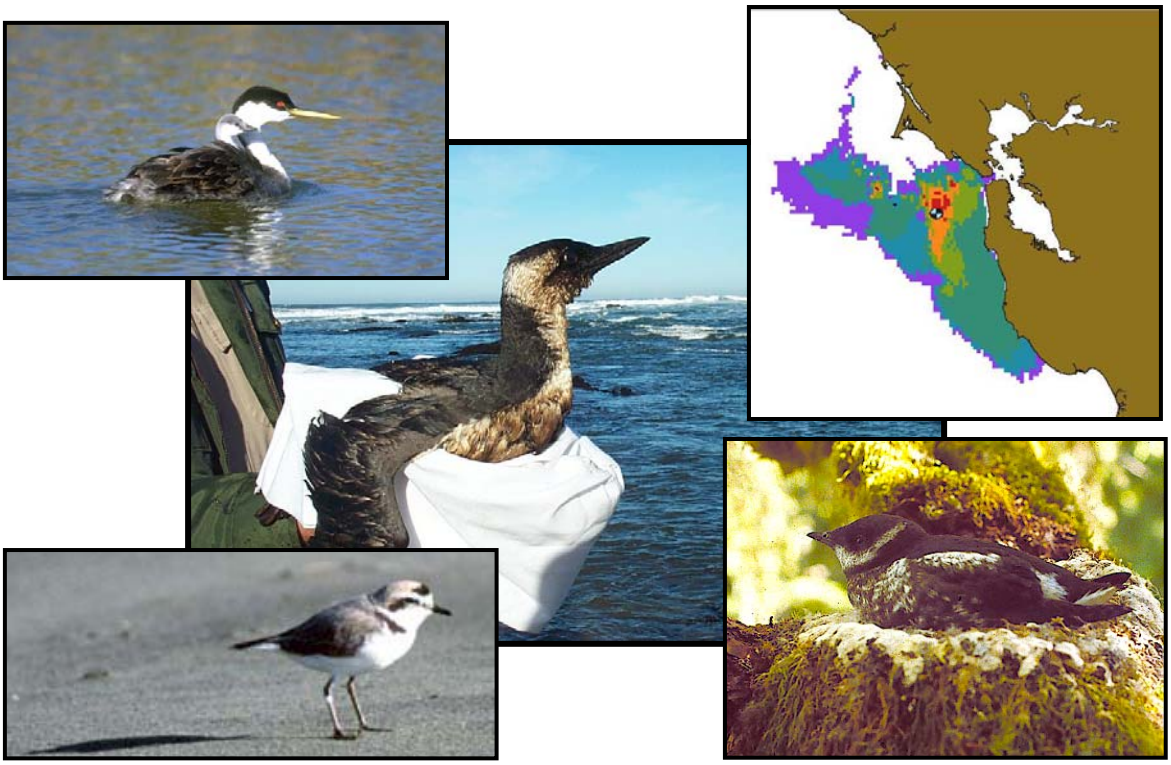
S.S. Jacob Luckenbach and Associated Mystery Oil Spills

FINAL

Damage Assessment and Restoration Plan/
Environmental Assessment



November 1, 2006

Prepared by:
California Department of Fish and Game
National Oceanic and Atmospheric Administration
United States Fish and Wildlife Service
National Park Service

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FACT SHEET

Final Damage Assessment and Restoration Plan / Environmental Assessment for the *S.S. Jacob Luckenbach* and Associated Mystery Oil Spills

Trustee Agencies: U.S. Fish and Wildlife Service, National Park Service, National Oceanic and Atmospheric Administration, California Department of Fish and Game

Abstract: Under the Oil Pollution Act of 1990 (OPA), the Natural Resource Trustee Agencies (Trustees) present a damage assessment/restoration plan/environmental assessment for natural resources injured during multiple oil spills that occurred off the coast of San Francisco, California, from 1990 to December 2003. The oil spills affected seabirds and marine mammals, including federally endangered Brown Pelicans and federally threatened Snowy Plovers, Marbled Murrelets, and Sea Otters. The Trustees have selected 14 restoration projects to restore the injured resources. The projects generally encompass the following:

i) Reduce human disturbance to seabird and waterfowl nesting habitat along the central California coast, at northern California lakes, at Kokechik Flats, Alaska, and on islands off Baja California, Mexico:

ii) Eradicate non-native predators from seabird nesting habitats at the Farallon Islands, California and the Queen Charlotte Islands, Canada, and protect nesting seabirds from non-native predators in New Zealand;

iii) Acquire and/or restore and enhance seabird and shorebird nesting habitat at Reading Rock in Humboldt County, Point Reyes, Año Nuevo Island, and the Santa Cruz Mountains, California;

iv) Manage and reduce corvid populations at Point Reyes to benefit nesting seabirds and in the Santa Cruz Mountains to benefit Marbled Murrelets;

v) Conduct education and outreach programs to reduce human and livestock effluent and their associated pathogens that are impacting Sea Otters in Monterey Bay.

The Trustees also present their environmental assessment on the selected projects under the National Environmental Policy Act (NEPA).

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Executive Summary

On July 14, 1953, the freighter *S.S. Jacob Luckenbach* collided with another vessel and sank in the Gulf of the Farallones. As it decayed on the ocean floor, it leaked oil and became the source of many oil spills, primarily during large winter storms when currents rocked the vessel. Major oiling events have occurred every few winters since at least 1973-74. It was not until January 2002 that these "mystery spills" were linked to the *Luckenbach*. These spills manifested themselves in the appearance of oiled seabirds on beaches from Bodega Bay to Monterey Bay. Oil chemistry analysis has confirmed the presence of *Luckenbach* oil on dead birds for every winter since 1992-93 (the earliest date for which samples are available).

A smaller percentage of the oiled wildlife has been attributed to other mystery oil spills besides the *Luckenbach*. These other mystery spills are likely the result of unreported discharges at sea from various vessels because oil fingerprinting suggests the oil came from a wide variety of sources (see Hampton et al. 2003a). This document also addresses injuries from those spills. In compliance with the Oil Pollution Act of 1990 (OPA), this document focuses on injuries that occurred after August 1990. It includes oiling events through December 2003.

The owners of the *Luckenbach* are no longer viable, and the sources of the other spills are unknown. However, OPA authorizes the use of the federal Oil Spill Liability Trust Fund (OSLTF) for the payment of claims for uncompensated costs associated with oil removal and for natural resource damages assessment, restoration, and compensation in cases where there is no financially viable responsible party or in mystery spill cases. The OSLTF is managed by the United States Coast Guard's National Pollution Funds Center (NPFC).

In the summer of 2002, the NPFC spent approximately $20 million removing oil from the *Luckenbach*. The NPFC may also pay for restoration projects to restore the natural resources impacted by such a spill. A claim to the OSLTF for natural resource damages assessment and restoration dollars must be made to the NPFC by the appropriate natural resources Trustee agencies. In this case, the Trustees for injured natural resources are the United States Fish and Wildlife Service (USFWS), the National Park Service (NPS), the Bureau of Land Management (BLM), the National Oceanic and Atmospheric Administration (NOAA), and the California Department of Fish and Game (CDFG) (the Trustees). As a designated Trustee, each of these agencies 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.

Damage Assessment and Restoration Plan (DARP)/Environmental Assessment (EA)
Prior to submitting a claim for restoration funds, the Trustees must prepare a draft Damage Assessment and Restoration Plan (DARP) for public review and comment. The Trustees did that on February 28, 2006 and accepted public comment thru April 14. This document is the final DARP, an amended version of the draft DARP after consideration

of public comments. In compliance with NPFC guidelines, this document describes the injuries resulting from the spills and the restoration projects intended to address the injuries. It also provides the rationale for the size and scope of each restoration project. This document is also intended to serve as an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA) and, therefore, is called a DARP/EA. Additional environmental compliance may be required for some of the selected projects described herein, if selected and prior to actual implementation. This will be determined once detailed engineering design work or operational plans are developed for those projects.

The Trustees cooperatively developed the draft and final DARP/EA. With the completion of this final DARP/EA, the Trustees will submit a claim to the NPFC to fund these preferred restoration projects.

What was injured?

The major documented injuries were impacts to birds and a few Sea Otters. Impacts to shoreline habitats, cultural resources, and the water column were minimal. Likewise, there were no beach closures and no significant impact to recreational beach use. Most of the birds were oiled while foraging at sea, but a small number were oiled by tarballs on beaches. Oiled birds came ashore from Salmon Creek (north of Bodega) to Point Lobos (south of Carmel). During the period of spills covered by this plan (August 1990 thru December 2003), over 51,000 birds and 8 Sea Otters are estimated to have been killed.

Although over 50 species of birds were impacted, the species impacted in the greatest numbers were Common Murres, Red Phalaropes, Northern Fulmars, Rhinoceros Auklets, Cassin's Auklets, and Western Grebes. Four federally- and state-listed species, the Brown Pelican, Western Snowy Plover, Marbled Murrelet, and California Sea Otter, were impacted as well. Additionally, Ashy Storm-Petrels were impacted in significant numbers relative to their population size.

What restoration projects will compensate for these injuries?

The Trustees have selected 14 restoration projects that are designed to address the various species injured by the spills. These projects differ based on the species they address. Nevertheless, all are designed to restore and replace bird and otter populations through restorative on-the-ground actions. Furthermore, several of the projects address multiple species. The projects were selected based upon the biological needs of the species. For nearly all species, this meant focusing restoration on their breeding grounds, where they face various threats. For some migratory species, the breeding grounds may be far from the area of the spills (e.g. northern California lakes, Alaska, British Columbia, Baja California, and New Zealand). Where feasible restoration project alternatives existed within the spill area, those projects were given priority. Section 1.3 provides short summaries of the preferred projects; section 4.2.2 lists the criteria used in project selection; and section 4.3 lists all projects considered (by species group) and provides detailed information on the projects and scaling information regarding the size of each project. The total cost of all the selected projects is approximately $21 million (in 2007 present value terms).

What changes were made as a result of the public comments?
All of the written public comments are presented in Appendix O. They are summarized in Appenidix N, as well as Trustee replies to each point. The major changes between the draft DARP and this final DARP are that one project was added (Shearwater Colony Protection at Taiaroa Head, New Zealand) and all of the project budgets have been re-estimated and now include estimated overhead charges.

ABBREVIATIONS

ATV	All-Terrain Vehicle
BLM	Bureau of Land Management
CBNMS	Cordell Bank National Marine Sanctuary
CDFG	California Department of Fish and Game
CESA	California Endangered Species Act
CEQA	California Environmental Quality Act
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DARP	Damage Assessment and Restoration Plan
DOI	United States Department of the Interior
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
FWCA	Fish and Wildlife Coordination Act
GGNRA	Golden Gate National Recreation Area
GFNMS	Gulf of the Farallones National Marine Sanctuary
MBNMS	Monterey Bay National Marine Sanctuary
MBTA	Migratory Bird Treaty Act
MMPA	Marine Mammal Protection Act
NOAA	National Oceanic and Atmospheric Administration
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuaries Act
NPFC	National Pollution Funds Center
NPS	National Park Service
NRDA	Natural Resource Damage Assessment
NWR	National Wildlife Refuge
OPA	Oil Pollution Act of 1990
OSLTF	Oil Spill Liability Trust Fund
PISCO	Partnership for Interdisciplinary Studies of Coastal Oceans
PRBO	PRBO Conservation Science (formerly Point Reyes Bird Observatory)
PRNS	Point Reyes National Seashore
REA	Resource Equivalency Analysis
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service

BIRD SPECIES' COMMON AND SCIENTIFIC NAMES

Yellow-eyed Penguin (*Megadyptes antipodes*)
Little Blue Penguin (*Eudyptula minor*)
Brant (*Branta bernicla)*
Greater Scaup (*Aythya marila)*
Lesser Scaup (*Aythya affinis)*
Surf Scoter (*Melanitta perspicillata)*
White-winged Scoter (*Melanitta fusca)*
Black Scoter (*Melanitta nigra)*
Bufflehead (*Bucephala albeola)*
Red-breasted Merganser (*Mergus serrator)*
Ruddy Duck (*Oxyura jamaicensis)*
Red-throated Loon (*Gavia stellata*)
Pacific Loon (*Gavia pacifica*)
Common Loon (*Gavia immer*)
Pied-billed Grebe (*Podilymbus podiceps)*
Horned Grebe (*Podiceps auritus)*
Red-necked Grebe (*Podiceps grisegena)*
Eared Grebe (*Podiceps nigricollis)*
Western Grebe (*Aechmorphorus occidentalis)*
Clark's Grebe (*Aechmorphorus clarkii)*
Short-tailed Albatross *(Diomedea albatrus)*
Northern Royal Albatross (*Diomedea sanfordi*)
Northern Fulmar (*Fulmarus glacialis)*
Pink-footed Shearwater (*Puffinus creatopus)*
Sooty Shearwater (*Puffinus griseus)*
Short-tailed Shearwater (*Puffinus tenuirostris)*
Black-vented Shearwater (*Puffinus opisthomelas)*
Leach's Storm-Petrel (*Oceanodroma leucorhoa)*
Ashy Storm-Petrel (*Oceanodroma homochroa)*
Black Storm-Petrel *(Oceanodroma melania)*
Brown Pelican (*Pelecanus occidentalis californicus)*
Brandt's Cormorant (*Phalacrocorax penicillatus)*
Double-crested Cormorant (*Phalacrocorax auritus)*
Pelagic Cormorant (*Phalacrocorax pelagicus)*
Spotted Shag (*Stictocarbo punctatus*)
Peregrine Falcon *(Falco peregrinus anatum)*
American Coot (*Fulica americana*)
Snowy Plover (*Charadrius alexandrinus nivosus)*
Sanderling (*Calidris alba)*
Red-necked Phalarope (*Phalaropus lobatus)*
Red Phalarope (*Phalaropus fulicaria)*
Bonaparte's Gull (*Larus philadelphia)*
Heermann's Gull (*Larus heermanni)*
Mew Gull (*Larus [canus] brachyrynchus)*
Ring-billed Gull (*Larus delawarensis)*
California Gull (*Larus californicus)*
Herring Gull (*Larus [argentatus] smithsonianus)*
Western Gull (*Larus occidentalis)*
Glaucous-winged Gull (*Larus glaucescens)*
Glaucous Gull (*Larus hyperboreus)*
Red-billed Gull (*Larus novaehollandiae*)
Black-legged Kittiwake (*Rissa tridactyla)*
Least Tern *(Sterna antillarum browni)*
Common Murre (*Uria aalge)*
Pigeon Guillemot (*Cepphas columba)*
Marbled Murrelet (*Brachyramphus marmoratus)*
Xantus's Murrelet *(Synthliboramphus hypoleucus)*
Ancient Murrelet (*Synthliboramphus antiquus)*
Cassin's Auklet (*Ptychoramphus aleuticus)*
Rhinoceros Auklet (*Cerorhinca monocerata)*
Horned Puffin (*Fratercula corniculata)*
Burrowing Owl (*Athene cunicularia)*
Common Raven *(Corvus corax)*

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1.0 Introduction and Purpose

This final Damage Assessment and Restoration Plan and Environmental Assessment (DARP/EA) has been prepared by state and federal natural resource Trustees responsible for restoring natural resources[1] and resource services[2] injured by releases of oil from the *S.S. Jacob Luckenbach* and other mystery spills occurring in the same vicinity, from Bodega Bay to Monterey Bay, between August 1990 and December 2003 (the spills). This document provides details regarding the injuries and their quantification, restoration planning, and the final selected restoration projects to address the injuries. The purpose of restoration is to make the environment and the public whole for injuries resulting from the spills by implementing restoration actions that return injured natural resources and services to baseline conditions and compensate for interim losses.

The United States Fish and Wildlife Service (USFWS), the National Park Service (NPS), the Bureau of Land Management (BLM), the National Oceanic and Atmospheric Administration (NOAA), and the California Department of Fish and Game (CDFG) are Trustees for the natural resources injured by the spill. 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. For purposes of coordination and compliance with OPA and NEPA, the USFWS is designated as the lead federal Trustee.

There is no viable responsible party (RP) in this case. The owner of the *S.S. Jacob Luckenbach*, the Luckenbach Steamship Company, no longer exists. However, OPA authorizes the use of the federal Oil Spill Liability Trust Fund (OSLTF), managed by the United States Coast Guard's National Pollution Funds Center (NPFC) for the payment of claims for uncompensated costs associated with removal and natural resource damage assessment, restoration, and compensation in cases where there is no RP or in mystery spill cases.[3]

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[1] 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.

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

[3] The OSLTF receives funds from four primary sources: (1) an oil tax (five cents a barrel on domestically produced or imported oil collected from the oil industry; this is suspended when the fund reaches $1 billion but may be reinstated if the fund falls below this amount); (2) interest on fund principal; (3) cost recovery from responsible parties (The parties responsible for oil spills are liable for costs and damages. All monies recovered go either back to replenish the Fund or to the U.S. Treasury); and (4) penalties (including civil penalties assessed to the responsible parties).

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. This document also integrates NEPA requirements. . Nevertheless, some of the selected projects may require additional environmental compliance prior to actual implementation. This decision will be made after engineering designs or operational plans are developed for those projects. .

The Trustees released a draft DARP/EA on February 28, 2006 and received public comments thru April 14. After considering those comments, the Trustees have amended the draft DARP/EA and prepared this final DARP/EA. With the completion of this final DARP/EA, the Trustees will make a claim to the NPFC, requesting funds to implement the preferred projects. If the NPFC grants the Trustees' request, the Trustees will be obligated to spend the funds only on the specified projects, and will be required to return any extra funds remaining after implementation to the NFPC.

1.1 Overview of the Incident

Since the 1970s, the central California coast has been plagued with recurring mystery oil spills (Nur et al. 1997). These spills usually shared the following characteristics: (1) they occurred in winter and were associated with large storms; (2) they manifested themselves in the appearance of oiled seabirds, primarily Common Murres, on beaches from Bodega Bay to Monterey Bay; and (3) very little oil was ever seen on the beaches or in the water. Finally, in early 2002, the U.S. Coast Guard and various responding agencies determined that the *S.S. Jacob Luckenbach*, a vessel that sunk in 1953, was responsible for most of the oiled birds. This 469-foot freighter, carrying railroad parts to South Korea, collided with its sister ship, the *S.S. Hawaiian Pilot*, and sank in 178 feet of water, approximately 17 miles west-southwest of San Francisco in the Gulf of the Farallones.

Figure 1: Location of the S.S. Jacob Luckenbach

In the summer of 2002, the U.S. Coast Guard, using approximately $20 million from the OSLTF, conducted oil removal operations. These efforts relied upon divers breathing mixed gas and living in a pressurized chamber for up to a month. They used vacuum hoses to pump oil from the vessel to a barge stationed on the surface. During these operations, approximately 100,000 gallons of oil were removed (McCleneghan 2003). Because the oil was located in over 30 different compartments on the vessel, complete oil removal was difficult, and approximately 29,000 gallons that were not removable remain onboard. The remaining holes in the vessel were sealed at the completion of the response actions. It is estimated that over 300,000 gallons of oil were released from the *Luckenbach* over time.

Although how long the *Luckenbach* has been releasing oil is not known, major oiling events have been documented, mostly during the winter, since at least 1973. The major events thought to be associated with the *Luckenbach* are described in Table 1.

Table 1: Major Oiling Events Likely Associated with the *Luckenbach*

OILING EPISODE	COMMENTS
Winter 1973-4	100+ live oiled birds collected by the public
Winter 1981-2	218 oiled birds observed on Southeast Farallon Island
August 1983	500 live oiled birds collected by the public
Winter 1989-90	243 oiled birds observed on Southeast Farallon Island
Winter 1990-91	195 live oiled birds collected by the public; 127 oiled birds observed on Southeast Farallon Island
Winter 1992-93	46 oiled birds observed on Southeast Farallon Island
Winter 1995-96	<100 birds collected by the public at Point Reyes National Seashore
Winter 1997-98 (Pt. Reyes Tarball Incidents)	2,964 birds collected by the public and Trustee response
Winter 2001-02 (San Mateo Mystery Spill)	1,921 birds collected by the public and Trustee response
Summer 2002 *Luckenbach* oil removal	257 birds collected by the public and Trustee response
Winter 2002-03	546 birds collected by the public and Trustee response

Note that, under OPA, the Trustees will be addressing injuries incurred only after August 1990. Oil fingerprinting linked many of the earlier mystery spills to the *Luckenbach*. As part of their damage assessment, the Trustees relied on existing oil chemistry analyses, as well as 77 additional sample analyses that focused on samples collected at times and locations not sufficiently analyzed earlier. Oiled feather samples and tarballs are routinely collected from oiled birds and beaches found during regularly scheduled shoreline surveys, although not all are analyzed. Samples from beachcast birds exist for all of the episodes listed in Table 1 starting with winter 1992-93. Matches to the *Luckenbach* oil have been found for all of these major episodes.

In addition to the major episodes listed in Table 1, a small number of oiled birds and tarballs have been found each year, throughout summer and winter. *Luckenbach* oil has been detected on at least a few oiled birds every winter since 1992. However, *Luckenbach* oil has been found in lower amounts on birds and beaches in summer (not

including 2002, when oil removal operations resulted in some oil releases and oiled birds). Oil that did not match the *Luckenbach* was compared with other oils with known fingerprints. This includes Monterey Formation oil, which occurs both naturally in California from oil seeps (mostly in southern California) and from anthropogenic crude oil extraction and transport. Oil could not always be matched with known sources, but any oil in this region that is not Monterey Formation would have to be anthropogenic in origin, such as from an unreported release from a vessel. Table 2 presents the results of the oil chemistry analysis for oiled feather samples collected during various spill episodes and seasons.

