.)

Pursuant to the California Endangered Species Act (CESA), it is the policy of the State of California that State agencies should not approve projects as proposed that would jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat essential to the continued existence of those species if there are reasonable and prudent alternatives available. However, if reasonable alternatives are infeasible, individual projects may be approved if appropriate mitigation and enhancement measures are provided.

Pursuant to the CESA, the Fish and Game Commission has established a list of threatened and endangered species based on criteria recommended by the California Department of Fish and Game. Section 2080 of the California Fish and Game Code prohibits "take" of any species that the Commission determines to be an endangered species or a threatened species. Take is defined in Section 86 of the Fish and Game Code as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." The CESA allows for take incidental to otherwise lawful development projects. The CESA emphasizes early consultation to avoid potential impacts to rare, endangered, or threatened species and to develop appropriate mitigation planning to offset project-caused losses of populations of listed species and their essential habitats.

Two State-listed bird species occur in the area affected by this DARP/EA. The State endangered Brown Pelican and Marbled Murrelet may utilize waters or lands in areas selected for implementing restoration projects. Additionally, these species are the target for the proposed restoration in certain of the proposed restoration projects. Marbled Murrelets nest near and around the proposed corvid control projects sites and nest within the acquisition project sites. Corvid and Murrelet surveys will occur in a manner that will not disturb Murrelets, and are intended to increase nest success of Murrelets. The California Brown Pelican may utilize

beaches near the proposed recreational use projects, habitat restoration projects, and seabird restoration projects.

While the Trustees do not believe the selected restoration projects would result in the take of any State-listed species, the implementing entity will be required to consult with the CDFG as may be appropriate pursuant to the requirements of the CESA.

California Harbor and Navigation Code, Section 294

Harbors and Navigation Code Section 294 creates absolute liability for damages from the discharge or leaking of gas, oil, or drilling waste onto marine waters. Damages include cost of wildlife rehabilitation and injury to natural resources or wildlife, and "loss of use and enjoyment of public beaches and other public resources or facilities."

Public Resources Code, Division 6, Sections 6001, et seq.

The Public Resources Code, Division 6, gives the CSLC trustee ownership over State sovereign tide and submerged lands. Permits or leases may be required from the CSLC if a restoration project is located on such lands.

3.1.2.3 Other Potentially Applicable Statutes and Regulations

Additional statutes, regulations, or executive orders may be applicable to NRD restoration activities, including those listed below.

- National Park Act of August 19, 1916 (Organic Act), 16 U.S.C. 1, *et seq*.
- Archaeological Resources Protection Act, 16 U.S.C. 460, *et seq*.
- National Historic Preservation Act of 1966 as amended (16 U.S.C. 470-470t, 110)
- Clean Air Act, 42 U.S.C. 7401, *et seq*.
- Executive Order 11514 – Protection and Enhancement of Environmental Quality
- Executive Order 11990 – Protection of Wetlands
- Executive Order 11991 – Relating to the Protection and Enhancement of Environmental Quality
- Porter-Cologne Water Quality Control Act, CA Water Code, Section 7

4.0 Injury Quantification and Restoration Planning

This chapter describes the Trustees' efforts to quantify the nature, extent, and severity of injuries to natural resources and the lost recreational uses resulting from the oil spill (please refer to Section 3.1.1.2, above, which describes the cooperative assessment approach utilized by the Trustees). It begins with an overview of the data collected immediately after the Spill as part of the "pre-assessment" phase, followed by a description of the damage assessment strategy and methods used to determine and quantify the injuries. The remainder of the chapter presents summaries of the injury quantification results, restoration options, including a no-action alternative, and restoration scaling for all injury categories.

4.1 Overview of Pre-assessment Activities and Findings

Following the Spill, pre-assessment activities, as described in the OPA regulations, focused on collecting ephemeral data essential to determine whether: (1) injuries had resulted, or were likely to result, from the incident; (2) response actions were adequately addressing, or were expected to address, the injuries resulting from the incident; and (3) feasible restoration actions existed to address the potential injuries. The following summarizes key Pre-assessment activities and findings:

Oiled Wildlife Search and Collection: These activities were conducted for response purposes to capture live oiled wildlife (for potential rehabilitation) and to remove dead oiled wildlife from the impacted areas. Data gathered as a result of these activities were useful for natural resource damage Pre-assessment. Search and collection effort spanned 31 days (from November 5 to December 5, 1997; see Ford *et al.* 2002). Teams searched the interior shoreline of the bay, collecting birds from both Arcata Bay and South Bay regions of the Humboldt Bay complex. Teams also searched the outer coast, finding injured birds as far north as Gold Bluffs Beach, and as far south as Centerville Beach. A total of 961 birds (479 live and 482 dead) were either collected by search teams or brought in by the public. Nine of these birds were Marbled Murrelets. A breakdown by species is provided under the injury categories below.

Shoreline Cleanup and Assessment Team (SCAT) Surveys: These surveys were conducted for response purposes, to inform and guide the Incident Command Center in their efforts to cleanup the oil. The data gathered by these surveys were useful for natural resource damage Pre-assessment. In this case, the surveys spanned 10 days (from November 6 to 15, 1997). SCAT surveys were conducted on shorelines inside the bay, as well as on the outer coast. Outer coast segments were as far north as Patrick's Point State Park and as far south as the South Spit of Humboldt Bay.

Aerial Surveys: These surveys were conducted for response purposes, to provide counts and species identification of marine birds and mammals in the vicinity of the Spill or Spill trajectory. The data gathered by these surveys were useful for natural resource damage Pre-assessment. Surveys were conducted from November 7 to November 9, 1997. Near shore survey lines were flown parallel to the coast on each of the three days. These surveys extended as far north as Patrick's Point State Park and as far south as the mouth of Eel River. Surveys lines were flown progressively farther offshore as the Spill progressed. On November 9, 1997, oil was observed over 12 km offshore.

Boat Surveys: These surveys were conducted for response purposes: (1) to provide information on the location of oil on water; (2) to pick up sick oiled birds for transport to the Marine Wildlife Care Unit at Humboldt State University; (3) to remove dead oiled birds from the environment; and (4) to census marine birds and mammals that were at risk of exposure to oil. Surveys were conducted in Humboldt Bay (north and south bays, and the shipping channel) and adjacent offshore waters (Big Lagoon to Table Bluff) from November 5 to December 5, 1997. Offshore survey transects ran parallel to the shore at distances of 400 m, 800 m, 1.4 km, 2 km, 3 km, and 5 km. A survey transect was also run at 8 km offshore from

Trinidad to Humboldt Bay to cover the area of oil observed by NOAA Scientific Support aerial overflights.

Human Recreational Use Research: During the Spill, the Trustees documented beach closures and maintained communication with local authorities and the Incident Command Center regarding other possible impacts to human recreational activities.

Based on information collected during the Pre-assessment efforts summarized above, the Trustees identified the following categories of injury: (1) birds (which were further divided into sub-groups according to species and restoration options), (2) shoreline habitat, and (3) recreational use. The Trustees determined that a number of potential restoration actions exist to compensate for the losses and proceeded with injury assessments.

4.2 Overview of Injury and Damage Assessment Strategy

The goal of injury assessment is to determine the nature, extent and severity of injuries to natural resources, thus providing the technical basis for evaluating and scaling restoration actions. The OPA regulations define injury as "an observable or measurable adverse change in a natural resource or impairment of a natural resource service." Diminution in the quantity and/or quality of recreational use of natural resources also constitutes an injury as defined by the OPA regulations.

For each of the injury categories, the Trustees selected appropriate assessment procedures based on the: (1) range of procedures available under Section 990.27(b) of the OPA regulations; (2) time and cost necessary to implement the procedures; (3) potential nature, degree, and spatial and temporal extent of the injury; (4) potential restoration actions for the injury; (5) relevance and adequacy of information generated by the procedures to meet information requirements of planning appropriate restoration actions; and (6) input from consultants with damage assessment experience, scientific experts, and/or technical consultants representing Kure.

Each injury assessment focused on determining both the magnitude of the injury (i.e., number of animals killed or area of habitat affected) and the time to full recovery. This produces an estimate of direct plus interim (from the time of injury until full recovery) loss of resources resulting from the oil. Injury estimates in future years were discounted at three percent per year (NOAA 1999).

4.2.1 Damage Assessment Methods for Birds

4.2.1.1 Estimation of Numbers of Birds Impacted

In this section, the Trustees present their final bird mortality estimates, which include modifications to address the fate of rehabilitated birds and likely non-spill related birds. For pelicans, the Trustees have relied on a report by Jacques and Ford (2000). A more detailed explanation of the derivation of the final mortality estimates is presented in Appendix B.

The first step in injury quantification was to estimate the number of birds, by species, impacted by the Spill. The Trustees contracted with Glenn Ford, of R.G. Ford Consulting Company, to provide a report on the total mortality estimate for most species, using several different methods. The report, "Draft Final Report*:* Estimates of Bird Impacts Resulting from the M/V Kure/Humboldt Bay Oil Spill of November 5, 1997", is available in the Administrative Record (Ford *et al.* 2002a).

Not all spill-impacted birds are found and collected during spill response. Many are missed for a variety of reasons:

- *Unsearched areas*. Because precipitous parts of the coastline are inaccessible, they often remain unsearched by spill responders. In this case, much of the Trinidad Head area was unsearched or sparsely searched.
- *Scavenging*. Scavengers (including mammals such as raccoons and birds such as gulls and crows) may pick apart or entirely remove dead birds from the beaches.
- *Search efficiency*. Spill responders searching for beach cast birds may not find them all.
- *Re-wash*. Bird carcasses that are deposited on a beach may be subsequently removed from the beaches by high tides or large waves and re-deposited elsewhere (outside the searched area). One recent study found that birds on sandy beaches were more subject to re-wash than birds on rocky coastlines (R.G. Ford, R.G Ford Consulting Company, Inc., personal communication). Over time, birds would end up disproportionately on rocky shorelines, where they are less likely to be removed by re-wash processes. This study also found that dead birds were just as likely to strand on rocky coastlines, with cliffs and rocks, as they were to strand on sandy "depositional" beaches.
- *Beach transit*. It is often assumed that live oiled birds come to the beaches and simply stop there. Recent experience, however, has noted that many birds, including Common Murres, may continue walking inland, perhaps in search of cover. In one case, 16 of 16 live, presumably oiled, beached murres walked several hundred meters inland into a dune complex, where they could not be found (S. Hampton, CDFG, personal communication). This was based on observations of Common Murre tracks heading into adjacent dunes.
- *Removal or burial by the public*. On beaches with even light human use, dead birds are subject to being tossed in trash cans or buried in the sand. This may prevent their discovery by spill response crews.
- *At-sea loss*. Because many oiled hypothermic birds lose bodyweight quickly and die of starvation within two days (Oka and Okuyama 2000), some birds never make it to the beach. Dead or dying birds are often subject to winds and currents, which may carry them offshore. Additionally, dead and dying birds are subject to scavenging and predation while at sea.
- *Departure from the area*. Larger birds, such as pelicans, are sometimes able to survive minor oiling for many days. During this time, they may travel well outside the spill zone and beyond the scope of response personnel.

At the same time, not all birds collected are spill-related. During any spill response, some level of natural background mortality can be expected to contribute to the number of birds collected. Note, however, that it is not sufficient to assume that birds without visible oiling are not spill related.

Spill related birds might show no visible oiling for the following reasons:

- *Thin sheen or small amounts of oil*. For ocean-going birds that forage at sea, a spot of oil the size of a nickel may be sufficient to cause death. Like a hole in a wetsuit, the oil destroys the feathers' ability to insulate the bird, thus allowing cold ocean water to spread against the bird's skin. Oiled birds most typically die of hypothermia and starvation (Moskoff 2000). Often, such small traces of oil may be difficult to see on a bird. They may appear wetted, like a wet dog, but show no oil.
- *Scavenging*. Oil usually coats the under parts of a bird, such as the belly and breast, as the bird swims in the ocean. These are the same parts of the bird that are removed by scavengers. Experience in California and a recent study in Canada have found that scavengers do not hesitate to feed upon oiled birds (Wiese 2002).
  When this occurs, those feathers are often removed. Scavenging often occurs in the first few hours or days after a bird is beached. It is not unusual for a fresh bird to be reduced to a skeleton overnight.
- *Dark plumage*. Because oil is usually black, it is most difficult to see on dark-plumaged birds. While most seabirds have white under parts, some are entirely dark in plumage color.

There are two approaches to account for natural mortality:

1. Examine each entry in the intake log and remove individual birds that seem unlikely to be spill related (e.g. old, desiccated carcass on the first day of the spill; gunshot wound, etc.)
2. Estimate the average background carcass deposition rate and subtract a flat rate from the total number of birds collected during the response. In some cases, beached bird surveys in the area may provide historical data for individual beaches and time of year, by species.

In general, the former approach is best applied to short-term spills and responses lasting days to a few weeks, whereas the latter is useful for long-term responses lasting months. In the Kure case, the Trustees used the first approach. Of the 961 birds collected, the Trustees believe that 33 were unlikely to be related to the Spill and did not include them in the estimates of bird injuries. Reasons for removing these dead birds included gunshot wounds, broken wings, and a state of decomposition that suggested they died prior to the Spill.

There are several approaches to estimating total bird mortality, as described in the Ford report. The Trustees relied on the Beached Bird Model for all but pelicans and shorebirds. Pelicans required special treatment because of their large size. They are capable of surviving moderate levels of oiling for several days, during which they may have the strength to leave the area. For pelicans, the Trustees relied on surveys of free-flying oiled pelicans, considering their level of oiling and whether or not they would likely survive. Shorebirds, primarily Dunlin, (*Calidris alpina*) required different treatment because of their smaller size relative to individuals of other bird species killed by the Spill coupled with the tendency of dying birds to seek vegetation in which to hide. The typical proximity of such vegetation to shorebird habitat resulted in greater difficulty locating shorebird carcasses compared to seabirds. For shorebirds, the Trustees relied

on surveys of oiled and unoiled live shorebirds in the days after the Spill, as described in the Ford report.

The Beached Bird Model (see Ford *et al.* 1987) seeks to estimate the number of birds killed from the numbers of birds found on the beach (a method called "back casting"). Using estimated rates of carcass disappearance and the efficiency of the human search effort, the number of birds removed or not found on the beaches is then estimated. Using a simplified example, if the odds of a bird being removed by a scavenger in the course of a day are 50% and the odds of it being overlooked by a searcher are 50%, then the odds of it being recovered are 25%. This would imply that, for every one bird found, three more are missed. This would result in a "beached bird multiplier" of four. That is, one bird recovered implies that four birds were impacted.

The Beached Bird Model used in this case was based on Ford *et al.* (1987; 1996). Two on-site studies were conducted to develop parameters for scavenging rates and search efficiency for use in the model, as described in the Ford report. Based on the results of these studies, the model incorporated different scavenging rates (based upon the size of the bird and geographic area; Ford *et al.* 2002b) and different search efficiency rates (based upon the size of the bird and the type of beach that was searched; Ford and Ward 2000).

Because of the location of the Spill and level of search effort, re-wash, beach transit, removal or burial by the public, at-sea loss, and departure from the area were considered to be relatively small factors in this case and were not evaluated nor included in the model. To the extent that these factors contributed to carcass disappearance, the model may underestimate actual bird mortality. Finally, the Trustees evaluated the likely survival rate of rehabilitated and released birds, using available data and literature (Sharp 1996; Newman *et al*. 2004). The Trustees estimated that 25% of the rehabilitated birds would return to the breeding population. The remaining 75% were added to the mortality estimate.

Table 4-1 provides a summary of the results, with total mortality estimates for various groupings of birds. Further details of mortality estimation are provided in Appendix B.

Table 4-1: Bird Mortality from the M/V Kure Spill by Species Group

Species Group	# Collected During Spill	Total Mortality Estimate
Loons	29	**75**
Grebes	92	**168**
Pelicans	5	**31**
Cormorants	16	**35**
Gulls	73	**154**
Murres	311	**719**
Procellarids	113	**191**
Marbled Murrelets	9	**130**
Shorebirds	59	**2033**
Waterfowl	240	**414**
Other or unknown	14	NA
TOTAL	**961**	**3950**

4.2.1.2 Bird Restoration Categories

To facilitate restoration planning, the Trustees concluded that it was not desirable to implement restoration projects for each of the (at least) 48 bird species impacted. For many of these species, no restoration project has ever been recommended or implemented, creating challenges with respect to feasibility. For others, the impact was relatively small, implying that a small restoration project would suffice for compensation. The implementation of many small projects, however, would be economically inefficient, as each project incurs some level of fixed costs. Thus, in order to focus restoration efforts on larger, efficient, and feasible projects, the Trustees created restoration categories for birds according to the following criteria:

1. The species in each group should be similar in their habitat preferences and life histories.
2. The species in each group are likely to benefit from a single restoration action.
3. Each grouping must contain one or more species for which there are feasible restoration options.
4. Species with declining populations and special restoration needs should be specifically addressed to the extent feasible.

This resulted in the following bird groupings:

Marbled Murrelet
This species is unique in that it is the most sensitive species to suffer direct mortality from the Spill when comparing bird loss to local population size. Furthermore, among those impacted by the Spill, this species has relatively narrow habitat requirements. It thus requires special attention in terms of both primary and compensatory restoration.

Grebes and Loons
These species are fairly similar in their breeding and wintering habitat preferences, as well as their foraging techniques and prey preferences.

Gulls, Cormorants, Pelicans
These species can all be found on coastal rocks and other platforms, where they nest or roost. They all forage in the near-shore ocean and in the Bay. A project providing nesting or roosting opportunities for any one of these species will likely benefit the others.

Alcids (except Marbled Murrelet), Procellarids
This category includes the Common Murre (*Uria aalge*), one of the most heavily impacted species in terms of numbers killed. All the species in this category forage at sea and nest on offshore rocks and islands.

Waterfowl
The injured species were primarily diving birds that feed on invertebrates and/or fish supported by local wetlands. Most of the birds in this category are migratory. They do not nest in the Humboldt Bay area, but instead utilize its rich forage resources. White-winged Scoter (*Melanitta fusca*), Surf Scoter (*M. perspicillata*), and American Coot (*Fulica americana*) suffered the majority of the spill-related mortality in this grouping.

Shorebirds
These are wading birds that forage (primarily for invertebrates) on extensive mudflats of Humboldt Bay. Over 80% of the shorebirds collected during the Spill were Dunlin (*Calidris alpina*).

All impacted birds have been accounted for in the calculation of compensatory damages. Thus, just because a species was grouped with others and may not benefit from a species-specific restoration project, it was not ignored in the damage estimations. Spill-related mortality was estimated for each species and all injuries within each grouping were counted when scaling restoration.

4.2.1.3 Damages Quantification for Birds

The Trustees sought to determine appropriate restoration projects to both restore the injured resources and compensate for the interim losses between the time of the Spill and full recovery to baseline conditions (see NOAA 1997). Restoration scaling is the process of determining the appropriate size of a restoration project. These projects, because of their compensatory nature, are intended to provide resources "of the same type and quality, and of comparable value" as the resources which were injured (see NOAA 1995). For this task, the Trustees relied upon the Resource Equivalency Analysis (REA) method for injury and restoration scaling.

The REA method is divided into two main tasks: the debit calculation and the credit calculation. The debit calculation involves determining the amount of "natural resource services" that the affected resources would have provided had they not been injured. The unit of measure may be acre-years, stream feet-years, or some other metric (such as bird-years). The credit calculation seeks to estimate the quantity of those resource services that would be created by a proposed compensatory restoration project. Thus, the size of the restoration project is said to be "scaled" to equal the size of the injury. Consistent with federal recommendations for NRDA (see NOAA 1997; NOAA 1999) and generally accepted practice in the field, future years are discounted at a rate of 3% per year. This discounting is done based on the assumptions that present services are more valuable than future services, and that some uncertainty exists when estimating future restoration benefits. This assumption is typically used by the Trustees when scaling restoration projects.

When the injury is primarily to individual animals rather than to a complete habitat, the REA may focus on lost animal-years. For example, suppose an oil spill causes negligible injury to a body of water, but results in the death of 100 ducks. Using information about the life history of the ducks (e.g., annual survival rate, average life expectancy, average fledging rate, etc.), it is possible to mathematically model/estimate the lost "duck-years" due to the spill. On the credit side, restoration projects can be designed to create duck nesting habitat and scaled, such that the size of the project is sufficient to create as many "duck-years" as were lost in the incident. This is the approach used for the bird species groups listed above. The scaled project sizes and some of the details used in the scaling calculations are provided below. See Appendix C for further details on the REA method.

There are a variety of ways to calculate lost bird-years, all of which involve assumptions regarding the recovery of the species from the Spill. For all species, the Trustees assumed that a representative section from each age class was killed by the Spill. For all species except the Marbled Murrelet, the Trustees employed a single-generation stepwise replacement approach, which will be described here. The Marbled Murrelet calculation will be described below under the Injury Quantification section for that species.

The single-generation stepwise replacement approach to calculation of lost bird-years assumes that in each year after a spill the juvenile age class will be entirely replaced. That is, despite the fact that some breeding adults have been removed from the population, the population produces the same number of juveniles post-spill as it did pre-spill.[5] Thus, the youngest age class impacted by the spill will fully recover to its pre-spill level after the next breeding season. The second-year age class will fully recover two years after the spill, as the recovered first-year birds grow older. Likewise, the third-year age class will fully recover after three years, and so on. Mathematically, this is equal to calculating the number of years lost by the killed birds, based on the life expectancy of each age class. Details regarding the demographic parameters used to calculate lost bird years are presented in Appendix D.

The bird-years gained by each restoration project were evaluated individually, depending upon the benefits associated with each specific project. These will be explained below.

4.2.2 Damage Assessment Methods for Shoreline Habitat

The Trustees evaluated shoreline impacts by separating them into four categories: (1) mudflat, (2) wetland, (3) rip rap shoreline; and (4) sand and gravel beaches. The Trustees estimated the number of acres oiled, the degree of oiling, and the associated degree and duration of injury associated with the oiling. This injury quantification information was then used in a Habitat Equivalency Analysis (HEA) to scale restoration of wetlands to the size of the injury (see NOAA 1997).

4.2.3 Damage Assessment Methods for Recreational Use

For recreational use impacts, the Trustees sought to place a direct dollar value on the loss to the public. The analysis was based upon the following:

1. Determination of the types of recreational activities impacted.
2. Quantification of the number of trips lost due to closures of beaches and boat ramps.
3. Determination of the appropriate values per trip for various activities, based on previous economic studies of the value of outdoor recreation.

The total value of the lost recreational use was calculated by multiplying the value of each individual trip by the number of trips lost.

[5] Biologically, this could occur if the population was at carrying capacity with respect to breeding opportunities (perhaps limited by available nesting habitat or food base during the nesting season). The loss of some adults would open up room for other adults to take over the vacant nesting opportunities and thus maintain the population's annual production of juveniles.

4.2.4 Restoration Project Selection Criteria

The Trustees considered numerous restoration alternatives to compensate the public for spill-related injuries. Each restoration alternative was evaluated using the initial screening criteria:

Phase I - INITIAL SCREENING CRITERIA: The following initial screening criteria were used to select the preferred and non-preferred restoration projects presented in this final DARP/EA.

A. **Consistency with Trustees' Restoration Goals.** Projects must meet the Trustees' intent to restore, rehabilitate, replace, enhance, or acquire the equivalent of the injured resources and resource services.

B. **Technical Feasibility.** The project must be technically and procedurally sound. The Trustees will consider the level of risk or uncertainty associated with the project meeting stated objectives compared with the degree of success of projects utilizing similar or identical techniques in the past.

C. **Cost-Effectiveness.** The Trustees will consider the relationship of expected project costs to expected resource and service benefits. The Trustees seek the least costly approach relative to delivery of an equivalent or greater amount and type of benefit(s).

D. **Relationship to Injured Resources and/or Services (nexus).** Projects that benefit the same or similar resources or services injured by the spill are preferred to projects that benefit other comparable resources or services. Consideration is given to the types of resources or services injured by the spill, the location, and the connection or nexus of project benefits to those injured resources.

E. **Time to Provide Benefits.** Consideration is given to the time it takes for benefits to be provided to the target ecosystem, species, or the public to minimize interim resource loss (sooner = better).

F. **Duration of Benefits.** The Trustees consider the expected duration of benefits from the project, toward the objective of long-term benefits.

Phase II - ADDITIONAL SCREENING CRITERIA: The following additional criteria are not considered to be of lesser importance than the initial screening criteria. These criteria are generally more appropriately applied after more detailed project plans and scopes of work are developed. To the extent that sufficient information was available, these criteria were used during the preferred restoration project identification process. These additional screening criteria will be used to further evaluate and prioritize preferred projects for funding and implementation.

G. **Avoidance of Adverse Impacts.** The project should avoid or minimize adverse impacts to the environment and the associated natural resources. Adverse impacts may be caused by collateral injuries when implementing, or as a result of implementing, the project.

Consideration is given to avoiding future short-term and long-term injuries as well as mitigating past injuries.

H. **Likelihood of Success.** The Trustees consider the potential for success and the level of expected return of resources and resource services. Consideration is given also to the ability to evaluate the success of the project, the ability to correct problems that arise during the course of the project, and the capability of individuals or organizations expected to implement the project.

I. **Multiple Resource and Service Benefits.** The extent to which the project benefits more than one injured natural resource or resource service is considered, as measured in terms of the quantity and associated quality of the types of natural resources or service benefits expected to result from the project.

J. **Compliance with Applicable Federal, State, and Local Laws and Policies.** The project must comply with applicable laws and policies.

K. **Public Health and Safety.** The project must not pose a threat to public health and safety.

L. **Maintenance and Oversight of Project.** Consideration is given to opportunities to protect the implemented project and resulting benefits over time through conservation easements, land acquisition, or other types of resource dedication. Long-term protection is preferable.

M. **Opportunities for Collaboration.** The Trustees consider the possibility of matching funds, in-kind services, volunteer assistance, and coordination with other ongoing or proposed projects. External funding and support services that reduce costs or extend benefits are preferable. Funds, however, shall not be used to offset the costs of ongoing mitigation projects required pursuant to State or federal law.

N. **Total Cost and Accuracy of Estimate.** The total cost estimate should include costs to design, implement, monitor, and manage the project. Its validity is determined by the completeness, accuracy, and reliability of methods used to estimate costs, as well as the credibility of the person or entity submitting the estimate.

O. **Comprehensive Range of Projects.** Consideration is given to the extent to which the project contributes to the more comprehensive restoration package. The Trustees evaluate the project for the degree to which it benefits any otherwise uncompensated spill injuries.

Phase III - SUPPLEMENTAL CRITERIA: The following criteria will be considered when appropriate (e.g., as a tie-breaker in the case of more than one project being equally preferred after Phase I and II evaluations).

P. **Ability to Document Benefits to the Public.** Consideration is given to the ability to document receipt or delivery of benefits to the public as a result of the project.

Q. **Educational/Research Value.** Consideration is given to the project's potential for public education and outreach and/or clarification of restoration planning issues.

R. **Non-Duplication.** Projects should not duplicate other efforts already ongoing at the same location.

4.3 Injury Quantification and Restoration Alternatives by Category

The following sections provide the details regarding injury quantification, the range of potential restoration options, and, for each injury category, a description of the selected restoration project and the scaling of the size of that project.

4.3.1 Loon and Grebe Injury and Restoration

This grouping of species combines two orders of birds: loons (Gaviiformes) and grebes (Podicipediformes). These two orders are quite similar. Both are duck-like birds that spend most of their lives floating on the water and diving for fish. All of these species nest on inland lakes along marsh edges and winter in near-shore ocean waters and/or inland lakes.

Horned Grebe (*Podiceps auritus*), Western Grebe (*Aechmophorus occidentalis*), Common Loon (*Gavia immer*), and Pacific Loon (*Gavia pacifica*) account for 83% of the birds collected from this species group. These species occur regularly along the California coast in winter. No loons currently nest in California, although Common Loons historically nested in small numbers in northeastern California (Grinnell and Miller 1944). Loon nesting in western North America is largely restricted to undisturbed portions of Alaska and Canada (McIntyre and Barr 1997). The Common Loon is listed as a California State Species of Special Concern.