Table 2: Oiled Feather Sample Chemistry Analysis Results, 1992-2003

PERIOD	# OF SAMPLES	MATCH TO *LUCKENBACH*	MATCH TO MONTEREY	OTHER SOURCE
Winter 1992-93	16	81%	13%	6%
Winter 1997-98	67	93%	0%	7%
Winter 2001-02	49	73%	0%	27%
Winter 2002-03	11	100%	0%	0%
Sub-total for major spill episodes	**143**	**85%**	**1%**	**14%**
Other winters (1993 thru 2001)	71	32%	14%	54%
Summers (1994 thru 2001)	23	13%	13%	74%

Notes: Monterey refers to Monterey Formation oil. Winter is defined as November thru mid-May, corresponding to oiled bird events. Summers are mid-May thru October (not including 2002, when oil removal operations caused known releases).

The results demonstrate that oil matching the *Luckenbach* oil is strongly correlated with the major oiled bird episodes, accounting for 85 percent of the 143 samples analyzed. Natural seep oil is only likely to be responsible for, at most, 1 percent of the oiled birds, because Monterey Formation oil may also be transported by vessels. Tarball samples were much less likely to match the *Luckenbach* oil.

During all summers and winters without major oiled bird episodes, the smaller numbers of birds collected were predominately impacted by oil from other anthropogenic sources. This included Alaska North Slope and Basra (Iraq) crude oils, as well as other unidentified oils. Three additional feather samples were analyzed from summer 2002, during the oil spill removal operations. As expected, all three matched the *Luckenbach* oil.

Hampton et al. (2003b) describes how *Luckenbach* oiling events were strongly correlated with strong winter storms that generate very large swells (greater than 22 feet). Storms of this magnitude occur every few years during the winter months. Experience during the oil removal operations suggests that strong swells lead to strong undersea currents near the vessel, which washes oil out through various openings.

In the summer of 1998, following the 1997-98 spills (the Pt. Reyes Tarball Incidents), the Trustees, with the National Park Service (NPS) acting as the federal Lead Administrative Trustee, requested $333,145.62 from the NPFC to initiate an assessment of natural resource damages. On August 3, 1998, the request was granted. That natural resource damage assessment (NRDA) focused only on injuries that occurred from November 1997 through February 1998. A report on the results of that investigation was completed in July 2003 (see Carter and Golightly, eds. 2003). The bird mortality estimated in that analysis has been revised and incorporated in this document.

As a result of continuing oil spills between 2001 and 2003, and the discovery of the *Luckenbach* as the source for much of the oil, the Trustees conducted further NRDA work. The Trustees opted not to pursue restoration immediately for the 1997-98 Point Reyes Mystery Tarball spills, but rather to wait and, combining those injuries with those associated with other spills, pursue restoration for all the spills under a single plan. This document represents that comprehensive effort and presents the final selected restoration projects that will address spill injuries from 1990 through 2003. See Carter and Golightly, eds. (2003) for a summary of the 1997-98 injury assessment.

The story of the *Luckenbach*, its discovery, its impacts, and the response operations have been widely documented. Related publications include:

Elliott, G. 2002. The *SS Jacob Luckenbach*: A Ghost Story. *California Coast & Ocean* 18: 14-17.

Hampton, S., R.G. Ford, H.R. Carter, C. Abraham, and D. Humple. 2003. Chronic oiling and seabird mortality from the sunken vessel *S.S. Jacob Luckenbach* in central California. *Marine Ornithology* 31:35-41.

Nevins, H.R. and H.R. Carter. 2003. Age and sex of Common Murre Uria aalge recovered during the 1997-98 Point Reyes Tarball Incidents in Central California. *Marine Ornithology* 31:51-58.

McCleneghan, K. 2003. Ghost of the *SS Jacob Luckenbach*: The hunt for clues to a killer. *Outdoor California* 64: 4-11. Also in *Oil Spill Intelligence Report* XXV, 12 December 2002.

McGrath, G.G., J.A. Tarpley, H.A. Parker-Hall, A. Nack. 2003. The investigation to identify the *SS Jacob Luckenbach*: Using technology to locate a hidden source of oil that caused years of impacts and the future implications of sunken shipwrecks. *Proceedings of the 2003 International Oil Spill Conference.* Vancouver, British Columbia, Canada.

Parker-Hall, H.A., S. Hampton, and J. Haas. 2003. Integrating trustee issues into a balanced response: Working toward a common goal. *Proceedings of the 2003 International Oil Spill Conference*. Vancouver, Canada. Washington, DC: American Petroleum Institute.

Hampton, S. and M. Zafonte. 2005. An analysis of factors influencing beached bird collection during the *Luckenbach* 2001-2002 oil spill. *Proceedings of the Pacific Seabird Group and The Waterbird Society Annual Meeting.* Portland, OR

Addassi, Y.N., K. Jennings, M. Ziccardi, J. Yamamoto, and S. Hampton. 2005. Long-term wildlife operations: Adaptations to traditional Incident Command Structure (or ICS). A case study of the *SS Jacob Luckenbach*. *Proceedings of the International Oil Spill Conference 2005*, Miami, FL.

Massey, G., Hampton, S. M. Ziccardi. 2005. A cost/benefit analysis of oiled wildlife response. *Proceedings of the International Oil Spill Conference 2005*, Miami, FL.

Additionally, a report commissioned by CDFG after the 1992-93 mystery spill, examining the effects of chronic oil pollution on the Common Murre (Nur et al. 1997), unknowingly addressed impacts caused by the *Luckenbach* and other mystery spills.

Finally, the *Luckenbach* has been the subject of three television features:

CALIFORNIA CONNECTED - 1-hour newsmagazine on PBS (in California only) - 15-minute segment, first broadcast on every public television station in California on May 8, 2003. It was updated and rebroadcast on July 15, 2004.

EXTREME EVIDENCE on Court TV (cable & satellite) - 30-minute program titled, "Deadly Tide" first aired on January 26, 2004, and rebroadcast at least once to an international audience. Produced by LMNO Productions of Hollywood.

DEEP SEA DETECTIVES on The History Channel (cable & satellite) - 1-hour program titled, "Time Bomb of the Deep" first aired on August 30, 2004, and rebroadcast at least once to an international audience. Produced by KPI Productions of New York.

1.2 Summary of Natural Resource Injuries

The injuries from these oil spill episodes were primarily limited to birds. In addition, an estimated 8 Sea Otters were impacted. Impacts to shoreline habitats, cultural resources, and the water column were minimal. This was likely a result of relatively small quantities of oil slowly released over time at sea. With the oil emanating from the *Luckenbach* 17 miles offshore, the small amounts of oil would weather (or stick to birds) and form small tarballs before making landfall. During most spill episodes, no oil was found on beaches. There were no beach closures and no significant impact to recreational beach use. Most of the birds were oiled while foraging at sea, but a few (e.g., Snowy Plovers) were oiled by tarballs on beaches.

This plan describes restoration projects that benefit the various species of birds impacted and the otters, according with their degree of injury. The primary species was the

Common Murre. However, other species, including the federally- and state-listed Marbled Murrelet, Brown Pelican, Snowy Plover, and Southern Sea Otter, were impacted as well. Here is a summary of the impacted species, as well as the number estimated killed since August 1990:

- Waterfowl (primarily Surf Scoter): 862
- Loons (primarily Pacific Loon): 1,314
- Grebes (primarily Western Grebe): 4,106
- Procellarids (primarily Northern Fulmar): 4,796
- Brown Pelican: 278
- Cormorants (primarily Brandt's Cormorant): 1,460
- Gulls (primarily California, Western, and Glaucous-winged Gulls): 2,388
- Snowy Plover: 30
- Other shorebirds (primarily Red Phalarope): 1,554
- Common Murre: 31,806
- Marbled Murrelet: 45
- Other alcids (primarily Ancient Murrelet, and Cassin's and Rhinoceros Auklets): 2,763
- Sea Otters: 8

Including a small number of other species and unidentified birds, the total estimated number of animals killed is 51,569.

1.3 Summary of Final Selected Restoration Projects

The Trustees' mandate under OPA (see 33 U.S.C. 2706(b)) is to make the environment and the public whole for injuries to natural resources and natural resource services resulting from the discharge of oil. This requirement 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, or nexus, between the natural resource injuries and the 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 active restoration where feasible or cost-effective active restoration actions are not available, or where the injured resources will recover relatively quickly without human intervention.

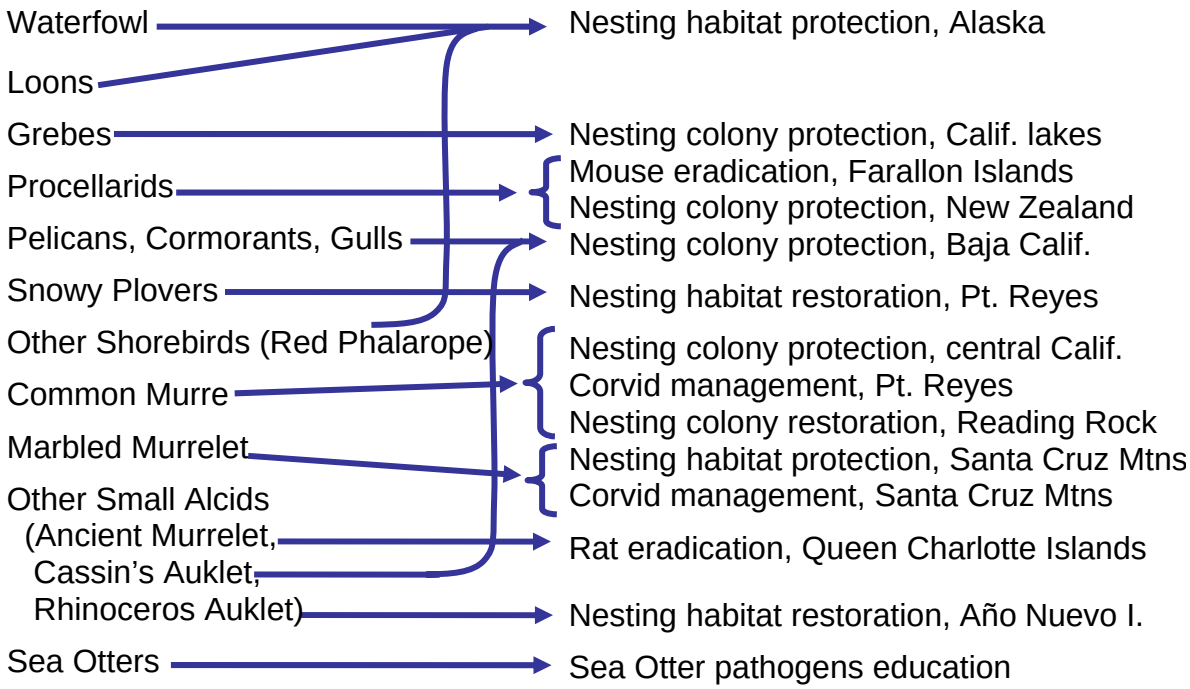
Compensatory restoration is any action taken to compensate for interim losses of natural resources and services pending recovery to baseline conditions. The scale, or amount, of the required compensatory restoration will depend on the extent and severity of the initial resource injury and how quickly each resource and associated service returns to baseline. Primary restoration actions that speed resource recovery will reduce the amount of compensatory restoration. To the extent that restoration projects are implemented prior to the completion of natural recovery, there is an element of primary restoration to the project. This factor is taken into account in the scaling of the restoration project sizes.

The Trustees and their scientific advisors considered over 30 restoration concepts and alternatives with the potential to provide primary and compensatory restoration. These were evaluated based on selection criteria developed by the Trustees consistent with the legal guidelines provided in the OPA regulations (15 C.F.R. 990.54(a)). Section 4.2.2 presents OPA-based selection criteria developed by the Trustees for this spill. Based on the Trustees' evaluation, a total of 14 restoration projects have been selected. These are summarized below and presented in detail in section 4.3.

It is the intent of the Trustees to address all injuries. However, rather than develop separate restoration projects for each species impacted, the Trustees have grouped the injuries into categories, sometimes combining impacts to similar species. In this way, one restoration project, benefiting a suite of species or one primary species, addresses all injuries for that category.

Because some restoration projects may benefit several species of birds, the Trustees grouped bird species with similar restoration needs. After evaluating several restoration project concepts, the Trustees developed the list of 14 restoration projects. Several projects outside California (including one in Mexico and one in Canada) were identified because they provide the most cost-effective benefits to the impacted migratory species. Table 3 provides a conceptual guide to the injury categories and the restoration projects that would address each injury.

Table 3: Matching Injury Categories to Restoration Projects



In accordance with OPA, all 14 of the selected projects have been "scaled" in size, such that the benefits of the restoration offset the injuries caused by the spill. Summaries of

the selected restoration projects are provided below. More details on the projects are provided in section 4.0.

PROJECT: ***Nest Protection at Kokechik Flats, Alaska***
BENEFITS: Waterfowl, Loons, and Other Shorebirds
This project will protect nesting seabirds from human disturbance at Kokechik Flats, Alaska, a private in-holding within the Yukon Delta National Wildlife Refuge. Kokechik Flats is home to nesting waterfowl, Pacific Loons, Red-throated Loons, and Red Phalaropes (as well as other species), all of which were impacted by the *Luckenbach* and associated mystery spills. This nesting area has been continually threatened with disturbance by ATV riders and others. Planned actions include educating subsistence hunters and harvesters about sensitive resources, providing designated staging and camping areas, recommending transportation routes through sensitive nesting areas, developing written conservation and management guidelines and outreach materials, and providing on-site attendants to monitor activities and provide outreach for a 10-year period. Cost: $561,631.

PROJECT: ***Grebe Colony Protection at Northern California Lakes***
BENEFITS: Grebes
This project will fund many of the recommendations of the California grebe management plan (Ivey 2004), designed to protect Western and Clark's Grebe nesting colonies from human disturbance, for 10 years. 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 similar work will be done to protect colonies at other Eagle Lake, Thermolito Forebay, Lake Almanor, and Tule Lake National Wildlife Refuge. Cost: $965,435.

PROJECT: ***Mouse Eradication on the Farallon Islands***
BENEFITS: Procellarids
This project will fund eradication of the non-native House Mouse from Southeast Farallon Island, off the California coast. Removal of this invasive species will benefit nesting Ashy Storm-Petrels. Mice have directly depredated Ashy Storm-Petrel chicks and have artificially supported a small number of over-wintering Burrowing Owls that, in turn, depredate these smaller seabird species at unnaturally high levels. Cost: $975,597.

PROJECT: ***Shearwater Colony Protection at Taiaroa Head, New Zealand***
BENEFITS: Procellarids
This project will fund the construction of a predator-proof fence to protect a mainland colony of Sooty Shearwaters from disturbance caused by humans and sheep, and from predation caused by non-native predators such as brush-tailed possums, hedgehogs, rats, stoats, and other mammals. Cost: $55,649.

PROJECT: ***Seabird Colony Protection on Baja California Islands, Mexico***
BENEFITS: Brown Pelicans, Cormorants, and Cassin's Auklets
This project will add to on-going efforts to protect nesting seabirds from human disturbance and non-native animals. The islands, located off the Pacific Coast of the Baja California Peninsula, are San Martín, San Jeronimo, San Benito, Natividad, San Roque, and Asunción. These islands host large numbers of breeding seabirds. Planned actions include constructing boardwalks, trails, and other facilities to focus human traffic and prevent trampling of burrows and disturbance of nesting and roosting seabirds; education regarding the reintroduction of non-native animals; construction of nest boxes and deployment of social attraction techniques (e.g., decoys) to reestablish seabird colonies; and the establishment of seasonal stewards for six years to minimize disturbances from garbage, lights, and human activities. Of species impacted by the oil spills, these actions will directly benefit Cassin's Auklets, Brown Pelicans, and Brandt's and Double-crested Cormorants. Cost: $3,736,475.

PROJECT: ***Dune Habitat Restoration at Point Reyes National Seashore***
BENEFITS: Snowy Plovers
This project will expand ongoing efforts to remove non-native vegetation from coastal foredunes at Point Reyes National Seashore. The primary goal of this project is to create more nesting habitat for Snowy Plovers. Recent experience has demonstrated that plovers have benefited from restored habitat. Cost: $501,447.

PROJECT: ***Common Murre Colony Protection Project***
BENEFITS: Common Murres
This project will provide funding to extend a current program for 20 years to protect Common Murre nesting colonies off the central California coast from human disturbance. This program includes education and outreach to pilots, boaters, and others regarding the locations and sensitivity of nesting colonies, as well as maintaining seasonal warning buoys in the vicinity of the colonies. The colonies included in this project are located from Point Reyes south to the Big Sur coast, and include the Farallon Islands. Cost: $9,526,603.

PROJECT: ***Corvid Management at Point Reyes National Seashore***
BENEFITS: Common Murre
This project will improve Common Murre nesting success at the Point Reyes Headlands by implementing a suite of actions intended to reduce the raven population at Point Reyes National Seashore. Raven populations are artificially high as a result of the cattle and dairy operations; the ravens feed on cattle feed and carcasses. This, in turn, leads to increased predation of murre nests by corvids. The key component of this project is to address land use management at dairy and beef ranches that sustain unnaturally high raven populations near the murre colonies. Ranchers that are willing participants will be compensated for changes in land use practices that adversely affect their dairy operations. Another component of the project is the elimination of a key raven roosting area. Limited removal of certain ravens may also be implemented as a secondary activity if deemed necessary. Cost: $500,000.

PROJECT: ***Reading Rock Common Murre Colony Restoration***
BENEFITS: Common Murre
This project will contribute to a project to reestablish a nearly extirpated Common Murre colony at Reading Rock in Humboldt Colony. The project will use social attraction techniques (e.g., decoys, audio playback) to attract birds back to the colony, as well as education and outreach to minimize human disturbance of the colony site. Cost: $255,307.

PROJECT: ***Old Growth Forest Acquisition and Protection***
BENEFITS: Marbled Murrelets
This project will set aside funds to acquire and manage critical old-growth forest parcels that are (1) currently at risk of logging, (2) known to contain nesting Marbled Murrelets, and (3) located in the Santa Cruz Mountains. Because land may only be acquired from a willing seller, and such opportunities are limited and difficult to predict, funds will be held for five years, awaiting an opportunity to acquire threatened habitat. This project will benefit Marbled Murrelets, which depend upon such habitat for nesting. Cost: $1,745,000.

PROJECT: ***Corvid Management in the Santa Cruz Mountains***
BENEFITS: Marbled Murrelets
This project will improve Marbled Murrelet nesting success by contributing to on-going corvid (i.e., ravens, jays, crows) management efforts in state and county parks of the Santa Cruz Mountains of central California for five years. 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 include education of park campers and visitors regarding control of food waste, improved garbage facilities, limited raven removal, and outreach to nearby communities where food waste may support artificially high corvid numbers. Cost: $695,363.

PROJECT: ***Rat Eradication in the Queen Charlotte Islands, Canada***
BENEFITS: Ancient Murrelets
This project will fund eradication of the non-native Norway rats from Ellen Island and the Bischof Islands, part of the Queen Charlotte Islands, off the coast of British Columbia, Canada. Removal of this introduced species will benefit nesting Ancient Murrelets. Norway rats are predators of murrelet eggs and chicks and have seriously reduced (or completely eradicated) seabirds on many of their nesting islands. Cost: $188,405.

PROJECT: ***Nesting Habitat Restoration on Año Nuevo Island***
BENEFITS: Rhinoceros Auklets
This project will contribute to ongoing native vegetation restoration efforts on Año Nuevo Island, off the central California coast. The goal of this project is to restore low-lying vegetation cover to the central part of the island, prevent erosion, and thereby support Rhinoceros Auklets, which nest in burrows on the island. Cost: $974,037.

PROJECT: ***Sea Otter Pathogens Education and Outreach***
BENEFITS: Sea Otters
This project will fund an education and outreach project in the Monterey Bay region to communicate to the public the threats posed to Sea Otters by various human activities. Recent scientific research has found that the current decline in California's Sea Otters is a result of pathogens that enter the water through human and domestic animal feces. The project will suggest changes in how people manage pets and livestock, as well as boat and home septic tank systems. Cost: $121,155.

2.0 Environment Affected by the Spills

This section presents a brief description of the physical and biological environment affected by the oil spills. The physical environment includes approximately 220 miles of shoreline from Salmon Creek (north of Bodega Bay) to Carmel, as well as the Pacific Ocean extending at least 20 miles offshore. This section provides information on the affected environment for the selected projects within this area. Information on the affected environments for selected projects outside this area is provided along with the project descriptions in section 4.3.