Western Grebe populations have declined significantly in the past 25 years. Data from Christmas Bird Counts reveal that total Western Grebe counts have fallen from approximately 80,000 in 1980 to just over 40,000 in recent years. Western Grebes nest in dense colonies although they are also known to solitarily nest. Western Grebes nest in scattered locations in the northern half of the State. The largest colonies (greater than 300 nests) are at:

- Clear Lake in Lake County,
- Eagle Lake in Lassen County,
- Lake Almanor in Plumas County (personal communication, G. Ivey), and
- Tule Lake National Wildlife Refuge (North Sump) in Siskiyou County.

These four lakes comprise over 80% of the approximately 10,000 Western and Clarks' Grebes that nest in the State (Ivey 2004). Grebe nesting colonies in California are subject to several factors that may reduce or eliminate nest productivity in any given year: wave wash from boat wakes, disturbance and direct destruction of nests from boats or personal watercraft (e.g. jet-skis), and sudden changes in water levels (Ivey 2004).

4.3.1.1 Injury Quantification

There were 120 birds collected in this species group (Table 4-2). Using a total dead-bird multiplier of slightly greater than two, the total estimated dead was 243.

Table 4-2: Loon and Grebe Mortality from the M/V Kure Spill

Species	Collected Alive	Collected Dead	Total Collected	Total Estimated Dead
Loons				
Red-throated Loon	1	1	2	
Pacific Loon	9	3	12	
Common Loon	14	1	15	
Subtotal	*24*	*5*	*29*	*75*
Small Grebes				
Horned Grebe	28	12	40	
Eared Grebe	3	4	7	
Subtotal	*31*	*16*	*47*	*87*
Large Grebes				
Western Grebe	19	14	33	
Clark's Grebe	0	2	2	
Red-necked Grebe	2	0	2	
grebe, sp.	0	7	7	
Subtotal	*21*	*23*	*44*	*81*
TOTAL	**76**	**44**	**120**	**243**

Because population data were not available for every species, lost bird-years were calculated relying on the demographic characteristics of Common Loon (for the loons), an average of small grebe species (for the small grebes), and Western Grebe (for the large grebes). See Appendix D for details. The Trustees applied the single-generation stepwise replacement approach to calculating lost bird-years as described in the Methods section above. This produced the following estimates of lost bird-years:

Table 4-3: Estimated Bird-Year Loss of Loons and Grebes

Species	Total Estimated Dead	Bird-Year Multiplier	Total Lost Bird-Years
Loons	75	6.25	469
Small Grebes	87	2.64	230
Large Grebes	81	3.35	271
TOTAL	**243**		**970**

These lost bird-years represent the interim losses between the time of the Spill and return of these populations to pre-spill conditions. Thus, any restoration project benefiting this species group should seek to replace 970 lost bird-years.

4.3.1.2 Restoration Alternatives

Restoration options for loons and grebes on their wintering grounds are limited. Furthermore, because their populations are most likely limited by pressures on their nesting grounds, it makes most sense to focus restoration at these locations. Because Common Loons, Horned Grebes, and

Western Grebes were the predominant species impacted, the Trustees examined potential restoration options for these species. Restoration for Common Loons and Horned Grebes would require actions far removed from the spill area, most likely in Canada or Alaska and specific restoration projects in these areas have not been identified. Table 4-4 lists the two projects considered for benefiting Western Grebes in California.

Table 4-4: Potential Restoration Projects for Grebes

PROJECT CONCEPT	BENEFITS
Acquisition of land around Lake Earl to allow for higher lake levels and increase Western Grebe nesting habitat	Western Grebe
Protection of grebe nesting colonies at northern California lakes	**Western/Clark's Grebes**

After evaluating these projects using the initial and additional screening criteria, the Trustees have selected the grebe colony protection measures project, as this project holds the promise of immediate benefits at important breeding colonies, and represents the least-cost alternative that provides adequate benefits. The Lake Earl project provides fewer benefits at a higher cost.

Selected Project: Protection of Western/Clark's Grebe Nesting Colonies at Northern California Lakes

This project will fund many of the recommendations of the California grebe management plan designed to protect nesting Western and Clark's Grebes (*Aechmophorus clarkia*) from human disturbance and other perturbations in California (Ivey 2004). These two species nest together, and are subject to disturbances, usually from close approach by boats or personal watercraft (e.g. jet skis) which can result in nest abandonment or direct loss of chicks, eggs and nests. The colonies that will be considered for protection are located at Clear Lake, Eagle Lake, Lake Almanor, Tule Lake NWR, and the Thermolito Forebay (Figure 4-1). Clear Lake will be the top priority because disturbance there is most pronounced. Monitoring at other lakes will aid in identifying and prioritizing opportunities for implementing the project at additional sites.

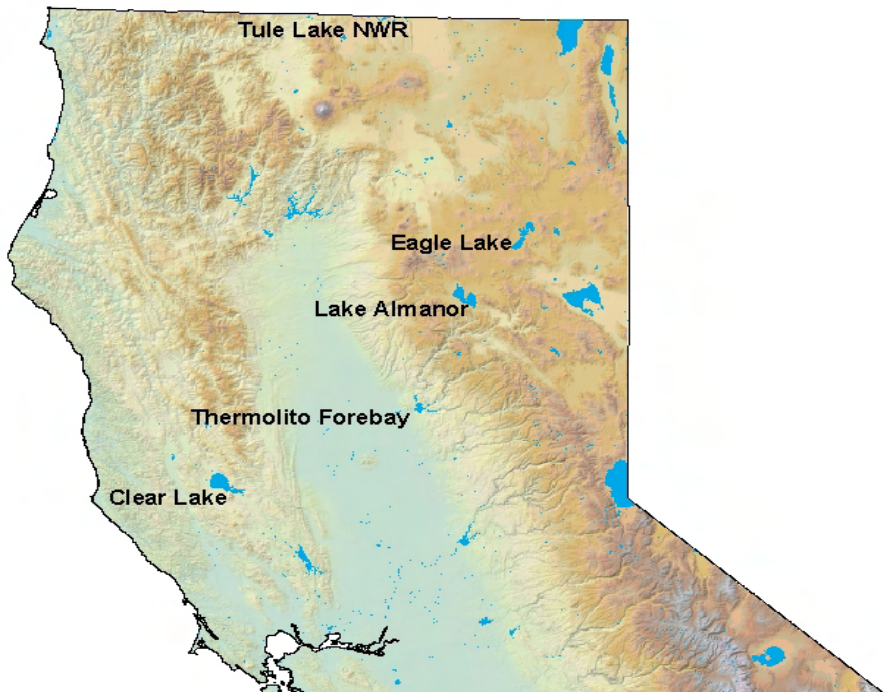


Figure 4-1: Grebe colony protection sites

Protective actions will include public education and outreach and the establishment of small seasonal buffers around grebe nesting colonies. Public education will include pamphlets and signs around boat launches, marinas, campgrounds, and other public places. Seasonal buffers will be marked with buoys and signs, typically within 100 to 200 yards of the shoreline where nests are located in emergent vegetation. All of these efforts will be coordinated with local enforcement and government officials. Other actions may include protection and restoration of emergent vegetation.

This project will expand upon a current pilot project at Clear Lake initiated by the *American Trader* oil spill Trustee Council. The Kure settlement funds allocated for this project total $250,000.

4.3.1.3 Scaling for Primary and Compensatory Restoration

As described in Section 4.3.1.1, the total injury to this restoration category was 970 lost bird-years. For restoration scaling, the Trustees relied on data from Clear Lake that suggest grebe colony protection measures may result in an increase of 0.295 fledges per nest for each year of the project. Assuming that project benefits begin in the year 2006 and last two years, the Trustees calculated that such a project would generate 1,274 additional bird-years resulting from the increased nest success. This would more than compensate for the injury. Because the project is only divisible by years, and a one-year project would be inadequate, the Trustees will fund a two-year project.

Appendix E provides additional details regarding the bird REA for this species group.

4.3.1.4 Environmental Consequences

Beneficial Effects

This project will lead to increased nest success for Western and Clark's Grebes. Further, it will serve to protect important nesting colonies. The public will also be educated regarding behavior and characteristics of these attractive and conspicuous birds.

Adverse Effects

There are no adverse impacts anticipated for wildlife and habitat, as this project will protect areas from human disturbance. There will be minor inconveniences to boaters and users of personal watercraft, as grebe colonies will be protected by buffers that restrict boating access. However, these buffers are relatively small, extending only 50 to 100 meters from shore, and span only the length of shoreline where the colonies are located. Given the size of these lakes, these buffers typically represent less than 1% of the total lake surface area. Additionally, the buffers are seasonal, as they are only needed during the breeding season (primarily July and August).

4.3.1.5 Probability of Success

As the primary goal of this project is to modify human behavior, successfully protecting grebe colonies from all human disturbances is difficult to achieve. It is likely there will be a low level of disturbance regardless of the project. Nevertheless, this project should prevent the kind of catastrophic disturbance events that have occurred in the past. If so, nest success should stabilize at more natural levels each year, thus improving the likelihood that the project will be successful.

4.3.1.6 Performance Criteria and Monitoring

The goal of this project is to prevent disturbance of nests and to ensure that the juvenile/adult ratio does not fall below 0.35 due to human disturbance in any one year. To measure both compliance and grebe nest success, the project provides for monitoring during each breeding season. Grebes will be monitored using both aerial and boat surveys, according to current protocol and previous surveys as described in Ivey (2004).

4.3.1.7 Evaluation

The Trustees have evaluated this project against the initial and additional screening criteria developed to select restoration projects and concluded that this project is consistent with these selection factors. The Trustees determined that this type and scale of project would effectively compensate for injuries to loons and grebes that occurred as a result of the Spill, and consequently, have selected this project.

4.3.2 Pelican, Cormorant, and Gull Injury and Restoration

This species grouping includes all pelicans, cormorants, and gulls collected during the Spill response. These species share several characteristics: they all forage in near-shore waters and in bays, they all spend considerable time out of the water roosting on rocks or other platforms, and they are frequently found roosting and foraging together.

The California Brown Pelican is listed as a State and federal endangered species. However, due to its improving population status, on February 20, 2008 the USFWS proposed to remove this species from protection under the federal ESA. Nesting occurs in Mexico and on islands off southern California; the pelican occurs in Humboldt County during the non-breeding season as a seasonal migrant, primarily during fall and winter. Brown Pelicans typically forage in relatively shallow coastal waters, feeding almost entirely on surface-schooling fish caught by plunge diving in coastal waters. Brown Pelicans are rarely found away from salt water and do not normally venture more than 32 kilometers (20 miles) out to sea. During the non-breeding season, Brown Pelicans roost communally; roosting sites and loafing areas are essential habitat for local individuals and Mexican migrants. Brown Pelicans are tropically-derived seabirds that have wettable plumage so they must have terrestrial roost sites to dry wet plumage after feeding or swimming (Jaques and Anderson 1987). Roost sites are also important for resting and preening. The essential characteristics of roosts include: nearness to adequate food supplies; presence of physical barriers to predation and disturbance; sufficient surface space for individuals to interact normally; and adequate protection from adverse environmental factors such as wind and surf (Jaques and Anderson 1987). Major roosts are found on jetties and other human-made structures, offshore islands and rocks, and beaches at the mouths of estuaries (Jaques and Anderson 1987). In many sections of the coast, such roosting sites are in short supply (Jaques 1994; Jaques and Strong 2002).

Double-crested, Brandt's, and Pelagic Cormorants (*Phalacrocorax auritus, P. penicillatus, P. pelagicus*) occur in California year-round. The latter two species are found strictly along the coast, while Double-crested occurs inland as well. The Double-crested Cormorant has also been listed as a California Species of Special Concern as a result of human disturbance and impacts from DDT in past decades. Like the pelican, these species require disturbance-free roost sites to enable them to rest and dry their plumage after foraging for fish in the water. Likewise, their nesting is limited to disturbance-free areas, typically small offshore rocks and human-made structures (e.g., abandoned piers).

Western Gulls (*Larus occidentalis*) breed along the California coast and are present year-round. Glaucous-winged, Ring-billed, and Mew Gulls (*L. glaucescens, L. delawarensis, and L. canus*) breed north of California or inland and are present along the California coast primarily in the winter months. Heermann's Gull (*L. heermanni*) is a winter migrant in northern California, and primarily breeds on a single island in the Sea of Cortez, Mexico.

4.3.2.1 Injury Quantification

There were 86 spill-related birds collected in this species group (Table 4-5). Using a total dead-bird multiplier of approximately 2.6, the total estimated dead was 220.

Table 4-5: Pelican, Cormorant, and Gull Mortality from the M/V Kure Spill

Species	Collected Alive	Collected Dead	Total Collected	Total Estimated Dead
Pelicans				
Brown Pelican	2	2	4	31
Cormorants				
Pelagic Cormorant	7	2	9	
Double-crested Cormorant	1	4	5	
Brandt's Cormorant	0	1	1	
Subtotal	8	7	15	35
Gulls				
Western Gull	9	16	25	
Heermann's Gull	5	2	7	
California Gull	4	2	6	
Glaucous-winged Gull	2	3	5	
Ring-billed Gull	0	2	2	
Mew Gull	1	0	1	
gull, sp.	1	20	21	
Subtotal	22	45	67	154
TOTAL	**32**	**54**	**86**	**220**

Because population data were not available for every species, lost bird-years were calculated relying on the demographic characteristics of Brown Pelican, Double-crested Cormorant (for all cormorants), and Western Gull (for all gulls). See Appendix D for details. Table 4-6 presents the lost bird-years the Trustees calculated by applying the single-generation stepwise replacement approach as described in the Methods section above.

Table 4-6: Estimated Bird-Year Loss of Pelicans, Cormorants, and Gulls

Species Category	Total Estimated Dead	Bird-Year Multiplier	Total Lost Bird-Years
Pelicans	31	5.92	184
Cormorants	35	4.37	153
Gulls	154	4.44	684
TOTAL	**220**		**1020**

These lost bird-years represent the interim losses between the time of the Spill and return of these populations to pre-spill conditions. Thus, any restoration project benefiting this species group should seek to replace 1020 lost bird-years.

4.3.2.2 Restoration Alternatives

The restoration concepts for this group of species share one goal: to provide roosting benefits for Brown Pelicans in the vicinity of the Spill. Some of the projects provide nesting benefits for cormorants, nesting or roosting benefits for gulls, as well as a variety of other species and services outside the restoration category. These potential projects are listed in Table 4-7.

Table 4-7: Potential Restoration Projects for Pelicans, Cormorants, and Gulls

PROJECT CONCEPTS	BENEFITS
Pelican Roost Site Protection in the Humboldt Bay area	**Brown Pelicans, cormorants, gulls**
South Spit of Smith River acquisition and management (57 acres of dune/sand)	Brown Pelicans, gulls, shorebirds, Snowy Plovers
Island Roost at Lake Talawa – building up the island above high water	Brown Pelicans, cormorants, gulls, Snowy Plovers, shorebirds, Aleutian Geese
Artificial Pelican Roosts – float at Samoa Bridge and tree in Crescent City Harbor	Brown Pelicans, cormorants, gulls,
Old Arcata Wharf Restoration – refurbishing and enlarging of abandoned wharf	Double-crested Cormorant, Brown Pelicans
South Spit of Humboldt Bay acquisition (627 acres of dune and salt marsh) – protection from disturbances	Snowy Plover, shorebirds, pelicans, human recreational. Use
Pelican roost at North Jetty on North Spit – cut off to create an island	Brown Pelicans
Pelican signs on South Spit – to reduce human disturbances	Brown Pelicans

After evaluating these projects using the initial and additional screening criteria, the Trustees have selected the Pelican Roost Site Protection project. Land acquisition and increasing the size of the island at Lake Talawa were deemed not cost effective; the South Spit of Humboldt Bay has recently been acquired and is being managed to protect the natural resources; and other projects are more proximal than the Crescent City project. The Trustees were recently informed that the Arcata Wharf project is potentially in conflict with federal resource agency goals to focus on more natural solutions. Protection of pelicans on the North Jetty and South Spit can be incorporated into the selected project described below.

Selected Project: Brown Pelican Roost Site Protection

The objective of this project is to protect Brown Pelican roost sites from human disturbance. Communal roost sites are essential for Brown Pelicans at all times of year throughout their range (Gress and Anderson 1983, Jaques 1994). Brown Pelicans are unlike many seabirds in that they have wettable plumage (Rijke 1970) and will become heavy and hypothermic in cold water if they do not come ashore regularly to dry and restore their plumage. Brown Pelicans spend a large portion of their daily time budget at terrestrial roosts. These birds have many behavioral adaptations, including careful habitat selection, in order to conserve energy, as they are among the heaviest flying birds (Pennycuik 1972).

Roost site selection is based on proximity to prey resources, isolation from potential predators and human disturbance, and microclimate features that aid in thermoregulation. The primary roost sites for Brown Pelicans in the western US are offshore rocks and islands on the outer coast, and sand islands within large estuaries (Briggs *et al.* 1987, Jaques 1994). Intense shoreline development, wetland filling, and other habitat alteration has eliminated much of the natural onshore roost habitat. Loss of historic roost habitat from human encroachment has been somewhat offset by the addition of artificial structures, such as jetties, breakwaters and floating structures. Pelicans now rely heavily on these types of structures for roost sites in California (Jaques *et al.* 1996). Pelicans spread out to a larger number of roosts by day and gather into a smaller number of highest quality roosts at night. Island-type habitat is generally required at night to protect them from disturbance. Major night roosts support hundreds to thousands of pelicans on a given night (Briggs and Chu 1987, Jaques and Anderson 1988, Jaques *et al.* 1996).

In the Humboldt Bay area, pelicans are most common in the fall. There are plentiful roosting locations within the bay during low tide on exposed mudflats. However, high tide roost sites are much more limited.

This project may partner with the Bureau of Land Management (BLM), State and local governments to protect pelican roosts in the Humboldt Bay area, as well as roost sites to the north in Del Norte County. The project will flexibly respond to disturbance issues as they arise or are anticipated. While specific measures will be tailored to the needs at each location, potential project elements include:

- Initial survey to identify vulnerable pelican roosts
- Public education and outreach via signs and educational materials
- Placement of buoys at strategic locations
- Protective fencing or signage
- Other measures to protect pelican roost sites
- Annual monitoring and adaptive management

Some of the locations targeted by the project may include locations around Humboldt Bay, Trinidad Head, and the mouths of rivers and streams (e.g., Elk, Eel, Smith, etc.). Some outreach and education elements of this project may be combined with Common murre colony protection efforts.

The Kure settlement funds allocated for this project total $250,000.

4.3.2.3 Scaling for Primary and Compensatory Restoration

As described in Section 4.3.2.1, the total injury to this restoration category was 1,020 lost bird-years. Initially, the Trustees focused on cormorant nesting for restoration scaling, estimating the increased number of bird-years derived from additional nests assuming the Old Arcata Wharf project would be implemented. Appendix F provides additional details regarding the bird REA for this project. Thereafter, the Arcata Wharf project was deemed infeasible and the Trustees replaced it with the Brown Pelican Roost Site Protection Project. The benefits that will be provided by the pelican roost-site protection project are difficult to quantify. However, the Trustees believe that funds recovered based upon the scaling of the Old Arcata Wharf project will be sufficient to pay for a range of adaptive protective measures that will provide adequate benefits to compensate for the injuries.

4.3.2.4 Environmental Consequences

Beneficial Effects

Protection of pelican roosts will have positive benefits to pelicans by reducing energy costs associated with commuting between prey and roosts, and with flushing and relocating due to human disturbance. Reducing energy expenditures should result in improved body condition of

individual birds, which should lead to increased juvenile and adult survival and increased reproductive success of pelicans.

Cormorants and gulls often roost and nest at the same locations where pelicans roost. To the extent that this occurs at locations protected by this project, these species will benefit as well.

Adverse Effects

This project will rely primarily on education and outreach, encouraging voluntary compliance to protect roosting pelicans. This project may restrict human access to small areas (e.g. tips of jetties) seasonally; any access restrictions will be carefully considered. Likewise, signs will be carefully designed and located so as not to detract from the natural beauty of any area.

4.3.2.5 Probability of Success

Education and awareness programs, including displays, signs, and brochures nearly always attract public attention. If done well, experience has demonstrated that such programs instill in the public new knowledge and appreciation of the subject considered. Informational and warning signs to protect seabirds are likely to reduce human behaviors that are detrimental to the resource.

4.3.2.6 Performance Criteria and Monitoring

The project will include on-going monitoring to guide project implementation and evaluate success. The primary performance criterion is the maintenance of an adequate supply of disturbance-free roost sites for all pelicans from Humboldt Bay to Crescent City.

4.3.2.7 Evaluation

The Trustees have evaluated this project against initial and additional screening criteria developed to select restoration projects (see Section 4.3.2.2) and concluded that this project is consistent with these selection factors. The Trustees determined that this type and scale of project would effectively compensate for injuries to pelicans, cormorants, and gulls and consequently have selected this project.

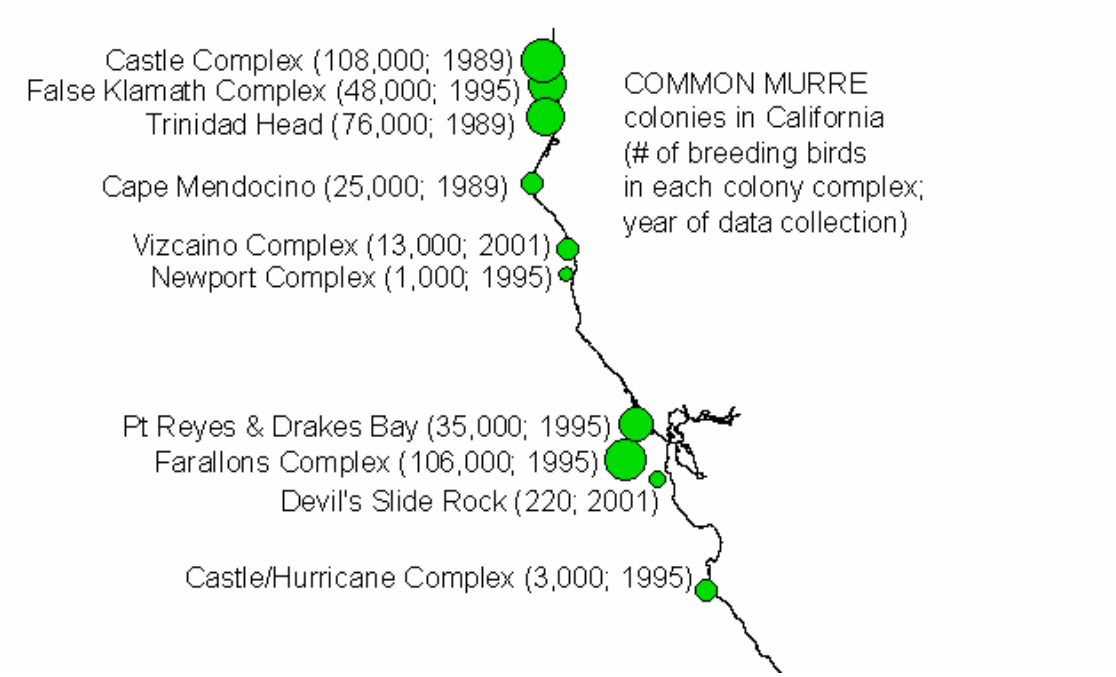
4.3.3 Common Murre, Other Alcids (except Marbled Murrelet) and Procellarid Injury and Restoration

This grouping of species includes alcids (except Marbled Murrelets) and procellarids. Alcids are small to medium-sized seabirds, resembling ducks or small penguins (although they are capable of flight). Alcids spend much of their lives at sea, where they swim on the surface and dive for fish. They typically nest in large colonies on cliff edges or in burrows on islands or remote headlands along the coast. Puffins are the most well-known members of the alcid family. Procellarids are highly pelagic seabirds resembling gulls. Procellarids spend most of their lives at sea, where they travel great distances soaring low over the waves, stopping to land on the water wherever food is available. They typically nest on remote islands or cliffs.

In addition to their highly pelagic habits and preference for remote nesting locations, alcids and procellarids have other similarities: they are among the longest-lived and slowest reproducing of all birds; some species rear only one chick a year (if they nest at all) and often live in excess of 20 or 30 years.

Within this grouping, the Common Murre accounts for the majority of all estimated mortalities. The Common Murre, despite its name, has a population that is well below historical levels. It is estimated that over a million birds once nested on the Farallon Islands alone (Carter *et al.* 2001). Beginning in the late 1800s, hunting, egging, human disturbance, and oil pollution took a tremendous toll on the birds. By 1959, less than 10,000 birds remained on the Farallon Islands. Since then, however, numbers have increased, although with some setbacks due to oil spills and gill-netting. Today, with gill-netting, hunting, and egging eliminated, most murre colonies in the State are either remaining steady or increasing towards historical levels.

To a large degree, the nesting colonies in California can be divided into two regions: northern California (encompassing Del Norte, Humboldt and Mendocino Counties) and central California (encompassing the Gulf of the Farallones region to Big Sur). From 1979-95, Common Murres were recorded breeding at 13 locations in northern California: Del Norte County (Castle Rock, Sisters Rocks, and False Klamath Rock); Humboldt County (Redding Rock, White Rock, Green Rock, Flatiron Rock, Blank Rock, Pilot Rock, False Cape Rocks, and Steamboat Rock); and Mendocino County (Rockport Rocks and Cape Vizcaino) (Carter *et al.* 2001). Since 1995, murres also have bred at Newport Rocks, Kibesillah Rock, and Goat Island Area in Mendocino County.



Focusing on the northern California colonies, Carter *et al.* (2001) note that "murres currently use much of the available and suitable breeding habitat on all large islands in Del Norte and Humboldt counties, although breeding densities could increase further." They then note that suitable locations that lack murre colonies are subject to human disturbance.

4.3.3.1 Injury Quantification

Over 400 birds in this species group were collected after the Spill (Table 4-8). Using a total dead-bird multiplier of slightly more than two, the total estimated dead was over nine hundred.

Table 4-8: Alcid (except Marbled Murrelet) and Procellarid Mortality from the M/V Kure Spill

Species	Collected Alive	Collected Dead	Total Collected	Total Estimated Dead
Alcids (Not Marbled Murrelets)				
Common Murre	192	117	309	
Cassin's Auklet	0	1	1	
Subtotal	192	118	310	719
Procellarids				
Northern Fulmar	14	92	106	191
TOTAL	**206**	**210**	**416**	**910**

Because population data were not available for every species, lost bird-years were calculated relying on the demographic characteristics of Northern Fulmar (*Fulmaris glacialis*) and Common Murre (for the alcids). See Appendix D for details. Table 4-9 contains the lost bird-years the Trustees calculated by applying the single-generation stepwise replacement approach described in the Methods section above.

Table 4-9: Estimated Bird-Year Loss of Alcids (except Marbled Murrelets) and Procellarids

Species Category	Total Estimated Dead	Bird-Year Multiplier	Total Lost Bird-Years
Alcids (non-MAMU)	719	7.25	5213
Procellarids	191	12.71	2428
TOTAL	**910**		**7641**

These lost bird-years represent the interim losses between the time of the Spill and return of these populations to pre-spill conditions. Thus, any restoration project benefiting this species group should seek to replace 7641 lost bird-years.

4.3.3.2 Restoration Alternatives

The Trustees did not identify any practicable restoration options for Northern Fulmars in California. While Northern Fulmars are common to abundant in offshore waters during winter, this species breeds in Alaska, Canada, Europe, and Asia. Instead the Trustees focused on Common Murres, one of the most severely impacted species (with respect to number of individuals oiled).

Restoration options exist for some of the other alcids besides Common Murres, although the projects brought to the Trustees' attention are relatively small and experimental in nature. Table 4-10 lists all projects considered to benefit this species group.

Table 4-10: Potential Restoration Projects for Alcids (except Marbled Murrelets) and Procellarids

PROJECT CONCEPTS	BENEFITS
Trinidad Seabird Colonies – re-colonization of Tufted Puffin at Green and Puffin Rocks	Tufted Puffin
Trinidad Seabird Colonies – re-colonization of Common Murre at Sea Lion Rock	Common Murre
Trinidad Seabird Colonies – enhance nesting habitats for Leach's Storm-Petrel at Little River and Prisoner Rocks	Leach's Storm-Petrel
Whaler Island Restoration (Crescent City Harbor) – re-establish it as a seabird colony	Leach's Storm-Petrel, Fork-tailed Storm-Petrel, Common Murre, Pigeon Guillemot, Cassin's Auklet, Western Gull
Human Disturbance Reduction Program – for Humboldt and Del Norte County seabird colonies	Common Murre, alcids (except Marbled Murrelet), storm-petrels
Cape Vizcaino Area seabird colonies – acquisition and management	Common Murre, alcids (except Marbled Murrelet), cormorants, gulls, Black Oystercatcher
Redding Rock murre re-colonization and protection	**Common Murre**

Because Common Murres represent the vast majority of birds in this category, and were determined by the technical working group to be a surrogate for all other species in this category, murre-related projects were retained and projects which do not benefit murres were screened out. After evaluating the projects using the initial and additional screening criteria, the Trustees have selected contribution to the restoration of a murre colony at Redding Rock. This project will restore murres at a location most proximate to the spill site and redress impacts caused from past and on-going human disturbance. In addition, it will benefit a highly impacted murre colony using restoration methods that are known to be effective.

Selected Project: Redding Rock Murre Re-colonization

This project is intended to restore a depleted Common Murre colony on Redding Rock, which is located 4 miles off Gold Bluff Beach in Humboldt County. This offshore rock is part of the California Coastal National Monument and is managed by BLM in cooperation with the Yurok Tribe. Redding Rock is of cultural importance to the Yurok Tribe which traditionally hunted California Sea Lions (*Zalophus californianus*) there. Common Murres nest on the rock, and California Sea Lions haul out on the rock. While murre numbers at most colonies in northern California have been stable or increasing, Redding Rock is a notable exception. Numbers of breeding murres were variable between 1979 and 1989 (ranging from 800–2,100 birds; Carter *et al.* 2001) but have declined since 1995. By 2002, few breeding murres were noted during aerial surveys. A detailed description of the decline of this colony requires counting several years of archived aerial photographs (1987 to 2002). Colony extirpation seems imminent due to the following causes: human disturbance by USCG crews that service the automated light; probable aircraft and boat disturbances; California Sea Lions hauling out high on the rock; and mortality from the 1997 *Kure* and 1999 *Stuyvesant* oil spills. Natural re-colonization or recovery likely will not occur in the near future without restoration efforts.

Restoration actions may include: a) cooperation between USCG, BLM, Federal Aviation Administration (FAA), CDFG, and other State and federal agencies to prevent human disturbance of murres during the nesting season and development of a site specific restoration plan to address protection from overflights and on-water disturbance using an adaptive approach relying primarily on education and voluntary compliance (if closures appear necessary, they will be implemented in accordance with the California Coastal National Monument Resource Management Plan and any other applicable requirements); b) installation of small barriers to keep California Sea Lions off the top areas of the rock (barriers have been used elsewhere for sea lions and topography at Redding Rock would assist their effectiveness); and c) use of social attraction techniques (e.g., decoys, recorded vocalizations, and mirrors) to attract murres to Redding Rock (especially recent breeders that are more likely to rapidly re-colonize). The education and outreach regarding disturbance at the rock may also include other murre breeding rocks in the vicinity. Monitoring would be achieved by aerial photography because the rock is located four miles from shore. By employing several restoration techniques in the next few years, permanent colony extirpation may be avoided and the colony should return to higher levels than seen since 1979, given the amount of suitable nesting habitat available.

The Kure settlement funds allocated for this project total $450,000.

4.3.3.3 Scaling for Primary and Compensatory Restoration

As Section 4.3.3.1 described, the total injury to this restoration category was 7,641 lost bird-years. For restoration scaling, the Trustees relied on data from the Devil's Slide Rock Common Murre Re-colonization Project off the Central California coast. This project has many similarities to the proposed Redding Rock project: 1) both projects seek to re-colonize murres to offshore rocks; 2) the potential colony size on each rock is quite similar; and 3) the techniques to be employed are identical.

Using data from the first seven years (1996–2002) of the Devil's Slide Rock project (Knechtel *et al.*, 2003), and assuming continued growth in colony size until maximum colony size is reached, such a project would generate 48,927 additional bird-years over the course of 100 years. Because 7641 bird-years were lost due to the Spill, approximately 16% of the 48,927 bird-years anticipated from the very similar Devil's Slide Rock project, the Trustees concluded that a 16% contribution to the Redding Rock project would be appropriate to compensate for the injury to these birds. Additional funding may be available from other oil spill damages (e.g., *Stuyvesant*) as well as other sources.

Appendix G provides additional details regarding the bird REA for this species group.

4.3.3.4 Environmental Consequences

Beneficial Effects

This project is designed to reestablish a Common Murre colony. In the long run, this will lead to an overall increase in the number of murres in Humboldt County, as well as an increase in the number of colonies. As a secondary benefit of this project, government agencies and the public

may develop a greater awareness regarding human disturbances at other seabird colonies in the vicinity.

Adverse Effects

The adverse impacts associated with this project are minimal. USCG's maintenance of the automated navigational light should not be affected. The USCG recently reached an agreement with BLM regarding the maintenance of the light. Under the terms, USCG maintenance will be scheduled for periods outside of the Common Murre nesting season and will seek to minimize disruption of the natural resources. California Sea Lions will continue to have access to much of the lower reaches of the rock, where the majority of sea lions haul out. If education and voluntary compliance measures fail and closures are warranted, any restriction of recreational fishing around the rock will be small and limited to the nesting season. If these measures appear necessary, they will be implemented in accordance with the Resource Management Plan developed by BLM, CDFG, and California State Parks for the offshore rocks included in the California Coastal National Monument and any other applicable requirements. Moreover, a balance will be sought between minimizing the impacts on the resource and preserving quality opportunities for recreation. Anglers and boaters from Humboldt Bay to Eureka will be notified of any buoys and restricted areas in order to minimize inconvenience.

4.3.3.5 Probability of Success

Social attraction techniques (e.g., the use of decoys) to reestablish a murre colony have been successfully used in central California. This project will replicate those techniques. Because murres have used Redding Rock in the recent past and because there are many murres in the area, the Trustees believe this project will be successful. The educational components of this project will likewise draw on materials and methods developed for a successful human disturbance reduction project in Oregon. By employing these restoration techniques in the next few years, permanent colony extirpation should be avoided and the colony should eventually return to the highest levels since 1979, given the amount of suitable nesting habitat available.

4.3.3.6 Performance Criteria and Monitoring

The project also contemplates 10 years of monitoring in order to measure increases in murre attendance at the rock. Because of the remote location of the rock, the monitoring will rely on aerial photographs and will not be able to measure nest productivity. This is a standard method for documenting murre breeding effort.

4.3.3.7 Evaluation

The Trustees have evaluated this project against initial and additional criteria developed to select restoration projects and concluded that this project is consistent with these selection factors. The Trustees determined that this type and scale of project would effectively provide appropriate compensation for injuries to murres, other alcids (except Marbled Murrelet), and Procellarids that occurred as a result of the Spill and consequently have selected this project.

4.3.4 .Marbled Murrelet Injury and Restoration

The Marbled Murrelet is a small-bodied seabird in the alcid family found along the Pacific Coast from Alaska to California. At sea, it feeds by diving for small fish in near-shore waters, typically within 5 km of the coastline. Unlike most alcids, the Marbled Murrelet nests up to 50 km (most within 30 km) inland in late-successional and old-growth coniferous forests. In California, it nests almost exclusively in redwoods older than 200 years (Nelson 1997). Like most alcids, the Marbled Murrelet is a long-lived slow-reproducing species, laying only one egg per year. Given these demographic characteristics, the vast majority of the population consists of breeding adults, whose survival is critical to sustaining the species (Beissinger 1995).

The Marbled Murrelet was federally listed as a threatened species in Washington, Oregon and California on September 28, 1992 (U.S. Fish and Wildlife Service 1992). The draft recovery plan was released on August 1, 1995 and the final recovery plan was released in 1997 (U.S. Fish and Wildlife Service 1997). The species is State listed as endangered in California and as threatened in Oregon and Washington (U.S. Fish and Wildlife Service 1997). Timber harvest in nesting habitat was the primary reason for listing the species (U.S. Fish and Wildlife Service 1992).

The recovery plan recommends implementing the following short-term actions to stabilize and increase the population: (1) maintain all occupied nesting habitat on federal lands administered under the Northwest Forest Plan (USDA Forest Service and U.S. Bureau of Land Management 1994); (2) on non-federal lands, maintain as much occupied habitat as possible and use the Habitat Conservation Planning process to avoid or reduce the loss of this habitat; (3) maintain potential and suitable habitat in large contiguous blocks; (4) maintain and enhance buffer habitat surrounding occupied habitat; (5) decrease adult and juvenile mortality; and (6) minimize nest disturbances to increase reproductive success. The recovery plan also recommends implementing the following long-term actions to stop population decline and increase population growth: (1) increase the amount and quality of suitable nesting habitat; (2) decrease fragmentation by increasing the size of suitable stands; (3) protect “recruitment” nesting habitat to buffer and enlarge existing stands, reduce fragmentation, and provide replacement habitat for current suitable nesting habitat lost to disturbance events; (4) increase speed of development of new habitat; and (5) improve and develop north/south and east/west distribution of nesting habitat. The recovery plan identifies six Marbled Murrelet Conservation Zones throughout the listed range. The Kure Spill occurred outside the entrance to Humboldt Bay within Marbled Murrelet Conservation Zone 4 (Zone 4). Zone 4 extends from North Bend, Coos County, Oregon, south to the southern end of Humboldt County, California.

The 2007 population estimate for Zone 4 is 3,791 birds, with a 95 percent confidence interval of 2,687 to 7341 (USFWS 2007). Fecundity can be estimated from juvenile-to-adult ratio data gathered during monitoring at-sea or from individual reproductive histories gathered from radio telemetry work. Current estimates using both techniques suggest that the population in Zone 4 is declining (Beissinger and Peery 2003; Beissinger 1995). The majority of Marbled Murrelets in California breed in the coastal redwoods of Del Norte and Humboldt Counties. A relatively isolated population of approximately 500 birds breeds in the Santa Cruz Mountains in San Mateo and Santa Cruz Counties of central California (Peery *et al.* 2002). A small number of birds may

also nest at scattered locations in Mendocino County (Thomas Hamer, personal communication). In winter, some Marbled Murrelets appear to move away from their breeding areas and can be regularly found along the coast as far south as Pt. Sal (Peery *et al.* 2002).



In addition to loss of nesting habitat due to logging, potential causes of murrelet decline include nest predation by corvids (e.g., ravens, jays) and other predators, oil spills, marine pollution, and possibly prey availability as a function of oceanographic events (U.S. Fish and Wildlife Service 1997; Nelson 1997). Predation of eggs and chicks is a major cause of nest failure (Nelson and Hamer 1995). Nelson and Hamer (1995) further predict that even small increases in predation can have deleterious effects to population viability due to the Marbled Murrelet's low reproductive rate.

In northern California, availability of nesting habitat is widely thought to be a limiting factor on the Marbled Murrelet population and the primary reason for its decline (Ralph *et al.* 1995; Miller *et al.* 1997). When logging occurs in nesting habitat, displaced Marbled Murrelets do not "pack" into the remaining good habitat at higher densities (Burger 2001; Miller *et al.* 2002). In fact, Marbled Murrelet nesting densities or other standardized observations of nesting birds are remarkably constant within forest types, even after logging of nearby nesting habitat occurs (Burger 2002; Burger and Tillmanns 2002; Conroy *et al.* 2002). Meyer and Miller (2002) report that displaced birds continue to use small forest fragments for several years before abandoning the area. Because these locations are marginal, breeding success is likely lower and the displaced subpopulation fails to sustain itself and is eventually lost after several years (Miller *et al.* 2002).

4.3.4.1 Injury Quantification

Nine Marbled Murrelets were collected as a result of the Spill (Table 4-11). Using a 14.4 dead bird multiplier, the Trustees estimated total mortality at 130 individuals. This is higher than the multiplier calculated for most other birds killed in the Spill. As noted above, Marbled Murrelets are small-bodied birds. This makes their carcasses difficult to find for human searchers and easily removed by scavengers.

Table 4-11: Marbled Murrelet Mortality from the M/V Kure Spill

Species	Collected Alive	Collected Dead	Total Collected	Total Estimated Dead
Marbled Murrelet	0	9	9	130

4.3.4.2 Restoration Alternatives

Table 4-12 lists the restoration concepts considered by the Trustees.

Table 4-12: Potential Restoration Projects for Marbled Murrelets

PROJECT CONCEPTS	BENEFITS
Preservation of old growth/residual habitat at risk of logging	**Marbled Murrelet**
Corvid management programs	**Marbled Murrelet**
Silviculture of second growth forest to create nesting habitat	Marbled Murrelet
Captive breeding	Marbled Murrelet
Artificial nest platforms	Marbled Murrelet

Captive breeding, silviculture and the use of artificial nests are relatively untested concepts and were therefore not considered by the Trustees to be projects having a relatively high likelihood of success. In general, restoration options for Marbled Murrelets are limited by the lack of information on the survival and reproductive requirements of the species, as well as its unusual life history.

After evaluating these projects using the initial and additional screening criteria, the Trustees have selected the remaining two projects for murrelet restoration. The first, preservation and management of old growth habitat, will provide permanent protection from potential logging and enhance murrelet nesting habitat. The second, corvid management, will maintain or increase murrelet nest productivity in the region.

Selected Project: Preservation/Management of Murrelet Habitat

The Trustees considered three different projects that included preservation of old growth forest: (1) contribution to the acquisition and management of the Grizzly Creek Marbled Murrelet Conservation Area (MMCA) located in Humboldt County; (2) acquisition of a parcel located near Redwoods National Park in Del Norte County owned by Green Diamond Resource Company and commonly referred to as “W-530”; and (3) a conservation easement on parcels containing old growth stands owned by Green Diamond Resource Company and commonly known as the "Big Mynot/E.F. Hunter Complex” in Del Norte County.

The Grizzly Creek MMCA was set aside in the 1999 Pacific Lumber Company Habitat Conservation Plan for a period of five years to provide an opportunity for acquisition and

permanent protection of the MMCA by the United States and/or the State of California. A portion of the MMCA was acquired by the State in 1999, and in 2003, the California Wildlife Conservation Board (WCB) purchased the remaining 600 acres with the understanding that funds for Marbled Murrelet habitat protection obtained through settlement of the Kure case might be available to replace at least a portion of the WCB funds used for this purchase.[6] The 600 acres includes 328 acres of residual redwood forest and 24 acres of un-entered old growth redwood forest.

Kure representatives proposed the acquisition of W-530, a 217-acre parcel containing 32 acres of old growth redwood located immediately to the east of Redwoods National Park, to be managed for its natural resource values. Although proximate to the National Park, the bulk of the W-530 parcel is separated from the National Park by a power line easement which is subject to periodic clearing, creating an "edge" effect. Although the W-530 parcel is of potential value as Marbled Murrelet habitat, the Trustees determined that it was not of sufficient size and quality to adequately compensate for the injuries to this species.

The Big Mynot/E.F. Hunter Complex project involves purchase of a conservation easement over two parcels containing two of the largest remaining old growth stands in private ownership in Northern California. Under this easement, Green Diamond Resource Company would agree to refrain from timber harvesting and other disturbance-causing activities in these stands as well as in the specified buffer areas (second growth forest) around the stands. Furthermore, Green Diamond Resource Company would agree to management practices (carried out by the Trustees or their representatives) for the enhancement of Marbled Murrelet habitat and reproduction in the parcels. The subject parcels are considered to be occupied by Marbled Murrelets and, together, contain approximately 77 acres of un-entered old growth redwood forest. A total of 222 acres of surrounding buffer areas would be included in the easement to protect the old growth stands. The conservation easement would be held by a non profit organization whose purposes include the protection and enhancement of old growth redwood forests. The Trustees would have the right to enforce the terms of the easement.

The Trustees prefer the Big Mynot/E.F. Hunter Complex project to the W-530 proposal because it contains 45 more acres of un-entered old growth and provides superior Marbled Murrelet habitat. They prefer the Big Mynot/E.F. Hunter Complex project to the MMCA project because it is more cost-effective and because the Green Diamond properties are at greater threat of harvesting than the MMCA.

Selected Project: Corvid management at Redwood National and State Parks and vicinity This project would contribute to on-going management efforts to limit anthropogenic food sources

[6] The CDFG advised the WCB that any use of recovered funds would be conditioned upon the Trustees' compliance with the Oil Pollution Act's requirement for "adequate public notice, opportunity for a hearing, and consideration of all public comments," prior to finalizing and implementing a restoration plan for the spill. The CDFG also advised the WCB that: 1) any settlement of the Trustees' claims for natural resource damages will be set forth in a judicial consent decree which is also subject to public comment before the court will enter it as a judgment; and 2) the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) apply to the approval of the restoration plan of which projects to address Marbled Murrelet injuries would be a component.

that result in unnaturally large corvid (*i.e.*, Steller's Jay (*Cyanocitta stelleri*), Common Raven (*Corvus corax*), and American Crow (*Corvus brachyrhynchos*)) populations. In addition, as a form of adaptive management, the possible removal of certain ravens will be considered based on an evaluation of the results of the food source removal actions. The specific method of raven removal and any required permits or environmental compliance will be completed by the implementing agency (National Park Service and/or California Department of Parks and Recreation). Corvids are some of the primary nest predators of Marbled Murrelets (Nelson 1997; Brand and George 2000). Nelson (1997), in discussing murrelet fecundity in general, notes:

> Predators contribute substantially to nest failure in North America (43% of 32 nests, Nelson and Hamer 1995; 71% of 14 nests, I. Manley pers. comm.). Eggs may be preyed on when nests are neglected for short periods of time or abandoned, or if adult is chased off nest. Adults are vulnerable during incubation and during flights to nests. Chicks may be preyed on anytime during the 27-40 days they are along [*sic*] in the nest.
>
> Avian predators (1) of eggs: include Common Ravens (*Corvus corax*) and Steller's Jays (*Cyanocitta stelleri*), (2) of chicks: include Common Ravens, Steller's Jays, and Sharp-shinned Hawks (*Accipiter striatus*), (3) of adults on nest: include Common Ravens and Sharp-shinned Hawks, and (4) of adults flying in forests: include Peregrine Falcon (*Falco peregrinus*); Singer *et al.* 1991, Marks and Naslund 1994, Nelson and Hamer 1995, D. Suddjian pers. Comm..).

Raven predation of endangered species is not a new problem. It has been widely documented in the Mojave Desert with respect to the Desert Tortoise (*Gopherus agassizii*). In that context, a comprehensive program to address anthropogenic food sources that support ravens is being recommended to supplement lethal control efforts (Boarman 2002). The problem of corvid management has also been addressed in a recent statewide Corvid Management Plan, which reviews many potential management options (Liebezeit and George 2002).

The Kure settlement funds allocated for the corvid management project total $750,000.

4.3.4.3 Scaling for Primary and Compensatory Restoration

For Marbled Murrelets, as with the other bird species groups, the Trustees used a REA approach for scaling the appropriate size of a restoration project. Because Marbled Murrelets are a declining species, this REA differed from the others in how lost and gained bird-years were calculated. The Trustees' framework for scaling restoration included: (1) a population model to quantify lost bird-years due to the Spill, and (2) a nest model to examine the benefits, in terms of gained bird-years, from protecting nests via land acquisition (see Appendix H for a more detailed description). The injury model was based upon a similar life-cycle as used by Beissinger (1995) and Beissinger and Nur (1997). It incorporated a density-dependent mechanism, whereby birds preferentially (but not exclusively) nested in higher quality versus lower quality old-growth habitat. Bird-year loss was measured by projecting the number of females in the local population over the recovery period under injured and uninjured scenarios.

A nest-based model was used to assess the number of highly productive nests that would need to be protected in order to compensate for the injury. A productive nest was defined as one where murrelets were nesting at a "stationary fecundity" (i.e., nest productivity was sufficiently high to

offset losses due to natural mortality/survivorship). The benefit of the land acquisition project was assumed to be the difference between (1) the numbers of birds in the population over time as a result of having active nests at a highly productive "acquisition site" versus (2) the fate of those same birds and their offspring nesting at a much less productive "alternative" site. This simulated murrelets having to find new nesting areas after their current habitat is removed (due to logging).

Because of uncertainty in Marbled Murrelet demographics (e.g., survivorship, fecundity), the Trustees examined a wide range of plausible scenarios when scaling restoration. Results suggest that *more than* 13 highly productive nests would need to be protected from imminent logging in order to compensate for the mortality resulting from the Spill.

The Trustees believe that protection, enhancement, and management of the Big Mynot/E.F. Hunter parcels (for Marbled Murrelets) will compensate for the Marbled Murrelet injury under optimistic assumptions. Because there are considerable uncertainties regarding the actual benefits from protecting nests within the parcels, e.g., we don't know whether or not more than 13 nests with stationary fecundity exist in these parcels, the Trustees also believe that a contribution to on-going corvid management efforts in the Redwood National and State Parks and vicinity, is important for full compensation for injuries to murrelets.

4.3.4.4 Environmental Consequences

Beneficial Effects

The Big Mynot/E.F. Hunter Complex project will protect nesting Marbled Murrelet habitat and guarantee that it remains in existence primarily for the benefit of Marbled Murrelets in the future. It is known that murrelets have nested within the Big Mynot/E.F. Hunter parcels and that they would not be able to do so if the area were logged.

The corvid management project is intended to improve Marbled Murrelet nest success through a decrease in predation caused by ravens, crows, and jays. Sustaining the Marbled Murrelet population through the next few decades will enable future murrelets to access increasing amounts of protected old growth forest and second growth forest as it matures into suitable nesting habitat.

Because campgrounds are located near the largest old growth trees, many known nesting stands with the highest Marbled Murrelet activity are near campgrounds. To the extent that the campgrounds serve as source populations for jays and ravens, the project may considerably lower corvid numbers in areas adjacent to the campgrounds as well. Consequently, those Marbled Murrelets beyond the immediate vicinity of the campgrounds may also benefit from the project.

The educational components of the corvid management project will teach the public about imbalances in the ecosystem that may be caused as different species respond positively and negatively to human actions. Specifically, the public will learn how seemingly innocuous interactions with wildlife (e.g., feeding jays at a picnic table) or poor housekeeping at a campsite (e.g., leaving a bag of chips on a table) sustains corvid populations at unnaturally high levels,

which in turn can have long-term negative consequences for the Marbled Murrelet. The educational message may carry beyond the campgrounds to local residences and other human gathering places, resulting in increased awareness at those locations as well. From a recreational standpoint, an additional benefit to campers from the corvid management project is enhanced aesthetic appeal of campgrounds due to improved garbage control.

Adverse Effects

With respect to the Big Mynot/E.F. Hunter Complex project, there are no obvious adverse impacts to wildlife or habitat provided that the habitat is managed according to approved Marbled Murrelet habitat management guidelines.

With regard to the corvid management program, this project will have direct impacts upon both campers at campground and picnic areas and upon corvids and possibly other animals that scavenge food waste at these sites. Campers will be made more aware of existing rules and restrictions upon their food management and could face potential enforcement action should they fail to comply. While corvids and other animals such as raccoons will not be trapped and removed, they will likely experience a reduction in their available food supply. For corvids, this may lead to decreased fledgling survival and lower reproductive success. These adverse impacts are an inevitable part of the transition from artificially (through human activities) elevated population levels to lower, more natural, population levels. Corvids, raccoons, and other animals currently living outside of the campgrounds are not likely to be impacted. If, in the future, the project implementers contemplate the augmentation of this project by removing corvids, additional environmental review will occur, including consideration of any adverse effects.

4.3.4.5 Probability of Success

The probability of success of the Big Mynot/E.F. Hunter Complex project is high. Similar land protection/management projects have been done in the past (e.g., by the Apex Houston Oil Spill Trustee Council) and such lands remain protected and still contain nesting Marbled Murrelets. There is no reason to expect Marbled Murrelets will abandon suitable nesting habitat where there is low disturbance.

The success of the corvid management project will depend on several linkages: the link between project tasks and an actual reduction in food waste; the link between a reduction in food waste and an actual reduction in corvid numbers; and the link between a reduction in corvid numbers and an actual reduction in nest predation.

The first two linkages have been demonstrated at other campgrounds dealing with bear problems. For example, daily camper education, constant enforcement, and improved food waste receptacles at Yosemite National Park substantially limit the amount of food available to wildlife. In the Santa Cruz Mountains, corvid density has been correlated with the level of campground occupancy (D. Suddjian, David Suddjian Biological Consulting, personal communication). The elevated corvid levels at campgrounds and picnic areas suggest that corvids depend on human food waste, and thus corvid numbers may be reduced by a reduction in food waste.

The final link between corvid numbers and actual nest predation is difficult to measure directly, as Marbled Murrelet nests are difficult to find and study. However, experiments with artificial eggs have found that predation pressure declines with decreasing corvid density (Raphael *et al.* 2002). Thus, the project has a reasonable probability of success.

4.3.4.6 Performance Criteria and Monitoring

These projects will include several years of monitoring. In the Big Mynot/E.F. Hunter parcels, surveys for Marbled Murrelet presence will be conducted for 22 years. At the locations for the corvid management programs, surveys of corvids, relative to control locations, will be conducted.

4.3.4.7 Evaluation

The Trustees have evaluated these projects against initial and additional screening criteria developed to select restoration projects and concluded that these projects are consistent with the selection factors. The Trustees have determined that this type and scale of projects will effectively provide appropriate compensation for Marbled Murrelets injured as a result of the Spill and consequently have selected these projects.

4.3.5 Waterfowl Injury and Restoration

This group includes at least seventeen waterfowl species. White-winged Scoter (*Melanitta fusca*), Surf Scoter (*Melanitta perspicillata*), and American Coot (*Fulica americana*) account for 83% of the birds collected at the Spill within this category. Most of these species do not breed in the vicinity of the Spill, but are winter visitors to the area. Their nesting grounds are often far to the north or far inland (e.g., boreal lakes for scoters).

4.3.5.1 Injury Quantification

There were 226 spill-related birds collected in this species group (Table 4-13). Using a total dead-bird multiplier of slightly less than two, the total estimated dead was 414.

Table 4-13: Waterfowl Mortality from the M/V Kure Spill

Species	Collected Alive	Collected Dead	Total Collected	Total Estimated Dead
White-winged Scoter	64	22	86	
Surf Scoter	39	40	79	
American Coot	8	15	23	
Greater Scaup	3	4	7	
Green-winged Teal	0	5	5	
American Wigeon	0	3	3	
Lesser Scaup	2	1	3	
Northern Shoveler	0	2	2	
Brant	0	2	2	
Bufflehead	1	1	2	
Northern Pintail	0	2	2	
Ruddy Duck	0	1	1	
Black Scoter	0	1	1	
Gadwall	0	1	1	
Muscovy Duck	1	0	1	
Red-breasted Merganser	0	1	1	
Tundra Swan	1	0	1	
Unknown Duck	0	3	3	
Unknown Scoter	0	3	3	
TOTAL	**119**	**107**	**226**	**414**

Because population data were not available for every species, lost bird-years were calculated relying on the demographic characteristics of an average of scoter species, as described in Sperduto *et al.* (1999). See Appendix D for details. Table 4-14 presents the lost bird-years the Trustees calculated by applying the single-generation stepwise replacement approach as described in the Methods section above.

Table 4-14: Estimated Bird-Year Loss of Waterfowl

Species Group	Total Estimated Dead	Bird-Year Multiplier	Total Lost Bird-Years
Waterfowl	414	2.59	1072

These lost bird-years represent the interim losses between the time of the Spill and return of these populations to pre-spill conditions. Thus, any restoration project benefiting this species group should seek to replace 1,072 lost bird-years.

4.3.5.2 Restoration Alternatives

Because these species are associated with wetlands (either directly or indirectly), the Trustees considered a wide variety of project concepts to restore wetlands in the Humboldt Bay area. Many of these projects aim to restore converted pasture lands back to tidally-influenced salt marsh habitat. Additionally, several projects focused directly on certain species of birds. Table 4-15 lists all the projects considered.