2.1 Physical Environment

The area affected by the spills is rich with marine life and encompasses a wide diversity of protected natural resources, both at sea and along the coast. The at-sea impacted areas include:

- Cordell Bank National Marine Sanctuary
- Gulf of the Farallones National Marine Sanctuary
- Point Reyes National Seashore (boundary extends ¼ mile offshore)
- Monterey Bay National Marine Sanctuary
- Farallon National Wildlife Refuge

Along the mainland coastline, the impacted areas include:

- California Coastal National Monument
- Point Reyes National Seashore
- Golden Gate National Recreation Area
- Salinas River National Wildlife Refuge
- Duxbury Reef Marine Reserve
- James V. Fitzgerald Marine Reserve
- Año Nuevo State Reserve
- Point Lobos State Reserve
- Tomales Bay State Park
- Mount Tamalpais State Park
- Big Basin Redwoods State Park
- Wilder Ranch State Park
- Sonoma Coast State Beaches
- Montara State Beach
- Half Moon Bay State Beach
- San Gregorio State Beach
- Pomponio State Beach
- Pescadero State Beach
- Bean Hollow State Beach
- Natural Bridges State Beach
- Twin Lakes State Beach
- New Brighton State Beach

- Manresa State Beach
- Sunset State Beach
- Zmudowski State Beach
- Moss Landing State Beach
- Salinas River National Wildlife Refuge
- Salinas River State Beach
- Marina State Beach
- Monterey State Beach
- Asilomar State Beach
- Carmel River State Beach

This region contains a wide range of coastal habitats, including sandy and rocky intertidal beaches, open ocean, protected bays, harbors and jetties, offshore rocks, and the Farallon Islands.

The environment impacted by the spills encompasses 4,000 square miles of Pacific Ocean along with near shore tidal flats, wetlands, rocky intertidal areas, coastal beaches, subtidal reefs, kelp forests, and underwater canyons. Brief descriptions of the areas affected by the oils spills are presented below.

The Gulf of the Farallones National Marine Sanctuary (GFNMS) and the Monterey Bay National Marine Sanctuary (MBNMS) were established in 1981 and 1992, respectively, to protect the thousands of seabirds, sea mammals, fish, and other wildlife off the California coast.

The Farallon National Wildlife Refuge is a group of islands located 28 miles west of San Francisco, which was established in 1969 to protect some of the largest colonies of seabirds and marine mammals on the Pacific Coast of North America. The refuge sustains the largest seabird breeding colony south of Alaska and contains 30 percent of California's nesting seabirds. Thirteen species, representing up to 250,000 individuals breed here, including the largest colonies of Brandt's Cormorant, Ashy Storm-Petrel, and Western Gull found anywhere.

The California Coastal National Monument, which was designated by Presidential Proclamation on January 11, 2000, runs the entire length of the California coast (840 miles) between Oregon and Mexico. It extends 12 nautical miles from the shoreline and encompasses thousands of BLM-administered islands, rocks, exposed reefs, and pinnacles above mean high tide.

The Point Reyes National Seashore, which was established in 1962 to protect both the natural and cultural resources within its boundaries, encompasses about 73,000 acres of land and the boundary of the seashore extending ¼ mile offshore. It includes 20,000 acres of coastal and estuarine waters. Point Reyes is the center of one of only five coastal boundary upwelling ecosystems in the world and the only one in North America. Located at the convergence of a number of ocean currents, the adjacent waters are rich in nutrients and support an abundant fishery and associated fauna. The geology of the

peninsula and its association with the Pacific Ocean have created unique estuarine environments that have been described as some of the most unspoiled in the United States. Tomales Bay, formed by seismic activity along the San Andreas Fault, is a long narrow bay included within the National Seashore. Much of the area (33,000 acres) is a congressionally designated wilderness area. Drake's Estero, Rodeo Lagoon, Estero de Limantour, and Abbott's Lagoon are also significant estuarine resources. Drake's Estero has been characterized as possibly the most pristine estuary on the Pacific Coast. The estero is used by numerous avian species, many of which are either state or federally listed. Limantour Estero is a state marine reserve, designated by the California Department of Fish and Game in 1970s. Tomales Bay also harbors tens of thousands of migratory waterfowl and the federally-listed Tidewater Goby (*Eucyclogobius newberryi*). Point Reyes Headland and several large nearshore rocky islands along the peninsula support several thousand nesting and roosting seabirds, particularly large colonies of Common Murre, cormorants, Ashy Storm-petrels, and Brown Pelicans.

Golden Gate National Recreation Area comprises approximately 75,000 acres of coastal lands including the mouth of San Francisco Bay. The legislative boundary of this federal park, which was established in 1972, encompasses the Marin Headlands north of and the ocean shoreline south of the Golden Gate, Alcatraz Island, and Angel Island. Alcatraz supports several species of nesting and roosting seabirds and waterbirds, including Brown Pelicans. Rodeo Lagoon also harbors migratory waterfowl and the Tidewater Goby.

In addition to these areas, numerous other federal, state, and local parks dot the coastline within the impacted area, many with a rich or unique array of natural resources. These include Tomales Bay and Mount Tamalpais State Parks, Duxbury Reef and Fitzgerald Marine Reserves, Año Nuevo State Reserve, and 19 state beaches.

The dominant oceanic current within the affected environment is the California Current, which flows southward from Alaska to Mexico. During the year, several oceanic phenomena affect this current, including the northward-flowing Davidson Counter Current prevailing during the winter, upwelling processes, local gyres and eddies, and tidal exchanges with San Francisco and Monterey Bays. The average annual ocean surface temperature is 55° F.

The three distinct ocean seasons along the central California coast are the oceanic period (July-October), the Davidson Current period (October- March), and the upwelling period (March/April-August). The oceanic period is the season in which the California Current dominates the circulation pattern. This period is characterized by low temperature, low salinity, high-nutrient, and highly oxygenated sub-arctic water. The Davidson Counter Current carries oxygen-poor, nutrient-rich waters that are characteristically warmer and more saline than the California Current. Low temperatures, high salinities, and high nutrient levels usually characterize coastal upwelling. This process increases primary productivity of surface waters by supporting large phytoplankton blooms. Rich zooplankton and fisheries production ensues.

The coastal terrestrial landscapes are equally significant, diverse, and rare, representing a high degree of endemism. They include such diverse vegetation alliances as active coastal fore dunes, coastal terrace prairie, and northern coastal salt marsh.

2.2 Biological Environment

The affected area has one of the most diverse and abundant assemblages of marine organisms in the world. A rich array of habitats─including the open ocean, rugged rocky shores, sandy beaches, lush kelp forests, and wetlands─support large numbers of seals and sea lions, whales, fish stocks, otters, and seabirds. The environment is home to, or a migration corridor for, 36 species of marine mammals, 94 species of seabirds and waterbirds, 400 species of fish, 4 species of sea turtles, 31 phyla of invertebrates, and over 500 species of marine algae. Other important species in the impacted area include the Sea Otter (*Enhydra lutris*), Gray Whale (*Eschrichtius robustus*), Blue Whale (*Balaenoptera musculus*), Humpback Whale (*Megaptera novaeangliae*), Market Squid (*Loligo opalescens*), Brown Pelican, California Coho Salmon (*Oncorhynchus kisutch*), rockfish (*Sebastes sp.*), commercial sea urchin (Class *Echinoidea*), and Giant Kelp (*Heterostichus rostratus*). For many migratory species, such as the whales, seals, salmonids, and Brown Pelicans, the affected area is also an important link to other habitats beyond their boundaries.

Marine Mammals

Pinnipeds

Thirty-six species of marine mammals have been observed in the affected area, including six species of the sub-order pinnipedia (seals and sea lions), two species from the sub-order fissipedia (Sea Otter and River Otter), and twenty-eight species of the order cetaceans (whales and dolphins).

Año Nuevo, Point Reyes, and the Farallon Islands are important pinniped breeding sites in the area and the most important pinniped rookeries and resting areas in central and northern California. The five species of pinnipeds considered common within the affected area include California Sea Lions (*Zalophus californianus*), Steller Sea Lions (*Eumetopias jubatus*), Northern Elephant Seals (*Mirounga angustirostris*), Northern Fur Seals (*Callorhinus ursinus*), and Pacific Harbor Seals (*Phoca vitulina richardii*). An additional species, the Guadalupe Fur Seal (*Arctocephalus townsendi*), has been documented on the Farallon Islands, at Point Reyes, and at Año Nuevo Island.

In any season, California Sea Lions are the most abundant pinniped in the area (Bonnell et al. 1983, Keiper et al. 2005). They breed farther south along the coast in the summer and then migrate northward, reaching their greatest numbers in central California in autumn. Sea lions haul out on offshore rocks and islands. Both haul-out sites and foraging grounds are essential to the species' health. In contrast, the Steller Sea Lion (*Eumetopais jubatus*),a federally-listed species, is declining in the region and currently breeds at Año Nuevo, the Farallon Islands, and Fort Ross (Sydeman and Allen 1999). Historically, Steller Sea Lions bred at Point Reyes. But since the 1970s their numbers

have diminished significantly. Reasons for their decline are unclear but may be a combination of exposure to pollutants, disease, decreases of favored prey such as salmonids and sardines, and competition with California Sea Lions.

Northern Elephant Seals breed in the winter months and then disperse to feed in pelagic waters throughout the eastern North Pacific and Alaskan waters. The population returns to the terrestrial colony later in the year to undergo an annual molt. Peak abundances occur on land in the spring when juveniles and females haul out to molt. The largest populations are on Año Nuevo Island, the adjacent mainland point, and at Point Reyes Headland. The winter population of Northern Elephant Seals on land during the breeding season exceeds 4,000 at Ano Nuevo and 2,000 at Point Reyes (M.L. Bonnell pers. com., S. Allen pers. com.).

Pacific Harbor Seals are year-round residents in the area. They haul out at dozens of sites along the coast from Point Sur to Point Arena. Peak abundance on land is reached in late spring and early summer when they haul out to give birth to pups, breed, and molt. Favorite haul-out sites in the outer coast are isolated sandy beaches and rocky reef areas exposed at low tide. Harbor seals also use the estuarine habitats of Elkhorn Slough, Drake's Estero and Limantour Esteros, and Tomales Bay. More than 20 percent of the breeding population of harbor seals in the state of California occurs at Point Reyes, accounting for around 7,000 seals (Sydeman and Allen, 1999, Allen et al. 2004).

Northern Fur Seals occur in the open waters in winter and spring. They feed offshore after migrating from the Pribilof Islands in Alaska and the Channel Islands off southern California. The greatest density of individuals is found well offshore over the continental slope in waters from 100 to 1,000 fathoms (200 to 2,000 m) deep. Northern Fur Seals have a declining population currently estimated to be 1.2 million animals. Many causes have been attributed to this decline, including entanglement in marine debris and competition with commercial fisheries. This species has been proposed for designation as a depleted species by NOAA. Northern Fur Seals regularly haul out on the Farallon Islands and have pupped on the island every year since 1996. Fur seals also occasionally haul out on Año Nuevo Island and at Point Reyes.

Cetaceans

Approximately 20 species of whales and dolphins have been sighted within the affected areas. Ten species are seen regularly and of these, the Killer Whale (*Orcinus orca*), Minke Whale (*Balaenoptera acutorostrata*), Harbor Porpoise (*Phocoena phocoena*), Dall's Porpoise (*Phocoenoides dalli*), and Pacific White-sided Dolphin (*Lagenorhynchus obliquidens*) are considered year-round "residents." The affected area also lies on the migratory pathway of the Gray Whale and other large baleen whales. More than a third of the world's cetacean species occur off San Francisco Bay and Point Reyes. Of particular note are Gray Whales that migrate close to shore and forage within the waters of Point Reyes and around the Farallon Islands. Blue and Humpback Whales are also common and are annually seen foraging in the region.

Fissipeds

The California or Southern Sea Otter (*Enhydra lutris nereis*) is a threatened species that is found throughout shallow waters in the affected area. Sea Otters inhabit a narrow zone of coastal waters, normally staying within one mile of shore. They forage in both rocky and soft-sediment communities as well as in the kelp understory and canopy. They seldom are found in open waters deeper than 30 m, preferring instead the kelp beds which serve as vital resting, foraging, and nursery sites. Otters are an important part of the marine ecosystem. By foraging on kelp-eating macroinvertebrates (especially sea urchins) Sea Otters can, in many instances, influence the abundance and species composition of kelp assemblages and animals within nearshore communities (Reidman 1990).

The California Sea Otter population is a remnant of the North Pacific population that was decimated by the commercial fur trade in the 18th and 19th centuries. Further discussion of Sea Otter recovery and conservation issues is presented in section 4.3.11. Approximately 31 percent of California's Sea Otter population is found in the area from Point Sur north to Año Nuevo/Pigeon Point.

Seabirds

Marine habitats along the affected coast are among the most productive in the world as evidenced by the numbers of seabirds supported year-round. These populations forage in nearshore waters within the Gulf of the Farallones National Marine Sanctuary (GFNMS), Cordell Bank National Marine Sanctuary (CBNMS), and Monterey Bay National Marine Sanctuary (MBNMS) and are highly dependent on the productive waters of the three sanctuaries, and in the nearshore waters of Point Reyes National Seashore and Golden Gate National Recreation Area (Veit et al. 1996, Ford et al. 2004). The Farallon Islands, a National Wildlife Refuge surrounded by the waters of GFNMS, support the largest concentrations of breeding marine birds in the continental United States (Ainley and Boekelhide 1990). The islands support a diverse nesting community of 13 species, including nearly 100,000 breeding pairs of Common Murres, the species most heavily impacted by the oil spills. The populations of Brandt's Cormorants, Ashy Storm-Petrels, and Western Gulls breeding on the Farallones are the largest for these species worldwide; although, in recent years a large population of Brandt's Cormorants has begun breeding at Alcatraz Island in San Francisco Bay. The Ashy Storm-Petrel reaches the northern limit of its breeding range on the Farallones and Bird Rock off Point Reyes (Ainley and Boekelheide 1990, Ainley 1995). Rhinoceros Auklets disappeared from the Farallones in the 1860s, but re-colonized and began breeding in the 1970s (McChesney and Whitworth 1995). In addition the island supports breeding colonies of Cassin's Auklets and Tufted Puffins.

Several significant seabird colonies occur along the mainland as well, including one of the largest concentrations of Common Murres in California at Point Reyes. Eleven known seabird species nest at Point Reyes, but a much larger number of seabirds, shorebirds and waterbirds (nearly 200 species) forage in the area, including several federally- and state-listed species such as the Brown Pelican, Marbled Murrelet, and the Short-tailed Albatross. The Western Snowy Plover, a federally-listed shorebird, also

breeds at Point Reyes and on several beaches along the San Mateo County coast. Several Species of Special Concern also nest at Point Reyes, including Rhinoceros Auklets, Ashy Storm-Petrels, and Tufted Puffins.

Many seabird species use the affected area for foraging and during migrations from their nesting areas. These include waterfowl (e.g., scoters), loons, grebes, various Procellarids, Brown Pelican, various gulls, various shorebirds (such as Red Phalarope), and various alcids (e.g., Ancient Murrelet). These species that migrate through or winter within the affected area nest around the Pacific Rim, including Alaska, Canada, Baja California, and New Zealand.

The American Bird Conservancy recognized Point Reyes as one of 100 Globally Important Bird Areas (IBA) in the world for bird diversity (Freeman 2001). Populations of some species of seabirds are among the most abundant of western North American, south of the Aleutians (Carter et al. 1992). Both Bolinas Lagoon and Tomales Bay were designated as Wetlands of International Importance under the United Nations Educational, Scientific, and Cultural Organization's Convention on Wetlands (known as Ramsar) because of their significance to migratory waterfowl and shorebirds.

Fish

The diversity and abundance of the fish within the affected area is a significant resource. Generally, the area exhibits the very rich cold-water fish fauna of the Oregonian province (Briggs et al. 1987). The same environmental factors that determine the distribution, abundance, and species composition of the other living resources of the area also affect the fish communities.

Approximately 400 species of fish are found within the affected area. The diverse habitats of the area each have their own characteristic assemblage of fishes. Fishes of the nearshore subtidal habitats exhibit the greatest diversity. This habitat includes many commercially important fishes such as the pelagic schooling species [Northern Anchovy (*Engraulis mordax*), Pacific Herring (*Clupea pallis*), Jack Mackerel (*Thyrsitops sp*.), and California Sardine (*Sardinops caeruleus*)], the large predators [King or Chinook salmon (*Oncorhynchus tshawytscha*), Sablefish (*Anoplopoma fimbria*), sharks)], and some demersal species [English *Parophrys vetulus*) and Petrale Sole (*Eopsetta jordani*)]. Many important species of rockfish are found over rocky reefs, and federally-listed Coho Salmon (*Oncorhynchus kisutch*), California coastal Chinook (*Oncorhynchus tshawytscha),* and Steelhead (*Oncorhynchus mykiss*) can all be found within the boundaries of the affected waters.

Small pelagic species, such as California Grunion (*Leuresthes tenuis*) and smelt (*Atherinopsis spp*.), use sandy intertidal of Tomales Bay and San Francisco Bay for spawning. Other species that forage near sand flats include the surf perch (Family *Embiotocidae*), Striped Bass (*Morone lineatus*), Jacksmelt, Sand Sole (*Pegusa lascaris*), Pacific Sanddab (*Citharichthys sordidus*), and Starry Flounder (*Platichthys stellatus*). Most of the finfish found in shallow rocky reefs are also common in kelp beds. The kelp canopy, stips, and holdfasts increase the available habitat for pelagic and demersal

species and offer protection to juvenile finfish. Greenling (*Hexagrammos sp.*), Lingcod (*Ophiodon elongatus*), and numerous species of rockfish are the dominant fishes.

The rocky intertidal habitat is characterized by a rather small and specialized group of fish adapted for life in tide pools and wash areas. The most representative species are the Monkey-face Eel (*Cebidichthys violaceous*), Rock Eel (*Pholis gunnellus*), Dwarf Surfperch (*Micrometrus minimus*), juvenile Cabezon (*Scorpaenichthys marmoratus*), sculpins (*Cottidae sp.*), and blennies (*Blennius sp.*) (California Department of Fish and Game 1979).

Fishes in the submarine canyon of MBNMS are characterized by a variety of little known meso- and bathypelagic species. Because the canyon allows deep-living species to come close to shore, many uncommon deep-sea fishes have been taken in Monterey Bay. Anderson et al. (1979) reports fishes belonging to 41 families were captured in Monterey Bay by Moss Landing Marine Laboratories or by fishermen. Several of the species were previously unrecorded in the area, while others were extremely rare or far beyond their normal range.

Few fishes live year-round in sloughs and estuaries although some fish such as the Tidewater Goby (*Eucyclogobius newberryi*) and the Three-spined Stickleback (*Gasterosteus aculeatus leiurus)* depend upon the more brackish upper reaches of the estuarine habitats. Full time residents such as the Staghorn Sculpin and the bay pipefish depend upon the mud, eelgrass and other microhabitats to feed, reproduce and hide from predators. Mid-water swimmers such as the northern anchovies, Pacific Herring, Topsmelt and Jacksmelt also use the area for feeding while simultaneously using the microhabitats for protection from predators (Silberstein and Campbell 1989). Large marine predators such as Bat Rays (*Myliobatis californica*) and Leopard Sharks (*Trakis semifasciata*) forage extensively on the benthic fauna of the more saline lower reaches of the estuaries. Sardines were the basis for an extensive fishery in the 1930s. Overfishing in combination with environmental factors caused stocks of the Pacific sardine to decrease until the fishery collapsed in the late 1950s.

Point Reyes supports a diverse and abundant assemblage of marine fish and crustaceans, several of which also have state or federal protection, including about eight species such as California Freshwater Shrimp, Coho Salmon, and Steelhead Trout. A recent inventory documented over 170 species of fish in the park waters that extend ¼ mile offshore and include estuaries (NPS 2005). There are also numerous important commercial and sport fish and shellfish including about 20 species of rockfish (*Sebastes*), Pacific Herring, Dungeness Crab, and Pink and Red Abalone. Point Reyes also has one of the few healthy populations of Black Abalone, a state species of concern. Within the boundary of the park there are numerous commercial oyster operations at Tomales Bay and Drake's Estero.

Sea Turtles

Four species of sea turtles are found in the affected area. The Leatherback (*Dermocheysp coriacea)* is the most common followed by the Green Sea Turtle (*Chelonia mydas agassizi*), the Loggerhead Sea Turtle (*Caretta caretta*), and an

occasional Olive Ridley (*Lepidochelys olivaceas*). There are no sea turtle nesting areas in the affected area; however, NOAA surveys indicate that Point Reyes is a hot spot for Leatherback Sea Turtles in the state (Scott Eckert, pers. comm). They are mostly seen during their foraging activities in the summer and early fall. Most appear during the warmest sea temperatures (above 16º C and most common above 18º C). Many of the turtle's distributions seem to be regulated by the 16º C isotherm (Scott Eckert, pers. comm.).

Algae

Large marine algae, or seaweeds, are diverse and abundant within the affected area. The extent of this diversity is shown by the presence of over 500 of the 669 species of algae described for California (Abbott and Hollenberg 1976). The area has the largest marine flora of the temperate northern hemisphere, with numerous endemic species and the only population of one large understory kelp (*Eisenia arborea*) between southern California and Canada.

The seaweeds of the Gulf of the Farallones region and Monterey Bay area are composed of three main phyla: Red Algae (Division *Rhodophycota*), Brown Algae (Division *Phaeophycophyta*), and Green Algae (Division *Chlorophycota*). They occur primarily in areas of rocky substrate and only rarely in water deeper than 40 m (Abbott and Hollenberg 1976). The most extensive algal communities are dominated by forests of Giant Kelp (*Macrocystis integrifolia*) and Bull Kelp (*Nereocystis leutkeana*). Bull Kelp rejuvenates itself annually; giant kelp is generally perennial, growing all year.