Table 4-15: Potential Restoration Projects for Waterfowl

PROJECT CONCEPT	BENEFITS
Tract 20 acquisition (302 acres of tidelands) for Humboldt NWR – protection from oyster culture	Eelgrass, mudflats, shorebirds
Hunt Ranch acquisition (74 acres of diked agricultural land) and conversion back to wetlands	Salt marsh, mudflats, shorebirds, wetlands
Eel River Wildlife Area acquisition (up to 3,000 acres of nearby agricultural land) and conversion to wetlands	Wetlands (brackish, estuary, and freshwater)
Mad River Slough Wildlife Area acquisition (up to 1,000 acres of nearby agricultural land) and conversion to wetlands	Wetlands (brackish, estuary, and freshwater)
Old Arcata drive-in theatre acquisition (25 acres) and conversion to wetlands	Wetlands (freshwater)
White Slough Field at Humboldt Bay NWR – restore tidal action w/ setback levee	Eelgrass, salt marsh, shorebirds
North Spit eelgrass bed restoration – remove fill on 10 acres	Eelgrass
North Bay eelgrass bed restoration – remove oyster shell debris on 100 acres	Eelgrass
Hookton Slough restoration – move levee to restore tidal action to 140 acres	Salt marsh, mudflat, shorebirds, wetlands, possibly eelgrass
McDaniel Slough restoration – remove tide gate and move levee to restore tidal action	**Saltmarsh, mudflat, shorebirds, wetlands**
Bayview/Schmidbauer acquisition (290 acres of diked agricultural land) – restore to wetlands	Salt marsh, mudflat, shorebirds, wetlands, possibly eelgrass
Industrial shoreline enhancement – re-establish “natural” shoreline	Shorebirds
Shorebird viewing blinds and signs – s. of Samoa Bridge	Shorebirds, human rec. use
Tide gate improvements – to restore some tidal action to various streams	Fish (Tidewater Goby, Coho Salmon); waterfowl
Table Mountain heron/egret rookery acquisition (4 acres w/ 60 pairs) for Humboldt Bay NWR	Herons, egrets
Promotion of shellfish areas – to establish more shell fish areas	Scoters, waterfowl
On-water seaduck roosting zones – protection from disturbance	Scoters, waterfowl

After evaluating these projects using the initial and additional screening criteria, the Trustees have selected a contribution to the McDaniel Slough Wetland Enhancement project. All of the projects except Hookton and McDaniel Slough were originally screened out for various reasons. For example, some of them would have benefited only a single or narrow range of resources whereas the selected project will provide multiple resource and service benefits. In addition, several would have benefited mostly brackish or freshwater habitats, or eelgrass habitats which were not among those habitats injured by the Spill. McDaniel Slough project will provide resource benefits very similar to those anticipated from the Hookton Slough project, but in a more cost-effective and timely manner, and with identified partnering funds. Contributing to this project’s cost-effectiveness is the fact that the McDaniel Slough project also benefits the Human Recreational Use injury category discussed in Section 4.3.8.

Selected Project: McDaniel Slough Wetland Enhancement

The McDaniel Slough Wetland Enhancement Project is described in detail in the Environmental Impact Report (EIR) prepared by the City of Arcata (City of Arcata, 2006). The project is planned for a 240-acre parcel of land located at the southwest corner of the City of Arcata and owned by the State of California and the City of Arcata. The property consists of Humboldt Bay tidelands that were diked and drained approximately 100 years ago. Because tidal gates at the

mouth of McDaniel Slough restrict tidal flow into the area, the existing habitat is a mixture of seasonally wet agricultural fields and a small amount (approximately 6 percent) of riparian habitat or marsh. To restore the tidal connection between Humboldt Bay and 200 acres of the site, the tide gates at McDaniel Slough will be removed to create a breach in the bay-front levee. Portions of existing interior levees along McDaniel Slough would be removed to improve marshplain drainage and habitat transition and new levees would be constructed around the project site perimeter. Approximately 30,000–40,000 cubic yards of suitable excavated soil will be graded onto 20–27 acres of low elevation areas within the project area to build up the marsh plain and accelerate the development of the desirable pickleweed habitat elevation.

Kure settlement funds totaling $420,000 have been allocated to the McDaniel slough project. This total includes contributions to compensate for injuries to waterfowl, shorebirds, and shoreline habitat, and for lost recreational use.

4.3.5.3 Scaling for Primary and Compensatory Restoration

As Section 4.3.5.1 described, the total injury to this restoration category was 1,072 lost bird-years. Because these species use Humboldt Bay wetlands and associated habitats primarily as a winter foraging area and not as a breeding area, restoration scaling could not be based on increased nesting, fecundity, or some related measure of reproductive success. Instead, the scaling was based upon potential bird use, as measured in bird user-days.

Construction of the McDaniel Slough project began in 2007. The EIR predicts rapid colonization of the intertidal area within the project within the first ten years, because the site has suitable elevations for colonization and a nearby source of estuarine sediment. After 50 years, a mature marshplain will develop throughout the area below mean higher high water (City of Arcata 2006). For the purpose of restoration scaling, the Trustees assumed that (1) bird usage will increase gradually beginning in 2009, to reflect subtle increases in the local population sizes as a result of habitat restoration; and (2) the project will have a 50-year effective life. Combining these assumptions with waterfowl density estimates from CDFG surveys in Humboldt Bay, the Trustees calculated that McDaniel Slough would generate 33,626 additional waterfowl user-days per acre of waterfowl habitat provided. Assuming that 391,375 waterfowl user-days (i.e., 1,072 waterfowl-years) were lost due to the Spill, a contribution of 11.6 acres to the McDaniel Slough project would be appropriate to compensate for losses to waterfowl.

Additional acres of wetland restoration will be required to compensate for injuries to shorebirds (see Section 4.3.6) and shoreline habitat (see Section 4.3.7). Appendix I provides additional details regarding the REA for the waterfowl species group.

4.3.5.4 Environmental Consequences

Beneficial Effects

The McDaniel Slough project will restore 200 acres of salt marsh habitat, creating a mosaic of vegetated habitats, mudflats, tidal sloughs, and other intertidal wetlands. This habitat restoration will benefit a wide variety of birds including egrets, waterfowl, shorebirds, and other wetland

species by providing food, shelter, and nest sites. Some portions of the existing levee that borders the McDaniel Slough/Janes Creek channel will be left in place to serve as roosting islands for birds. The project provides an important linkage between bird habitat on the City's Arcata Marsh Sanctuary and habitat on the CDFG's Mad River Slough Wildlife Area. Invertebrate and fish species associated with salt marsh habitats will benefit from the increased amount of aquatic and intertidal habitat. The removal of the tide gates will also permit upstream and downstream migration of anadromous fish. The proposed project includes trails, wildlife viewing structures, benches, and information kiosks that will provide recreational and educational benefits in addition to the ecological benefits provided by the habitat restoration.

Adverse Effects

The environmental effects of the project are described in detail in the EIR (City of Arcata 2006), along with mitigation strategies for potential adverse effects. There will be a permanent change in the type of habitat at the site from terrestrial or seasonally wet habitat to tidal wetland habitat, which may adversely affect terrestrial wildlife species. Tidal wetlands will replace freshwater or brackish wetlands. These impacts are mitigated by the large amount of tidal habitat that will be restored and by the creation of 40 acres of brackish and freshwater ponds on the 40 acres of the project area that are not being restored to tidal action.

4.3.5.5 Probability of Success

This project has a high probability of success because it relies on proven techniques. Much of the restoration will occur over time through natural processes as tidal flows return to the area after the tide gates are removed and the levee is breached. The probability of successful restoration to tidal marsh will be increased by placing 30,000–40,000 cubic yards of suitable excavated soil onto 20–27 acres of low elevation areas within the project area to build up the marsh plain. The experience and cooperativeness of the landowners also increase the probability of success, as does the amount of planning that has already taken place in preparation of the EIR.

4.3.5.6 Performance Criteria and Monitoring

This project will include annual monitoring regarding vegetation type and bird use to document the re-creation of salt marsh habitat. Presence of plant and bird species associated with salt marsh will indicate successful restoration.

4.3.5.7 Evaluation

The Trustees have evaluated this project against initial and additional screening criteria developed to select restoration projects and concluded that this project is consistent with these selection factors. The Trustees determined that this type of project would effectively provide appropriate compensation for wetlands birds (as defined above) injured as a result of the Spill and consequently have selected this project.

Additionally, as will be described below, the Trustees determined that this type of project would also provide compensation for shorebirds, shoreline habitat, and recreational uses injured as a

result of the Spill. The Trustees' total financial contribution toward the project will compensate for all four categories of injury: waterfowl, shorebirds, shoreline, and human recreational use.

4.3.6 Shorebird Injury and Restoration

This group includes at least nine shorebird species. Dunlin account for 84% of the birds collected at the Spill within this category. Similar to the injured waterfowl, most of these species do not breed in the vicinity of the Spill, but are winter visitors to the area. Their nesting grounds tend to be either far to the north (e.g., northern Alaska or Canada for Dunlin) or far inland.

4.3.6.1 Injury Quantification

There were 58 birds collected in this species group (Table 4-16). Using a total dead-bird multiplier of 35, the total estimated mortality was 2,033. The relatively high multiplier (compared to some other bird groupings) was the result of the small size of the shorebirds, combined with low detection probability as dying birds retreated to nearby marsh vegetation making it very difficult for human searchers to find carcasses.

Table 4-16: Shorebird Mortality from the M/V Kure Spill

Species	Collected Alive	Collected Dead	Total Collected	Total Estimated Dead
Dunlin	41	8	49	
Virginia Rail	2	0	2	
Black Turnstone	0	1	1	
Least Sandpiper	1	0	1	
Long-billed Dowitcher	0	1	1	
Marbled Godwit	0	1	1	
Sanderling	1	0	1	
Western Sandpiper	1	0	1	
Willet	0	1	1	
TOTAL	**46**	**12**	**58**	**2033**

Because population data were not available for every species, lost bird-years were calculated relying on the demographic characteristics of Dunlin, as described in Warnock and Gill (1996). See Appendix J for details. Due to the relatively low numbers of birds collected in this species group (except for Dunlin), further refinement of the demographic assessment would yield little change in the final restoration scaling results. Table 4-17 presents the lost bird-years the Trustees calculated by applying the single-generation stepwise replacement approach as described in the Methods section above.

Table 4-17: Estimated Bird-Year Loss of Shorebirds

Species Group	Total Estimated Dead	Bird-Year Multiplier	Total Lost Bird-Years
Shorebirds	2033	2.83	5753

4.3.6.2 Restoration Alternatives

The shorebird species, like waterfowl, are associated with local wetlands (either directly or indirectly), primarily with the intertidal mudflat component of these wetlands. The Trustees thus considered the same project concepts for shorebirds as was considered for waterfowl. McDaniel Slough Wetland Enhancement project was again selected due to: (1) the likely benefits to shorebird resources; and (2) the opportunity to provide for timely restoration. See Section 4.3.5.2 for a detailed list of restoration alternatives and a description of the McDaniel Slough project.

Kure settlement funds totaling $420,000 have been allocated to the McDaniel Slough Wetland Enhancement project. This total includes contributions to compensate for injuries to waterfowl, shorebirds, and shoreline habitat, and lost recreational use.

4.3.6.3 Scaling for Primary and Compensatory Restoration

The total injury to this restoration category was 5753 lost bird-years. Like waterfowl, the shorebird species use Humboldt Bay wetlands and associated habitats primarily as a winter foraging area and not as a breeding area. As a result, restoration scaling could not be based on increased nesting, fecundity, or some related measure of reproductive success. Instead, the Trustees used the same "bird user-day" approach to restoration scaling that was used in Section 4.3.5.3 for waterfowl.

The Trustees expect that the McDaniel Slough project will provide benefits to shorebirds over a similar timeline as assumed for waterfowl in Section 4.3.5.3. Based upon the calculations outlined in Appendix J, the McDaniel Slough project would generate 558,549 additional shorebird user-days per acre of shorebird habitat restored. This accounts for the higher densities of shorebird usage in Humboldt Bay (compared to waterfowl). Assuming that 2,099,987 bird-days (*i.e.*, 5,753 lost bird-years) were lost due to the Spill, a contribution of 3.8 acres to the McDaniel Slough project would be appropriate to compensate for losses to shorebirds.

4.3.6.4 Environmental Consequences

The environmental consequences of the McDaniel Slough project are outlined under Section 4.3.5 (above), along with an assessment of the probability of success, a description of performance criteria and monitoring, and a general evaluation of the project.

4.3.7 Shoreline Habitat Injury and Restoration

The shoreline impacts of the Spill were concentrated within the Humboldt Bay complex. The Trustees evaluated shoreline impacts to four categories of habitats: (1) tidal mudflats, (2) intertidal wetlands, (3) riprap shoreline; and (4) sand and gravel beaches. *Tidal mudflats* and associated eelgrass beds support diverse fish and macro invertebrate communities, as well as provide highly productive year-round foraging habitats for wading birds and shorebirds. *Intertidal wetlands* are the source of much of the primary productivity, nutrients, and invertebrate biomass. In addition to benefiting fish, these wetlands help support the large

numbers of birds that use the bay as a wintering area and migratory staging area. *Riprap shoreline* consists of artificial structures that are home to many mussels, snails, other invertebrates, and certain shorebirds. *Sand and gravel beaches* host a variety of invertebrate organisms in their intertidal zones, drier areas of the upper beach, and in the wrack (e.g., "seaweed" stranded on the beach). These invertebrates are an important source of food for many shorebirds (e.g., Dunlin).

The likelihood of exposure of invertebrates to oil in these areas is high. These animals actively feed on the surface of rocks, sand, mud, or other soil. Invertebrates feeding at these oiled surfaces would easily be exposed to the oil itself, or a waterborne fraction, through external contact, respiration, and ingestion. New animals would be exposed as stranded oil was lifted from one area and transported to new locations. Some animals were likely lost due to smothering wherever oil stranded on the beach. Polychaetes were probably exposed to some waterborne fraction, but are generally resistant to small amounts of oil.

In addition to oiling, the necessary removal of oiled wrack from beaches during the clean-up process decreases the abundance of detritus and decaying organic matter available for shelter and food. This would cause immediate impacts as well as delay recovery.

4.3.7.1 Injury Quantification

The Trustees estimate that approximately 6,200 acres were exposed to oil. Over 95% of this area was mudflat habitat that was lightly swept by oily water. Since this area was only very lightly injured, it was expected to recover within one month. Table 4-18 summarizes the injury categories used by the Trustees in their calculations.

Table 4-18: Summary of Shoreline Injury

Habitat Type	Area (acres)	Initial Injury	Days to Full Recovery
Mudflat			
Heavy Impact	0.11	100%	90
Moderate Impact	2.31	50%	60
Lightly Swept	5902.21	10%	30
Sand and Gravel Beaches			
Heavy Impact	1.22	100%	120
Moderate Impact	1.00	50%	120
Light Impact	8.24	25%	120
Lightly Swept	199.33	10%	30
Marsh			
Heavy Impact	0.68	100%	730
Moderate Impact	69.16	50%	365
Light Impact	1.02	25%	180
Riprap			
Heavy Impact	1.34	100%	365
Moderate Impact	1.10	50%	180
Light Impact	4.07	25%	60

4.3.7.2 Restoration Alternatives

Most of the shoreline injury occurred due to service losses from marsh and mudflat habitats. As a result, the Trustees focused on restoration options that provided benefits to both these habitats. Because most of the waterfowl and shorebird projects also benefit marsh and mudflat habitats, the Trustees considered the same list of projects here as considered for injuries to waterfowl and shorebirds. The McDaniel Slough Wetland Enhancement project has been chosen as the project for shoreline habitat injuries because of: (1) the benefit it provides to marsh and mudflat resources; and (2) the opportunity it provides for timely restoration. See Section 4.3.5.2 for a detailed list of restoration alternatives and a description of the McDaniel Slough project.

Kure settlement funds totaling $420,000 have been allocated to the McDaniel Slough Wetland Enhancement project. This total includes contributions to compensate for injuries to waterfowl, shorebirds, and shoreline habitat, and for lost recreational use.

4.3.7.3 Scaling for Primary and Compensatory Restoration

The Trustees assume that the project benefits begin in the year 2009, ramp up quickly over a ten-year period, and continue to increase gradually over a 50-year total project life, as described in the Section 4.3.5.3. The Trustees calculate that such a project would generate 5.98 acre-years of services per acre. Using the inputs in Table 4-18, the Trustees calculate that 44.5 acre-years of services were lost due to the Spill. Thus, 44.5/5.98 = 7.5 acres of McDaniel Slough restoration would be appropriate to compensate for injury to shoreline habitat. These 7.5 acres may be added to the acres needed to compensate for waterfowl and shorebird injuries. Details of the shoreline HEA/REA are presented in Appendix K.

4.3.7.4 Environmental Consequences

The environmental consequences of the McDaniel Slough project are outlined under Section 4.3.5 (above), along with an assessment of the probability of success, a description of performance criteria and monitoring, and a general evaluation of the project.

4.3.8 Human Recreational Use Losses and Restoration

Potentially impacted human recreational activities from the Spill include: (1) sea kayaking; (2) surfing; (3) camping; (4) recreational boating; (5) recreational crabbing, clamming, and fishing; and (6) hunting. Based upon surveys of concessionaires and land managers in the Humboldt Bay area, the Trustees have determined that quantifiable impacts occurred to kayaking, surfing, and camping. Impacts to other activities were small and were not quantified.

4.3.8.1 Injury Quantification

There are two general impacts that an oil spill can have on a recreational activity. The spill can preclude a recreational activity trip altogether, resulting in lost use. Alternatively, a spill may reduce the value of trips that are taken despite the spill, resulting in diminished use. Because the Spill affected a relatively small number of recreational users over a relatively short period of

time (e.g., a few days to a few weeks), the Trustees focused on lost use values that resulted from oiling and/or closures of beaches, waterways, or campgrounds.

Table 4-19 summarizes the estimated damage to recreational services affected by the Spill.

Table 4-19. Summary of Recreational Losses and Damages

Activity	Number of Lost Days	Value per Lost Day	Total Value (1996 $)
Sea Kayaking	73	$61.57	$4,515
Surfing	400	$61.57	$24,628
Camping	294	$30.36	$8,926
TOTAL	**767**		**$38,069**
Adjustment for inflation (24.7%) = **$47,000**			

Details of the recreational loss analysis are presented in Appendix L.

4.3.8.2 Restoration Alternatives

The Trustees considered a variety of potential projects in Humboldt Bay and along the outer coast (Table 4-20). Projects considered offer a range of benefits, including increased beach access, boating and harbor improvements, educational facilities/materials, and enhancements of public use of wildlife areas.

Table 4-20: Potential Restoration Projects for Recreational Beach Use

PROJECT CONCEPTS	BENEFITS
South Spit recreational access facilities – complete plan of proposed projects	Human rec. use
Education center for Humboldt Bay NWR – build and maintain	Human rec. use
Interpretive signs at boat launches in Humboldt Bay	Human rec. use/education
Eel River boat ramp – construction of new ramp to replace non-functional one	Human rec. use
Wildlife Area parking areas – at Eel River, Elk River, Fay Slough, and Mad River	Human rec. use
Education center for DFG Wildlife Area – build and maintain	Human rec. use
EcoAtlas of Humboldt Bay watershed – for education	Human rec. use/education
Interpretive displays – at Arcata Marsh, Woodley Is Marina, Elk River WA, others	Human rec. use/education
McDaniel Slough – construction of trails in a wetlands restoration project that restores tidal action	**Human rec. use/education**
Trinidad Bay/Trinidad Rancheria harbor improvements	Human rec. use/education
Ocean foods study – short and long term effects of oil spills on consumers of ocean food resources	Human rec. use/education
Indian Island cleanup and restoration	Human rec. use/education
Humboldt Bay Trails Project– planning, design, and easements	Human rec. use

After evaluating these projects using the initial and additional screening criteria, the Trustees selected McDaniel Slough Wetland Enhancement project. It is described in Section 4.3.5.2. In addition to providing wildlife benefits, the McDaniel Slough project includes a network of trails that will benefit recreational users. The McDaniel Slough project, in addition to addressing

multiple resource and human use benefits, also has partnering funds. The other projects which were not preferred either would likely generate less direct human recreational use or were less cost-effective.

Kure settlement funds totaling $420,000 have been allocated to the McDaniel Slough Wetland Enhancement project. This total includes contributions to compensate for injuries to waterfowl, shorebirds, and shoreline habitat, and for lost recreational use.

4.3.8.3 Scaling for Primary and Compensatory Restoration

For this injury and restoration category, the Trustees have elected to use the value-to-cost approach to restoration scaling. In this approach, a dollar value is attached to the injury, and that value becomes the damages that are then spent on restoration projects.

Under the NOAA guidelines for damage assessment, the Trustees must first consider and reject the service-to-service (or, implicitly, value-to-value) approach (e.g., REA) before using the value-to-cost approach to restoration scaling (see NOAA 1997, page 4-9). In this case, use of the service-to-service or value-to-value approach would require either the estimation of increased user days over time from the restoration projects and/or an estimate of the value of the project to the public in the future. Given the relatively small size of the recreational use injury, the Trustees concluded that the increased assessment costs required to employ the service-to-service approach could likely exceed the value of the injury. It was concluded that the value-to-cost approach was the most cost-effective and reasonable method to use in this case. Thus, the cost of the restoration projects for human recreational uses has been calculated to be approximately **$47,000**. This contribution to the McDaniel Slough project would be in addition to the contributions from injuries to waterfowl, shorebirds, and shoreline habitat, which total 22.9 acres.

4.3.8.4 Environmental Consequences

This project should result in positive benefits by enhancing the quality and amount of public use near the area affected by the Spill. Improvements to wetland habitat at McDaniel Slough will enhance public enjoyment of natural resources. Additional environmental consequences of the McDaniel Slough project are outlined under Section 4.3.5 (above), along with an assessment of the probability of success, a description of performance criteria and monitoring, and a general evaluation of the project.

4.4 “No Action” Alternative

NEPA requires the Trustees to consider a “no action” alternative, and the OPA regulations require consideration of a somewhat equivalent “natural recovery” option. Under this alternative, the Trustees would take no direct action to restore injured natural resources or compensate for lost services pending natural recovery. Instead, the Trustees would rely on natural processes for recovery of the injured natural resources.

The principal advantages of the natural recovery approach are the ease of implementation and the absence of monetary costs. Natural processes rather than human intervention would determine the trajectory of recovery. However, while natural recovery would occur over time for most of the injured resources, the interim losses suffered would not be compensated for under the no-action alternative. OPA clearly establishes Trustee responsibility to seek compensation for interim losses pending recovery of natural resources. Losses were, and continue to be, suffered during the period of natural recovery from this Spill, and technically feasible, cost-effective alternatives exist to compensate for these losses.

4.5 Cumulative Impacts

The Trustees examined a variety of alternatives to restore resources and/or services lost as a result of the Spill. Project specific environmental consequences for each selected project are provided in Section 4.3. As required by NEPA, this section addresses the potential overall cumulative environmental impacts of implementing this restoration plan.

Cumulative environmental impacts are those combined effects on the quality of the human environment that result from the incremental impact of the alternative when added to other past, present and reasonably foreseeable future actions, regardless of what federal or non-federal agency or person undertakes the other actions (40 CFR 1508.7, 1508.25(a), and 1508.25(c)). As the projects are intended to achieve recovery of injured natural resources, the cumulative environmental consequences will be largely beneficial for birds and wildlife habitat.

Seabirds
The Trustees believe the projects selected in this restoration plan to address the injuries to seabirds, in conjunction with other existing and anticipated seabird restoration projects, including those funded from damage recoveries from other OPA cases, will have a local and regional, long term, moderate, and beneficial impact on seabird populations. The selected projects that benefit seabirds include Protection of Grebe Nesting Colonies on Northern California Lakes, Redding Rock Murre Re-colonization and Protection Project, Acquisition of Old Growth/Residual Habitat at risk of Logging, Pelican Roost Site Protection, and McDaniel Slough Wetland Restoration. All of these projects are designed to have beneficial impacts to seabirds.

Corvids
The Trustees have selected a project that may negatively affect local jay and raven numbers near seabird nesting and roosting sites, i.e., funding to continue the Corvid Management Project at Redwood National and State Parks. This project includes components for public education and outreach and removing anthropogenic food sources which attract ravens and jays. While not currently planned, the project may be augmented to include lethally removing a small number of ravens in the future if additional measures are needed to protect nesting Marbled Murrelets.

A study conducted in the San Francisco Bay Region shows that ravens are more common in urban and suburban environments than in rural areas and have increased dramatically in recent decades (Kelly and Etienne, 2002). Thus, they have not been subject to loss of habitat. Relatively small numbers of ravens have been killed by the U.S. Department of Agriculture's Wildlife Services Program in recent years, but most of this has been done in the Mohave Desert

to protect endangered Desert Tortoises (Boarman 2002). From 2001 to 2004, Wildlife Services killed 185 to 277 ravens in all of California. Ravens are also subject to impacts by West Nile Virus, although no substantial decline has yet been documented.

There are no other known corvid control programs being implemented in the area. In addition the project is focused on a relatively small geographical region around Redwood National and State Parks. On a regional scale, there are various educational programs throughout the State aimed at reducing anthropogenic sources of food at campgrounds for corvids. Considering the size of the State and the artificially high numbers of corvids at campgrounds, urban and suburban areas, the cumulative impact to corvids from this project is expected to have a minor, local, medium term, negative impact.

Human Use

The Trustees have selected five projects that may change human use of natural resources. The projects are: Protection of Nesting Grebe Colonies at Northern California Lakes, Corvid Management at Redwood National and State Parks, Redding Rock Murre Re-colonization and Protection, Pelican Roost Site Protection, and McDaniel Slough Wetland Restoration. Project components include public education and outreach and limiting access to and/or use of sensitive areas.

The Protection of Grebe Nesting Colonies at Northern California Lakes: This project is an expansion of an existing pilot project to benefit Western and Clark's Grebe nesting colonies. The selected project at Northern California Lakes will involve education and outreach and create a few small exclusion zones, impacting existing regulated waters and activities. These limitations on recreational and other human uses, in conjunction with existing fishing and boating regulations, will have local, medium term, minor impacts.

Corvid Management at Redwood National Park and State Parks: This project will have impact to humans at campgrounds and picnic areas. Humans will be required to manage food more carefully to prevent feeding corvids and other animals. However, there will be some beneficial impacts. The campgrounds should become cleaner and have less litter providing a more aesthetically pleasing environment. In addition, there will be increased educational opportunities for adults and children. The impact to humans will be local, medium term and minor; and also beneficial in regard to the educational component.

Redding Rock Murre Re-Colonization and Protection: There may be some minimal impacts to humans from this project. State and federal agency employees will coordinate to avoid disturbing Common murres during breeding season. This project has the potential to have a beneficial impact to humans through increased education**.** If education and voluntary compliance measures fail, closures may be warranted. During the breeding season, buoys may mark closures to boats within 200 feet of the rock. Any restrictions to recreational boaters around the rock will be small and limited to the breeding season. Therefore impacts to humans from this project will be local, medium term and minor.

Pelican Roost Site Protection: There may be minimal impacts to humans from this project. It has potential to restrict access to small areas (e.g. tips of jetties) seasonally. Any potential restrictions will be carefully considered. It also has potential to have a beneficial impact to humans through increased education**.**

McDaniel Slough Wetland Restoration: Cumulative impacts to humans for this project were evaluated in the McDaniel Slough Wetland Enhancement Project Final EIR (EIR), dated December, 2006. The EIR summarizes, "the project when viewed cumulatively with other projects, will not have a significant impact." In addition, the project will have a beneficial impact for humans through increased recreational activities including picnicking, wildlife viewing, hiking, and education.

Overall, four of the selected projects will have local, medium term, minor impacts to humans. One project is specifically designed to benefit human recreation. All of the projects will have beneficial impacts to ecosystems of which humans are a part.

Summary

The Trustees believe that, overall, the alternatives selected in this restoration plan, when considered along with past and reasonably foreseeable future projects, will have long term, local and regional beneficial impacts to natural resources; short term, minor, negative impacts to some human recreation; and also beneficial impacts to other human recreation. When viewed cumulatively with other projects, they will not have a significant negative impact on the quality of the human environment.