Kelp beds are continuous from San Simeon in the south of the affected area to the city of Monterey. Within Monterey Bay from the city of Monterey to south of Santa Cruz there are no kelp beds due to the sandy substrate of the shore. Kelp beds are thick off of Santa Cruz and intermittent up to Año Nuevo. Giant Kelp is rare from Año Nuevo north to Half Moon Bay, the northern limit of its dominance, where Bull Kelp then becomes the dominant kelp along the coast. The Santa Cruz County coast between Terrace Point and Point Año Nuevo has changed from almost total dominance of Giant Kelp in 1911 to an increase in the number of Bull Kelp stands (Yellin et al. 1977). Although Sea Otters may produce further changes, the primary factors affecting these kelp forests appear to be storms and substrate composition (reviewed in Foster and Schiel 1985).

In addition to the marine and coastal types of algae, the estuary and slough habitats provide sheltered areas for an abundant growth of marine algae as well as specifically adapted vascular plants, such as eelgrass (*Zostera marina*) and pickleweed (*Salicornia* sp.). These in turn provide rich micro-habitats for other organisms, and some species are dependent on them such as Black Brant and Pacific herring on eel grass beds.

Fauna of Sandy and Rocky Shoreline Habitats

Sandy beaches are the dominant intertidal habitat within the affected area. This is a very dynamic habitat with constantly shifting sands caused by wave action. Most animals capable of tolerating the stresses of the intertidal area are burrowing organisms. The

overall productivity of this habitat is lower than that for rocky intertidal habitats (Nybakken 1982).

Polychaete worms, bivalve mollusks, and crustaceans are the predominant invertebrates on sandy beaches. Sand Dollars (*Clypeaster subdepressus*) and gastropod mollusks are also found here (Wilson 1986). The only fishes that are common are those that use sandy beaches for spawning [e.g., the Surf Smelt (*Hypomesus pretiosus*)]. Benthic diatoms are the only marine algae that may be present and growing within this habitat, although kelp beds may be common in subtidal habitats just offshore from sandy beaches. However, drift algae may accumulate on some sandy beaches, providing refuge and food for amphipods, insects, and shorebirds. Sandy beaches are important winter foraging habitat for migratory shorebirds and nesting habitat for the Western Snowy Plover. Peregrine Falcons nest along numerous rocky shoreline areas in the region including around Muir Beach, the Golden Gate and Tomales Point. Also, in recent years, California Condor are sighted regularly in the Big Sur coastal area, occasionally feeding on marine mammal carcasses.

Rocky intertidal habitats are highly productive and diverse environments and located throughout the affected area within the lowest and highest tidal level. Organisms living in this area must be able to withstand periodic desiccation, high temperature and light, low salinities, and strong wave action (Nybakken 1982). Variation in the degree of exposure to these environmental factors can create marked zonation patterns within this habitat (Foster et al. 1988). Marine plants are primarily red, brown, and green algae. The invertebrates include mostly sessile species such as mussels, barnacles (Infraclass *Cirripedia*), and anemones (Order *Actiniaria*). Mobile grazers and predators include crabs (Order *Decapoda*), amphipods (*Stygobromus sp.*), littorine snails (Class *Gastropoda*), limpets (Subclass *Streptoneura*), sea stars (Subclass *Asteroidea*), and sea urchins. Tidepool fishes include the Striped Surfperch (*Embiotoca lateralis*), Tidepool Sculpin (*Oligocottus maculosus*), and Tidepool Snailfish (*Liparis florae*).

Rocky intertidal habitats are probably the best studied of all habitats in and adjacent to Monterey Bay. These habitats are not uniform within Monterey Bay, but vary in composition within short distances. In addition, Point Reyes, Duxbury Reef, the Fitzgerald Marine Reserve, Asilomar Beach, and Point Sur are well known areas for invertebrates. Fitzgerald Marine Reserve supports one of the largest intertidal reefs in California, supporting an extremely diverse and abundant array of invertebrate species. California Department of Fish and Game, federal agencies (NOAA and NPS), and the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) maintain numerous intertidal monitoring stations throughout the study area, some of which have been monitoring for over 30 years.

2.2.1 Threatened and Endangered Species

There are several species known to be impacted by the spills that are of special concern due to their population status. The various federal and state levels of special-status designations include:

- Federally Endangered
- Federally Threatened
- State Endangered
- State Threatened
- State Fully Protected Species
- California Species of Special Concern (pursuant to the 1978 list)
- Proposed California Species of Special Concern (based on the 2003 list, which has not been officially adopted).

The federal Endangered Species Act of 1973 (16 USC Section 1531 *et seq*.) and the California Endangered Species Act of 1970 (Ca. Fish and Game Code Section 2050 *et seq*.) direct the protection and conservation of listed endangered and threatened fishes, plants, and wildlife. The habitat of endangered, threatened, and rare species takes on special importance because of these laws, and the protection and conservation of these species requires diligent management. Four state- and/or federally-listed species were impacted by the spill: the California Brown Pelican, the Western Snowy Plover, the Marbled Murrelet, and the California or Southern Sea Otter.

Several other state- and/or federally-listed sensitive species are found in the affected area. These species are not thought to have been affected by the spill either because they were not present in the area due to migration patterns or because of low overall population density or regional scarcity. These species include the Short-tailed Albatross, the Peregrine Falcon (recently delisted), the Least Tern, the Steller Sea Lion, Guadalupe Fur Seal, all four species of sea turtles that occur in the area (Leatherback, Green, Loggerhead, and Olive Ridley), and the Blue and Humpback Whales.

Additionally, the North American Waterbird Conservation Plan (Kushlan et al. 2002), supported by NOAA and the USFWS, assigns "categories of conservation concern" for all colonial or semi-colonial species. The National Audubon Society also has evaluated bird population status and trends and has developed a "watchlist," in which the most vulnerable species are on the "red list" and less vulnerable species are on the "yellow list" or "green list." Table 4 below lists species impacted by the oil spills and their special status or level of concern on the various lists.

Table 4: Special Status Species Impacted by the Spills

SPECIES	FEDERAL STATUS	STATE STATUS	CATEGORY OF CONSERVATION CONCERN	AUDUBON WATCHLIST STATUS
Common Loon		CSSC 1978, 2003	Not evaluated	
Eared Grebe			Moderate	
Western Grebe			Moderate	
Northern Fulmar			Moderate	
Pink-footed Shearwater			High	Red List
Sooty Shearwater			Moderate	
Black-vented Shearwater			High	Red List
Ashy Storm-Petrel		CSSC 1978, 2003	Highly Imperiled	Red List
Brown Pelican	Endangered	Endangered; Fully Protected	Moderate	
Brandt's Cormorant			High	
Double-cr. Cormorant		CSSC 1978	Not at risk	
Pelagic Cormorant			High	
Black Brant		CSSC 2003	Not evaluated	Yellow List
Western Snowy Plover	Threatened	CSSC 1978, 2003	Not evaluated	Red List
Bonaparte's Gull			Moderate	
Heermann's Gull			Moderate	Red List
California Gull		CSSC 1978	Moderate	
Common Murre			Moderate	
Pigeon Guillemot			Moderate	
Marbled Murrelet	Threatened	Endangered	High	Red List
Ancient Murrelet			High	
Cassin's Auklet		CSSC 2003	Moderate	
Rhinoceros Auklet		CSSC 1978, 2003	Low	
Horned Puffin			Moderate	
Sea Otter	Threatened	Fully Protected		

Notes: CSSC = California Species of Special Concern. 1978 refers to the current official version of the list; 2003 refers to the proposed draft revision of the list, which has not been approved. Category of Conservation Concern refers to the status assigned by the North American Waterbird Conservation Plan. Those species considered under that plan as "Low Concern" or "Not currently at risk," and with no other special status, are not included above.

2.3 Archeological and Cultural Resources

Humans settled in the vicinity of the affected environment at least 10,000 years ago. At the time of Spanish arrival in the early 1700s, about 40 Native American tribes populated the coastal areas. The size of coastal middens suggests that Native Americans were the principal controllers of animal population sizes in the intertidal zone in some areas. The Spanish, the first European settlers, arrived in the late 1700s, and began to exploit local marine resources by hunting Sea Otters and harvesting abalone for trade with northwest coast Native Americans.

Many shipwrecks along this coastline are a result of significant maritime exploration and trade coupled with a coastline dotted with shallow, rocky headlands that are largely exposed to prevailing winds and storms. More than 100 shipwrecks have been documented in this region, and there are undoubtedly more that are unrecorded. Some of the most significant shipwrecks of North America have occurred in the region, including the Spanish galleon *San Augustin* that sank in 1592 at Point Reyes.

2.4 Recreational Services

The Central California coast is well known for its scenic rocky coastline, open sandy beaches, and picturesque coves. Because much of the San Mateo and Marin County coast is undeveloped, many of these beaches have a remote, wild feeling. At the same time, Highway 1 and ample parking lots and pull-outs provide easy public access. These beaches host a wide range of recreational activities, including general beach use, hiking, biking, fishing, surfing, camping, wildlife viewing, horseback riding, and other specialized uses. Campgrounds are located near several beaches in northern Monterey Bay, Marin County, and Sonoma County. Some of the beaches are characterized by the remote locations and/or rugged beauty (e.g., Limantour Beach in Marin County and various cove beaches along the San Mateo and Santa Cruz County coastlines), while others are located near urban areas and receive considerable beach use (e.g., Ocean Beach, Santa Cruz City Beach, Monterey Beach Park).

3.0 Coordination and Compliance

3.1 Federal and State Trustee Agencies

The U.S. Fish and Wildlife Service (USFWS), the National Park Service (NPS), the Bureau of Land Management (BLM), the National Oceanographic and Atmospheric Administration (NOAA), and the California Department of Fish and Game (CDFG) are the state and federal trustee agencies (Trustees) who are addressing the natural resources injured by the spills. The USFWS, NPS, BLM, and NOAA are designated Trustees for natural resources pursuant to subpart G of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR § 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). CDFG has been designated as a state trustee for natural resources pursuant to Section 1006 (b) (3) of the Oil Pollution Act and subpart G of the NCP. Additionally, CDFG has state natural resource trustee authority pursuant to Fish and Game Code §§ 711.7 and 1802 and the Lempert-Keene-Seastrand Oil Spill Prevention and Response Act (Government Code § 8670.1 *et seq*.). 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. The USFWS is designated as the lead federal Trustee for purposes of coordination and compliance with OPA and NEPA.

3.2 Coordination

3.2.1 Coordination Among the Trustees

Federal regulations implementing OPA 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 CFR § 990.14(a)). The Trustees in this matter have worked together in a shared effort to fully restore the resources that were injured. OPA is described in more detail below.

3.2.2 Coordination with the NPFC

The Trustees and the NPFC have been involved with these spills since 1997, when the Trustees responded to the winter 1997-98 Point Reyes Tarball Incidents. The NPFC paid for response costs (primarily bird collection) during this spill episode, as well as during the winter 2001-02, summer 2002, and winter 2002-03 episodes. In the summer of 2002, the NPFC authorized and paid $20 million for oil removal operations at the sunken *Luckenbach*.

With regard to NRDA, the NPFC approved and paid $333,145.62 for an Initiation of NRDA as a result of the 1997-98 Point Reyes Tarball Incidents. The results of that work, documented in Carter and Golightly (2003), are incorporated into the injury

quantification described in this document. After the winter 2001-02 spills, the NPFC again authorized Initiation of NRDA, paying $80,464 in assessment costs.

The Trustees have remained in contact with the NPFC, informing it of the status of the DARP/EA and assessment activities, with the goal of submitting a final claim to the NPFC to fund the selected restoration projects and to reimburse the Trustees for unreimbursed assessment costs.

3.2.3 Coordination with the Public

Public review of the draft DARP/EA was an integral component of the restoration planning process and is required pursuant to the National Environmental Policy Act (NEPA). NEPA is described in more detail below. A 45-day public review period was held on the draft plan and environmental assessment. This comment period opened February 28, 2006 and closed on April 14. Comments are included and summarized in Appendix N, along with Trustee replies.

The Trustees continue to maintain a website http://www.dfg.ca.gov/ospr/organizational/scientific/nrda/NRDAluckenbach.htm that provides information on the case and on-going restoration planning.

In addition, 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 by the Trustees during the assessment and restoration planning process.

The Record is on file at:

California Department of Fish and Game
Office of Spill Prevention and Response
1700 K Street, Suite 250
Sacramento, CA 95814

Arrangements may be made to review the Record by contacting Steve Hampton by telephone at (916) 323-4724.

The Trustees also released a Notice of Intent to Conduct Restoration Planning after the *Luckenbach* was discovered to be a primary source of the oil spills and the assessments of injuries from the various spill episodes were merged into a single effort (Federal Register: January 6, 2004, Volume 69, Number 3, Page 673-675).

3.3 Compliance with Environmental Laws, Regulations, and Policies

3.3.1 The Oil Pollution Act

The Oil Pollution Act, Title 33 USC § 2701 *et seq*. (OPA), establishes a liability regime for oil spills that injure or are likely to injure natural resources and/or the services that

those resources provide to the ecosystem or humans. Pursuant to OPA, 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. The draft and final DARP/EAs have been prepared jointly by the USFWS, NPS, NOAA, and CDFG. As described above, each of these agencies is a designated natural resource Trustee for natural resources injured by the 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 authorizes the Trustees to assess damages for natural resources injured under their trusteeship. OPA further instructs 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 regulations for natural resource damage assessments under OPA are found at 15 C.F.R. Part 990.

3.3.2 The National Environmental Policy Act

The National Environmental Policy Act (NEPA), 42 U.S.C. 4321, et seq.; 40 C.F.R. Parts 1500-1508, sets forth a specific process of impact analysis and public review. NEPA is the basic national charter for the protection of the environment. Its purposes are 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. NEPA provides a mandate and a framework for federal agencies to consider all reasonably foreseeable environmental effects of their proposed actions and to involve and inform the public in the decision-making process. NEPA also established the Council on Environmental Quality (CEQ) in the Executive Office of the President to formulate and recommend national policies which ensure that the programs of the federal government promote improvement of the quality of the environment.

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. Depending on whether the effects of a selected project are considered significant, an environmental impact statement (EIS) or a finding of no significant impact (FONSI) will be issued.

In accordance with the regulations implementing the OPA NRDA process, the Trustees integrated OPA restoration planning with the NEPA process (15 CFR § 990.23). Accordingly, the draft DARP was integrated with a NEPA EA document. The integrated process allowed the Trustees to meet the public involvement requirement of OPA and NEPA concurrently. The Trustees anticipate that this DARP/EA will meet the required NEPA compliance requirements for most of the selected restoration projects described herein. However, subsequent NEPA compliance may be required prior to

implementation of some of the restoration actions that are conceptual at this stage (e.g., mouse eradication on the Farallon Islands) pending development of sufficient project-level detail.

3.3.3 Other Federal and State Laws, Regulations, and Policies

As described above, OPA, NEPA, and federal regulations implementing these laws are the major federal laws and regulations guiding the development of this DARP/EA for restoration of injured resources and services resulting from the *Luckenbach* and the other mystery spills. However, there are other federal and state laws, regulations or policies that may be pertinent to either the approval of this DARP/EA or to implementation of the specific restoration actions proposed herein. Potentially relevant laws, regulations, and policies are set forth below.

3.3.3.1 Federal Laws, Regulations, and Policies

Clean Water Act, 33 U.S.C. 1251, et seq.

The federal Water Pollution Control Act (commonly referred to as the Clean Water Act, CWA, or the Act) is the principal federal statute governing water quality. The Act's objective is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. The CWA regulates both the direct (point source) and indirect (non-point source) discharge of pollutants into the Nation's waters.

Section 402 pf the Act established the National Pollution Discharge Elimination System (NPDES) program. The Act allows EPA to authorize state governments to implement the NPDES program. 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 319 of the Act directs states to identify best management practices and measures to reduce non-point source pollution.

Section 311 of the CWA regulates, *inter alia*, the discharge of oil and other hazardous substances into navigable waters, adjoining shorelines, and waters of the contiguous zone. The CWA 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 discharge of dredged or fill material into the waters of the United States. Section 401 of the Act provides that any applicant for a federal permit or license to conduct any activity which may result in any discharge into navigable waters must obtain certification of compliance with state water quality standards.

Although the Trustees do not anticipate that any of the restoration projects will trigger CWA permitting requirements, the implementing entity for each project will be required to apply for the appropriate permits prior to project implementation.

Rivers and Harbors Appropriation Act of 1899, 33 U.S.C. § 401 et seq.

The Rivers and Harbors Act regulates the 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 U.S. Army Corps of Engineers with authority to regulate discharges of fill and other materials into such waters.

The Trustees do not believe that any of the restoration projects have the potential to negatively affect navigable waters because none of the projects will result in the obstruction or alteration of navigable waters.

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. NOAA approved the California Coastal Management Program in 1977. The enforceable policies of the CZMA are found in Chapter 3 of the California Coastal Act. For the entire California coast, except San Francisco Bay, the California Coastal Commission implements the federal Coastal Zone Management Act of 1972 (in the San Francisco Bay area, the implementing agency is the San Francisco Bay Conservation and Development Commission).

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.

The Trustees believe that each of the selected projects can be implemented in a manner that will either have no effect on coastal resources or uses or is consistent to the maximum extent practicable with the CZMA and the California Coastal Management Program. The USFWS, on behalf of the federal trustees, has determined that at least twelve of the selected projects will not adversely affect coastal zone resources and/or uses, and the California Coastal Commission has concurred. As to those two selected projects that require further design or details in order to make such a determination, the federal agency responsible for implementing such projects will seek California Coastal Commission concurrence in its determination.

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 NFMS) 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.

If the federal action agency concludes that the project will not adversely affect listed species or 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's determination of "not likely to adversely affect," then the consultation (informal to this point) is completed 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. There is a designated period in which to consult (90 days), and beyond that, another set period for the USFWS and/or NOAA Fisheries Service to prepare a biological opinion (45 days). 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.

Several federally-listed species occur in the affected area for this Restoration Plan (see Table 4). The federally endangered Sea Otter and Brown Pelican and the federally threatened Marbled Murrelet and Snowy Plover may utilize waters and lands which may be included in selected areas for implementing restoration projects. Additionally, these species are the target for the proposed restoration in some of the selected projects.

[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.

The Trustees do not believe any of the restoration projects will likely adversely affect a listed species or critical habitat because the projects are designed to restore and benefit injured resources including certain federally-listed species. The USFWS has been consulted regarding those three bird species for which it is responsible and has concurred with this determination. NOAA Fisheries will be consulted regarding the Sea Otter.

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 of 1996 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 do not believe that any of the selected restoration projects will adversely affect 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 FCWA 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.

The Trustees will consult with the appropriate agencies on any of the selected restoration projects that involve activities that affect, control or modify water bodies.

Marine Mammal Protection Act, 16 U.S.C. § 1361, et seq.

The Marine Mammal Protection Act (MMPA) prohibits, with certain exceptions, the take of marine mammals in U.S. waters and by U.S. citizens on the high seas, 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 NOAA Fisheries. The Secretary of the Interior (through the USFWS) is responsible for walruses, sea and marine otters, polar bears, manatees, and dugongs.

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 actions have the potential to result in the take, injury, or harassment of any species protected under the MMPA. One possible exception may be the mouse eradication project at the Farallon Islands, where some short term disturbance of marine mammals may occur. This will be addressed by additional environmental compliance associated with that project, if selected. Additionally, work on Año Nuevo Island is already being done with an MMPA permit due to occaisional minor harassment of pinnipeds in the course of accessing and working on the island. That permit will be amended as necessary. If work on Reading Rock is deemed to have similar impacts as those at Año Nuevo, an MMPA permit 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 rehabilitation, possession and salvage 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.

Implementation of restoration projects selected in this DARP/EA 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 at-sea areas impacted by the spills include the Cordell Bank National Marine Sanctuary, the Gulf of the Farallones National Marine Sanctuary, the Monterey Bay National Marine Sanctuary, and the Farallon Islands National Wildlife Refuge. For restoration projects that have the potential to affect resources within a sanctuary (i.e. the Seabird Colony Protection Program activities that include the Farallon Islands) the Trustees will consult with and apply for permits as appropriate to conduct activities within sanctuary boundaries.

Park System Resource Protection Act, 16 U.S.C. 19jj

The Park System Resource Protection Act (16 U.S.C. 19jj), authorizes the Secretary of the Interior (Secretary) to assess and monitor injuries, and to seek damages for restoration, for 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 National Park Service…." The Act specifically allows the Secretary to seek response costs and damages from the responsible party causing the destruction, loss of, or injury to park system resources.

The Trustees do not believe that any of the restoration projects have the potential to negatively affect NPS resources.

***Wilderness Act, 16 U.S.C.* Public Law 88-577**

The Wilderness Act established a National Wilderness Preservation System to be composed of federally owned areas designated by Congress as wilderness areas, to be administered in such a manner that will leave them unimpaired for future use and enjoyment as wilderness. In 1976, Congress designated a portion of Point Reyes National Seashore (33,000 acres) as wilderness, including Point Reyes Headlands, the shoreline north of the peninsula, and the shoreline from Limantour Estero south.