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7.0 Appendices

Appendix A: Federally Listed/Proposed Threatened and Endangered Species (Candidates Included)

Del Norte County

June 18, 2007
Document number: 902943973-11144

TYPE		SCIENTIFIC NAME	COMMON NAME	CATEGORY	CRITICAL HABITAT
Plants					
		Arabis macdonaldiana	McDonald's rock-cress	E	N
		Lilium occidentale	western lily	E	N
Invertebrates					
		Polites mardon	mardon skipper	C	N
		Speyeria zerene hippolyta	Oregon silverspot butterfly	T	Y
Fish					
		Eucyclogobius newberryi	tidewater goby	E	P
	*	*Oncorhynchus kisutch*	S. OR/N. CA coho salmon	T	Y
	*	*Oncorhynchus tshawytscha*	CA coastal chinook salmon	T	Y
Reptiles					
	*	*Caretta caretta*	loggerhead turtle	T	N
	*	*Chelonia mydas (incl. agassizi)*	green turtle	T	N
	*	*Dermochelys coriacea*	leatherback turtle	E	Y
	*	*Lepidochelys olivacea*	olive (=Pacific) ridley sea turtle	T	N
Birds					
		Brachyramphus marmoratus	marbled murrelet	T	P
		Charadrius alexandrinus nivosus	western snowy plover	T	P
		Coccyzus americanus	Western yellow-billed cuckoo	C	N
		Haliaeetus leucocephalus	bald eagle	T	N
		Pelecanus occidentalis	brown pelican	E	N
		Phoebastris albatrus	short-tailed albatross	E	N
		Strix occidentalis caurina	northern spotted owl	T	Y
Mammals					
	*	*Balaenoptera borealis*	sei whale	E	N
	*	*Balaenoptera musculus*	blue whale	E	N
	*	*Balaenoptera physalus*	fin whale	E	N
	*	*Eumetopias jubatus*	Steller (=northern) sea-lion	T	Y
		Martes pennanti pacifica	Pacific fisher	C	N
	*	*Megaptera novaengliae*	humpback whale	E	N
	*	*Physeter macrocephalus*	sperm whale	E	N

Humboldt County

June 18, 2007
Document number: 902943973-1114

	TYPE	SCIENTIFIC NAME	COMMON NAME	CATEGORY	CRITICAL HABITAT
Plants					
		Erysimum menziesii	Menzies' wallflower	E	N
		Layia carnosa	beach layia	E	N
		Lilium occidentale	western lily	E	N
		Thlaspi californicum	Kneeland Prairie penny-cress	E	Y
Fish					
		Eucyclogobius newberryi	tidewater goby	E	P
	*	*Oncorhynchus kisutch*	S. OR/N. CA coho salmon	T	Y
	*	*Oncorhynchus mykiss*	Northern California steelhead	T	Y
	*	*Oncorhynchus tshawytscha*	CA coastal chinook salmon	T	Y
Reptiles					
	*	*Caretta caretta*	loggerhead turtle	T	N
	*	*Chelonia mydas (incl. agassizi)*	green turtle	T	N
	*	*Dermochelys coriacea*	leatherback turtle	E	Y
	*	*Lepidochelys olivacea*	olive (=Pacific) ridley sea turtle	T	N
Birds					
		Brachyramphus marmoratus	marbled murrelet	T	P
		Charadrius alexandrinus nivosus	western snowy plover	T	P
		Coccyzus americanus	Western yellow-billed cuckoo	C	N
		Haliaeetus leucocephalus	bald eagle	T	N
		Pelecanus occidentalis	brown pelican	E	N
		Phoebastris albatrus	short-tailed albatross	E	N
		Strix occidentalis caurina	northern spotted owl	T	Y
Mammals					
	*	*Balaenoptera borealis*	sei whale	E	N
	*	*Balaenoptera musculus*	blue whale	E	N
	*	*Balaenoptera physalus*	fin whale	E	N
	*	*Eumetopias jubatus*	Steller (=northern) sea-lion	T	Y
		Martes pennanti pacifica	Pacific fisher	C	N
	*	*Megaptera novaengliae*	humpback whale	E	N
	*	*Physeter macrocephalus*	sperm whale	E	N

KEY:
(PE) Proposed Endangered Proposed in the Federal Register as being in danger of extinction
(PT) Proposed Threatened Proposed as likely to become endangered within the foreseeable future
(E) Endangered Listed in the Federal Register as being in danger of extinction
(T) Threatened Listed as likely to become endangered within the foreseeable future
(C) Candidate Candidate which may become a proposed species Habitat Y = Designated, P = Proposed, N = None Designated
* Denotes a species Listed by the National Marine Fisheries Service

Appendix B: Bird Mortality Estimation

1.0. Summary

The Trustees' estimates of total bird mortality for each species are based upon reports by Ford (for all species except pelicans) and Jacques (for pelicans only). This appendix describes the Trustees' modifications to the estimates in those reports.

1.1. The Ford Report

The Ford report provides mortality estimates using several different methods, primarily based on the Maximum Instantaneous Oiling Rate and the Beached Bird Model. Because the oiled area of the ocean was relatively near-shore (i.e., within a few miles of shore) and search effort was fairly comprehensive on most beaches, the Beached Bird Model provides a reliable estimate for all species except pelicans and shorebirds. Ford specifically addresses shorebird mortality and provides a mortality estimate based upon surveys of oiled and unoiled live birds in the days after the spill. The Trustees have relied upon those results presented in Ford, with two modifications. First, the Trustees have removed 33 birds from the dataset, determining them to be non-spill-related. Second, the Trustees have incorporated likely mortality suffered by rehabilitated and released birds. The number of rehabilitated and released birds is presented in the Ford report, but no estimate of their fate is provided.

1.1.1.Additional Non-Spill-Related Birds

Of the 961 birds collected, the Trustees initially removed 10 birds from the data that were subsequently used by Ford in his analysis. Nine of these birds had suffered gunshot wounds or broken wings, possibly due to gunshot or collision with an object. All nine were not visibly oiled. The tenth bird appeared oiled (an American Coot collected within Humboldt Bay), but was identified at intake as having been oiled by a "lighter oil". After the completion of Ford's report, the Trustees determined that 23 additional birds should be removed. These 23 birds include one bird previously identified as a Marbled Murrelet, but later determined to be an unoiled Common Murre chick that, based on age at death, pre-dated the spill. The other 22 birds were all non-visibly oiled, unscavenged, and in an advanced state of decomposition. Thus, the Trustees have adjusted Ford's results accordingly, using the average Beached Bird Model mortality multiplier for the appropriate species group. For example, Ford's Beached Bird Model estimated that 343 waterfowl were killed, extrapolated from 230 that were collected (and initially determined to be spill-related). This implies a multiplier of 1.5. The Trustees have determined that 6 of the waterfowl originally identified as injured by the Kure oil spill were most likely not related to the spill, and thus have removed 9 (1.5 x 6 = 9) from the mortality estimate. This adjustment methodology was used for all of the species groups other than the Marbled Murrelet. For the Marbled Murrelet injury, the Beached Bird model was re-run by Ford after deducting the initially misidentified single bird.

1.1.2. Fate of Rehabilitated Birds

Additionally, the Trustees have evaluated the fate of rehabilitated and released birds. During the response, 386 birds were rehabilitated and released, including 147 Common Murres and 90 scoters. Although there is uncertainty associated with the fate of such birds, several studies have

suggested that post-rehabilitation survival is extremely low (e.g., less than 10%), especially for alcids such as Common Murres (Sharp 1996). After the *Stuyvesant* oil spill in Humboldt County in 1999, the Oiled Wildlife Care Network conducted a telemetry study of Common Murres associated with the oil spill. Based on this study (Newman *et al*. 2004), the Trustees assumed that 75% of the rehabilitated birds died (n = 290), while 25% survived to join (or re-join) the breeding population.

1.2. The Jacques Report

The Jacques report examines impacts to Brown Pelicans as a result of the spill. It does not directly estimate total pelican mortality. Based upon surveys of pelican roost sites, the report conservatively estimates that 77 pelicans were oiled by the spill (61 were lightly oiled, 16 were moderately or heavily oiled). These birds may or may not have been collected by response teams, which collected five pelicans (two live and three dead). Of these five, one collected dead (unoiled) was determined to be non-spill related and one collected live was rehabilitated and released. Of the two oiled pelicans collected dead, one was heavily oiled and one was lightly oiled.

The Trustees have estimated total mortality for Brown Pelicans by summing the following: 1) all 16 pelicans that were moderately or heavily oiled; 2) 25% of the 61 pelicans (n=15) that were lightly oiled. Because only one pelican was rehabilitated and released, and the Trustees have assumed that 25% of released birds survive, no additional adjustment is made for the one bird. Note that Anderson et al. (1996) estimated low survival rates for oiled and rehabilitated pelicans. In conclusion, the total number of pelicans estimated killed is 31.

1.3. Final Results

The table below summarizes the results of Ford's estimates, the Trustees' two modifications to the Beached Bird Model results, and the Trustees' final mortality estimates.

Table B–1: Acute Mortality Estimates for the M/V Kure Spill by Species Grouping

Species Group	Ford: Maximum Instantaneous Oiling Rate Estimated Dead	Ford: Beached Bird Model Estimated Dead	Correction for non-spill-related birds	# of rehabbed birds estimated died	FINAL TRUSTEE ESTIMATE
Loons	508	61	0	14	**75**
Grebes	1097	136	0	32	**168**
Pelicans	Not estimated by Ford.			1	**31**
Cormorants	124	33	2	4	**35**
Gulls	1189	154	12	12	**154**
Murres, alcids	1809	611	2	110	**719**
Procellarids	8	196	10	5	**191**
Marbled Murrelets	36	151	21	NA	**130**
Shorebirds	5220*	286	0	33	**2033**
Waterfowl	5946	343	9	80	**414**
				TOTAL:	**3950**

*Ford compares the results of the two approaches and provides a conservative estimate of 2,000 dead shorebirds. The Trustees have relied upon this estimate, plus 33 additional birds that were rehabilitated and released.

Appendix C: Resource Equivalency Analysis (REA) Method

1.0. Background

There are two basic approaches to measuring the compensation for natural resources injuries. The "consumer valuation approach" focuses on the demand side; the "replacement cost" approach focuses on the supply side. In the former, we seek to measure the monetary value that the public puts on the natural resources (i.e., how much the public demands the services of natural resources); in the latter, we seek to measure how much it costs to replace the natural resource services that the public loses as a result of the injury (i.e., how much it costs to supply natural resource services). See the Glossary for complete definitions of some of the terms used here.

FIGURE C-1: Consumer Valuation versus Replacement Cost Approaches for Natural Resource Damage Calculation

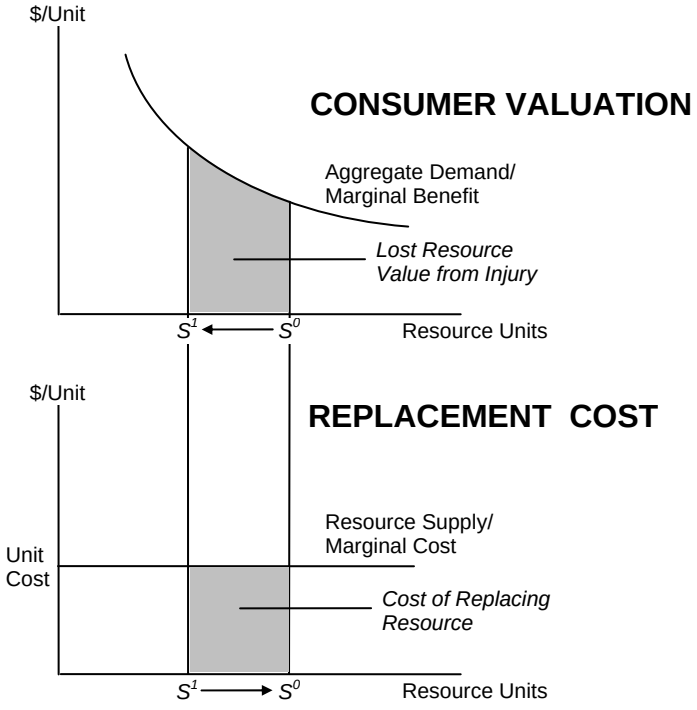


Figure C-1 illustrates the difference between these two approaches. In both graphs, the supply of natural resources shifts from S^0 to S^1 as a result of an incident (e.g., oil spill, sediment discharge into a stream, illegal removal of vegetation). The shaded area in the top graph illustrates the dollar value of the resource loss as measured by the monetary payment that would make the public indifferent to the incident. For example, if each individual in a 30 million person society would need a $0.05 payment (on average) to make them indifferent to the resource loss, the shaded area in the top graph would equal $1.5 million. Because the difficulty in observing market prices that reveal the level of cash payment that would compensate individuals for resource losses, the quantitative characteristics of the demand curve(s), and consequently the size of the shaded area in the upper graph, are difficult to measure. Contingent Valuation (CV) and

other types of analyses are designed to estimate this dollar value. These methodologies typically involve large surveys and can be costly.

The lower graph illustrates a replacement cost approach. Beyond noting that the injured resource has value, the actual extent to which the public values it is not directly considered. Instead, the determination of adequate compensation depends on the level of natural resource provision (versus monetary payments) that compensates society for what it has lost as a result of the incident. The cost of providing this compensation becomes the estimate of damages. Resource Equivalency Analysis (REA) is the primary methodology for conducting this type of measurement in natural resource damage assessment. It is depicted by a resource supply shift in the lower graph from S^1 back to S^0. The shaded area is the total monetary cost of funding the supply shift. For example, if 2 acres of wetland enhancement are estimated to compensate for an incident that temporarily reduced the service value of 1 acre of wetland habitat, the cost of performing 2 acres of wetland enhancement becomes the estimate of damages.

It is clear from Figure 1 that the public's valuation of the resource (the shaded area in the top graph) is not necessarily equal to the total replacement cost (the shaded area in the bottom graph). This is especially true when unique resources or rare species are involved, as the slope of the aggregate demand curve (top figure) may be much steeper due to resource scarcity. This would result in a much larger monetary payment being necessary to compensate the public. In such a case, the replacement cost approach of REA may result in damages far less than the losses as valued by the public. However, because it is easier and less costly to measure the total replacement cost than the total public value, REA has an advantage over other methods, especially for small to medium-sized incidents with minimal impact on rare species.

1.1 Resource Equivalency Analysis

In this assessment, REA has been used to determine compensatory damages. This method is relatively inexpensive and relies primarily on biological information collected in the course of determining natural resource injuries caused by the spill. It is consistent with approaches recommended in the language of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the Oil Pollution Act of 1990 (OPA).

REA involves determining the amount of "natural resource services" that the affected resource would have provided had it not been injured, and it equates the quantity of lost services with those created by proposed compensatory restoration projects that would provide similar services. The unit of measure may be acre-years, stream feet-years, or some other metric. The size of the restoration project is scaled to the injury first; the cost of restoration is then calculated after the scaling has been done. The cost of restoring a comparable amount of resources to those lost or injured is the basis for the compensatory damages. In this sense, REA calculates the *replacement cost* of the lost years of natural resource services.

Future years are discounted at 3% per year, consistent with National Oceanic and Atmospheric Administration recommendations for natural resource damage assessments. Discounting of future years is done based on the assumption that present services are more valuable than future services. When it comes to natural resources, the question of whether or not society should value the present more than future is a philosophical question (e.g., one can recall the "greenhouse effect" and the question of how much expense we should incur today to preserve the future).

However, the question of how much society actually discounts the value of future natural resources is an empirical one. The 3% figure is currently the standard accepted discount rate for natural resource damage assessments.

REA involves three steps: 1) the debit calculation, 2) the credit calculation, 3) the computation of the costs of restoration. These calculations may be done in a variety of ways, but the most common are to estimate the injury and the restoration benefits in terms of area years of habitat or animal years.

1.1.1. Habitat Example

For example, suppose a 10-acre area is degraded due to an oil spill such that it supplies only 30% of its previous habitat services during the year following the incident. In the second year after the incident, the habitat begins to recover, supplying 90% of its baseline services. By the third year it is fully recovered. In this case, the lost acre years of habitat services would be 70% x 10 acres x 1 year + 10% x 10 acres x 1 year = 8 acre years of habitat services. Figure 2 illustrates this example by showing the recovery path of the habitat over time.

As stated above, future years are discounted at a 3% rate, thus the injuries in the second year count a little less. Incorporating this, 7.97 acre years of habitat services were lost. This difference appears minimal here, but becomes significant (due to compounding) if injuries persist many years into the future.

The credit calculation focuses on the gain in habitat services that result from a restoration project. Creating acre years of habitat services is a function of both area and time. Hypothetically, compensation could involve taking 7.97 acres of land with no habitat value (e.g., a parking lot) and turning it into productive habitat for 1 year. Alternatively, we could achieve compensation by creating 1 acre for 7.97 years. In reality, most restoration projects involve taking previously degraded habitat (at another nearby location) and restoring it over a number of years, and maintaining it into the future.

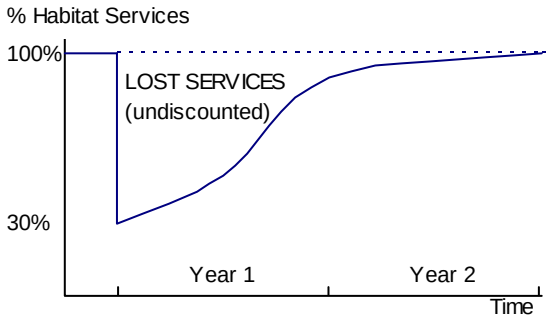


FIGURE 2: Biological Injury and Recovery

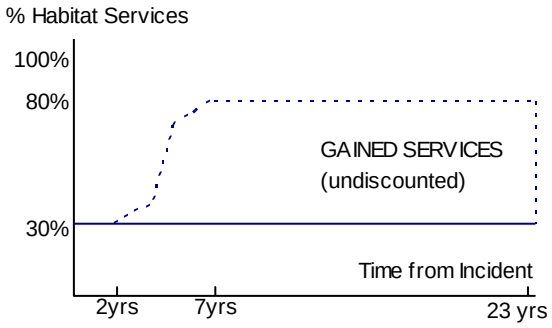


FIGURE 3: Restoration Trajectory/Credit

Suppose the restoration project improves the quality of a nearby degraded area, so that, if it previously provided only 30% of potential services, it would provide 80% of potential habitat services after restoration. Also suppose the project begins two years after the incident and it takes an additional 5 years for the 80% level to be achieved. Figure 3 provides an illustration of this restoration trajectory. In our hypothetical example, the project is expected to have a lifespan of 20 years. Note that, with future years discounted, the 20th year of the project (22–23 years

after the incident) counts little; years after that are effectively completely discounted due to uncertainty regarding the future.

Mathematically, we seek to restore an area that will provide 7.97 acre years of services over the discounted 20-year phased-in life span of the restoration project. In this example, that would be an area of about 1.3 acres. That is to say, restoration of 1.3 acres for 20 years would compensate the public for the 7.97 lost acre years of habitat services due to the spill. Visually, the area identified in Figure 2 (multiplied by the affected acres and calculated to measure the present discounted value) should equal the area identified in Figure 3 (again, multiplied by the acres targeted for restoration and calculated to measure the present discounted value, thus discounting future years).

The percentage of habitat services lost (or gained, in the case of the restoration project) may be measured in a variety of ways. For our hypothetical oil spill case, three examples might include (1) the use of a habitat-wide evaluation index, (2) the use of one or more surrogate species, or (3) the use of an estimate based on the degree of oiling. Care must be taken when using a surrogate species to represent the entire affected habitat. Ideally, this surrogate is the population of one or more species that is immobile (that is, the animals do not move easily in and out of the affected area) and that has significant forward and/or backward ecological links to other species in the affected ecosystem. For example, the population of red crossbills, a bird that feeds primarily on pine cone seeds and migrates erratically from year to year, would be a poor surrogate for measuring injuries to a streambed. The aquatic macroinvertebrate community within the stream, however, provides an ideal surrogate, as they play a key role in the streambed food chain.

Likewise, on the restoration side, care must be taken when the project targets one or a few species rather than the entire habitat. Ideally, a project that seeks to restore the population of a key indicator species will also benefit the entire habitat and, thus, other species as well. Indeed, such projects typically focus directly on habitat improvements. However, it is important to verify that such a species-centered project is indeed benefiting the entire habitat.

1.1.2. Animal Example

When the injury is primarily to individual animals rather than a complete habitat, the REA may focus on lost animal-years. For example, suppose an oil spill causes negligible injury to a body of water, but results in the death of 100 ducks. Using information about the life history of the ducks (e.g., annual survival rate, average life expectancy, average fledging rate, etc.), we can estimate the “lost duck years” due to the spill. On the credit side, we can examine restoration projects designed to create duck nesting habitat and scale the size of the project such that it creates as many duck years as were lost in the incident.

1.1.3. Restoration Costs = Natural Resource Damages

Once the proposed restoration projects are scaled such that they will provide services equal to those lost due to the incident, the cost of the projects can be calculated. Note that this is the first time dollar figures enter the REA process. Until now, all the calculations of the “equivalency” have been in terms of years of resource services. The cost of the restoration projects is the compensatory damage of the incident.

For another explanation of the REA methodology (in its more specific form for habitats), see "Habitat Equivalency Analysis: An Overview", prepared by NOAA. Copies of this document are available at http://www.darrp.noaa.gov/library/pdf/heaoverv.pdf .

1.4. Glossary of Terms

Aggregate demand

the demand of all consumers combined; e.g., if there are 20,000 people in a town and each person demands two pieces of bread each day, the aggregate demand is 40,000 pieces of bread per day.

Compensatory restoration

a restoration project which seeks to compensate the public for temporal or permanent injuries to natural resources; e.g., if a marsh is injured by an oil spill and recovers slowly over ten years, a compensatory project (which may be off site) seeks to compensate the public for the ten years of diminished natural resources.

Discount rate

the rate at which the future is discounted, i.e., the rate at which the future does not count as much as the present; e.g., a dollar a year from now is worth less than a dollar today; if the bank offers a 3% rate, whereby $1.00 becomes $1.03 in one year, the future was discounted at 3%.

Primary restoration

a restoration project which seeks to help an injured area recover more quickly from an injury; e.g., if a marsh is injured by an oil spill and would recover slowly over ten years if left alone, a primary restoration project might seek to speed the recovery time of the marsh and achieve full recovery after five years.

Replacement cost

the cost of replacing that which was lost; e.g., if fifty acre-years of habitat services were lost due to an oil spill, the cost of creating fifty acre-years of similar habitat services would be the replacement cost.

Appendix D: Demographic Parameters and Bird-Year Loss Calculations for Non-Marbled Murrelet Species

D.0. Summary

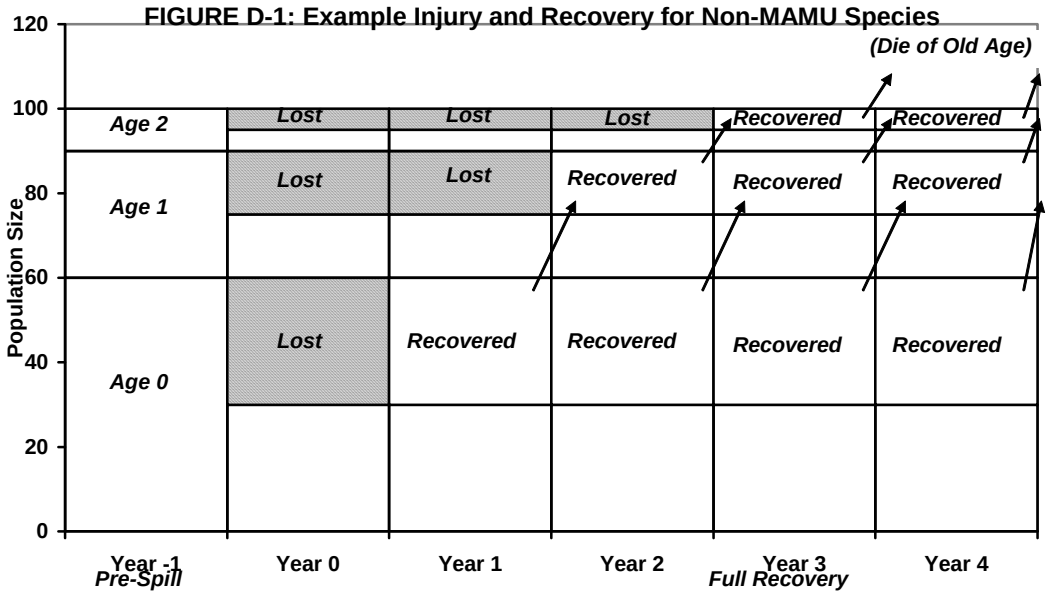
This appendix outlines the bird-year loss calculations used to assess temporal implications of acute bird mortality from the M/V Kure spill. It briefly (1) outlines how lost bird-years were calculated for selected species, (2) describes the demographic parameter inputs used in these calculations, and (3) presents the resulting multipliers used to translate bird mortality to "bird-year" loss.

D.1. Methodology

The trustee assessment of bird-year loss follows roughly the same approach as used by Sperduto *et al*. (1999, 2003) for calculating "direct loss" for birds with "extended" recovery times. We conceptualize temporal injuries as the expected difference between injured and baseline population trajectories over time (i.e., population sizes *with* and *without* the spill). Calculations are based upon the following assumptions:

> ***Assumption 1:*** Acute spill mortality is distributed proportionately across the various age classes of the injured population.
>
> ***Assumption 2:*** Rates of juvenile and adult survivorship are constant before and after the spill.
>
> ***Assumption 3:*** The pre-spill and fully recovered populations are roughly constant in size and stable in age-distribution, as determined by demographic characteristics of the species (specifically survivorship and fecundity).
>
> ***Assumption 4:*** There is a maximum age beyond which no birds live.
>
> ***Assumption 5:*** Surviving adult birds match the total reproductive output that the surviving and impacted birds would have had in the breeding seasons after the spill had the spill not occurred (e.g., potentially because of non-breeding "floaters" in the area, reduced competition for high quality nesting sites, decreased competition for foraging around the breeding area).

Figure 1 provides an example of how these assumptions combine to describe biological recovery in a hypothetical population with three one-year age classes. Year -1 depicts the population's pre-spill conditions. Year 0 shows population numbers prior to the first full year after the spill. The shaded area is the number of each age class killed, which is distributed proportionately between age classes (Assumption 1). The arrows describe how the recovered birds advance through each age class.



In the Year 1, the number of fledglings replaces the losses to the first age class (Assumption 5). The age classes from Year 0 all face annual mortality, with complete mortality for the third age class. This process continues in Year 2, with the recovered Age 0 juveniles from Year 1 facing mortality and growing one year older to reach Age 1. In Year 3, there is full recovery. These calculations do not include impacts to future generations of birds (i.e., "indirect loss" as considered by Sperduto *et al*. 1999, 2003).

We can formalize Assumptions 1–6 to write injury (I), measured in birds from year t, as:

$$I_t = N_M \sum_{i=t}^{k} p_i^* \quad \forall \quad i \le k \qquad (1)$$

where N_M is the estimate of acute mortality for the given specie, k is the maximum age beyond which no birds live (from Assumption 4), and p_i^* is the proportion of the population that falls in age class i at a stable age distribution. The youngest age class is denoted Age 0, to reflect that they have yet to live a full year.

The total debit (D) for a given bird specie (in discounted bird-years) is therefore:

$$D = \sum_{j=0}^{k} \left[\frac{N_M}{(1+d)^{j+1}} \sum_{i=j}^{k} p_i^* \right] \qquad (2)$$

where d is the discount rate. N_M, k, and p_i^* are defined above. This is simply the sum of each year's injury from Equation (1) discounted at rate d. For the purpose of our calculations we use d=0.03, consistent with common practice in natural resource damage assessments (e.g., see Julius 1999).

D.2. Demographic Parameters used in Injury Calculations

Table D-1 presents a list of selected species that suffered mortality from the M/V Kure spill. Because of the large number of species injured (over 52 species total for the spill), the trustees grouped the species into categories, and then chose a single proxy species for each group. Species were lumped together based upon a consideration of (1) life history characteristics; (2) the ability of species to benefit from similar restoration projects; and (3) acute mortality estimates. This section describes the demographic information used for each injury category.

D.2.1. Small Grebes (North Cape Grebe)

The North Cape REA (Spertudo *et al.* 1999) calculates injury to grebes by averaging demographic estimates for a variety of grebe species. The following set of roughly stationary demographic parameters is based upon their analysis:

- *Age of First Breeding: 2* Years Old
- *Female Offspring per Adult Female (Annual):* 0.91
- *Survivorship (From fledge to one year of age):* 60%
- *Annual Survivorship (Age 1+):* 64.7%
- *Maximum Age:* 24 Years Old

The only difference between these parameters and those used by Sperduto *et al*. (1999) is that annual survivorship beyond the first year has been increased 2.7%. This calibrates the life history to a population that maintains an approximately constant population size.

TABLE D-1: Proxy Species for Bird Injury Calculations

Bird Category	Species Suffering Mortality from Kure Spill	Potential Source of Demographic Parameters
Small Grebes	Horned Grebe Eared Grebe	*North Cape* Grebe
Large Grebes	Western Grebe Clark's Grebe Red-necked Grebe Unknown Grebe	Western Grebe
Loons	Common Loon Pacific Loon Red-throated Loon	*North Cape* Loon
Non-Marbled Murrelet Alcids	Common Murre Cassin's Auklet	Common Murre
Gulls	Western Gull California Gull Heerman's Gull Glaucous-winged Gull Ring-billed Gull Mew Gull Unknown Gull	Western Gull

TABLE D-1 (Continued): Proxy Species for Bird Injury Calculations

Bird Category	Species Suffering Mortality from Kure Spill	Potential Source of Demographic Parameters
Procellarids	Northern Fulmar	Northern Fulmar
Cormorants	Pelagic Cormorant Double-crested Cormorant Brandt's Cormorant	Double-crested Cormorant
Pelicans	Brown Pelican	Brown Pelican
Waterfowl	White-winged Scoter Surf Scoter American Coot Greater Scaup Green-winged Teal American Widgeon Lesser Scaup Northern Shoveler Brant Bufflehead Northern Pintail Ruddy Duck Black Scoter Gadwall Red-breasted Merganser Tundra Swan Unknown Duck Unknown Scoter	*North Cape* Scoter
Shorebirds	Dunlin Virginia Rail Black Turnstone Least Sandpiper Long-billed Dowitcher Marbled Godwit Sanderling Western Sandpiper Willet	Dunlin

D.2.2. Large Grebes (Western Grebe)

Large grebe demographic parameters are modifications of those used for the small grebe (D.2.1. above) that account for information collected on Western Grebes at Clear Lake, California.

- *Age of First Breeding: 2* Years Old
- *Female Offspring per Adult Female (Annual):* 0.6
- *Survivorship (From fledge to one year of age):* 60%
- *Annual Survivorship (Age 1+):* 0.7355
- *Maximum Age:* 24 Years Old

This juvenile survivorship, age of first breeding, and maximum age is from Sperduto *et al*. (2002). The estimate of female offspring per female is from observations of Western Grebes during "non-disturbance years" at Clear Lake, California (Dan Anderson, personal communication). The adult survivorship parameter was chosen so that the combination of parameters was consistent with a population that was maintaining an approximately constant population size over time.

D.2.3. Loons (General Loon)

The North Cape REA (Spertudo *et al.* 1999) calculates injuries to loons based upon Common Loon demographics. The following set of roughly stationary demographic parameters is based upon their analysis:

- *Age of First Breeding:* 5 Years Old
- *Female Offspring per Female (Annual):* 0.27
- *Survivorship (From fledge to one year of age):* 76%
- *Survivorship (Age 1+):* 88.5%
- *Maximum Age:* 24 Years Old

The only difference between these parameters and those used by Sperduto *et al*. (1999) is that annual survivorship beyond the first year has been increased 0.5%. As with the grebe calibration, this adjusts the implied loon life history to maintain an approximately constant population size.

D.2.4. Non-Marbled Murrelet Alcids (Common Murre)

Nur *et al*. (1994) created a Common Murre demographic model for the Farallon Islands. The following parameters are based upon their work, but have been calibrated to imply a roughly constant population size:

- *Age of First Breeding:* 5 Years Old
- *Female Offspring per Female (Age 5):* 0.126
- *Female Offspring per Female (Age 6):* 0.310
- *Female Offspring per Female (Age 7):* 0.405
- *Female Offspring per Female (Age 8+):* 0.420
- *Survivorship (From fledge to one year of age):* 40%
- *Annual Survivorship (Age 1–2):* 80%
- *Annual Survivorship (Age 2–3):* 87%
- *Annual Survivorship (Age 3+):* 91.6%
- *Maximum Age:* 36 Years

The difference between these parameters and those used by Nur *et al*. (1994) is that annual survivorship beyond the first year has been decreased 1.7%.

D.2.5. Gulls (Western Gull)

Nur *et al*. (1994) created a population model for Western Gull at the Farallon Islands. The following parameters draw from their analysis:

- *Age of First Breeding:* 3 Years Old
- *Male Offspring per Male (Age 3):* 0.012
- *Male Offspring per Male (Age 4):* 0.152
- *Male Offspring per Male (Age 5):* 0.454
- *Male Offspring per Male (Age 6):* 0.660
- *Male Offspring per Male (Age 7):* 0.695

- *Male Offspring per Male (Age 8):* 0.765
- *Male Offspring per Male (Age 9):* 0.785
- *Male Offspring per Male (Age 10):* 0.750
- *Male Offspring per Male (Age 11):* 0.710
- *Male Offspring per Male (Age 12 and 13):* 0.725
- *Male Offspring per Male (Age 14):* 0.705
- *Male Offspring per Male (Age 15):* 0.660
- *Male Offspring per Male (Age 16+):* 0.610
- *Survivorship (From fledge to one year of age):* 60%
- *Annual Survivorship (Age 1–2):* 75%
- *Annual Survivorship (Age 2–3):* 82%
- *Annual Survivorship (Age 3–4 to 6-7):* 84%
- *Annual Survivorship (Age 7–8 and 8–9):* 83%
- *Annual Survivorship (Age 9–10 and 10–11):* 82%
- *Annual Survivorship (Age 11–12):* 81%
- *Annual Survivorship (Age 12–13 to 14–15):* 80%
- *Annual Survivorship (Age 15–16 and 16–17):* 78%
- *Annual Survivorship (Age 17–18):* 75%
- *Annual Survivorship (Age 18–19):* 67%
- *Annual Survivorship (Age 19–20):* 57%
- *Annual Survivorship (Age 20–21):* 50%
- *Maximum Age:* 22 Years Old

The Nur *et al*. (1994) model tracks males in the population (assuming a 1:1 sex ratio).[1] The difference between the above parameters and those used by Nur *et al*. (1994) is that the survivorship from fledge to one year of age has been increased 4.5% to calibrate the model to approximate stationarity. This 60% survivorship from fledge to Age 1 is still within the range considered by Nur *et al*. (1994).

D.2.6. Procellarids (Northern Fulmar)

The following northern fulmar demographic parameters have been calibrated to imply a roughly constant population size:

- *Age of First Breeding:* 5 Years Old
- *Female Offspring per Female (Age 5):* 0.013
- *Female Offspring per Female (Age 6):* 0.026
- *Female Offspring per Female (Age 7):* 0.039
- *Female Offspring per Female (Age 8):* 0.053
- *Female Offspring per Female (Age 9):* 0.066
- *Female Offspring per Female (Age 10):* 0.079
- *Female Offspring per Female (Age 11):* 0.092
- *Female Offspring per Female (Age 12):* 0.105
- *Female Offspring per Female (Age 13):* 0.118

[1] Male Western Gulls are perceived to be the limiting factor in western gull population growth (Nur *et al*. 1994, Pierotti and Annet 1995). During the 1970s, some Western Gull populations displayed male-female sex ratios close to 2:3, presumably due to the feminization of male embryos from DDT (Pierotti and Annet 1995). Since that time sex ratios have returned to "near equity" (Pierotti and Annet 1995).

- *Female Offspring per Female (Age 14):* 0.131
- *Female Offspring per Female (Age 15):* 0.144
- *Female Offspring per Female (Age 16):* 0.158
- *Female Offspring per Female (Age 17):* 0.171
- *Female Offspring per Female (Age 18):* 0.184
- *Female Offspring per Female (Age 19):* 0.197
- *Female Offspring per Female (Age 20+):* 0.21
- *Annual Survivorship (Age 69–70):* 6.9%
- *Annual Survivorship (Age 68–69):* 16.9%
- *Annual Survivorship (Age 67–68):* 26.9%
- *Annual Survivorship (Age 66–67):* 36.9%
- *Annual Survivorship (Age 65–66):* 46.9%
- *Annual Survivorship (Age 64–65):* 56.9%
- *Annual Survivorship (Age 63–64):* 66.9%
- *Annual Survivorship (Age 62–63):* 76.9%
- *Annual Survivorship (Age 61–62):* 86.9%
- *Annual Survivorship (Age 5–6 to 60–61):* 96.9%
- *Annual Survivorship (Age 4–5):* 89.6%
- *Annual Survivorship (Age 3–4):* 82.4%
- *Annual Survivorship (Age 2–3):* 75.1%
- *Annual Survivorship (Age 1–2):* 67.9%
- *Survivorship (From fledge to one year of age):* 60.6%
- *Maximum Age:* 71 Years

A review by Hatch and Nettleship (1998) provides the basis for these choices. Their summary includes the following information specific to deriving demographic model parameters specific to Northern Fulmar:[2]

- *Age of First Breeding:* Dunnet (1992) noted first evidence of breeding Northern Fulmars at five years of age.
- *Female Offspring per Female (Ages 20+):* Hatch and Nettleship (1998) presented unpublished data by Nettleship that show the proportion of fulmar pairs that produce a fledgling ranged from 37.2 – 46.9% in three "good" years, and 5.4 % in one "bad" year. If we assume (1) the productivity is at the midpoint of the range in good years (0.4205) and (2) a one-to-one sex ratio, then the full productivity of Northern Fulmars is (0.4205)(0.5) = 0.21025,
- *Female Offspring per Female (Age 5-19):* Dunnet (1992) found evidence that first breeding in Northern Fulmars occurs when the birds are between five and twenty years of age. We assume that the productive capacity of northern fulmar increases linearly such that it is 6.25% in Year 5, 12.5% in Year 6, etc. until 100% are breeding in Year 20.
- *Annual Survivorship (Age 5–6 to 60–61):* Hatch (1987b) estimated average annual survival rates of Northern Fulmars at 96.9%.
- *Maximum Age:* With a constant 96.9% adult survivorship it is reasonable for some Northern Fulmars to live a very long time (greater than 80 years). Evidence of their long lifespan was found in Scotland where several birds banded in 1951 were still breeding in 1990 at ages likely to be greater than 50 years old (Dunnet 1991). For the

[2] The below citations are cited as referenced in Hatch and Nettleship (1998). They are not cited as primary sources.

purpose of this analysis, we chose a maximum age of 71. Because of our belief that the adult survivorship will decline as a bird reaches the older age classes, we assume that, starting at Age 61, survivorship decreases 10% per year until zero birds advance from 70 years-of-age to their 71st year.

To calibrate the model, we assume that the survivorship from Ages 0–1 to 4–5 increases linearly each year such that 96.9% adult survivorship was achieved at Age 5-6. We then calibrate Age 0–1 survivorship so that the sequence is consistent with a population maintaining a constant population size.

D.2.7. Cormorants (Double-Crested Cormorant)

The following Double-crested Cormorant demographic parameters have been calibrated to imply a roughly constant population size:

- *Female Offspring per Female (Age 1):* 0.028
- *Female Offspring per Female (Age 2):* 0.12
- *Female Offspring per Female (Age 3):* 0.58
- *Female Offspring per Female (Age 4+):* 0.54
- *Survivorship (From fledge to one year of age):* 48%
- *Annual Survivorship (Age 1–2):* 74%
- *Annual Survivorship (Age 2+):* 83.5%
- *Maximum Age:* 21 Years

A review by Hatch and Weseloh (1999) provides the basis for these parameter choices.[3] Their summary includes the following information specific to deriving demographic model parameters specific to Double-crested Cormorants:

- *Female Fledges per Female (Age 1).* Observations by van der Veen (1973) suggest that 4.7% of females first breed at Age 1. Hatch and Weseloh's (1999) summary of numerous studies suggests that each Double-crested Cormorant nest produces 1.2–2.4 fledges per nest. If we assume the low end of that range (which we use to calibrate demographic information) and a one-to-one sex ratio, then each Age 1 female produces (.047)(1.2)(0.50) = 0.028 fledging females on average.
- *Female Fledges per Female (Age 2).* Observations by van der Veen (1973) suggest that 16.5% of females first breed at Age 2. If we assume that 90% of past breeders nest, a one-to-one sex ratio, and 1.2 fledges per nest, then Age 2 each female produces (0.165)(1.2)(0.50) + (.047)(1.2)(0.50)(0.9) = 0.12 fledging females on average.
- *Female Fledges per Female (Age 3).* Observations by van der Veen (1973) suggest that 78.8% of females first breed at Age 3. If we assume that 90% of past breeders nest, a one-to-one sex ratio and 1.2 fledges per nest, than each Age 3 female produces (0.788)(1.2)(0.50) + (0.212)(1.2)(0.50)(0.9) = 0.59 fledging female on average.
- *Female Fledges per Female (Age 4+).* Observations by van der Veen (1973) suggest that all Age 4 and later females have already bred once. If we assume that 90% of past breeders nest, a one-to-one sex ratio and 1.2 fledges per nest, then each Age 4+ female produces (1.2)(0.50)(0.9) = 0.54 fledging female on average.

[3] The below citations are cited as referenced in Hatch and Weseloh (1999). They are not cited as primary sources.

- *Survivorship (From fledge to one year of age).* van der Veen (1973) estimates Age 0 survival at 48%.
- *Annual Survivorship (Age 1).* van der Veen (1973) estimated Age 1 survival at 74%.
- *Annual Survivorship (Age 2+).* van der Veen (1973) estimated Age 1 survival at 85%. We chose the slightly lower value of 83.5% to calibrate the model to a population that maintains constant numbers over time.
- *Maximum Age.* Klimkiewicz and Futcher (1989) noted that the oldest banded bird in 5,589 encounters was 17 years 9 months old. We chose a maximum age of 21 because that is the oldest age that at least 1% of the cormorants will reach given the demographic assumptions presented above.

Overall, choosing low range values for (1) *Age 2+ Survivorship* and (2) *Fledges per Nest* calibrates the model.

D.2.8. Pelicans (Brown Pelicans)

Demographic information on Brown Pelicans was compiled by the California Office of Environmental Health Hazard Assessment and summarized in the Cal/Ecotox online database (http://www.oehha.org/cal_ecotox/default.htm). The Cal/Ecotox database (and the research papers cited therein) provides the primary data source for the below potential parameter choices:

- *Age of First Breeding:* 3 Years Old
- *Female Offspring per Adult Female:* 0.33
- *Annual Survivorship (Age 3+):* 88%
- *Annual Survivorship (Age 2–3):* 80%
- *Annual Survivorship (Age 1–2):* 72%
- *Survivorship (From fledge to one year of age):* 64%
- *Maximum Age:* 34 Years

These are based upon the following citations from the Cal/Ecotox database.[4]

- *Age of First Breeding:* Lovett and Joanen (1974) noted that the age of first nesting is at three years old.
- *Female Offspring per Adult Female:* Anderson *et al*. (1982) examined six years of data and found 0.18–0.88 fledglings per nest on West Anacapa Island (California) and 0.23–1.20 fledglings per nest on Isla Coronado Norte (California). If we assume (1) a midpoint of the overall 0.18–1.20 fledglings per nest range (0.69), (2) a one-to-one sex ratio, and (3) 95% adults breeding each year, then we get (0.69)(0.5)(0.95) = 0.33 female offspring per adult female.
- *Annual Survivorship (Age 3+):* Anderson et al. (1996) found that sixteen of seventeen Brown Pelicans (94%) combined from two separate studies survived 180 days. If we extrapolate to a full year, we find that this is equivalent to approximately an 88% annual adult survival rate.

To calibrate the model, we assume that the survivorship from Ages 0–2 increases linearly each year such that 88% adult survivorship was achieved at Age 3. We then calibrate Age 0 survivorship so that the sequence of Age 0 to Age 3 survivorship rates is consistent with a

[4] The below citations are cited as referenced in the Cal/Ecotox database. They are not cited as primary sources.

population maintaining a constant population size. We chose a maximum age of 31 because that is the oldest age that at least 1% of the Brown Pelicans would reach given the survivorship assumptions presented above.

D.2.9. Waterfowl and Wetland Birds (General Scoter)

The North Cape REA (Spertudo *et al*. 1999) calculates injury to scoters by combining demographic information for both surf scoters and black scoters. For the purpose of settlement, we suggest drawing on their parameters for calculating injuries for waterfowl/wetland birds. Specifically:

- *Age of First Breeding: 2* Years Old
- *Female Offspring per Adult Female (Annual):* 1.2025
- *Survivorship (From fledge to one year of age):* 37%
- *Annual Survivorship (Age 1+):* 69.375%
- *Maximum Age:* 15 Years Old

The difference between these parameters and those used by Sperduto *et al*. (1999) is that fecundity and survivorship parameters have been decreased by 7.5% of the *North Cape REA* values (1.3, 40%, 75%) to calibrate the life history parameters to be consistent with a constant population size.

D.2.10. Shorebirds (Dunlin)

We use Dunlin as the basis for this injury quantification. The specific parameters used are the following:

- *Age of First Breeding:* 1 Years Old
- *Female Offspring per Age 1 Female:* 0.3074
- *Female Offspring per Age 2+ Female:* 1.007
- *Survivorship (From fledge to one year of age):* 33%
- *Annual Survivorship (Year 1+):* 73%
- *Maximum Age:* 24 Years Old

A review by Warnock and Gill (1996) provides the basis for these parameter choices. They summarize the following information used to derive demographic model parameters for Dunlin:

- *Age of First Breeding:* Warnock and Gill (1996) cited research showing that some birds breed in their first year.
- *Survivorship (From fledge to one year of age):* Warnock (1994) noted that 31–35% of first-year birds return to their wintering grounds. We chose the midpoint of the range (33%).
- *Annual Survivorship (Year 1+):* Warnock (1994) noted 69–77% of adult birds return to their wintering grounds. We chose the midpoint of the range (73%).
- *Maximum Age:* Warnock and Gill (1996) cited documents that support one Dunlin being recaptured at a minimum age of 24 years old. We use this as the basis for our maximum age.

We calibrate the number of female offspring per female parameters so that the population demographics are consistent with a zero growth size. To achieve this, we use (1) personal communications that Warnock and Gill (1996) cited with R. Homes noting 29% of returning birds bred at Barrow, Alaska and (2) the assumption that 95% of all returning adult birds breed.

D.3. Application of Model and Demographic Parameters to Temporal Loss

Table 2 applies the bird-year multipliers calculated using the methods and parameters described above to the acute mortality for selected species from the *M/V Kure* spill. The first column is the estimated acute mortality described in the body of the report. The second column is the estimated bird-year multiplier. The third column is the result of applying the bird-year multiplier to the acute mortality.

TABLE D-2: Injuries to Bird Populations Due to Acute Mortality from the M/V Kure Spill

Bird Category	Estimated Acute Mortality (in Birds)	Estimated Bird-Year Multiplier (in Years)	Total Estimated Injury (in Bird-Years)
Small Grebes	87	2.6	226
Large Grebes	81	3.3	267
Loons	75	6.3	473
Gulls	154	4.4	678
Cormorants	35	4.4	154
Pelicans	31	5.9	183
Non-MAMU Alcids	719	7.2	5,177
Procellarids	191	12.7	2.426
Waterfowl	414	2.6	1,076
Shorebirds	2,033	2.8	5,692

D.4. References

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Appendix E: Loon/Grebe REA Details

E.1. Injury Calculation

Species	Total Estimated Dead	Bird-Year Multiplier	Total Lost Bird-Years
Loons	75	6.25	469
Small Grebes	87	2.64	230
Large Grebes	81	3.35	271
TOTAL	**243**		**970**

See Appendix D for derivation of bird-year multipliers.

E.2. Credit Calculation (projected restoration benefits)

Year	Pairs Protected	Increased Fledges	Increased Bird-Years	Discounted to 1997
2005	0	0	0	0
2006	940	278	843	646
2007	940	278	843	627
2008	0	0	0	0
	This data comes from Clear Lake (see below) and assumes 0.295 additional fledges per pair with project implementation.		Based on 3.04 bird-years per fledge (life expectancy of a fledge)	Discounted at 3% per year
			Total Gained Bird-Years:	**1,274**

Note that delaying project implementation by one to three years does not affect the estimate of the appropriate project scale.

E.3. Note on Increased Fledge Calculation

Data regarding grebe productivity relative to human disturbance comes from Clear Lake, where 13 years of surveys (1992 – 2004) have documented post-breeding juvenile/adult ratios. In six of those years (1994, 1997, 1999, 2002, 2003, and 2004) definite, direct disturbances that resulted in low nesting productivity were recorded. These disturbances included boat traffic and fishing activities in and near nesting colonies, air boat activities associated with weed control within colonies and directly over nests, and marina construction activities near and through nesting colonies. Juvenile/adult ratios in years with major disturbance events averaged approximately 0.1. In other years, with lesser or no known disturbance, juvenile/adult ratios averaged approximately 0.5, which are within the normal range for Western Grebes (pers. comm. D. Anderson). Thus, the average juvenile/adult ratio over the 13-year period was 0.315. Without recurring disturbance, it would probably have been around 0.5 (the same as in non-disturbance years). Thus, recurring disturbance of nesting colonies results in an average annual loss of 0.185 juveniles per adult. Assuming that the number of pairs attempting to nest has been, on average, constant, the average number of lost fledges/pair would be twice that, or 0.369. For this project,

the Trustees assume an 80% success rate, or that 0.369 x 0.80 = 0.295 fledges/nest that would likely be lost to disturbance events, will be protected by the project.

Appendix F: Cormorant/Gull/Pelican REA Details

F.1 Injury Calculation

Species	Total Estimated Dead	Bird-Year Multiplier	Total Lost Bird-Years
Brown Pelican	31	5.92	184
Cormorants	35	4.37	153
Gulls	154	4.44	684
TOTAL	**139**		**1,020**

See Appendix D for derivation of bird-year multipliers.

F.2. Credit Calculation (projected restoration benefits *per nest*)

For restoration scaling, the Trustees focused on the increase in cormorant nesting opportunity that would result from the Old Arcata Wharf refurbishment project. The remnants of this abandoned wharf continue to be used by Double-crested Cormorants for nesting and by gulls and pelicans for roosting. It was assumed that, without refurbishment, the wharf will continue to fall apart and eventually cease to exist as a roosting and nesting location for birds. The Trustees estimated the increased number of bird-years that would be derived from additional nests at the wharf if it was refurbished. Assuming that project benefits would begin in 2006 and continue for 50 years, the Trustees determined that such a project would generate 50 additional bird-years per nest. Because 1020 bird-years were lost due to the Spill, a total of 20–21 new nests would compensate for the injury to these birds. Accordingly, the Old Arcata Wharf project would need to be sufficient in size to provide for this number of new nests. Because surveys have shown one nest for every 11 square feet on the existing platform, approximately 220 square feet would be required to provide for 20 new nests.

Year	Increased Fledges	Increased Bird-Years	Discounted to 1997
2006	0	0	0
2007	0.78	2.50	1.86
2008	0.78	2.50	1.81
2009	0.78	2.50	1.75
2010	0.78	2.50	1.70
2011	0.78	2.50	1.65
2012	0.78	2.50	1.61
2013	0.78	2.50	1.56
2014	0.78	2.50	1.56
2015	0.78	2.50	1.47
Continues to 2057	Based on 0.78 fledges per nest.	Based on 3.21 bird-years per fledge (life expectancy of a fledge)	Discounted at 3% per year
Total Gained Bird-Years/Nest:			**50**

The number of new nests needed to compensate for the injuries would be 1020/50 ~ 20 to 21 nests**.** Note that delaying project implementation for one to three years affects the estimate of the appropriate project scale by less than ten percent.

Appendix G: Common Murre REA Details

G.1. Injury Calculation

Species	Total Estimated Dead	Bird-Year Multiplier	Total Lost Bird-Years
Procellarids	191	12.71	2428
Murres, large alcids	719	7.25	5213
TOTAL	**1,937**		**7,640**

See Appendix D for derivation of bird-year multipliers.

G.2. Credit Calculation (projected restoration benefits)

Year	Increased Nests	Increased Fledges	Increased Bird-Years	Discounted to 1997
2005	0	0	0	0
2006	6	4	17	13
2007	9	6	26	19
2008	14	10	40	29
2009	70	51	199	140
2010	98	71	279	190
2011	115	83	327	216
2012	123	89	350	224
2013	132	95	374	233
2014	141	102	400	242
Continues to 2105	Continues at 7% annual growth until maximum at 1,800 nests.	Based on 0.722 fledges per nest.	Based on 3.94 bird-years per fledge (life expectancy of a fledge)	Discounted at 3% per year
			Total:	**48,927**

Note: First seven years of nest numbers and fledges per nest based on data from Devil's Slide Rock Murre Re-colonization Project (McChesney et al. 2004).

Contribution toward similar project would be 7,640/48,927 = **16%**. Note that delaying project implementation for one to three years affects the estimate of the appropriate project scale by less than ten percent.

G.3. References

McChesney, G.J., A.H. Robinson, J.S. Koepke, H.A. Knechtel, N.M. Jones, C.M. Caurant, T.B. Poitras, H.R. Carter, R.T. Golightly, S.W. Kress, M.W. Parker, and J. Stankiewizc. 2004. Restoration of Common Murre Colonies in Central California: Annual Report 2003. Report to the Apex Houston Trustee Council. U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex. Newark, CA

Appendix H: Marbled Murrelet REA Details

H.1. Injury Calculation

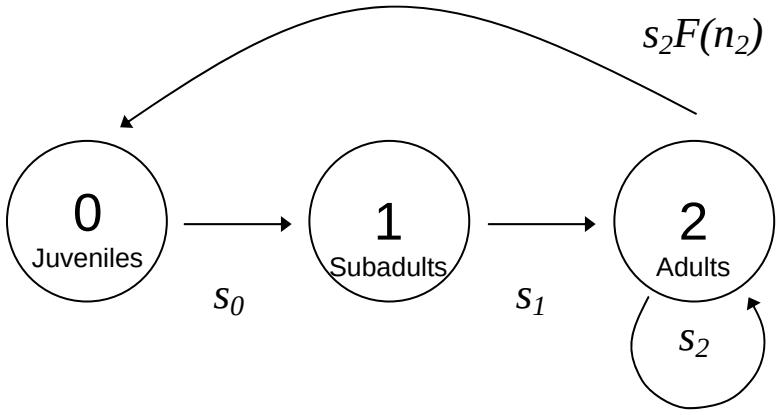
The Trustees calculated the injury to Marbled Murrelets based upon female bird-years, assuming a 1:1 sex ratio. This implies that a 130 bird acute mortality translates into an immediate loss of 65 female birds from the local population.

The discounted bird-year injury (or debit, *D*) was based upon the following formula:

$$D = \sum_{t=1997}^{2096} \frac{N_{BI,t} - N_{I,t}}{(1+d)^{t-1997}} \qquad \text{(H1)}$$

Here, $N_{BI,t}$ is the numbers of female birds in the subpopulation in period *t* had the spill not occurred, and $N_{I,t}$ is the number of female birds in the subpopulation at period *t* after the spill. For example, if we assume that the size of the injured population was 2100 females at the time of the spill and 65 females were killed, then $N_{BI,1997}$ = 2100 and $N_{I,1997}$ = 2100 – 65 = 2035. The parameter *d* is the discount rate. This is set at *d* = 0.03, consistent with federal NRDA guidance for a risk-free discount rate.

To calculate the trajectories $\{N_{BI,t}\}$and $\{N_{I,t}\}$, we use the following re-parameterization of the Beissinger (1995) model.



(H2)

The parameters s_0, s_1, and s_2 are the survivorships for juveniles, subadults and adults, respectively. The term $s_2F(n_2)$ reflects the "post-breeding" census convention (i.e., bird-years are counted in the Fall). This implies that adult murrelets (n2) must survive (s_2) before they are able to attempt successful breeding ($F(n_2)$). In the model, fecundity increases as the population becomes smaller (i.e., $dF(n_2)/dn_2 < 0$). This reflects the possibility that, as a population declines, it will tend to decline faster in more marginal areas leaving the remaining birds in higher quality habitat.

Combining the trajectories projected from (2) into Equation (1) yields our injury estimate of lost bird-years.