Executive Order (EO) 11988 – Construction in Flood Plains

The 1977 Executive Order 11988 seeks 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 federal 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 environmental impact statement prepared pursuant to NEPA. The agency should consider alternatives to avoid adverse effects and incompatible development in flood plains. If the only practicable alternative requires sitting 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 in a floodplain.

Executive Order 13112 - Invasive Species

The 1999 Executive Order 13112 requires that all federal agencies whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law, (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. Certain of the selected restoration projects are aimed at the removal or control of non-native species.

Executive Order (EO) 12898 - Environmental Justice

The 1994 Executive Order 12898 requires 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 CEQ has oversight of the federal government's compliance with Executive Order 12898 and NEPA.

The Trustees have involved the affected community by providing notice to the public, seeking public comments, holding public meetings and 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 DARP/EA is an information product covered by information quality guidelines established by NOAA and DOI for this purpose. The quality of the information contained herein is consistent with these guidelines, as applicable.

3.3.3.2 State Laws, Regulations, and Policies

California Environmental Quality Act, Pub. Res. Code 21000-21178.1

CEQA was adopted in 1970. 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 a discretionary action that is carried out, funded or authorized by an agency (i.e., the lead agency), and

that has the potential to impact the environment. Once the lead agency determines that the project is subject to CEQA, the lead agency must then determine whether the action is exempt from CEQA compliance under either a statutory or categorical exemption. Examples of categorical exemptions include actions taken by regulatory agencies for protection of natural resources and actions by regulatory agencies for protection of the environment (Title 14 CCR, Chapter 3, §§ 15307-15308).

If the lead agency determines that the project is not exempt, then an Initial Study is generally prepared to determine whether the project may have a significant effect on the environment. Based on the results of the Initial Study, the lead agency determines whether to prepare a Negative Declaration (i.e., the project will not result in significant adverse effects to the environment) or an Environmental Impact Report (EIR). The test for determining whether an 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 adverse effect on the environment.

CEQA encourages the use of a federal EIS or FONSI prepared pursuant to NEPA when such documents are available, or the preparation of joint state/federal documents, in lieu of preparing a separate EIR or negative declaration under CEQA. Accordingly, the State Trustee, CDFG, intends to use this federal NEPA EA document and resulting FONSI (if issued) as necessary towards CEQA compliance for the restoration alternatives described herein. Towards this end, the CDFG will coordinate with the federal Trustees to ensure the EA and FONSI (if issued) complies with the provision of CEQA guidelines (Title 14 CCR, Chapter 3, § 15220 *et seq*.).

The Trustees anticipate that this DARP/EA will meet the CEQA compliance requirements for most of the restoration projects described herein. Additional environmental compliance may be required for some of the projects prior to actual implementation. This will be determined once detailed engineering design work or operational plans are developed for the selected projects.

California Lempert-Keene-Seastrand Oil Spill Prevention and Response Act, Government Code § 9574.1, et seq.

The Lempert-Keene-Seastrand Oil Spill Prevention and Response Act became effective on September 24, 1990. This legislation is the key state compensatory mechanism for subsequent spills and establishes a comprehensive liability scheme for damages resulting from marine oil spills. Recoverable damages include damages for the injury to, destruction of, or loss of natural resources, including the reasonable costs of assessing the injury, destruction, or loss, the cost of rehabilitating wildlife, habitat, and other resources, and the 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.

California Coastal Act, California Public Resources Code § 30000, et seq.

The California Coastal Act was enacted by the California State Legislature in 1976 to provide long-term protection of California's 1,100-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 [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. New development in the Coastal Zone may require a permit from the Commission or the appropriate local government agency. The Commission also reviews and approves Local Coastal Programs, which are the basic planning tools used by local governments to guide development in the Coastal Zone.

The Trustees do not anticipate that any of the restoration projects will adversely affect coastal resources or involve development in the California Coastal Zone. However, the implementing entity for each project will be required to apply for any necessary permits and approvals, including any required coastal development permit.

California Endangered Species Act,* Fish and Game Code 2050 *et seq.

Pursuant to the California Endangered Species Act (CESA) (California Fish and Game Code Sections 2050 et seq.), it is the policy of the State of California that state agencies should not approve projects 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.

Several state-listed species occur in the affected area for this Restoration Plan (see Table 4). The state fully-protected Sea Otter, endangered Brown Pelican, and endangered Marbled Murrelet may utilize waters or lands which may be included in selected areas for implementing restoration projects. Additionally, these species are the target for the proposed restoration in certain of the restoration projects. While the Trustees do not believe the restoration projects will result in the take of any state-listed species, the

Trustees will evaluate the potential effects of the projects on these species and consult with the CDFG as may be appropriate pursuant to the requirements of the CESA.

Public Resources Code, Division 6,* § 6001, *et seq.

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

3.3.3.3 Other Potentially Applicable Statutes and Regulations

Additional legal requirements may be applicable to NRDA restoration planning activities. The statutes listed below, or their implementing regulations, may require permits from federal or state permitting authorities.

- National Park Act of August 19, 1916 (Organic Act), 16 USC 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, Water Code Sections 13000 et seq.

4.0 Injury Quantification and Restoration Planning

This section describes the Trustees' efforts to quantify the nature, extent, and severity of injuries to natural resources resulting from the spills. It begins with an overview of the data collected during the spills followed by a description of the damage assessment strategy and methods used to determine and quantify the injuries. The chapter also presents summaries of the injury quantification results, restoration alternatives including a no-action alternative, and restoration scaling for all projects. The environmental impacts, or consequences, of the selected projects are described in section 4.3, and potential cumulative impacts are summarized in section 4.5.

The Trustees have used available information, focused studies, and expert scientific judgment 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 recognized experts on the impacted species. There is, however, some uncertainty inherent in the assessment of impacts from oil spills. While collecting more information 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. The Trustees have sought to balance the desire for more information with the reality that further research would cost more money and would delay the implementation of the restoration projects.

4.1 Overview of Data Collection and Studies

Prior to 1997, when oiled birds were found on beaches, the Trustees largely depended on the public to collect live injured birds and bring them to local wildlife care centers, except in a few incidences such as the *Cape Mohican* and the *Puerto Rican* oil spills. Response by the Trustees was often limited, because no associated oil had been observed or reported on the water and there was no known oil spill. Instead the Trustees and the USCG focused on investigating possible sources of the oil. Nevertheless, a sample of beached birds and tarballs have been routinely documented and collected since 1993. Oiled wildlife and tarballs were collected through Gulf of the Farallones and Monterey Bay National Marine Sanctuaries beach surveys and analyzed at the CDFG Petroleum Chemistry Lab. The wildlife care centers documented the numbers of birds brought to them by the public. Data regarding species composition of beached birds show that most of the birds were Common Murres (Carter 1997; Nur et al. 1997; Roletto et al. 2003). Beginning with the 1997-98 spills (the Pt. Reyes Tarball Incidents), the Trustees responded in a more organized fashion to reports of oiled wildlife. The Trustees conducted daily beach searches and documented all birds collected (live and dead) in coordination with the Oiled Wildlife Care Network, which had been recently established to coordinate responses to oiled wildlife. Below is a list of activities conducted during the spills that resulted in important data for damage assessment. The Trustees used this response data to conduct their preassessment of natural resource damages (NRD).

Oiled Wildlife Search and Collection: These activities were conducted for response purposes to capture live oiled wildlife, if possible (for potential rehabilitation), and to

remove dead oiled wildlife from the beaches. In addition to documenting the date, location, species, and attributes of all birds collected, the surveyors also documented their search effort, including beaches searched, method, time, and number of birds collected (if any). This is the primary data used to estimate bird mortality.

Aerial Surveys: Limited aerial surveys were conducted in 1997-98 to search for oil (see Carter and Golightly, eds. 2003). More extensive surveys were conducted in summer 2002, during the oil removal operations at the *Luckenbach*, to evaluate resources at risk in the event on an unplanned release. This data provides important information on the presence of Marbled Murrelets in the spill area.

Based on the information collected during the response actions summarized above, the Trustees determined that injuries to birds had occurred. The Trustees also determined that potential restoration actions to compensate for the losses were feasible and proceeded with injury assessments. To that end, the Trustees engaged in some additional injury assessment and restoration planning studies after the response was over:

Bird Mortality Estimation: The Trustees used a Beached Bird Model to estimate the total number of birds impacted from all spills. The Trustees contracted with Glenn Ford, an expert in estimating bird mortalities resulting from oil spills, for this work. While the results are summarized in this document, a separate report on this analysis will be available (Ford et al. 2006a).

Carcass Re-wash Study: The Trustees conducted a study, using radio-tagged bird carcasses, to evaluate the fate of beachcast birds on narrow beaches in the spill zone subject to re-wash at high tides. The results of this study were input directly into the Beached Bird Model used to estimate bird mortality. The Trustees contracted with Glenn Ford for this work.

Scavenging Rate Study: The Trustees conducted a study, using radio-tagged bird carcasses, to evaluate the scavenging and removal rate of beachcast carcasses from several different types of beaches within the spill zone. The results of this study were input directly into the Beached Bird Model used to estimate bird mortality. The Trustees contracted with Glenn Ford for this work.

Analysis of Factors Influencing Bird Recovery Rates: The Trustees conducted a statistical examination of the response data, examining the effects of various beach search methods and attributes on the likelihood of finding beachcast birds. The results of this study were input directly into the Beached Bird Model used to estimate bird mortality. This work was performed by Trustee staff and is described further in Hampton and Zafonte (2005).

BeachWatch Data Preparation: BeachWatch is a program of regular beach surveys organized by the GFNMS. These surveys have recorded all beachcast birds, oiled and unoiled, throughout the year since 1993 in much of the spill area. Although some of the data were analyzed during the Point Reyes Tarball Incidents natural resource

damage initiation, much of the remaining data had never been entered into a digital format. The Trustees undertook this task to assist in bird mortality estimation. This data source was especially important for analyzing natural mortality rates as well as spill-related mortality outside of the major oiling episodes. The Trustees contracted with the Farallones Marine Sanctuary Association for this work.

Marbled Murrelet Telemetry Study: Because Marbled Murrelets are at risk and declining in central California, and because they are difficult to find on the beaches, the Trustees conducted a study to determine the winter dispersal of birds that nest in the Santa Cruz Mountains. The purpose was to learn the extent to which birds from this population would have been at risk of oiling. The Trustees contracted with UC Berkeley for this work and the results can be found in Peery et al. (2003).

Historical Oil Sample Analysis: In addition to oil samples already analyzed during the oil spill response and investigation of the source of the oil, the Trustees analyzed an additional 71 feather samples and 8 Sea Otter fur samples from the period of 1993 to 2001. This was done to determine the impacts of the *Luckenbach* in previous years and during the summer months, and to determine the extent to which natural seep oil may have been responsible for some of the impacts to wildlife. The Trustees used samples collected from bird rehabilitation facilities, past oil spill response efforts, and beached bird surveys (GFNMS Beach Watch program). CDFG's Petroleum Chemistry Laboratory performed the analyses.

Ancient Murrelet Restoration Planning: Because Ancient Murrelet restoration needs are at their breeding grounds in Canada and Alaska, the Trustees had little familiarity with potential restoration project alternatives. The Trustees contracted with Island Conservation to research suitable restoration projects, including making the necessary contacts with government officials and Native American tribal leaders.

Other Data Preparation and Research: Additional work performed by the Trustees included considerable time reviewing and preparing response data regarding beach search and bird collection for use in the Beached Bird Model. The Trustees also conducted considerable restoration planning including identifying and researching the costs and feasibility of restoration projects for the impacted species, as well as preparing this DARP/EA.

4.2 Injury and Damages Assessment

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 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 (1) the range of procedures available under section 990.27(b) of the OPA

regulations; (2) the time and cost necessary to implement the procedures; (3) the potential nature, degree, and spatial and temporal extent of the injury; (4) potential restoration actions for the injury; (5) the relevance and adequacy of information generated by the procedures to meet information requirements of planning appropriate restoration actions; and (6) input from scientific experts.

Each injury assessment focused on determining both the magnitude of the injury (e.g., number of animals killed) and the time to full recovery. This produced an estimate of the direct and interim (from the time of injury until full recovery) losses of resources resulting from the oil spills. Injury estimates in future years were discounted at 3 percent per year (NOAA 1999). (Discounting is described in section 4.2.1.3)

4.2.1 Damage Assessment Methods

4.2.1.1 Estimation of Numbers of Animals Impacted

A separate report, covering the period from 1990 through 2003, describes the details of mortality estimation for all birds except Snowy Plovers (Ford et al. 2006a). This section summarizes the general approach of that report.

The first step in injury quantification was to estimate the number of animals impacted by species. Not all impacted birds and otters are found and collected during spill response 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 Marin, San Mateo, and Santa Cruz County coastlines were sparsely searched.
- *Scavenging or predation*. Scavengers may pick apart or entirely remove dead birds from the beaches. This is especially true of small birds. Predators such as Peregrine Falcons or coyotes may more easily capture weakened oiled birds and remove them from the area (Ford and Ward 1999).
- *Search efficiency*. Spill responders searching for beachcast birds may not find them all. Dark-bodied animals are especially difficult to see on beaches littered with wrack (beachcast kelp, seagrass, wood, and other debris) (Ford et al. 2006b).
- *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, or buried *in situ*.
- *Beach transit*. It is often assumed that live oiled birds come to the beaches and simply stop there. Experience, however, has noted that many birds, including Common Murres, may continue walking inland, perhaps in search of cover. During the 2001-02 response at Point Reyes, tracks revealed that all 16 live beached murres walked several hundred meters inland into a dune complex, where they could not be found.
- *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. In this case, removal and burying was

known to occur at the south end of Monterey Bay, San Mateo County beaches, Ocean Beach, and Stinson Beach.

- *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 range of response operations.

The Beached Bird Model (see Ford et al. 1987, 1996) was used to determine the number of birds impacted for all species in this case except for Snowy Plovers and Marbled Murrelets. This model seeks to take some of the factors listed above into consideration, by estimating the number of birds killed from the numbers of birds found on the beach (a method called "backcasting"). Using estimated rates of carcass disappearance, the number of birds removed or not found on the beaches is then estimated. Using a simplified example, if the probability of a bird being removed by a scavenger in the course of a day are 50 percent, and the probability of it being overlooked by a searcher are 50 percent, then the probability of it being recovered are 25 percent. 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 found implies that four birds were impacted.

The Beached Bird Model used in this case was based on Ford et al. (1987, 1996). The model relied on some of the additional studies outlined above (e.g., re-wash study, scavenging study, analysis of factors affecting beach search efficiency) to inform the parameters. The model incorporated different scavenging rates for large and small birds; it was assumed that small birds were more likely to be removed from the beaches than large birds.[4] In addition, all birds were more likely to be scavenged when fresh, and less likely as they decomposed. Likewise, the model incorporated different search efficiency rates, depending upon the size of the bird. While foot searches in San Mateo County found birds at nearly twice the rate of vehicle searches in Monterey Bay, this was consistent with estimated deposition patterns. Thus, no adjustment was made for differential search mode.

Because of the location of the spill and the level of search effort, beach transit, removal or burial by the public, at-sea loss, and departure from the area were considered to be small factors and were not evaluated or included in the model. To the extent that these factors contributed to carcass disappearance, the model may provide an underestimate of actual bird mortality.

During any spill response, some level of natural background mortality can be expected to contribute to the number of birds collected. Before the Beached Bird Model can be employed, it is appropriate to separate such birds from the spill-related birds that were

collected. 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 must rely on the sea for their food, 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. Birds 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 underparts 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 becomes beached. It is not unusual for a fresh bird to be reduced to a skeleton overnight (Ford and Ward 1999).
- *Dark plumage*. Because oil is usually black, it is most difficult to see on black-plumaged birds. While most seabirds have white underparts, some are entirely black.
- *Preening and ingestion.* Birds may remove small amounts of oil through the process of preening. Internal oil is typically documented only if post-mortem examinations are performed. Due to costs, such examinations are not typically done.

There are two primary approaches to accounting for natural mortality among the birds collected:

1. Examine each entry in the intake log and remove each individual bird that seems unlikely to be spill related (e.g., old, desiccated carcass on the first day of the spill; gunshot wound, previously documented carcasses found through standardized beached bird monitoring programs)
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 this case, the latter approach was used because the response periods lasted many months. Furthermore, an extensive data set from the GFNMS Beach Watch program was available to analyze background levels of beached bird carcasses.

Additionally, the Trustees had to evaluate the fate of rehabilitated and released birds. During the responses between 1997 and 2003, 730 birds were captured alive, cleaned, and released. Of the released birds, 601 (82%) were Common Murres, and 75 (10%) were Western Grebes. The remainder represented a wide range of species. Although there is uncertainty associated with the fate of such birds, several studies have suggested that post-rehab survival is extremely low (e.g., less than 10%), especially for alcids such

as Common Murres (Sharp 1996). During the *Stuyvesant* oil spill response, the Oiled Wildlife Care Network conducted a telemetry study of rehabbed and released Common Murres (Newman et al. 2004). The results suggest a survival rate greater than the earlier studies, although it is difficult to compare the rehabilitated birds with the control birds due to the limited life of the radio transmitter batteries. There is one documented case of rehabilitated bird from the *Luckenbach* spills successfully laying an egg on the Farallon Islands. Based on the limited available information, the Trustees assumed that 75 percent of the rehabilitated birds died, and 25 percent survived to join (or rejoin) the breeding population. For injury quantification, this adjustment was only made for Common Murres and Western Grebes. This adjustment increases the mortality estimates by less than 2% for these species, and is incorporated in Ford (2006).

For Western Snowy Plovers and Marbled Murrelets, the Beached Bird Model could not be used because so few birds were found. This is not unusual for small-bodied birds with small populations. The methods used for quantifying total mortality for these species are described in the relevant sections below (section 4.3.6 for Snowy Plovers, and section 4.3.9 for Marbled Murrelets).

4.2.1.2 Restoration Categories

For restoration planning purposes, the Trustees concluded that it was not advantageous to implement restoration projects for each of the 51 bird species impacted. For many of these species, no restoration project has ever been 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, because 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 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 alternatives.
4. Species with declining populations with special restoration needs should be specifically addressed to the extent feasible.

Using these criteria, the impacted species were grouped accordingly:

- Waterfowl
- Loons
- Grebes
- Procellarids
- Brown Pelicans, Cormorants, Gulls
- Western Snowy Plovers
- Other Shorebirds
- Common Murres
- Marbled Murrelets
- Other Alcids
- California Sea Otters

All impacted birds and otters were accounted for in the calculation of compensatory damages. Spill-related mortality was estimated for each species and all injuries within each grouping were counted when scaling restoration.

4.2.1.3 Quantification of Damages

Quantification of damages relied on a service-to-service restoration-based approach; that is, 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 conditions had the spills not occurred (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 those injured (NOAA 1995). For this task, the Trustees relied upon Resource Equivalency Analysis (REA).

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 (NOAA 1997; see also NOAA 1999) and generally accepted practice in the field, future years are discounted at a rate of 3 percent per year. This discounting is done based on the assumption that present services are more valuable than future services, and that some uncertainty exists when estimating future restoration benefits.

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 A for further details on the REA method.

There are a variety of ways to calculate lost animal-years, all of which imply informed biological assumptions regarding the recovery of the species from the spills (Zafonte and Hampton 2005). For all species, the Trustees assumed that a representative section from each age class was killed by the spill. Nevins and Carter's (2003) examination of Common Murres collected dead during the Point Reyes Tarball Incidents supports this assumption. For each species, the Trustees examined the literature regarding population regulation mechanisms, identifying the factors that currently limit the population and how

the species might recover from the spill impacts over time. After considering these population recovery mechanisms, the Trustees used the most appropriate method for calculating lost bird-years. For further details, see Appendix C.

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

4.2.2 Restoration Project Selection Criteria

The Trustees considered numerous restoration alternatives to compensate the public for spill-related injuries. Each restoration alternative was subjectively evaluated using the criteria described below. This process resulted in the selection of the 14 projects.

Phase I - INITIAL SCREENING CRITERIA: The following initial screening criteria were used to select the restoration projects presented in this 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. Consider the level of risk or uncertainty and the degree of success of projects utilizing similar or identical techniques in the past.

C. **Cost-Effectiveness.** Consider the relationship of expected project costs to expected resource and service benefits. Seek the least costly approach to deliver an equivalent or greater amount and type of benefits.

D. **Relationship to Injured Resources and/or Services (nexus).** Projects that restore rehabilitate, replace, enhance, or acquire the equivalent of the same or similar resources or services injured by the spill are preferred to projects that benefit other comparable resources or services. Consider 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.** Consider the time it takes for benefits to be provided to the target ecosystem or public to minimize interim resource loss (sooner = better).

F. **Duration of Benefits.** Consider the expected duration of benefits from the project. Long-term benefits are the objective.

G. **Multiple Resource and Service Benefits.** Consider the extent to which the project benefits more than one natural resource or resource service. Measure in terms of the quantity and associated quality of the types of natural resources or service benefits expected to result from the project.

H. **Comprehensive Range of Projects.** Consider the extent to which the project contributes to the more comprehensive restoration package. Evaluate the project for the degree to which it benefits any otherwise uncompensated spill injuries.