H.2. Credit Calculation (projected restoration benefits)

The overall benefit of the land acquisition and management is scaled based upon the benefit of the project at an individual nest (in discounted female bird-years). The number of nests that need to be protected to compensate for the injury ($N_{Acquire}$) is based upon: (1) the size of the bird-year injury; and (2) the benefit of land acquisition to nesting birds and their offspring (in discounted female bird-years). This is written as:

$$N_{Acquire} = \frac{D}{B_{nest}} \qquad \text{(H3)}$$

where D is the Marbled Murrelet injury from (1) (measured in discounted female bird-years), and B_{Nest} is the benefit of the project per nest affected (in discounted female bird-years per nest). The benefits per nest (B_{Nest}) are calculated over a 100 year period, according to the formula:

$$B_{Nest} = \sum_{t=t_{\log}}^{2098} \frac{N_{R,t} - N_{BR,t}}{(1+d)^{t-1997}} \qquad \text{(H4)}$$

Here, $N_{R,t}$ is the expected numbers of female birds supported by a nest within an acquired site at time t.[5] $N_{BR,t}$ depicts the fate of the birds supported by the acquisition site at time t after logging. t_{log} is the number of years between spill and logging without the acquisition project. The parameter d is the discount rate, which is set at 0.03.

The trajectories for $N_{BR,t}$ and $N_{R,t}$ are based upon the same basic modeling framework as used in the injury calculation. However, there are two differences between the calculation performed here and the calculation used in the injury model. First, the model is applied at the "nest" scale, versus a local population scale. This implies that we follow the number of birds associated with a given nest (versus the entire local female population). Second, we assume that: (a) with acquisition, nests are sufficiently productive to maintain population levels ($\lambda = 1.0$); and (b) without acquisition, associated birds will reproduce at lower fecundity ($\lambda < 1.0$) after logging occurs (e.g., $t_{log} = 2007$).

[5] This would include one adult female per nest, along with corresponding sub-adults, juveniles, and potentially non-breeding adults.

Appendix I: Waterfowl REA Details

I.1. Injury Calculation

Species	Total Estimated Dead	Bird-Year Multiplier	Total Lost Bird-Years
Waterfowl	414	2.59	1,072

See Appendix D for derivation of bird-year multipliers. Total lost bird-days = 1072 bird-years x 365 days = **391,375**

I.2. Credit Calculation (projected restoration benefits *per acre*)

Year	Increased Bird-User Days/Year	Discounted to 1997	Year	Increased Bird-User Days/Year	Discounted to 1997
2008	0	0	2017	1,168	647
2009	130	91	2018	1,298	698
2010	260	177	2019	1,427	745
2011	389	257	2020	1,557	789
2012	519	333	2021	1,687	830
2013	649	404	2022	1,817	868
2014	779	471	2023	1,946	903
2015	908	534	2024	2,076	935
2016	1,038	592	2025	2,206	964
Continued on next three columns ↗			Continues to 2058	Based on year-round average of 7.1 birds per acre per day	Discounted at 3% per year
				Total:	**33,626**

Note: Average of 7.1 birds per acre derived from a conservative estimate using DFG waterfowl surveys in Humboldt Bay. Note that winter density is much greater than summer density. This estimate reflects a year-round average. Gradual phase-in is meant to reflect gradual increases in populations, as well as the gradual improvement in the restored habitat.

Number of acres needed for project would be 391,375/33,626 = **11.6 acres**.

Appendix J: Shorebird REA Details

J.1. Injury Calculation

Species	Total Estimated Dead	Bird-Year Multiplier	Total Lost Bird-Years
Shorebirds	2,033	2.83	5,753

See Appendix D for derivation of bird-year multipliers. Total lost bird-days = 5,753 bird-years x 365 days = **2,099,987**

J.2. Credit Calculation (projected restoration benefits *per acre*)

Year	Increased Bird-User Days/Year	Discounted to 1997	Year	Increased Bird-User Days/Year	Discounted to 1997
2008	0	0	2017	19,398	10,740
2009	2,155	1,512	2018	21,553	11,586
2010	4,311	2,935	2019	23,709	12,373
2011	6,466	4,275	2020	25,864	13,105
2012	8,621	5,534	2021	28,019	13,784
2013	10,777	6,716	2022	30,175	14,412
2014	12,932	7,824	2023	32,330	14,991
2015	15,087	8,862	2024	34,485	15,525
2016	17,243	9,833	2025	36,641	16,015
Continued on next three columns ↗			Continues to 2058	Based on year-round average of 118.1 birds per acre per day	Discounted at 3% per year
				Total:	**558,549**

Note: Average of 118.1 birds per acre derived from shorebird surveys in Humboldt Bay as described in Table 5 of Danufsky et al (2001). This estimate reflects a year-round average. Winter densities were assumed to encompass six months of the year, while spring, summer, and fall each encompass two months. Summer density was assumed to be zero for all species. Gradual phase-in is meant to reflect gradual increases in populations, as well as the gradual improvement in the restored habitat.

Number of acres needed for project would be 2,099,987/558,549 = **3.8 acres**.

J.3. References

Danufsky, T., M.A. Colwell, L.W. Leeman, R.L. Mathis and T.S. Leeman. 2001. Final Report. Humboldt Bay/Kure Oil Spill: Shorebird Abundance and Diversity at Oiled and Un-oiled Sites. Prepared for the California Department of Fish and Game, Sacramento, CA.

Appendix K: Shoreline HEA/REA Details

K.1. Injury Calculation

Table 4-18: Summary of Shoreline Injury

Habitat Type	Area (acres)	Initial Injury	Days to Full Recovery
Mudflat			
Heavy Impact	0.11	100%	90
Moderate Impact	2.31	50%	60
Lightly Swept	5902.21	10%	30
Sand and Gravel Beaches			
Heavy Impact	1.22	100%	120
Moderate Impact	1.00	50%	120
Light Impact	8.24	25%	120
Lightly Swept	199.33	10%	30
Marsh			
Heavy Impact	0.68	100%	730
Moderate Impact	69.16	50%	365
Light Impact	1.02	25%	180
Riprap			
Heavy Impact	1.34	100%	365
Moderate Impact	1.10	50%	180
Light Impact	4.07	25%	60

The Trustees calculate that this would result in approximately 44.5 acre-years lost (in 1997 resource service units)

K.2. Credit Calculation (projected restoration benefits *per acre*)

Year	Increased Resource Services (% Service Value per Acre)	Discounted acre-years to 1997 (at 3% annually)
2009	2%	0.01
2010	4%	0.03
2011	6%	0.04
2012	8%	0.05
2013	10%	0.06
2014	12%	0.07
2015	14%	0.08
2016	16%	0.09
2017	18%	0.10
2018	20%	0.11
2019	22%	0.11
2020	24%	0.12
2021	26%	0.13
2022	28%	0.13
2023	30%	0.14
2024	32%	0.14
2025	34%	0.15
2026	36%	0.15

2027	38%	0.16
2028	40%	0.16
2029	42%	0.16
2030	44%	0.17
2031	46%	0.17
2032	50%	0.18
2033	50%	0.17
2034	50%	0.17
2035	50%	0.16
2036	50%	0.16
2037	50%	0.15
2038	50%	0.15
2039	50%	0.14
2040	50%	0.14
2041	50%	0.14
2042	50%	0.13
2043	50%	0.13
2044	50%	0.12
2045	50%	0.12
2046	50%	0.12
2047	50%	0.11
2048	50%	0.11
2049	50%	0.11
2050	50%	0.10
2051	50%	0.10
2052	50%	0.10
2053	50%	0.10
2054	50%	0.09
2055	50%	0.09
2056	50%	0.09
2057	50%	0.08
2058	50%	0.08
	TOTAL:	5.98 Acre-years per Acre

The number of acres needed for the project is 44.5/5.98 = **7.5 acres**

Appendix L: Recreational Use Losses

L.0. Summary

This appendix describes and quantifies the lost human recreational use component of the Kure Oil Spill natural resource damage assessment (NRDA). The purpose of this assessment is to identify all impacts to human recreational uses that occurred as a result of the spill and to quantify the value of those lost uses.

Potential impacted activities include sea kayaking; surfing; camping; recreational boating; recreational crabbing, clamming, and fishing; and hunting. Based on surveys of concessionaires and land managers in the Humboldt Bay area, we have determined that quantifiable impacts occurred only with respect to sea kayaking, surfing, and camping. Impacts to the other activities were negligible and will not be quantified. This report only quantifies the value of lost trips; it does not estimate the diminished value of trips that were taken despite the spill. The value of a trip is estimated using the Benefits Transfer method, whereby estimates of trip value in the literature are examined and extrapolated to this setting. Table 1 summarizes the estimated damage to recreational uses affected by the Kure oil spill.

Table L-1: Summary of Lost Recreational Values

ACTIVITY	LOST DAYS	VALUE PER DAY*	TOTAL LOST VALUE
Sea kayaking	73	$61.57	$4,515
Surfing	400	$61.57	$24,628
Camping	294	$30.36	$8,926
		TOTAL:	**$38,069**

*In fourth quarter, 1996 dollars

Adjusted for inflation (24.7%), the total amount is approximately **$47,000**.

L.1. Impacts to Human Recreational Activities

An oil spill may impact recreational activities in two ways: 1) it may preclude the activities altogether, resulting in lost use; or 2) it may cause a loss of value to the activity, resulting in diminished use value. The former type of impact is rather objective and is typically the result of closures to beaches, waterways, or other venues. The latter type is more subjective, often requiring detailed knowledge of the impacted activity and the spill. Diminished use is often indicated when a recreational site is not closed due to a spill, but the number of visitors to the site decreases to levels well below normal. In that case, there is both lost use due to the decreased number of users, and quite likely diminished use for those users that went ahead with their activity.

This oil spill impacted most recreational activities for a relatively short period of time: a few days to a few weeks. Based on the rather limited impacts of this spill, and to simplify the assessment, we have not attempted to calculate diminished use. Instead, we have focused only on lost use that resulted from oiling and/or closures of beaches, waterways, or campgrounds.

We first identified activities that had the potential to be impacted. These included sea kayaking; surfing; camping; recreational boating; recreational crabbing, clamming, and fishing; and

hunting. We then contacted concessionaires and land managers in the Humboldt Bay area who would have knowledge of the impacts to these activities. From these conversations, we determined that impacts to recreational boating; recreational crabbing, clamming, and fishing; and hunting may have occurred but were quite small. Thus, we have not attempted to quantify these impacts. We have determined that quantifiable impacts did occur with respect to sea kayaking, surfing, and camping.

Specifically, sea kayaking was impacted by the closure of Humboldt Bay to recreational watercraft. Surfing was impacted by oiling and cleanup activities around the North Jetty. Camping was impacted by the temporary closure of Samoa Park Campground. These impacts are detailed in Section V.

L.2. Methodology Overview: Benefits Transfer

Because many of these activities involve using publicly available resources and exact little marginal cost on the user, there is no observable market price. We cannot see how much the user is really willing to pay for it. Thus, we cannot see its true value to the user. Surfing provides an excellent example. The marginal cost of a surfing day may be nothing more than a few dollars to park the car. However, there are additional costs that can be examined. These may include the value of the surfer's time spent surfing and the fixed costs associated with equipment (e.g., surfboard, wetsuit, etc.). One may also want to consider foregone job opportunities and career earnings just to live near a good surfing area and have time available to surf. All of these provide a lower bound on the value of surfing. If it were not worth these costs, the person would not choose to surf. Because the individual made the decision to surf, the activity must be worth *at least* these costs. Note that the economist does not ask the question: what does it cost to do this activity? Instead, we ask: what is the value of this activity to the user and what would they be willing to pay to do it?

A vast economic literature has emerged attempting to consider these factors and estimate the value of a recreational activity. Some of the methods commonly used include Travel Cost Method, Contingent Valuation, and Conjoint Analysis. For purposes of minimizing assessment costs, especially given the relatively small impacts in this case, we have relied on Benefits Transfer. This method relies on previous studies in the literature and transfers those values to the particular situation, often making various adjustments to account for differences between the study areas and the impacted site. This method greatly minimized the amount of research and study required to estimate the value of the lost activities.

The first step, however, does require specific data from the impacted area. The basic approach is to estimate the number of lost user days of a specific activity and multiply that by the value per user day of that activity, as derived from the Benefits Transfer method. The equation below describes this formally:

# of lost user days x value of a lost user day = total value of lost user days

Note that the analysis may also be done using lost user trips or hours or some other metric.

Unfortunately, there are no economic analyses specifically regarding the value of sea kayaking and surfing. However, there are many studies to draw on that focus on the value of other

recreational activities, such as fishing, hiking (including overnight backpacking), canoeing, whitewater rafting, and even snow-mobiling. These studies help provide a reasonable estimate of the value of the activities impacted by this spill.

L.3. Estimated Number of Lost User Days

L.3.1. Sea Kayaking

Based on conversations with Jay Dottle of Humboats, we estimate that a total of 220 boat hours were lost due to the spill. Dottle estimated that his concession lost 80 boat hours, while other sea kayak rental places and private individuals lost an additional 140 boat hours. Because we want to put the lost use in terms of user days, we have assumed that an average day trip lasted three hours. Thus, 220/3 = 73 user days were lost due to the spill.

L.3.2. Surfing

Based on communication with Kirk Johnson of Humboldt Surf Company, we estimate that 400 user days were lost due to the spill. Johnson notes that November offers prime surfing conditions at the North Jetty. He estimates that approximately 100 surfers per day would be expected to take advantage of this location. Indeed, at least two surfers were directly oiled at the beginning of the spill. Because the area could not be used for surfing for four days, we have estimated 400 lost user days.

L.3.3. Camping

The only place where camping was precluded due to the spill was at Samoa Park Campground. This campground had to be closed for several days due to cleanup and response activities. Bob Walsh, of Samoa Park Campground, stated that 84 camping reservations had to be cancelled. Walsh also estimates an average of three to four people per campsite. Assuming an average of 3.5 people per site, we have estimated that a total of 294 camping days were lost.

L.4. Valuation of Human Use Impacts

While an extensive review of the literature and the development of a complex Benefits Transfer function are possible, we have chosen to simplify the analysis and employ a simple “value transfer”. That is, we will use average values from other studies as the basis for determining the value of the activities of interest. We will rely on a recent meta-analysis of economic studies: Rosenberger and Loomis, 2000. This report examines the results of 163 different studies, spanning 21 different outdoor recreational activities, and reports on 760 measures of benefits. Table L-2 summarizes some of the results.

Table L-2: Results of Rosenberger and Loomis Report for Selected Activities

ACTIVITY	n	MEAN VALUE/USER DAY
Camping	40	$30.36
Float boating	19	$61.57
Swimming	12	$21.08
Biking	5	$45.15
Snowmobiling	2	$69.97
Rock climbing	4	$52.96

n = number of estimates
Values are in fourth-quarter, 1996 dollars.

For the purposes of this damage assessment, we have decided to use the mean value for camping in this report to estimate the value of a camping day, and the mean value for float boating to estimate the value of a sea kayaking and surfing day.

L.4.1. Camping

While it is possible to examine the large number of camping studies and derive a Benefits Transfer function that takes into account various campground attributes, such an effort may not be efficient given the small magnitude of the impacts here. Thus, we have simply employed the mean value.

L.4.2. Sea Kayaking

The various studies that were encompassed in the float boating category included both calm water canoeing and whitewater rafting from a wide variety of locations. For lack of a compelling reason to make any adjustment, we have employed the mean value without any changes.

L.4.3. Surfing

While surfing has yet to be specifically studied, we have focused on its similarity to other outdoor activities that offer both physical challenge and thrills, such as rock climbing, snow-mobiling, and mountain biking. Note that mountain biking is a sub-category of the biking category, with an estimated value of approximately $59/user day (see Table 2 of Rosenberger and Loomis, 2000). Given the range of these values, it seems not unreasonable to apply the float boating value to surfing as well.

In conclusion, we have used the values described above and added 13% to these dollar figures to adjust for inflation. The results are as follows:

Value of a camping day: $34.31
Value of a sea kayaking day: $69.57
Value of a surfing day: $69.57

Multiplying these values by the number of lost user days will produce the total lost recreational value associated with the Kure oil spill. The results are presented in Table 1.

L.5. References

Rosenberger, R.S., and J.B. Loomis. 2001. Benefit transfer of outdoor recreation use values: A technical document supporting the Forest Service Strategic Plan (2000 revision). Gen. Tech. Rep. RMRS-GTR-72. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Appendix M: Summary of Public Comments and Trustee Responses

The Kure Trustees received thoughtful and relevant comments on the Draft DARP/EA during the public review process. The Trustees grouped the comments below into similar subject matter headings and present responses after each comment/question.

1. What are the reasons for the Redding Rock common murre colony declines?

It appears that human disturbances as well as impacts from the Kure and Stuyvesant oil spills have impacted the colony. Human disturbances have been documented in the past from USCG staff, who access the rock during sensitive times of the year to maintain a signal light. One aspect of the project will be to support on-going coordination with the USCG. Also, encroachment or use of Redding Rock by fishermen is an additional possible cause of abandonment or disturbance.

2. Are there sea lions on Redding rock affecting nesting success of common murres?

Sea lions use Redding Rock as a haul out and rest site, and the numbers of sea lions using the rock has increased in recent years. However, it is unclear whether control measures for sea lions will be required to assist with improving murre populations. Sea lions may simply be increasing their use of the rock due to the decline in use by murres, rather than the other way around. The restoration project will include a component to assess the effects of the sea lion use of the rock on the murre breeding colony and, if warranted, steps will be taken to address the issue.

3. What is the restoration action at the Redding Rock murre colony?

The restoration project is aimed at increasing the number of murres and their nesting success at the Redding Rock murre colony by reducing disturbances to murres and, if necessary, utilizing ”social attraction” techniques that would predominately involve the use of bird decoys and sound systems. This is very challenging given the remote location of the site and logistical challenges. However, previous efforts to restore murres on Devil’s Slide Rock in central California have been highly successful despite the logistical challenges there (i.e., difficult site access).

4. What is the amount of the settlement and allocation to each project?

The final settlement includes acquisition of a conservation easement over approximately 300 acres of redwood forest, supported by a payment of $500,000 to monitor and enforce the terms of the conservation easement, plus approximately $2.5 million to fund other restoration projects. The settlement also requires payment of the balance of the trustees’ assessment costs (roughly $1.2 to $1.5 million).

The amount allocated to each of the projects is set forth in the Final DARP/EA.

5. Why isn’t lethal removal included in corvid management, e.g., around corvid nests?

Lethal removal of corvids is included as an option under the corvid management project, but it is not currently the method of choice. Initially we will utilize education of the public and garbage

control improvements, and will annually monitor the resident corvid populations. The populations will need to meet certain threshold criteria indicating population decreases, and if these reductions are not sufficient, lethal means will then be considered.

It is important to note that data from other sites where lethal control has been used indicate that success using this method is only temporary, as new birds will move into the area as long as the attractive food source is present. Since Marbled Murrelets nest at low densities and corvid numbers will have to be suppressed throughout the entire murrelet nesting season, a project relying on lethal control as the primary control mechanism would need to be sustained at a high level of effort over a large area to remove both occupying and immigrating corvids before they depredate murrelet nests. In addition, there is no guarantee that such an extensive effort would be successful for a predator as clever as a corvid within the redwood forest environment where visibility is often disrupted by physical obstructions.

Thus, we believe that the removal or strict control of attractive food sources in areas where marbled murrelets nest is a necessary component of any successful corvid control project, as well as the best long term solution to reducing corvid numbers, and ultimately reducing corvid predation on marbled murrelet nests.

6. Is there an example of a successful pelican project? Would the Trustees consider building structures?

Some roost-site protection projects are currently in use in southern California, including for example, the salt ponds in south San Diego Bay where jetties that have broken up, essentially creating islands, are being specifically protected as roost sites. Other examples include fencing of jetty ends, creation of floating platforms, and protection measures of natural structures. It is doubtful that new manmade structures would be built in Humboldt Bay, as we feel there are sufficient natural structures that can be utilized with protection measures in place.

7. Were shellfish considered in the NRDA?

Commercial oyster farmers made a private claim against Kure, specifically for damages to their resources. The terms of their settlement with Kure are confidential. For the NRDA, shellfish were collected and analyzed for petroleum. These data were considered in the assessment of the duration and severity of injuries to the shoreline habitat (includes injuries to mudflats, riprap, beaches and wetlands habitat) rather than injuries to shellfish as a separate resource.

8. Was there any attempt to assess fish impacts within Humboldt Bay?

Yes, fish were collected and analyzed for petroleum after the Kure Spill. The data were used in the estimate of the severity and duration of injuries assessed for the shoreline habitat. The habitat restoration projects, specifically the McDaniel Slough wetland enhancement project which will restore tidal action, will benefit fish as a component of the aquatic environment. We did not have any evidence of significant fish mortality after the Kure Spill, unlike the 1999 Stuyvesant spill in Humboldt Bay when we documented thousands of dead shrimp at the mouth of the Bay and included those in the injury assessment.

9. What do the Trustees use for baseline data for birds?

For several bird species, there were pre-existing survey data from other sources. For example, for Marbled Murrelets we used pre-existing boat surveys conducted by Redwood Science Lab. We were then able to conduct post-spill surveys using the pre-existing transect lines, thus allowing us to compare to previous survey protocol. For waterfowl within Humboldt Bay, we used pre-existing DFG overflight survey data. In addition, during the spill, we had experts conduct shorebird surveys around the Bay. We were able to document shorebird occurrences both prior to oil reaching the location, as well as documenting oiled shorebirds on impacted shorelines after the oil arrived.

10. Was there any soil monitoring after the Spill? Are the Humboldt State University results available to the public?

Of the habitats affected, the marshes around Humboldt Bay were the most heavily oiled (particularly around Indian Island and the Samoa Boat Ramp). A survey conducted by CDFG (Lesh and Broadman 1999; included in the Kure Administrative Record) monitored selected habitat and shorelines in the hardest hit areas (e.g., near Samoa Boat Ramp). This monitoring was conducted in January 1998, November 1998 (approximately one year after the spill), and in July 1999. No visual differences could be observed in the density of marsh plant species between oiled and unoiled areas one year after the spill. An asphalt sample found on leaf sheaths in July 1999 exhibited some similarities to Kure oil but all of the lighter and most of the medium weight hydrocarbons had been degraded and were no longer present. The vast majority (99.9%) of impacted mud flat was very lightly oiled. Humboldt State University (HSU) monitored shorebird use of oiled and unoiled mudflats from March 1998 through March 1999. No difference in shorebird density between oiled and unoiled areas was observed, suggesting that shorebird use of oiled habitats of Humboldt Bay was not adversely affected by the Spill. These results are available to the public as part of the Kure Administrative Record.

11. How do the Trustees determine that habitat has recovered?

When determining the amount of restoration needed to restore injured habitats, the Trustees consider the data collected by Shoreline Cleanup Assessment Teams (SCAT data) regarding extent of oiling and cleanup efforts. In addition, the Trustees often conduct additional sampling to determine extent and degree of oiling. They also consider impacted species within the habitats and the ecology of those species to estimate how long it would take them to recover. This information is used in the Habitat Equivalency Analysis calculations. In addition, the habitat restoration projects contain a monitoring component to document the success of the project. In situations where natural recovery is selected as the preferred project alternative, Trustees often include a monitoring component to document recovery.

12. To what extent are funds locked into restoration projects instead of an evaluation and monitoring for baseline information?

We are statutorily bound to develop plans to restore, replace or acquire the equivalent of the lost resources. So, we are required to use the recovered damages to fund restoration projects rather than for baseline monitoring unrelated directly to the event. Further, , it is impractical to collect baseline information for all environments and species. Nor can we predict where the next oil

spill will occur to target baseline data collection. However, we do use baseline information, where available, such as data from the Coastal Ocean Mammal and Bird Education and Research Surveys (Beach COMBERS) database. In addition, all of the restoration projects contain a monitoring component to evaluate whether the project has been successful.

13. Do birds that were rehabbed and released contribute to quantifying injury?

Yes. We recognize that many birds will die after they are rehabbed and released. We assume that 75% of the rehabilitated birds die or fail to contribute to the breeding population. This information is based on mean estimates from several studies that examine the survival of birds that are treated and released after oil spills. This included a specific rehab survival study for common murres conducted in the aftermath of the *Stuyvesant* oil spill.

14. Why did this case take so long?

Numerous case-specific factors contributed to the lengthy duration of this case. During the event and afterwards, there were contentions between the Trustees and the responsible party, both on the number of impacted species and on how to proceed with restoration. Specifically, the issues which required the most time to resolve involved the extent of injury to Marbled Murrelets, and the identification and evaluation of feasible restoration projects for those injuries. Thereafter, a considerable amount of time was spent selecting appropriate old growth parcels and negotiating the terms of a conservation easement with a non-party landowner. In addition, the responsible parties initiated and pursued for several years a lawsuit against the dock owner. Until that lawsuit was concluded, the responsible parties were not inclined to resolve the trustees' claims for natural resource damages. Also, there was an unusually high rate of turnover in the responsible party and trustee personnel involved in the case throughout the assessment and planning period, which slowed progress in reaching settlement.

15. Were effects on invertebrates, marine mammals, algae and vascular plants considered? Was there an assessment on the effects on ecosystem structure and function?

We did not have evidence of mortality to marine mammals. Invertebrates, algae and vascular plants were considered in the shoreline impacts which evaluated tidal mudflats and associated eelgrass beds, intertidal wetlands, riprap shoreline, and sand and gravel beach habitats. The shoreline habitats are a source of much of the primary productivity and nutrients supporting the Bay ecosystem. These habitats also support diverse invertebrate communities, many of which serve as important food sources for wading birds and shorebirds. Injuries to these habitats resulting in lost ecological services are considered in the shoreline injury quantification. The restoration project at McDaniel Slough will compensate for the lost natural resource services to these habitats as a result of the Spill.

Appendix N

Written Public Comments Received



"Peter A. Nelson" <panelson@ucdavis.edu>
09/18/2007 04:33 PM

To Carolyn_Marn@fws.gov
cc
bcc
Subject Kure/HBay oil spill

History: This message has been forwarded.

Hi Carolyn:

What's the potential for entertaining alternative assessment/restoration proposals? Very briefly, I've been involved in an effort to collect baseline data on seabird mortality patterns (spatial and temporal), from Humboldt County North to the Canadian border, Alaska and Hawaii. We have data also on how seabird carcasses, once found, degrade, move, disappear and reappear. Support for the former would be very useful in the event of a future spill; the latter could directly inform our understanding of the effects of the Kure spill and aid in predicting the effects of other spills.

I'd also suggest that the effects on fishes should be addressed; there are several potential avenues along those lines that could be pursued. Similarly, effects on invertebrates, marine mammals, algae and vascular plants should be considered. In keeping with recent interest in pursing an holistic, ecosystem-based approach to natural resource management, it'd be worth considering an assessment on the effects on ecosystem structure and function too. Were there no proposals to attempt any of these?

Cheers,

Pete

Peter A. Nelson, Ph.D.
panelson@ucdavis.edu
phone: 707.443.8369
cell: 707.267.5896



"Robert Browne"/
<bobb@mlfn.net>
09/19/2007 10:08 AM

To <Carolyn_Marn@fws.gov>
cc
bcc
Subject 1997 Humboldt Bay Oil Spill Restoration

History: This message has been forwarded.

Hello Carolyn,

I own 27 acres of property along the easterly shoreline of the Entrance Bay in Humboldt Bay. It is comprised of approximately 10 acres of upland at the base of the Elk River Spit and approximately 17 acres are submerged land along the westerly side of the railroad tracts. Fee title to the property was established in 1993 after a 13 year battle with the City of Eureka , The Harbor District and State Lands. I would like to know if this property may be affected or involved in the current restoration plan.

I believe a portion of the property would be suitable for your mitigation purposes and would be willing to discuss further that possibility with the appropriate agency.

Thank you

Robert Browne
(408) 691-4238

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Arcata Field Office
1695 Heindon Road
Arcata, CA 95521
www.ca.blm.gov/arcata

In Reply Refer To:
(CA330)P

October 29, 2007

Carolyn Marn
US Fish and Wildlife Service
2800 Cottage Way, Rm W-2605
Sacramento, CA 95825

Subject: Kure/Humboldt Bay Oil Spill Draft Damage Assessment and Restoration Plan/Environmental Assessment.

Dear Ms. Marn:

The BLM has reviewed the Kure/Humboldt Bay Oil Spill Draft Damage Assessment and Restoration Plan/Environmental Assessment. We offer the following comment for your consideration;

1. Please include the California Coastal National Monument Resource Management Plan, September 2005, under Section 3.1.2-Compliance and Potentially Applicable Laws and Regulations of the Kure/Humboldt Bay Oil Spill Draft Damage Assessment and Restoration/Environmental Assessment.