Phase II - ADDITIONAL SCREENING CRITERIA: To the extent that sufficient information was available, these additional screening criteria were used to further refine the selection of the restoration projects in this DARP/EA. These additional criteria are *not considered to be of lesser importance* than the initial screening criteria. However, these criteria are generally more appropriately applied after more detailed project plans and scopes of work are developed.

I. **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. Consider avoiding future short-term and long-term injuries as well as mitigating past injuries.

J. **Likelihood of Success.** Consider the potential for success and the level of expected return of resources and resource services. Consider also 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.

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

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

M. **Maintenance and Oversight of Project.** Consider the 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.

N. **Opportunities for Collaboration.** 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.

O. **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.

Phase III - SUPPLEMENTAL CRITERIA: The following criteria were also considered.

P. **Ability to Document Benefits to the Public.** Consider the ability to document receipt or delivery of benefits to the public as a result of a project or other use of funds.

Q. **Educational/Research Value.** Consider the potential for public education and outreach and/or clarifying 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

The following sections provide the details regarding injury quantification, the range of potential restoration alternatives, and, for each injury category, a description of the selected restoration project and the scaling of that project. Details of the scaling, such as the REAs for each project, are provided in Appendices D thru M. Included with each restoration project description below is a discussion of its impacts under "Environmental Consequences."

Project costs are intended to include design, permitting, implementation, and biological monitoring. They also include estimated overhead charged by contracting agencies when contracting with the private sector. (Note: budgets in the Draft DARP did not include estimated overhead charges.) The estimates presented here do *not* include costs for oversight and administration (e.g., managing contracts, reviewing annual progress reports) by the Trustees, or any budget for unexpected contingencies. However, the Trustees will take these costs into account when making the claim for funding to the NPFC, to ensure that there will be sufficient funds to implement the final selected projects.

All project budgets assume that funds will be received in 2007. For long-term projects, the budgets assume that funds for future years will also be received in 2007 and will be invested by the Trustees, earning an average of 1.5 percent real rate of return (i.e., after accounting for inflation). Thus, the budgets are in present-value (2007) dollars.

4.3.1 Waterfowl

Background

Waterfowl refer to swans, geese, and ducks. In this case, nearly all of the waterfowl impacted were diving ducks, along with a few Brant (geese). The Trustees have also lumped American Coot into this category.

Scoters (primarily Surf and White-winged) accounted for 88 percent of the birds collected from this species group. These species occur regularly along the California coast in winter, primarily near the surf zone but also in harbors and bays. They nest throughout Alaska and northern Canada, on lakes within forested areas. A recent telemetry study has shown that birds wintering in California originate from these northern regions (Takekawa 2005).

Conservation Issues

All scoter populations are showing declines in various surveys, especially in the West (Brown and Fredrickson 1997; Savard et al. 1998; Conant and Groves 2003). The reasons for these declines are not well understood. Elevated levels of toxic contaminants, particularly metals ingested on the wintering grounds, have been found in most studies. However, it is difficult to relate these findings to decreases in the population. Nesting habitats in Alaska and Canada face threats from recreational development and natural gas extraction (e.g. roads and pipelines through breeding habitat).

Injury Calculations

A total of 144 waterfowl were collected during the spills that occurred between 1997 and 2003. Additional waterfowl were likely collected between 1990 and 1996, although species composition regarding collected birds is limited for this time period. The total estimated dead from all spills is 862. Details on the number of birds collected during each spill event and the estimate of total mortality are in Appendix B and in Ford et al. (2006).

Realizing that waterfowl will benefit tremendously from the restoration project selected to benefit loons and phalaropes (protection of Kokechik Flats, Alaska, described in section 4.3.2), lost bird-years were not calculated for waterfowl.

Species	Total Collected*	Total Estimated Dead
Brant	1	
Lesser Scaup	1	
Greater Scaup	1	
Surf Scoter	99	
White-winged Scoter	22	
Black Scoter	1	
Scoter, sp.	4	**862**
Bufflehead	6	
Ruddy Duck	2	
Red-breasted Merganser	1	
Duck, sp.	2	
American Coot	4	
TOTAL	**144**	

* 1997-2003 only. Prior to 1997, data regarding the species composition of collected birds are limited.

Restoration Alternatives

Restoration options for scoters on their wintering grounds are limited. However, there are some feasible options for protecting nesting habitat on the breeding grounds. Because scoters were the predominant species impacted, the Trustees focused on waterfowl projects that included scoters among the beneficiaries. Four projects considered are listed in the table below.

PROJECT CONCEPTS	BENEFITS
Protection of nesting areas in Kokechik Flats, Alaska	**Waterfowl (also Pacific and Red-throated Loons and Red Phalarope)**
Nesting habitat protection via land acquisition at Yukon Flats, Alaska	Surf and White-winged Scoters, other waterfowl, loons
Nesting habitat protection via land acquisition near Togiak NWR, Alaska	Surf and White-winged Scoters, other waterfowl, loons
Land protection advocacy in MacKenzie River area, Canada	Surf and White-winged Scoters, other waterfowl, loons

The Kokechik Flats nest protection project was selected because it will provide the most benefits at a relatively lower cost, even though the waterfowl species composition at this site does not perfectly match the waterfowl species impacted by the spills (Black Scoters are the predominate scoter at Kokechik Flats). Furthermore, the Kokechik Flats project will simultaneously protect thousands of waterfowl and phalarope nests and, possibly, several hundred loon nests. The Yukon Flats and Togiak NWR projects protected a relatively small number of nests, and from less imminent threats. Thus, they would provide far fewer benefits than the selected project, and at a higher cost. The MacKenzie River advocacy proposal focused on lobbying for protection, rather than achieving it with certainty. Although lobbying for protection may ultimately lead to natural resource benefits, the inherent uncertainty associated with it caused the Trustees to question its likelihood of success in providing benefits in the short term.

Final Selected Project

Nest Protection at Kokechik Flats, Alaska

This project is described in the loon section below (section 4.3.2).

4.3.2 Loons

Background

Loons are duck-like birds that spend most of their lives floating on the water and diving for fish. They nest in very low densities on inland lakes, primarily in Alaska and Canada. Common Loons formerly nested in northeastern California, but have been extirpated for over 50 years. Loons winter in near-shore ocean waters, bays, and (less commonly) at inland lakes within California.

One species, the Pacific Loon, accounted for 73 percent of the beachcast birds from this species group. This species occurs regularly along the California coast in winter. They nest throughout Alaska and northern Canada, on tundra ponds and forested lakes. The Pacific Loon was likely impacted to a greater degree than the other species because they occur farther offshore in winter and closer to the oil spills.

Conservation Issues

Loon nests are constructed of small islands of vegetation that sit low in the water. Loons nest in low densities, often one pair per pond, depending on the size of the lake. They are highly sensitive to human disturbance. In one study from Alaska, Pacific Loons left the pond entirely if approached within 270 meters. This led to predation of eggs by jaegers (Russell 2002). A Common Loon restoration project in Maine, funded by the *North Cape* oil spill which occurred off Rhode Island in 1996, seeks to protect loon nesting areas from human disturbance, thereby increasing nest productivity.

Injury Calculations

A total of 146 loons were collected during the spills that occurred between 1997 and 2003. Additional loons were likely collected between 1990 and 1996, although species composition regarding collected birds is limited for this time period. The total estimated dead from all spills is 1,314. Details on the number of birds collected during each spill event and the estimate of total mortality are in Appendix B and in Ford et al. (2006). Details regarding the calculation of lost bird-years are presented in Appendix D.

Species	Total Collected*	Total Estimated Dead	Total Lost Bird-Years
Red-throated Loon	17		
Pacific Loon	107		
Common Loon	19	**1,314**	**10,348**
Loon, sp.	3		
TOTAL	**146**		

* 1997-2003 only. Prior to 1997, data regarding the species composition of collected birds are limited.

These lost bird-years represent the interim losses between the time of the spills and return of these populations to pre-spill conditions. Thus, any restoration project benefiting this species group should seek to replace **10,348** lost bird-years.

Restoration Alternatives

Restoration options for loons 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 Pacific Loons were the predominant loon species impacted, the Trustees examined potential restoration options for this species. At the same time, the Trustees considered more local restoration within California for Common Loons. Two projects were considered for benefiting loons, which are listed in the table below.

PROJECT CONCEPTS	BENEFITS
Nest Protection at Kokechik Flats, Alaska	**Pacific and Red-throated Loons (also waterfowl and Red Phalarope)**
Social attraction to re-establish Common Loon nesting in California	Common Loon

The Kokechik Flats, Alaska project was selected because it was deemed the only feasible project. This project will simultaneously benefit waterfowl and shorebirds (e.g. Red Phalarope). The use of social attraction to re-establish Common Loons as a breeder in California would be an experimental project with unknown benefits. Presently, it is rare to even find Common Loons over-summering at historical nesting locations in California. The Trustees are not aware of restoration projects designed to benefit these species on their wintering grounds in California.

Final Selected Project

Nest Protection at Kokechik Flats, Alaska

The goal of this project is to reduce human disturbance to nesting habitat of Pacific and Red-throated Loons, as well as waterfowl and Red Phalaropes, in coastal western Alaska. The Pacific Loon and the phalarope were two of the most impacted species from the *Luckenbach* oil spills. Brant, which will also benefit from this project, were impacted by the spills as well, although to a lesser degree.

Many of the species impacted by the spills only nest in the far north, such as in coastal Alaska or along the Arctic Ocean coastline. This is the case with the Pacific and Red-throated Loons and with Red Phalarope. The loons spend the winter at sea off the coast of California, while the phalarope migrates over the ocean off California. There are no known feasible restoration options for these species in the waters off California.

On their breeding grounds, these species face threats from land use changes and human disturbance. On the south side of Kokechik Bay, Alaska, there exists a 30,000-acre parcel that is a private in-holding within the Yukon Delta National Wildlife Refuge (NWR). This parcel is home to high densities of nesting Pacific and Red-throated Loons, Red Phalaropes, and other wetland species.

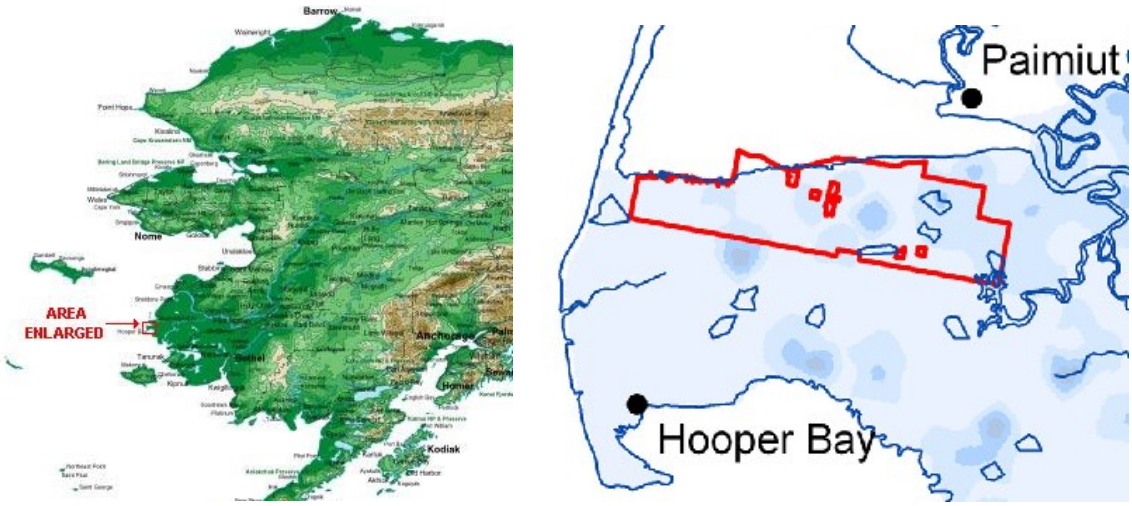


Figure 2: Map of Alaska on left, showing the Hooper and Kokechik Bay region; map of the region on right, outlining the Kokechik Flats parcel. The blue tones show relative Pacific Loon nesting densities.

Located only six miles north of the village of Hooper Bay, this parcel is increasingly subject to human disturbance (primarily on ATVs). The Sea Lion Corporation, an Alaska natives' corporation, owns the parcel and is concerned about the disturbance, although they lack the means to conduct ongoing outreach and management to protect the bird colonies. The Yukon Delta NWR considers this parcel their "number one priority" for wildlife protection and would like to work with the Sea Lion Corporation to protect the sensitive nesting habitat.

Figure 3: Aerial view of Kokechik Flats.

This project includes the following specific tasks: (1) develop habitat management guidelines to protect and enhance nesting habitat; (2) provide for and staff access, staging, and camping sites to minimize traffic and activities in sensitive areas; (3) provide staff to conduct on-site education and outreach about the sensitive resources and provide recommendations on avoiding impacts; and (4) periodically monitor the habitat to ensure that all management guidelines are implemented.

Budget

This project will provide $60,000/year for 10 years, for a total of **$561,631** (future years have been discounted to account for interest earned at an annual rate of 1.5% above inflation).

Scaling for Primary and Compensatory Restoration

Scaling focused on the injuries and benefits to loons. The Trustees believe that injuries to waterfowl and shorebirds (other than Snowy Plover) will be simultaneously addressed by this project. There are thousands of nesting waterfowl at the project site. Although data for scaling is lacking, Red Phalaropes are common nesters as well and will benefit substantially from the project. With regard to loons, as described above, the total injury to this restoration category was 10,348 lost bird-years. For restoration scaling, the Trustees relied on loon data from Kokechik Flats, as well as on data from loon disturbance studies in New England (Sperduto et al. 2003). The Trustees estimate that reducing nest disturbance at Kokechik Flats may result in an average increase of 0.32 fledges per nest for each year of the project. Assuming that project benefits begin in the year 2007 and last 10 years, the Trustees calculated that such a project would generate the bird-years required to offset the injury to loons.

Appendix D provides additional details regarding the bird REA for this project.

Affected Environment

This project will be located in the Yukon-Kuskowim River Delta of Alaska, a broad, flat delta interlaced with countless ponds, lakes and rivers, streams, inlets, bays, and coastal areas. Most of the region is managed by the Yukon Delta NWR for the benefit of large concentrations of nesting waterfowl and shorebirds, as well as large numbers of salmon and marine mammals. This project will enhance the NWR management of the area.

At 19.5 million acres, the Yukon Delta NWR is larger than the state of Maine. The Yukon-Kuskokwim Delta supports one of the largest populations of nesting water birds in the world, providing habitat for waterfowl from all four North American flyways. More than one million ducks and half a million geese breed annually. In terms of both density and species diversity, the delta is the most important shorebird nesting area in the nation. The delta also includes hundreds of miles of spawning and rearing habitat for 44 species of fish (including 5 species of Pacific salmon). The adjacent coastal waters of the Bering Sea support Harbor, Ribbon, Ringed and Bearded Seals, and Walrus. The ancestral home of the Yup'ik Eskimo, the refuge includes more than 40 Yup'ik villages whose residents continue to live a largely subsistence lifestyle.

Environmental Consequences (Beneficial and Adverse)

This project will protect nesting habitat for 10 years. Because the project focuses on the entire habitat, all nesting species in the vicinity should benefit as well. This includes Red-throated Loon, Pacific Loon, Tundra Swan, White-fronted Goose, Cackling Canada Goose, Emperor Goose, Black Scoter, Spectacled Eider, and Red Phalarope.

This proposed action is not expected to result in any significant adverse impacts. By design, human uses of this parcel will be reduced and concentrated, but these impacts are not expected to be significant, as there are alternative locations for human uses in the vicinity of Hooper Bay. The management guidelines will allow for some human access subject to limitations during the breeding season and perhaps at other times, in coordination with the local public and the Sea Lion Corporation managed by the local indigenous peoples. This project has the support of the tribal leaders.

Probability of Success

The probability of success is high. With active management of sensitive areas, there is every reason to expect that waterfowl, loon and phalarope nesting will be subject to reduced disturbance in the future. A pilot project in summer 2005 demonstrated significant benefits (M. Reardon, pers. comm.).

Performance Criteria and Monitoring

Yukon Delta NWR will be responsible for periodic monitoring of the habitat to ensure that all management guidelines are implemented and enforced. Periodic updates by the Yukon Delta NWR will be provided regarding the status of the habitat and the implementation of the habitat management guidelines.

Evaluation

Habitat protection is an effective and practical method to achieve restoration for these species. By providing funding to the Yukon Delta NWR to take over management of this habitat, the Trustees believe they are taking advantage of this unique opportunity to protect and promote nesting habitat and increase bird reproduction. Furthermore, by instituting land management guidelines, the project will work toward the goal that no use of the land will jeopardize bird nesting in the future.

The Trustees have evaluated this project using the threshold and additional screening criteria developed to select restoration projects and concluded that this project is consistent with and meets the objectives of these selection factors. They believe that this type and scale of project will effectively provide appropriate compensation for waterfowl, loons, and shorebirds (not including the Snowy Plover) injured as a result of the spills and have therefore selected this project as a preferred alternative.

4.3.3 Grebes

Background

Like loons, grebes are aquatic birds that spend most of their lives floating on the water and diving for fish. They nest on inland lakes along marsh edges and winter in near-shore ocean waters and inland lakes. Unlike loons, many grebes nest in temperate climates, including California.

Two species, the Western Grebe and the Clark's Grebe, are closely related and often nest in close proximity in dense colonies. These two species are known as *Aechmophorus* grebes. Together, they accounted for 82 percent of the birds collected from this species

group. These species occur regularly along the California coast in winter, as well as at large inland lakes. They nest at various lakes throughout the western United States and Canada. The total number of Western and Clark's Grebes nesting in California is at least 5,000 pairs (Ivey 2004). The vast majority of those birds (nearly 90%) nest at four lakes:

- Eagle Lake in Lassen County
- Tule Lake National Wildlife Refuge (North Sump) in Siskiyou County
- Clear Lake in Lake County
- Lake Almanor in Plumas County

Conservation Issues

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. Like loons, grebe nests are constructed of small islands of vegetation that sit low, usually floating at the surface of the water. Unlike loons, many species of grebes nest in dense colonies (although they are also known to solitarily nest). For example, the majority of California's grebes nest in a few colonies that are so concentrated that a single disturbance event by a boat could destroy the majority of a colony's breeding attempt in any given year. 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), sudden changes in water levels (Ivey 2004), and potentially reduced food supplies. Recent data from Clear Lake shows that grebe colonies have suffered from severe disturbance events (from boats) in 6 of the past 13 years (1992-2004), reducing nest productivity by an average of 80,percent in those years (D. Anderson, pers. comm.).

Injury Calculations

A total of 481 grebes were collected during the spills that occurred between 1997 and 2003. Additional grebes were likely collected between 1990 and 1996, although species composition regarding collected birds is limited for this period. The total estimated dead from all spills is 4,106. Details on the number of birds collected during each spill event and the estimate of total mortality are in Appendix B and in Ford et al. (2006). Details regarding the calculation of lost bird-years are presented in Appendix E.

Species	Total Collected*	Total Estimated Dead	Total Lost Bird-Years
Pied-billed Grebe	3		
Horned Grebe	16		
Red-necked Grebe	3		
Eared Grebe	15		
Western Grebe	349	**4,106**	**15,487**
Clark's Grebe	22		
Aechmorphorus grebe sp.	58		
Grebe, sp.	15		
TOTAL	**481**		

* 1997-2003 only. Prior to 1997, data regarding the species composition of collected birds are limited.

These lost bird-years represent the interim losses between the time of the spills and return of these populations to pre-spill conditions. Thus, any restoration project benefiting this species group should seek to replace **15,487** lost bird-years.

Restoration Alternatives

Restoration options for grebes on their wintering grounds are limited. Furthermore, as their populations are most likely limited by factors on their nesting grounds, and because restoration efforts when the birds are concentrated into nesting areas is logistically more feasible, it makes most sense to focus restoration at these locations. Because Western and Clark's Grebes were the predominant species impacted, the Trustees examined potential restoration alternatives for these two species. The two projects considered to benefit grebes are listed in the table below.

PROJECT CONCEPTS	BENEFITS
Grebe Colony Protection at Northern California Lakes	**Western and Clark's Grebes**
Acquisition of land around Lake Earl, California to allow for higher lake levels and increase Western Grebe nesting	Western Grebe

The nesting colony protection project is selected as the preferred project because it was deemed to provide more widespread benefits at a relatively lower cost. This project takes advantage of a significant restoration planning effort recently conducted by the *American Trader* oil spill trustee council, whereby a grebe management plan (Ivey 2004) was prepared which describes specific colony protection measures to implement at specific lakes. Although the *American Trader* Trustee Council only has funds available to implement a limited, small number of the protection measures (Gericke 2006), and for only two or three years, the project selected here seeks to build on and expand those efforts, implementing many of those measures for a longer period of time. The Lake Earl project was not preferred because it would provide fewer benefits at a much higher cost. Additionally, scaling calculations suggest that only a partial contribution to the project would be sufficient to compensate for the injury. However, without an additional contribution from other funds (which have not been identified), that project could not be implemented.

Final Selected Project

Grebe Colony Protection at Northern California Lakes

This project will fund many of the recommendations of the California grebe management plan (Ivey 2004), designed to protect Western and Clark's Grebe nesting colonies from human disturbance and other perturbations. These two species nest together and, as described above, are subject to disturbances when nesting; conservation issues for each species are identical and inseparable. These disturbances, usually from close approach by boats or personal watercraft (e.g., jet-skis) can result in nest abandonment or direct loss of chicks, eggs, or nest. The colonies considered for protection are located at Clear Lake, Eagle Lake, Lake Almanor, Tule Lake NWR, and the Thermolito Forebay. 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. The duration of the project will be 10 years.