We appreciate the opportunity to provide input and continued involvement in the Kure restoration efforts. If you have any questions, please contact Arlene Kosic @ 707-825-2345.

Sincerely,

Lynda J. Roush
Arcata Field Manager

Appendix O

NEPA Decision Document/Finding of No Significant Impact

NEPA Decision Document/Finding of No Significant Impact
For the Kure/Humboldt Bay Oil Spill
Damage Assessment and Restoration Plan/Environmental Assessment

U.S. Fish and Wildlife Service, Department of the Interior
April 2008

Background:

Under the Oil Pollution Act of 1990 (OPA), the Natural Resource Trustee Agencies (the Trustees), including the U.S. Fish and Wildlife Service (Service), the California Department of Fish and Game (CDFG), and the California State Lands Commission (CSLC) have prepared the *Kure/Humboldt Bay Oil Spill Final Damage Assessment and Restoration Plan/Environmental Assessment,* dated April, 2008 (DARP/EA). The DARP/EA assesses damages and evaluates restoration alternatives for natural resource injuries due to the November 5, 1997 spill of approximately 4,500 gallons of Intermediate Fuel Oil 180 into Humboldt Bay, near Eureka, California (the Spill). The Kure was tied to the dock and in the process of being repositioned for loading when its starboard hull struck a mooring "dolphin" that punctured the #3 fuel tank. Sorbent boom was deployed to contain the spill, but oil escaped the boom and spread with the tide. Personnel on the first overflights on November 6 identified black oil product as far as 17.5 miles north of the bay mouth; observers on subsequent overflights detected oily "mousse" just outside the surf zone as far north as Trinidad Head.

The DARP/EA proposes restoration projects that compensate for natural resource injuries caused by the Spill. Injuries to natural resources and recreational services included 3,950 birds estimated killed, 6,200 acres of mudflat, rocky intertidal, beach, and wetland habitat oiled, and 767 lost recreational user-days. The Trustees estimate that 46 bird species, including two federal and state listed threatened and endangered species (i.e., the Marbled Murrelet and California Brown Pelican) were injured. The Trustees prepared the DARP/EA which describes the injuries resulting from the Spill and proposed restoration alternatives. The plan was developed, in part, through cooperative studies with the Responsible Parties (i.e., Kure Shipping, S.A. and Patt Manfield & Co.).

Restoration Alternatives:

The DARP/EA evaluated several categories of restoration alternatives, including a "no action" alternative, and developed criteria to evaluate and prioritize the entire suite of restoration projects under consideration. The Trustees considered and rejected the no-action alternative, which relied on natural processes for recovery of the injured natural resources. Natural recovery does not allow for recovery of interim losses suffered by the resources and the OPA clearly establishes trustee responsibility to seek compensation for interim losses pending recovery of natural resources. Furthermore, technically feasible alternatives for restoration are available.
The six selected restoration actions are:

1. Protection of Western/Clark's Grebe Nesting Colonies at Northern California Lakes;
2. Brown Pelican Roost Site Protection;
3. Restoration of Common Murre Nesting Colony at Redding Rock;
4. Protection of Marbled Murrelet Nesting Habitat;
5. Protection of Marbled Murrelet Nesting Success through Corvid Management; and
6. Restoration of Salt Marsh Wetlands at McDaniel Slough

This decision document concludes that a Finding of No Significant Impact (FONSI) is appropriate for all of the restoration actions selected for implementation by the Trustees as identified in the DARP/EA and summarized here, with the possible exception of Brown Pelican Roost Site Protection and Restoration of Common Murre Nesting Colony at Redding Rock. As these projects are more fully developed, they may undergo additional environmental analysis prior to implementation.

Public Involvement:

The Trustees involved the public during development of the DARP/EA. The Trustees held a 45-day public review and comment period, from September 14 until October 29, 2007 for the draft DARP/EA. The Trustees also presented an overview of the draft DARP/EA and accepted public comments at a public meeting in Arcata, California on September 19, 2007. Written and oral comments received on the Draft DARP/EA are included as Appendices in the Final DARP/EA.

Alternatives Considered:

The Trustees grouped injured species in the DARP/EA in order to focus restoration projects for the 46 species of birds affected by the Spill. These groups are as follows: Loons and Grebes; Pelicans, Cormorants and Large Gulls; Alcids (except Marbled Murrelets) and Procellarids; Marbled Murrelets; Waterfowl, and Shorebirds. The remaining injury categories are shoreline habitat and human recreational use losses.

The DARP/EA evaluated specific project alternatives for each injury group specified above against certain criteria. The initial screening criteria included Consistency with Trustees' Restoration Goals, Technical Feasibility, Cost-Effectiveness, Relationship to Injured Resources and/or Services, Time to Provide Benefits, and Duration of Benefits. Additional screening criteria included Avoidance of Adverse Impacts, Likelihood of Success, Multiple Resource and Service Benefits, Compliance with Applicable Federal, State, and Local Laws and Policies, Public Health and Safety, Maintenance and Oversight of Project, Opportunities for Collaboration, Total Cost and Accuracy of Estimate, and Comprehensive Range of Projects. Supplemental screening criteria included, Ability to Document Benefits to the Public, Educational/Research Value, and Non-Duplication. The Trustees then selected the preferred alternatives based on the merits shown in the evaluation.

The specific project alternatives the Trustees considered for each injury category are listed below with the selected projects in italics.

Loons and Grebes:

- *Protection of Western/Clark's grebe nesting colonies at northern California lakes*
- Acquisition of land around Lake Earl to allow for higher lake levels and increase Western Grebe nesting

Pelicans, Cormorants and Gulls:

- *Brown Pelican roost site protection*
- South Spit of Smith River acquisition and management
- Island Roost at Lake Talawa—building up the island above high water
- Artificial pelican roosts—float at Samoa Bridge and tree in Crescent City Harbor
- Old Arcata Wharf restoration—refurbishing and enlarging of abandoned wharf
- South Spit of Humboldt Bay acquisition
- Pelican roost at North Jetty on North Spit—cut off to create an island
- Pelican signs on South Spit—to reduce human disturbances

Common Murres, Other Alcids (except Marbled Murrelet) and Procellarids:

- *Redding Rock murre re-colonization and protection*
- Trinidad seabird colonies—re-colonization of Tufted Puffin at Green and Puffin Rocks
- Trinidad seabird colonies—re-colonization of Common Murre at Sea Lion Rock
- Trinidad seabird colonies—enhance nesting habitats for Leach's Storm-Petrel at Little River and Prisoner Rocks
- Whaler Island restoration (Crescent City Harbor)—for Humboldt and Del Norte County seabird colonies
- Human disturbance reduction program—for Humboldt and Del Norte County seabird colonies
- Cape Vizcaino area seabird colonies—acquisition and management

Marbled Murrelets:

- *Preservation/Management of old growth/residual habitat at risk of logging;*
- *Corvid management at Redwood National and State Parks and vicinity;*
- *Silviculture of second growth forest to create nesting habitat*
- Captive breeding
- Artificial nest platforms

Waterfowl, Shorebirds and Shoreline Habitat:

- *McDaniel Slough Wetland Enhancement Project*
- Tract 20 acquisition for Humboldt Bay National Wildlife Refuge (NWR)
- Hunt Ranch acquisition and conversion to wetlands
- Eel River Wildlife Area acquisition and conversion to wetlands
- Mad River Slough Wildlife Area acquisition and conversion to wetlands
- Old Arcata drive-in theatre acquisition and conversion to wetlands
- White Slough Field restoration at Humboldt Bay NWR
- North Spit eelgrass bed restoration
- North Bay eelgrass bed restoration

- Hookton Slough restoration
- Bayview/Schmidbauer acquisition and restoration of wetlands
- Industrial shoreline enhancement—re-establish "natural" shoreline
- Shorebird viewing blinds and signs—south of Samoa Bridge
- Tide gate improvements
- Table Mountain heron/egret rookery acquisition for Humboldt Bay NWR
- Promotion of shellfish areas
- On-water seaduck roosting zones—protection from disturbance

Human Recreational Beach Use:

- *McDaniel Slough Wetland Enhancement Project*
- South Spit recreational access facilities
- Education center for Humboldt Bay NWR
- Interpretive signs at boat launches in Humboldt Bay
- Eel River boat ramp
- Wildlife Area parking areas at Eel River, Elk River, Fay Slough, and Mad River
- Education center for CDFG Wildlife Area
- EcoAtlas of Humboldt Bay watershed
- Interpretive displays at Arcata marsh, Woodley Island Marina, Elk River Wildlife Area
- Trinidad Bay/Trinidad Rancheria harbor improvements
- Ocean foods study—short and long-term effects of oil spills on consumers of ocean food resources
- Indian Island cleanup and restoration
- Humboldt Bay Trails Project

Environmental Consequences:

To comply with the National Environmental Policy Act (NEPA), the California Environmental Quality Act (CEQA), and other related State and Federal requirements, the Trustees analyzed the effects of each restoration project on the quality of the human environment. Specific measures are included, as appropriate, in some of the proposed projects to mitigate potential impacts. The Trustees will be responsible for ensuring that each project will be implemented as prescribed in the DARP/EA to address the injuries resulting from the Spill.

As contemplated in the NEPA regulations, the Brown Pelican Roost Site Protection Project and the Restoration of Common Murre Nesting Colony at Redding Rock project will undergo a subsequent phase of environmental analysis as project specific details are developed or when specific locations for habitat protection are identified. Attachment 1 includes a summary of the proposed projects, environmental consequences and any mitigation required at this time.

As documented in the DARP/EA, the Trustees determined the proposed actions will substantially benefit the resources targeted by the DARP/EA, and can be implemented without significant adverse effects to soil, air quality, water resources, floodplains, wetlands, vegetation, fisheries, wildlife, visual quality, aesthetics/recreation, wilderness, subsistence, cultural resources, park management, and the local economy.

The proposed actions are designed to make the environment and the public whole for injuries to, or lost use of natural resources and services from the Spill. The Service has determined that most of the proposed actions will not adversely affect any species listed under the federal Endangered Species Act. However, further consultation with the Service and NOAA Fisheries is required for the McDaniel Slough project prior to implementation of Phase II. Information on the potential project impacts is currently being collected and will be used to assess effects on currently listed species.

Cumulative Impact:

As required by NEPA, the DARP/EA addresses potential cumulative impacts of implementing the preferred alternative projects. The DARP/EA specifically examines Seabirds, Corvids, and Human Use.

Seabirds
The Trustees believe the preferred alternative projects selected in the DARP/EA that address injuries to seabirds, in conjunction with other existing and anticipated seabird restoration projects, including those funded from damage recoveries from other OPA cases, will have a local and regional, long term, moderate beneficial impact on seabird populations. The selected projects that benefit seabirds include: Protection of Western/Clark's Grebe Nesting Colonies on Northern California Lakes, Redding Rock Common Murre Re-colonization and Protection, Preservation/Management of Marbled Murrelet Nesting Habitat at Risk of Logging, Brown Pelican Roost Site Protection, and McDaniel Slough Wetland Enhancement.

Corvids
The Trustees have selected a project that will affect local jay and raven numbers near seabird nesting and roosting sites. The Trustees will provide funding to implement the Corvid Management Project at Redwood National and State Parks. Project components include public education and outreach, and removing anthropogenic food sources. If other measures to affect corvid densities are not successful, the project could potentially include lethal removal of a small number of jays and ravens in the future to ensure protection of Marbled Murrelet nests.

Because the selected projects are focused on relatively small geographical areas, and because only small numbers of corvids may be displaced or removed relative to their regional populations levels, the Trustees believe these alternatives will have a minor, local, medium term, negative impact on the local and regional population of corvids.

Human Use
The Trustees have selected five projects that may change human use of natural resources. The projects are Protection of Western/Clark's Grebe Nesting Colonies on Northern California Lakes; Corvid Management at Redwood National and State Parks; Redding Rock Common Murre Re-colonization and Protection; Brown Pelican Roost Site Protection; and McDaniel Slough Wetland Enhancement. Project components include public education and outreach and potentially limiting access to sensitive areas.

Overall, four of the selected projects will have local, medium term, minor impacts to humans. In addition, one of the projects will have beneficial impacts to humans, specifically benefits toward human recreation. All of the projects will have beneficial impacts to ecosystems of which humans are a part.

Summary
The Trustees believe that, overall, the alternatives selected in this restoration plan, when considered along with past and reasonably foreseeable future projects, will have long term, local and regional beneficial impacts to natural resources; short term, minor, negative impacts to some human recreation; and also beneficial impacts to other human recreation.

Environmentally Preferred Alternative:

The environmentally preferred alternative is the alternative that will promote NEPA, as expressed in Section 101 of NEPA. The environmentally preferred alternative is the one that best meets the following:

- Fulfill the responsibility of each generation as trustee of the environment for succeeding generations;
- Ensure for all Americans a safe, healthful, productive, and aesthetically and culturally pleasing surrounding;
- Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
- Preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice;
- Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Based upon analyses of the proposed action when compared to the alternative projects (non-preferred) and the no action alternative, the proposed action meets the criteria above and is therefore also the agencies' environmentally preferred alternative.

Basis for Decision:

Implementation of the proposed action will have minimal short-term impacts on natural, cultural, and social resources. Attachment 1 contains a summary of the proposed action, environmental consequences and any mitigation proposed at this time. No highly uncertain or controversial impacts, unique or unknown risks, significant cumulative negative effects, or elements of precedence have been identified, and implementing the proposed and preferred alternative will not violate Federal, State, or local environmental protection laws.

Conclusion:

Based upon an environmental review and evaluation of the DARP/EA for the Kure/Humboldt Bay Oil Spill as summarized above, the Service has determined, except as noted below, that implementation of the restoration plan does not constitute a major Federal action significantly affecting the quality of the human environment under the meaning of Section 102(2)(c) of the National Environmental Policy Act of 1969 (as amended). Accordingly, an environmental impact statement is not required for this action. However, the Brown Pelican Roost Site Protection Project and Restoration of Common Murre Nesting Colony at Redding Rock Project may be subject to further environmental review. The DARP/EA is available upon request from the Service's Sacramento Fish and Wildlife Office, 2800 Cottage Way, Room W-2605, Sacramento, CA 95825.

Regional Director, California and Nevada Region
Authorized Official, Department of the Interior

5-9-08
Date

Attachment 1

Each alternative project evaluated in the DARP/EA is presented below according to the injury category for which it is evaluated. Selected alternatives are presented in *italic*. Alternative projects not selected are presented in regular type. The presentation includes a summary of the selected project, rationale for selecting or rejecting the project, and discussion of environmental consequences and any mitigation proposed at this time.

1) Loons and Grebes:

- *Protection of Western/Clark's Grebe nesting colonies at northern California lakes*
- Acquisition of land around Lake Earl to allow for higher lake levels and increase Western Grebe nesting

The Trustees selected the nesting colony protection project as the preferred project because it will provide widespread benefits at lower cost than the Lake Earl project. Restoration for Common Loons would require actions far removed from the spill area, most likely in Canada or Alaska. Specific restoration projects in these areas have not been identified.

The nesting colony protection project would contribute funds to implement many of the recommendations of the California Grebe Management Plan, designed to protect Western and Clark's Grebe nesting colonies from human disturbances. These recommendations include public education and outreach, as well as the establishment of small seasonal buffers around grebe nesting colonies. The primary colonies targeted for protection are located at Clear Lake, where a pilot project is underway. Additional work may be implemented to protect colonies at other areas including Eagle Lake, Thermolito Forebay, Lake Almanor, and Tule Lake National Wildlife Refuge.

The Trustees do not anticipate significant adverse impacts for other species of wildlife and habitat because this project will protect areas from human disturbance. Experience indicates that there will be only minor inconveniences to boaters and users of personal watercraft because grebe colonies will be seasonally protected by buffers that restrict boating access. However, these buffers are relatively small, extending only 50 to 100 meters from shore, and span only the length of shoreline where the colonies are located. Given the large size of these lakes, these buffers typically represent less than 1 percent of the total lake surface area. Additionally, the buffers are seasonal because they are only needed during the breeding season (primarily May through August). As such, any impacts to human use of these areas are expected not to be significant.

This project will expand upon a current pilot project at Clear Lake initiated by the *American Trader* Oil Spill Trustee Council. The Kure settlement funds allocated for this project total $250,000.

2) Pelicans, Cormorants, and Gulls:

- *Brown Pelican roost site protection*
- South Spit of Smith River acquisition and management
- Island Roost at Lake Talawa
- Artificial pelican roosts
- Old Arcata Wharf restoration
- South Spit of Humboldt Bay acquisition
- Pelican roost at North Jetty on North Spit
- Pelican signs on South Spit

After evaluating these projects using the initial and additional screening criteria, the Trustees identified the Old Arcata Wharf project as the preferred project in the Draft DARP/EA. Land acquisition and increasing the size of the island at Lake Talawa were deemed not cost effective; the South Spit of Humboldt Bay has recently been acquired and is being managed to protect the natural resources; and other projects are more proximal than the Crescent City project. However, since the preparation of the draft DARP/EA, the Trustees obtained more information indicating that the Arcata Wharf project is potentially in conflict with other agency goals to focus on more natural solutions. Therefore, the Trustees selected the Pelican roost site protection project as the preferred project for this restoration category. Protection of pelicans on the North Jetty and South Spit can be incorporated into the project.

The objective of this project is to protect Brown Pelican roost sites from human disturbance. There are plentiful roosting locations within Humboldt Bay during low tide on exposed mudflats. However, high tide roost sites are much more limited. This project may partner with State and local governments and the Bureau of Land Management (BLM) to protect pelican roosts in the Humboldt Bay area, as well as to the north in Del Norte County. The project will flexibly respond to disturbance issues as they arise or are anticipated. While specific measures will be tailored to the needs at each location, potential project elements include:

- Initial survey to identify vulnerable pelican roosts
- Public education and outreach via signs and educational materials
- Placement of buoys at strategic locations
- Protective fencing or signage
- Other measures to protect pelican roost sites
- Annual monitoring and adaptive management

Protection of pelican roosts will have positive benefits to pelicans by reducing energy costs associated with commuting between prey and roosts, and with flushing and relocating due to human disturbance. Cormorants and gulls often roost and nest at the same locations where pelicans roost. To the extent that this occurs at locations protected by this project, these species will benefit as well. This project will rely primarily on education and outreach, encouraging voluntary compliance to protect roosting pelicans. This project has the potential to restrict human access to small areas (e.g. tips of jetties) seasonally; any access restrictions will be carefully considered. Likewise, signs will be carefully designed and located so as not to detract from the natural beauty of any area.

The Kure settlement funds allocated for this project total $250,000.

3) Common Murres, Other Alcids (except Marbled Murrelet) and Procellarids:

- *Redding Rock Common Murre re-colonization and protection*
- Trinidad Seabird Colonies—re-colonization of Tufted Puffin at Green and Puffin Rocks
- Trinidad Seabird Colonies—re-colonization of Common Murre at Sea Lion Rock
- Trinidad Seabird Colonies—enhance nesting habitats for Leach's Storm-Petrel at Little River and Prisoner Rocks
- Whaler Island Restoration (Crescent City Harbor)—re-establish as a seabird colony
- Human Disturbance Reduction Program for Humboldt and Del Norte County seabird colonies
- Cape Vizcaino Area seabird colonies—acquisition and management

Restoration options for Procellarids (in this case, primarily shearwaters) are quite limited. As a result, the Trustees did not identify any practicable restoration options for these species. Instead the Trustee-RP technical working group focused on Common Murres, the species most impacted by the spill (with respect to number of individuals oiled). While restoration options exist for some of the other alcids besides Common Murres, the projects brought to the Trustees' attention were rather small and experimental.

Because Common Murres represent the vast majority of birds in this category, and were determined by the technical working group to be a surrogate for all other species in this category, those projects which do not benefit murres were screened out. After evaluating the remaining Common Murre projects using the initial and additional screening criteria, the Trustees identified contribution to the restoration of a nearly extirpated murre colony at Redding Rock as the preferred project. This project will restore murres at a location most proximate to the spill site and redress impacts caused from past and on-going human disturbance. In addition, it will benefit a highly impacted murre colony using restoration methods that are known to be effective.

Restoration actions may include efforts to prevent human disturbance of murres during the nesting season through education and public outreach and use of social attraction techniques to attract murres to Redding Rock. By employing several restoration techniques in the next few years, permanent colony extirpation may be avoided and the colony should return to higher levels than seen since 1979, given the amount of suitable nesting habitat available.

The adverse impacts associated with this project are minimal. A balance will be sought between minimizing the impacts on the resource and preserving quality opportunities for recreation. If appropriate, additional environmental review/analysis specifically for this project will be conducted prior to implementation.

The available Kure settlement funds for this project total $450,000.

4) Marbled Murrelets:

- *Preservation/management of nesting habitat at risk of logging*
- *Corvid management programs at Redwood National and State Parks*
- Silviculture of second growth forest to create nesting habitat
- Captive breeding
- Artificial nest platforms

Captive breeding, silviculture and the use of artificial nests are relatively untested concepts and were therefore not considered by the Trustees to be feasible projects having an adequate likelihood of success. In general, restoration options for Marbled Murrelets are limited by the lack of information on the survival and reproductive requirements of the species, as well as its unusual life history. The Trustees identified the Preservation/management of nesting habitat and corvid management as the preferred restoration projects for murrelet restoration. Preservation and management of old growth habitat will permanently protect from logging, and enhance, murrelet nesting habitat. Corvid management will maintain or increase murrelet nest productivity in the region.

Preservation/Management of Murrelet Habitat

The Trustees considered three different projects that included preservation of old growth forest: (1) contribution to the acquisition and management of the Grizzly Creek Marbled Murrelet Conservation Area (MMCA) located in Humboldt County; (2) acquisition of a parcel located near Redwoods National Park in Del Norte County owned by Green Diamond Resource Company and commonly referred to as "W-530"; and (3) a conservation easement on parcels containing old growth stands owned by Green Diamond Resource Company and commonly known as the "Big Mynot/E.F. Hunter Complex" in Del Norte County. The Trustees prefer the Big Mynot/E.F. Hunter Complex project to the W-530 proposal because it contains 45 more acres of un-entered old growth and provides superior Marbled Murrelet nesting habitat. They prefer the Big Mynot/E.F. Hunter Complex project to the MMCA project because it is more cost-effective and because the Green Diamond properties are at greater threat of harvesting than the MMCA.

Under the conservation easement, to be held by a non-profit organization whose purposes include the protection and enhancement of old growth redwood forests, Green Diamond Resource Company would agree to refrain from timber harvesting and other disturbance-causing activities in the Big Mynot/E.F. Hunter Complex stands as well as in the specified buffer areas (second growth forest) around the stands. Furthermore, Green Diamond Resource Company would agree to management practices (carried out by the Trustees or their representatives) for the enhancement of Marbled Murrelet habitat and reproduction in the parcels.

The Big Mynot/E.F. Hunter Complex project will protect nesting Marbled Murrelet habitat and guarantee that it remains in existence primarily for the benefit of Marbled Murrelets in the future. It is known that murrelets have nested within the Big Mynot/E.F. Hunter parcels and that they would not be able to do so if the area were logged. There are no obvious adverse impacts of the Big Mynot/E.F. Hunter Complex project to wildlife or habitat provided that the habitat is

managed according to approved Marbled Murrelet habitat management guidelines. Nor will human use be affected as the parcels subject to the conservation easement are not presently accessible to the public and their present use will not change.

Corvid Management at Redwood National and State Parks and vicinity
This project would contribute to on-going management efforts to limit anthropogenic food sources that result in unnaturally large corvid (*i.e.,* Steller's Jay, Common Raven, American Crow) populations. The corvid management project is intended to improve Marbled Murrelet nest success through a decrease in predation caused by ravens, crows, and jays. Sustaining the Marbled Murrelet population through the next few decades will enable future murrelets to access increasing amounts of protected old growth forest and second growth forest as it matures into suitable nesting habitat.

The corvid management project will educate the public about imbalances in the ecosystem that may be caused as different species respond positively and negatively to human actions. The corvid management project will have direct impacts upon both campers at campground and picnic areas and upon corvids and possibly other animals that scavenge food waste at these sites. Campers will be made more aware of existing rules and restrictions upon their food management and may be subject to enforcement actions should they fail to comply. While corvids and other animals such as raccoons will not be trapped and removed, they will likely experience a reduction in their available food supply. For corvids, this may lead to decreased fledgling survival and lower reproductive success. These adverse impacts are an inevitable part of the transition from artificially (through human activities) elevated population levels to lower, more natural population levels. Corvids, raccoons, and other animals currently living outside of the campgrounds are not likely to be impacted.

The Kure settlement funds allocated to this project total $750,000.

5) Waterfowl, Shorebirds, Shoreline Habitat, and Human Recreational Use:

- *McDaniel Slough Wetland Enhancement Project*
- Tract 20 acquisition for Humboldt NWR
- Hunt Ranch acquisition and conversion back to wetlands
- Eel River Wildlife Area acquisition and conversion to wetlands
- Mad River Slough Wildlife Area acquisition and conversion to wetlands
- Old Arcata drive-in theatre acquisition and conversion to wetlands
- White Slough Field at Humboldt Bay NWR – restore tidal action with setback levee
- North Spit eelgrass bed restoration – remove fill on 10 acres
- North Bay eelgrass bed restoration – remove oyster shell debris on 100 acres
- Hookton Slough restoration – move levee to restore tidal action to 140 acres
- Bayview/Schmidbauer acquisition – restore to wetlands
- Industrial shoreline enhancement – re-establish "natural" shoreline
- Shorebird viewing blinds and signs – south of Samoa Bridge
- Tide gate improvements – to restore some tidal action to various streams
- Table Mountain heron/egret rookery acquisition for Humboldt Bay NWR

- Promotion of shellfish areas – to establish more shell fish areas
- On-water seaduck roosting zones – protection from disturbance

All of the projects except Hookton and McDaniel Slough were screened out either because they would have benefited only a single or narrow range of resources or they would have benefited mostly brackish, freshwater, or eelgrass habitats which were not among those habitats injured by the Spill. The Trustees initially identified a contribution toward wetlands restoration at Hookton Slough as a tentative preferred project. However, the McDaniel Slough Wetland Enhancement project in Humboldt County will provide resource benefits very similar to those originally anticipated from the Hookton Slough project, but in a more cost-effective and timely manner, and with identified partnering funds. The McDaniel Slough Wetland Enhancement project will provide multiple resource and service benefits. Contributing to this project's cost-effectiveness is the fact that this project also will provide benefits to address the Human Recreational Beach Use injury category.

The McDaniel Slough project will return tidal action to tidelands in Humboldt Bay that were diked and drained about 100 years ago. The project is planned for a 240-acre parcel of land located at the southwest corner of the City of Arcata and owned by the State of California and the City of Arcata. To restore the tidal connection between Humboldt Bay and 200 acres of the site, the tide gates at McDaniel Slough will be removed to create a breach in the bay-front levee. The project will restore 200 acres of salt marsh habitat, creating a mosaic of vegetated habitats, mudflats, tidal sloughs, and other intertidal wetlands. This will benefit a variety of birds, including egrets, waterfowl, shorebirds, and other wetland species by providing food, shelter, and nest sites. The proposed project also includes trails, wildlife viewing structures, benches, and information kiosks that will provide recreational and educational benefits in addition to the ecological benefits provided by the habitat restoration

The environmental effects of the project are described in detail in the Environmental Impact Report (EIR) prepared by the City of Arcata (2006), along with mitigation strategies for potential adverse effects. There will be a permanent change in the type of habitat at the site from terrestrial or seasonally wet habitat to tidal wetland habitat, which may adversely affect terrestrial wildlife species. Tidal wetlands will replace freshwater or brackish wetlands. These impacts are mitigated by the large amount of tidal habitat that will be restored and by the creation of 40 acres of brackish and freshwater ponds on 40 acres of the project area that are not being restored to tidal action.

This project should result in positive benefits to humans by enhancing the quality and amount of public use near the areas affected by the spill. Improvements to public access will also be implemented in ways that protect and minimize future adverse impacts to habitats subject to frequent human use/visitation. Implementation of these projects will result in improved public education regarding the project areas and will expand appropriate public access to areas that could not formerly be accessed safely or without harm to habitats.

Settlement funds allocated for this project total $420,000.