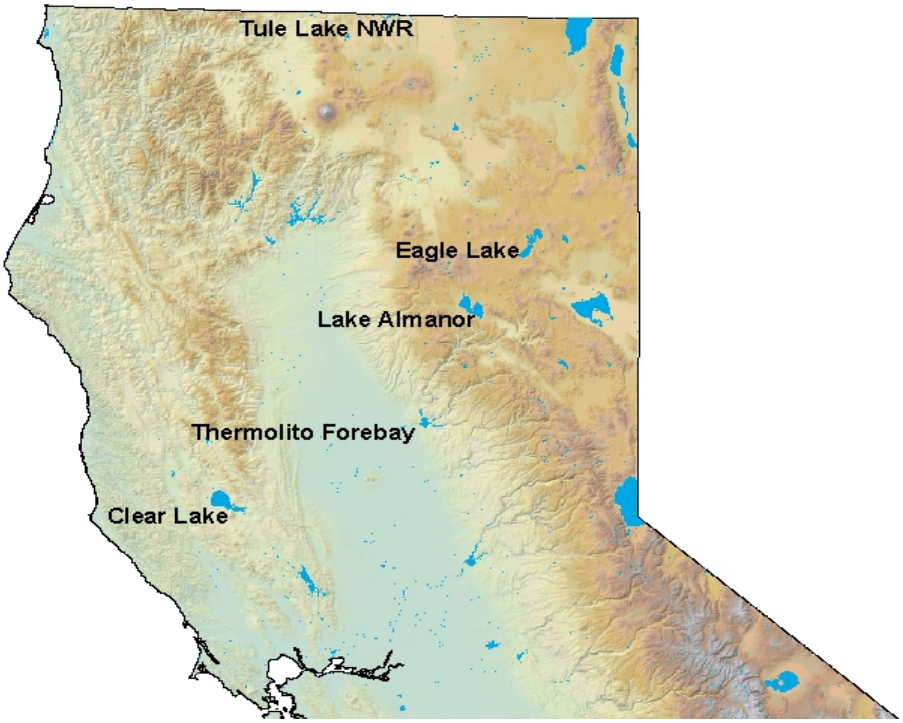


Figure 4: Grebe colony protection sites.

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 two-year pilot project at Clear Lake initiated by the *American Trader* oil spill Trustee Council (Gericke 2006).

Budget

The budget for the total project (10 years at Clear Lake and 10 years at other lakes) is estimated at **$965,435** (in present value).

Scaling for Primary and Compensatory Restoration

As described above, the total injury to this restoration category was 15,487 lost bird-years. For restoration scaling, the Trustees relied on data from Clear Lake, where significant disturbance events have drastically impacted breeding colonies in 6 of the last 13 years (D. Anderson, pers. comm.) The data suggest that grebe colony protection measures (with an 80% effectiveness rate) may result in an average increase of 0.30 fledges per nest for each year of the project (almost doubling current average productivity). Assuming that project benefits begin in the year 2007 and continue for 10 years, the Trustees calculated that such a project would generate half of the bird-years required to offset the injury. Assuming that restoration costs and benefits from other

lakes would be similar, the Trustees propose to fund a 10-year project at Clear Lake and 10 years worth of similar efforts at other breeding lakes (e.g., Eagle Lake, Lake Almanor, Tule Lake NWR, and the Thermolito Forebay).

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

Affected Environment

This project will be located at various large lakes in northern California. These lakes offer a wide variety of human recreational opportunities (e.g., fishing, water-skiing), especially during the summer months. In addition to the grebe colonies, small numbers of other birds (e.g., waterfowl, American Coots) use the lakes in the summer. The water levels in the lakes are managed for a variety of purposes, including storage for irrigation water, water supply for hydroelectric facilities, and water for wildlife habitat and human recreation.

Environmental Consequences (Beneficial and Adverse)

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. Other species, such as small numbers of Eared and Pied-billed Grebes, may indirectly benefit as well.

There are no significant adverse impacts anticipated for other species of wildlife and habitat because this project will protect areas from human disturbance. Our growing experiences indicate 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.

Probability of Success

Because the primary goal of this project is to modify human behavior, successfully protecting grebe colonies from all human disturbances will be difficult. While it is unlikely this project will entirely eliminate disturbance, it 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 ensuring project success. Initial results from the current pilot project have been positive, suggesting that grebes at Clear Lake experienced the largest production of young in 14 years of study (D. Anderson, pers. comm.).

Performance Criteria and Monitoring

The goal of this project is to prevent disturbance of nests, educate boaters, and to ensure that the juvenile/adult ratio in any one year does not fall below 0.35 due to human

disturbance. To measure both compliance and grebe nest success, the project includes 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). Although Ivey (2004) examined the levels of human disturbance at each lake, additional monitoring may be required to strategically plan project activities.

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 and meets the objectives of these selection factors. The Trustees determined that this type and scale of project will effectively provide appropriate compensation for injuries to grebes that occurred as a result of the spill and have selected this project as a preferred alternative.

4.3.4 Procellarids

Background

Procellarids, also called tubenoses, are highly pelagic seabirds. They include albatrosses (although no albatrosses were known to be impacted by the spills), shearwaters, and storm-petrels. Shearwaters and the Northern Fulmar resemble gulls, although they are typically longer-winged and have a more graceful, arching flight. Storm-petrels are much smaller, fluttering and dancing over ocean waves as they search for food. 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.

One species, the Northern Fulmar, accounts for 94 percent of the beachcast birds collected from this species group. This species breeds in dense colonies on the cliffs of remote islands in Alaska and Canada. They occur regularly along the California coast in winter. The Pink-footed Shearwater nests primarily off Chile, the Sooty Shearwater off New Zealand, the Short-tailed Shearwater off Australia, and the Black-vented Shearwater off Baja California, Mexico. All of these species occur regularly off the California coast seasonally. The Leach's Storm-Petrel nests on islands in both the northern Pacific and Atlantic Oceans. The Ashy Storm-Petrel occurs only off the California and Baja California coasts and nests from the Farallon Islands and Point Reyes to the Coronados Islands, Mexico. Its total population of just 10,000 individuals makes it the rarest Procellarid impacted by the spills.

Conservation Issues

Procellarids around the world face a variety of threats at their breeding grounds and at sea. For many species, over 90 percent of the population nests at a few locations, sometimes on a single island. At these locations, the entire colony may be at risk from predation by introduced non-native species (e.g., rats, cats) or from habitat and ecosystem changes caused by non-native species (e.g., rabbits, goats). Human disturbance and trampling of burrows is also significant at some locations. At sea, Procellarids are at risk from certain commercial fishing practices, such as long-lines and drift nets, although

recent improvements in methods have reduced the by-catch of some species of seabirds in some regions (e.g., Alaska). Procellarids also suffer mortality from the ingestion of plastic waste floating on the ocean's surface.

Of the species impacted by the spills, the Ashy Storm-Petrel, with its small population and limited range, is probably the most threatened. It is the only bird species impacted by the spills that is considered "highly imperiled," the most serious category of conservation concern, in the North American Waterbird Conservation Plan (Kushlan et al. 2002). Approximately half of the world's population of Ashy Storm-Petrels breeds on the Farallon Islands, and around 10 percent occur at Point Reyes. Between 1972 and 1992, this population declined 42 percent (Sydeman et al. 1998). Part of this has been due to predation of chicks by introduced non-native House Mice, and predation of adults by Burrowing Owls, which are, in turn, seasonally sustained on the island by the House Mouse (see discussion of the restoration project in section 4.4.3).

The various shearwater species face various threats at their breeding colonies, most often associated with non-native predators (e.g., rats). Some of these issues are being addressed through restoration actions overseas. For example, one project seeks to eradicate non-native rats on four islands off New Zealand where Sooty Shearwaters breed. This project is funded in part by funds from the *Command* oil spill settlement (Command Trustee Council 2004).

Northern Fulmars, perhaps because of their willingness to scavenge offal from commercial fishing vessels, have increased dramatically in recent years (Hatch and Nettleship 1998). Because of this, they have not been a focus of conservation concern.

Injury Calculations

A total of 375 Procellarids were collected during the spills that occurred between 1997 and 2003. Additional birds were likely collected between 1990 and 1996, although species composition regarding collected birds is limited for this time period. The total estimated dead from all spills is 4,796. Adjustments for non-spill related die-offs of Northern Fulmars in certain years have been incorporated into this estimate. Although specific mortality for Ashy Storm-Petrels was not estimated from the two individuals collected, it is likely that the ratio of actual dead to recovered dead is similar to that of Ancient Murrelets and Cassin's Auklets, which are also very small and highly pelagic species. For the relevant time periods when Ashy Storm-Petrels were recovered, this would imply that total mortality for this species was approximately 21 individuals. Details on the number of birds collected during each spill event and the estimate of total mortality are in Appendix B and in Ford et al. (2006). Assuming the same dead bird multiplier for fulmars and shearwaters would imply that 4,496 fulmars and 266 shearwaters were killed. Details regarding the calculation of lost bird-years are presented in Appendix F.

Species	Total Collected*	Total Estimated Dead	Total Lost Bird-Years
Northern Fulmar	352	4,496	72,509
Pink-footed Shearwater	1	266	2,228
Sooty Shearwater	11		
Short-tailed Shearwater	3		
Black-vented Shearwater	3		
Shearwater, sp.	3		
Leach's Storm-Petrel	1	34	1,044
Ashy Storm-Petrel	2		
TOTAL	**375**	**4,796**	**75,781**

* 1997-2003 only. Prior to 1997, data regarding the species composition of collected birds are limited.

These lost bird-years represent the interim losses between the time of the spills and return of these populations to pre-spill conditions. Thus, any restoration project benefiting this species group should seek to replace **75,781** lost bird-years.

Restoration Alternatives

There is a wide range of restoration alternatives on various breeding islands around the world, many of which are being addressed. Addressing at-sea causes of mortality (e.g., by-catch associated with commercial fishing; ingestion of plastic waste) is more difficult. The table below provides a list of restoration concepts considered by the Trustees.

PROJECT CONCEPTS	BENEFITS
Mouse Eradication on the Farallon Islands	**Ashy Storm-Petrel**
Shearwater Colony Protection at Taiaroa Head, New Zealand	**Sooty Shearwater**
Reduction of plastics waste at sea	Many Procellarid species
Rabbit eradication on Santa Clara I. (in Juan Fernandez Is.), Chile	Pink-footed Shearwater
Shearwater colony protection at Isla Mocha, Chile	Pink-footed Shearwater
Other breeding habitat restoration in Chile	Pink-footed Shearwater
Habitat improvement at the Farallon Islands	Ashy Storm-Petrel, Cassin's Auklet
Rat eradication at Northeast Titi Islands, New Zealand	Sooty Shearwater
Sooty Shearwater burrow-cam in New Zealand	Sooty Shearwater
Ground-squirrel eradication at the Semidi Islands, Alaska	Northern Fulmar, storm-petrels, alcids

The Trustees have selected the eradication of the non-native House Mouse on the Farallon Islands and the shearwater colony protection project at Taiaroa Head, New Zealand as the preferred projects to address injuries to this species group. The mouse eradication project has the full support of the Farallon Islands NWR, has already been planned and budgeted (with some partnering funds already received), is located near the spills, and will benefit the species of greatest concern (Ashy Storm-Petrel). Members of the public proposed the shearwater colony protection project in New Zealand during the public comment period. While the project is relatively small, it provides significant benefits to Sooty Shearwaters, one of the other impacted Procellarids.

Two other projects to benefit Sooty Shearwaters were not selected. The rat eradication project was deemed too large relative to the injury, while the burrow-cam was strictly an educational project that provided no direct benefits to the birds. A project intended to reduce plastic waste at sea was not selected because there is no known feasible method

for achieving this. Several projects benefiting Pink-footed Shearwaters in Chile were also less preferred because this species was among the least impacted, and there are feasible projects benefiting more impacted species. A project to improve nesting habitat for burrow and crevice-nesting seabirds at the Farallon Islands was not selected for feasibility concerns, as well as the fact that Cassin's Auklets are already receiving significant benefits from the Baja California project. Finally, a project to eradicate Arctic Ground-Squirrels from one or more of the Semidi Islands, Alaska, may provide an excellent opportunity for seabird restoration in the future. However, at present, the project still requires substantial investigation into its feasibility. Additional details on these issues are provided in Appendix N.

Final Selected Project

Mouse Eradication on the Farallon Islands

This project restores critical seabird nesting habitat on Southeast Farallon Island for the Ashy Storm-Petrel by eradicating the introduced non-native House Mouse (*Mus musculus*). The Trustees have selected this project to compensate, in part, for injuries to Procellarids.

Island ecosystems like the Farallon Islands are key areas for conservation because they are critical habitat for seabirds and pinnipeds that use thousands of square kilometres of open ocean, but depend on islands for breeding and resting. In addition, islands tend to be rich in endemic species. Islands make up about 3 percent of the earth's surface, but are home to 15-20 percent of all plant, reptile, and bird species.

Unfortunately, islands have been disproportionately impacted by humans and the non-native species (e.g., mice, rats, cats) introduced there. Approximately 70 percent of recorded animal extinctions have occurred on islands, and most of these extinctions, including 8 of 11 seabird extinctions, were caused by non-native introduced species. Invasive species are the major cause for population decline for over 50 percent of the 59 endangered seabird species. House Mice have been introduced onto islands worldwide, causing ecosystem-wide perturbations, with profound effects on the distribution and abundance of native flora and fauna (e.g. Crafford and Scholtz 1987; Crafford 1990; Copson 1986). On the Farallon Islands, introduced House Mice are directly and indirectly impacting the breeding success of burrow nesting seabirds, particularly the Ashy Storm-Petrel.

Mice are known predators of eggs and chicks of the storm-petrel. Potentially as many as 12 percent of the eggs and chicks are lost to House Mice (Ainley and Boekelhide 1990). More importantly, the exotic mice appear to be indirectly responsible for the *hyperpredation* and decline of the Farallon Island's Ashy Storm-Petrel breeding population by non-resident, predatory owls. This form of *apparent competition* (see Holt 1977; Roemer et al. 2002) occurs when a local prey species (e.g., Ashy Storm-Petrel) declines due to predation pressure from a predator (owls that normally are not resident on the Farallones) sustained by an alternative prey, in this case the exotic House Mouse. This type of interaction is now thought to be an underappreciated mechanism of biodiversity loss. It has been recently demonstrated on Santa Cruz Island, California,

resulting in a wholesale restructuring of the food web including the near extinction of the island fox (Roemer et al. 2002). A similar pattern has been seen on seabird colonies where feral cat populations are subsidized by non-native rats and rabbits when the seabirds are absent, thereby causing increased seabird mortality through higher cat populations during the breeding season (see Atkinson 1985, J. Donlan, pers. comm.).

Figure 5: Southeast Farallon Island.

On Southeast Farallon Island, over-wintering Burrowing Owls are thought to cause significant mortality to the Ashy Storm-Petrel population. Each October, young Burrowing Owls stop off on the Farallones during migration (Pyle and Henderson 1991), when the House Mouse population peaks there. Because of the abundant food source provided by the mice, the owls choose to stay at the island for the winter. Under natural circumstances they would continue migrating to more favorable wintering locations. Once winter rains arrive, the mouse population crashes and the owls are forced to seek other prey. Because this coincides with the arrival of Ashy Storm-Petrels to excavate ground nest sites, the owls switch to eating these seabirds. But the storm-petrels and auklets do not seem to provide enough nutrition for the owls, and most wintering owls die before the spring migration period occurs in April-May. Emaciated owl carcasses are routinely found on the island by staff biologists. Up to 10 Burrowing Owls have been recorded wintering per year on the Farallones, and biologists have found wings of up to 20 storm-petrels (and 2 or 3 auklets) at an owl roost site. The breeding population of Ashy Storm-Petrels on the Farallones is currently estimated at only about 1,400 birds. This devastating scenario for both storm-petrels and owls has been confirmed through the collection of owl pellets (approximately 65 % of which contain storm-petrel and auklet feathers in late winter and spring) (Mills 2001).

Rodent eradications have been carried out on many islands worldwide (Torr 2002). The preferred method is to use rodenticide bait pellets. Trapping alone has proven to be ineffective for rodent eradication from islands (Moors 1985). Although there are nine rodenticides registered for use in the United States, the vast majority of eradications have used brodifacoum, an anticoagulant that has the greatest efficacy against mice, can kill mice after one feeding, and for which resistance in mice populations is rare.

Factors that will determine the rodenticide of choice are previous successful use in island restoration projects, demonstrated ability to control the mouse population, and potential effects in the Farallon Island environment (see below).

The key to successfully eradicating mice from islands is to dispense bait into every mouse territory. This may be achieved through the use of manually-placed bait stations or by a broadcast method (e.g., by hand or by helicopter) in which bait pellets are distributed evenly at a density of approximately one pellet per square meter. The approach used is dictated by a combination of the island's topography and size and a host of other biological constraints. Much of Southeast Farallon Island is accessible by foot, although the island's steep and rugged cliffs and offshore rocks present a logistical challenge to delivering bait. Fixed ropes will likely have to be installed for operators to service bait stations in these areas. Aerially broadcasting bait would overcome this danger, but precautions would be needed to ensure adequate amount of bait is delivered into all habitats inhabited by mice and to minimize spread of the bait into marine waters.

The removal of the mice will be timed according to a set of biological conditions that maximize the probability of eradicating mice and minimize the potential impact to the Farallon environment (see below). On the Farallon Islands, the House Mouse annual population cycle typically peaks in the fall and declines precipitously with the onset of the winter rains, with a low in late spring (Mills 2001). Thus, the ideal time to eradicate the mice is in late fall through early winter as mouse abundance declines. Fortunately, this coincides with the time of year when the fewest numbers of sensitive or breeding wildlife individuals will be affected.

Budget

The total budget for this project is **$975,597**. It will be implemented by the USFWS and private contractors as needed. This budget does not include $157,520 that has already been received from other sources to conduct pre-implementation environmental compliance.

Scaling for Primary and Compensatory Restoration

As described above, the total injury to this restoration category was 75,781 lost bird-years. For restoration scaling, the Trustees relied on data regarding the Ashy Storm-Petrel on the Farallon Islands. Using a population model that employs current population parameters and replicates the historical decline in this species, the Trustees assumed that the project will result in increases in storm-petrel nest success and adult annual survivorship. The population will likely stabilize or slowly increase, rather than continuing to decrease. Assuming the project provides these benefits through 2100, the project will compensate for most of the lost bird-years in this species group. The Sooty Shearwater project described below will address the remaining lost bird-years.

Appendix F provides additional details regarding the bird REA for this project.

Affected Environment

This project will be located on the Farallon Islands, which are described in section 2.0.

Environmental Consequences (Beneficial and Adverse)

Without mice, the Farallones are unlikely to support a wintering population of owls and thereby greatly reduce adult Ashy Storm-Petrel mortality on the colony. The removal of mice will almost certainly improve breeding success of the Ashy Storm-Petrel and possibly other seabirds as well. For example, the mice spread seeds of non-native vegetation that impedes the ability of seabirds to dig burrows. The eradication will prevent seed dispersal by mice and will make it easier to control exotic weeds, a project underway and funded by the Cape Mohican Trustee Council. Introduced plants are perennial and grow through the seabird breeding season, blocking burrow and crevice entrances. Native plant species are annuals that die back, leaving access to burrows and crevices during the breeding season. Cassin's Auklet mortality will also be reduced somewhat, although modelling shows that owl predation of auklets scarcely impacts that species. In addition, the entire island ecosystem, including terrestrial invertebrates, the native salamander (*Aneides lugubris farallonensis*), landbirds, and native plants, may benefit in unforeseen ways from removal of the non-native mice. Such was the case when rats were removed from Anacapa Island.

The Burrowing Owl will also benefit from this project. Very few, if any, of the Burrowing Owls that choose to spend the winter on Southeast Farallon Island survive to migrate to their breeding grounds in the spring.

There are potential negative impacts from the eradication operation. These include incidental poisoning of non-target species and disturbance to wildlife from the personnel conducting the eradication. A number of factors contribute to the risks to non-target species including (1) toxicology of the rodenticide, (2) bait composition and application method, (3) behavior of target species, (4) behavior of non-target species, and (5) local environmental factors (Record and Marsh 1988; Taylor 1993). Each of these variables will be considered in the planning phase and in a subsequent NEPA environmental assessment and upon development of sufficient project-level detail. Understanding the risks associated with the use of the rodenticide allows for planning and implementation of effective measures to reduce those risks and for predicting more specifically any negative impacts.

Wildlife such as roosting seabirds and marine mammals hauled out on beaches may be temporarily disturbed during either an aerial or bait station operation. However, the operation will be timed to coincide with seasonal minimums in the number of seabirds and marine mammals on the island. The disturbance will be of very short duration, and there will always be alternative roosting/haul out location at any point in time. Therefore, any such disturbances are expected to be minor.

Should negative impacts occur, they are expected to be temporary and minor and will be offset by the long-term benefit of the removal of mice. However, these potential negative effects will be fully evaluated during the project-planning phase and in a subsequent environmental assessment of this specific project. The recent rat eradication on Anacapa Island, Channel Islands National Park in Southern California, can be used to predict the likely impacts from eradication activities. The measures implemented on Anacapa will

provide a model for appropriate measures on the Farallon Islands to reduce risks from project activities.

Probability of Success

House Mice have been successfully removed from islands around the world up to 700 hectares (ha) in size (Torr 2002). The Farallon Islands are approximately 55 ha. Thus, the Trustees believe the eradication of mice from the Farallon Islands is a realistic, achievable goal. The House Mouse would be the last non-native mammal to be removed from the islands and the removal will have direct benefits to seabirds and the entire island ecosystem. Cats and rabbits were successfully removed from Southeast Farallon Island in the early 1970's, shortly after the islands became the Farallon Islands NWR. The eradication of mice from offshore islands has been successful worldwide in a wide variety of climatic conditions. The Farallones are within the size range of successful island mouse eradications and there are no logistical, biological, or regulatory constraints that could hinder the success of the project. The probability of success is very high if similar techniques employed in other mouse eradication programs are used. Furthermore, the Farallon Islands NWR will implement protective measures to prevent the accidental reintroduction of mice in the future.

The recent successful removal of rats from Anacapa Island in Southern California (see Whitworth et al. 2005) has pioneered the pathway through the complex regulatory and biological challenges facing these types of projects. The experience and knowledge gained from Anacapa will be applied to the Farallon Islands to efficiently plan and implement the mouse removal project.

Performance Criteria and Monitoring

The ultimate success of this project will be the removal of the mouse and the recovery and increase in the populations of the Ashy Storm-Petrel. Mice will be monitored via chew indicator blocks, track boards, and traps. At all times a small number of NWR staff and researchers are present on the island. These people provide additional monitoring for mice via their presence.

All breeding bird species are already subject to regular monitoring by PRBO Conservation Science (PRBO). In fact, 30 years of pre-project data on seabird breeding population and productivity, vegetation structure, Burrowing Owl occurrence patterns, salamander populations, and invertebrate and intertidal communities, will allow comparisons of pre- and post-project changes in reproductive parameters, colonization of newly created habitat, and other aspects of the Farallon Island ecosystem.

Evaluation

The Trustees have evaluated this project against all initial and additional screening criteria developed to select restoration projects and concluded that this project is consistent with and meets the objectives of these selection factors. The Trustees determined that this type and scale of project will effectively provide appropriate compensation, in part, for injuries to Procellarids that occurred as a result of the spills and have selected this project as a preferred alternative.

Final Selected Project

Shearwater Colony Protection at Taiaroa Head, New Zealand

This project protects one of the last remaining mainland nesting colonies of Sooty Shearwaters in New Zealand. The Trustees have selected this project to compensate, in part, for injuries to Procellarids.

The Sooty Shearwater is the most abundant seabird in the California Current System during the summer months (Briggs and Chu 1986), although it faces threats on its breeding grounds and has declined in California (Viet et al. 1997). It breeds during the California winter in the Southern Hemisphere, primarily in New Zealand. There, it has largely been reduced to nesting on small offshore islands, as non-native mammalian predators now occupy the mainland. Nesting colonies also face disturbance and trampling from humans and sheep. Shearwater breeding colonies were once common on headlands and near-shore islets throughout mainland New Zealand. However, declines and local colony extinctions have been well documented at many sites (Jones 2000; Lyver et al. 2000) and have been attributed to depredation of eggs, chicks, and adults by introduced predators (Hamilton 1998; Lyver et al. 2000; Jones 2002; Jones et al. 2003). The number of colonies has declined by 54% during the past 50 years (Jones 2000).

The largest remaining mainland colony is at Taiaroa Head, Dunedin, which currently has about 750 pairs. This colony is threatened by predation by non-native brush-tailed possums, hedgehogs, rats, rabbits, stoats, and other mammals. Periodic surveys suggest the colony declined 26% between 1995 and 2002 (Mckechnie 2002), equating to an annual decline of 4.3%. This decline, coupled with the continued exposure of the colony to exotic predators, makes this breeding population extremely vulnerable to extinction in the short-term.

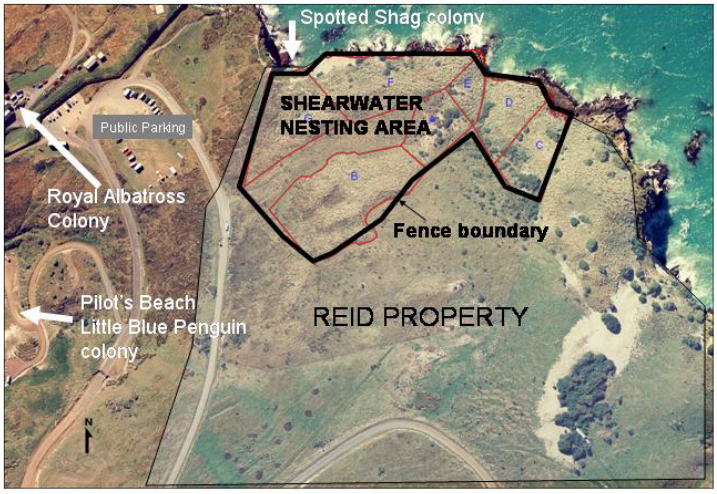


Figure 6: Aerial view of shearwater colony

This project would protect this colony by constructing a 700-meter long predator-proof fence. This fence will provide needed protection for this colony and will forestall further

colony declines. Several outreach signs will be posted to prevent human disturbance as well as to educate the public regarding the importance of this conservation action.

The land is privately owned by Perry Reid and family. The Reids operate Natures Wonders Eco-tours, primarily to view a nearby colony of Northern Royal Albatross. While a fence already protects the albatross colony, the shearwater colony remains vulnerable. The Reids are conservation-minded land stewards and are willing partners in this effort to protect one of the few remaining mainland colony areas. The Reids have agreed to have the fence built on their property and would maintain the fence and give access to researchers (through the University of Otago).

Budget

The total budget for this project is **$55,649**. The Reid family will provide monitoring and maintenance of the fence.

Scaling for Primary and Compensatory Restoration

As described above, the total injury to this restoration category was 75,781 lost bird-years. For restoration scaling, the Trustees relied on data from the Taiaroa Head Sooty Shearwater colony. The Trustees assumed that the project will result in increases in shearwater nest success and adult annual survivorship. The population will likely stabilize or slowly increase, rather than continuing to decrease. Assuming the project provides these benefits through 2100, the project will compensate for many of the lost bird-years in this species group. The Farallon Islands project described above addresses the remaining lost bird-years.

Appendix F provides additional details regarding the bird REA for this project.

Affected Environment

Although implemented by an American organization, this project will be located in New Zealand. The project will comply with all relevant New Zealand laws and includes a budget for appropriate local permits and environmental compliance.

Specifically, two types of permits will be necessary for this project, a building permit and a resource consent. The project will require a resource consent under the New Zealand Resource Management Act because it will require some earth moving through a sensitive area. The project will comply with all applicable local laws.

Environmental Consequences (Beneficial and Adverse)

This project is expected to have no adverse environmental affects. Fencing will reduce the pressure from introduced mammalian predators on the shearwater colony, likely reducing the take of eggs, chicks, and adults. The reduction in grazing will increase native vegetation, and reduce soil erosion and perturbation to shearwater nesting burrows in the fragile sandy soil.

The fence may benefit other cliff-nesting species nesting below the shearwater colony area, such as Spotted Shags (*Stictocarbo punctatus*) and Red-billed Gulls (*Larus*

novaehollandiae). Adjacent to the property is the world-renown mainland Northern Royal Albatross colony and nearby are nesting beaches of Yellow-eyed and Little Blue Penguins (Figure 6). The outreach signage will increase the public understanding of the threat of introduced predators on seabird populations and the importance of conservation actions such as the proposed project.

Probability of Success

The likelihood that this project will succeed is high. Oikonos, the American project implementer, and the Reid family, the New Zealand landowners, have considerable knowledge and experience with predator control. Also, similar fencing projects have been implemented with success throughout New Zealand. These include fences at the reserve at Orokonui, near Dunedin, and at the Karori Wildlife Sanctuary near Wellington. Hamilton and Moller (1995) suggest that 80% predator effectiveness will ensure population persistence. The University of Otago research team has a long history of cooperation with the Reid family, who has provided researchers with access to the site for over 15 years. Similarly, the Trustees have an established relationship with Oikonos based on Oikonos' implementation of restoration projects in New Zealand sponsored by the *Command* Trustee Council. The long-term protection of this colony will be provided through a currently existing conservation covenant that, under New Zealand law, is binding on both the current and successor landowners.

Performance Criteria and Monitoring

The primary objectives are to (1) erect an effective predator fence, (2) remove all grazers and mammals within the enclosure, (3) educate the public about the threat of non-native mammals to seabird conservation, and (4) measure initial results of shearwaters occupancy. In the three years following the installation of the fence, a research team from the University of Otago will conduct surveys to monitor burrow density and shearwater occupancy to compare to previous reports (Jones 2000, Mckechnie 2003).

Evaluation

The Trustees have evaluated this project against all initial and additional screening criteria developed to select restoration projects and concluded that this project is consistent with and meets the objectives of these selection factors. The Trustees determined that this type and scale of project will effectively provide appropriate compensation, in part, for injuries to Procellarids that occurred as a result of the spills and have selected this project as a preferred alternative.

4.3.5 Brown Pelicans, Cormorants, and Gulls

Background

These three species groups were combined because of the substantial overlap in restoration projects that benefit these species. Most of the proposed projects that benefit one of these species groups benefit the others as well.

The California Brown Pelican is listed as a state and federal endangered species. This subspecies nests in three main areas: islands in the Sea of Cortez, islands off the Pacific

Coast of Baja California, and two of the Channel Islands off southern California (Anacapa and Santa Barbara Islands). They do not nest in central or northern California. The vast majority are from the Sea of Cortez. Pelicans occur off the central California coast 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 20 miles out to sea.

Cormorants are large, mostly black, duck-like birds that dive for fish. Three cormorant species were impacted by the oil spills: Double-crested, Brandt's, and Pelagic. All three species are frequently found roosting and foraging in close proximity to each other. Brandt's and Pelagic are found strictly along the coast, while Double-crested occurs inland as well. Along the coast, they forage in near-shore waters and in bays and spend considerable time out of the water roosting on rocks or other platforms, often among pelicans and gulls. One species, the Brandt's Cormorant, accounts for 84 percent of the estimated impacted birds from this species group.

Gulls come in a wide variety of species, from a variety of ecological niches. Of the ten species impacted by the spills, only one breeds along the California coast and is common year-round (Western Gull). Others breed along far northern coasts (Black-legged Kittiwake, Glaucous-winged Gull), at inland lakes in California and elsewhere (California Gull, Ring-billed Gull), along rivers and lakes in the interior of Alaska and Canada (Herring Gull, Mew Gull, Bonaparte's Gull), or along the tundra coast of far northern Alaska and Canada (Glaucous Gull). One species (Heermann's Gull) breeds primarily on a single island in the Sea of Cortez, Mexico. All of the species occur along the California coast in winter (although Glaucous Gull is rare and Black-legged Kittiwake occurs primarily offshore). Like the pelicans and cormorants, most gulls in winter forage in near-shore waters and in bays, spend considerable time out of the water roosting on rocks or other platforms, and are frequently found roosting and foraging together, often among pelicans and cormorants. The primary species impacted were Western Gull (36% of all gulls collected), Glaucous-winged Gull (16%), and California Gull (15%).

Conservation Issues

While the two pelican colonies in southern California are protected by the Channel Islands National Park, various breeding colonies in Mexico suffer from disturbance from humans and non-native animals (e.g., dogs, donkeys). This has led to the extirpation or severe reduction of several colonies along the Pacific Coast. During the non-breeding season, Brown Pelicans require disturbance-free roost sites to rest and to dry wet plumage after feeding or swimming (Jaques and Anderson 1987). Major roosts are typically on jetties and other manmade structures, offshore islands and rocks, and on beaches at the mouths of estuaries (Jaques and Anderson 1987). In many sections of the coast, such roosting sites are in short supply or are subject to considerable human disturbance (Jaques 1994; Jaques and Strong 2002). Another issue in California is pelican entanglement in fishing lines or direct hooking by anglers on piers or fishing boats.

Like the pelican, cormorant nesting is limited to disturbance-free areas, typically small offshore rocks and anthropogenic structures (e.g., abandoned piers). Likewise, cormorants require disturbance-free roost sites to enable them to rest and dry their plumage after foraging for fish in the water.

In general, gull populations have benefited from human presence, as they forage on food waste and garbage. As a result, most gull species have increased in numbers in recent decades. Although they can suffer from the same nest site disturbances that afflict other species (e.g. pelicans and small alcids), gulls are more adaptable and tolerant of human presence. In many situations, gulls benefit from (and exacerbate the problem of) human disturbances, as they predate the eggs and chicks of other seabirds that flush when approached by humans.

Injury Calculations

A total of 41 Brown Pelicans, 162 cormorants, and 261 gulls were collected during the spills that occurred between 1997 and 2003. Additional birds were likely collected between 1990 and 1996, although species composition regarding collected birds is limited for this time period. The total estimated dead from all spills is 278 Brown Pelicans, 1,460 cormorants, and 2,388 gulls. Details on the number of birds collected during each spill event and the estimate of total mortality are in Appendix B and in Ford et al. (2006).

Species	Total Collected*	Total Estimated Dead	Total Lost Bird-Years
Brown Pelican	41	**278**	**2,083**
Brandt's Cormorant	136	**1,460**	**7,070**
Double-crested Cormorant	6		
Pelagic Cormorant	17		
Cormorant, sp.	3		
Bonaparte's Gull	2	**2,388**	Not applicable.
Heermann's Gull	20		
Mew Gull	2		
Ring-billed Gull	5		
California Gull	40		
Herring Gull	11		
Western Gull	93		
Glaucous-winged Gull	43		
Glaucous Gull	2		
Black-legged Kittiwake	15		
Gull, sp.	26		
Western x Gl-W Gull hybrid	2		

* 1997-2003 only. Prior to 1997, data regarding the species composition of collected birds are limited.

These lost bird-years represent the interim losses between the time of the spills and return of this population to pre-spill conditions. Thus, any restoration project benefiting California Brown Pelicans should seek to replace **2,083** lost bird-years. Any restoration project benefiting cormorants should seek to replace **7,070** lost bird-years. Details regarding the calculation of lost bird-years are presented in Appendix G.

Realizing that gulls will benefit substantially from the project for Brown Pelicans and cormorants (as well as the Año Nuevo Island restoration project benefiting Rhinoceros Auklets, described in section 4.3.10), the Trustees did not consider any restoration projects specifically for gulls. Furthermore, the Trustees believe these other projects will simultaneously more than compensate for impacts to gulls. Thus, lost bird-years were not calculated for gulls, as such quantification was not necessary for project scaling.

Restoration Alternatives

The table below provides a list of restoration concepts considered by the Trustees.

PROJECT CONCEPTS	BENEFITS
Seabird Colony Protection on Baja California Islands, Mexico	**Brown Pelican, Brandt's and Double-crested Cormorants, Western Gull (also Cassin's Auklet)**
Roost site protection in northern California	Brown Pelican, Brandt's and Double-crested Cormorants, Western Gull
Pelican entanglement education on fishing piers in California	Brown Pelican

The Trustees selected the colony protection work on the Baja California islands as the preferred project. This project not only provides direct benefits to Brown Pelicans, cormorants, and gulls, but also benefits Cassin's Auklets (see section 4.3.10 for details regarding injuries to auklets). This project benefits these species at their breeding grounds in Mexico, where the vast majority of California's pelicans originate. The other projects would benefit these species when they are foraging and roosting in California. However, other oil spill trustee councils and other agencies are already implementing these.

Final Selected Project

Seabird Colony Restoration on Baja California Islands, Mexico

The goal of this project is to restore seabird populations on six islands along the Pacific Coast of Baja California: San Martín, San Jeronimo, San Benito, Natividad, San Roque, and Asunción. Restoration efforts will target a suite of seabirds including Brown Pelicans, Brandt's and Double-crested Cormorants, Western Gulls, and Cassin's Auklets. Restoration actions will include (1) social attraction techniques (using decoys and playback of bird calls) to re-establish colonies; (2) re-designing paths and walkways to manage human traffic; (3) shielding light sources; (4) native vegetation restoration; and (5) public outreach and education to reduce disturbance of nesting birds. This project has been designed to benefit the pelicans, cormorants, and gulls species groups, as well as Cassin's Auklets.

The California Current System stretches along the west coast of North America from southern British Columbia to Baja California. The islands off Baja California are critically important for many of the seabirds that occur in California, hosting some of the largest breeding colonies for several species. Many of these islands present important opportunities for seabird restoration. The Montrose Trustee Council is planning to

address the restoration needs for two of these islands (Coronados and Todos Santos) (Montrose Settlements Restoration Program 2005).

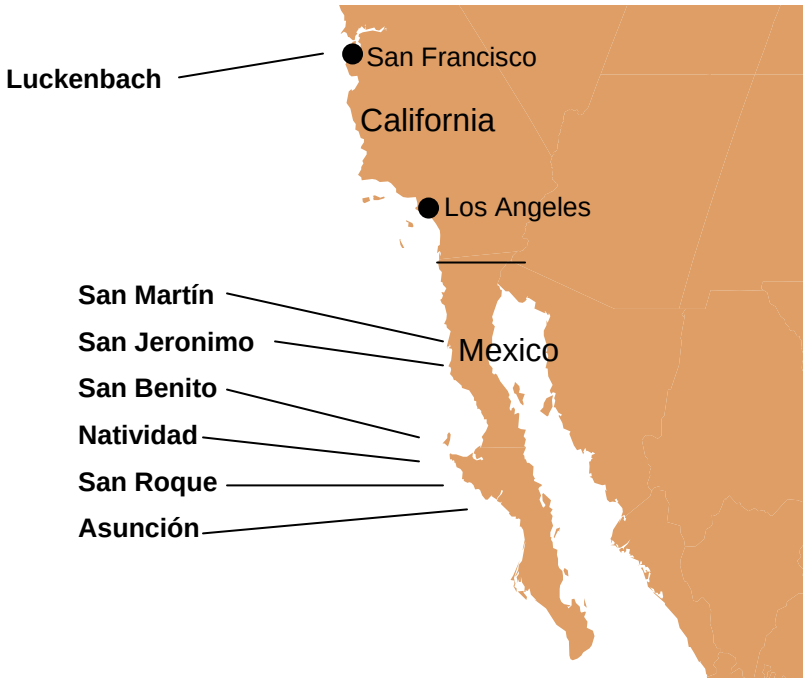


Figure 7: Islands for seabird restoration

Most of the seabird colonies in Mexico and California form part of a larger metapopulation of seabirds that breed, forage, and disperse into California. For example, there are several sub-populations of Brown Pelican, only one of which breeds in California. While the majority of the birds breed in Mexico, there is interchange among colonies (Anderson and Gress 1983, Gress et al. 2005). Metapopulations serve to create more stable and viable populations because each individual colony buffers the others against extinction.

In addition to movement of breeding birds and natal dispersal between colonies on either side of the U.S./Mexico border, a large number of birds breeding in Mexico annually disperse north during the non-breeding season into the U.S. Dispersal also occurs in the reverse direction, with birds from the U.S. going south to Mexico. During the fall and winter, populations of Brandt's Cormorants, Double-crested Cormorants, and Brown Pelicans increase dramatically in California, surpassing the total number of breeders in California. These birds are arriving from their breeding grounds on islands in Mexico. Other species that follow this pattern include the Craveri's Murrelet (Deweese and Anderson 1976), Black-vented Shearwater (Keitt et al. 2000), Heermann's Gull, Elegant Tern (Burness et al. 1999), Xantus's Murrelet (Drost and Lewis 1995), Least Storm-Petrel, and Black Storm-Petrel (Ainley and Everett 2001). Because seabird populations overlap international boundaries, protection and restoration of seabird colonies in Mexico directly benefits seabird populations in the U.S. Robust seabird colonies in Mexico are also important to ensure the survival of shared species should catastrophic events (e.g., oil spills) lead to a severe decline in seabird numbers in California. For example, when

the population of Brown Pelicans in southern California suffered from severe DDT-induced declines several decades ago, surviving sub-populations in Mexico most likely supplied animals that immigrated to help restore the overall population. San Martín Island in Mexico is likely one such source island for pelicans to the U.S. portion of their range (Anderson and Gress 1983).

For the past 10 years, significant conservation efforts have taken place on many of these islands. This project builds on this past progress. Specifically, a successful collaboration between local universities, Mexican and U.S. nonprofit conservation organizations, local fishing cooperatives, and Mexican governmental agencies has resulted in the removal of introduced species (e.g. cats, dogs, goats, burrows, etc.) from 24 islands in the region, 12 of which are on the Pacific Coast of Baja California (Tershy et al2002). This removal of non-native species forms a foundation that makes future restoration efforts possible. Of 19 animal extinctions on islands in northwest Mexico, 18 can be attributed in whole or part to introduced mammals (Donlan et al. 2000). With the recent efforts, 35 exotic mammal species have been removed from islands in the region. With the removal of these introduced species, suitable habitat is once again available to seabirds for nesting and roosting. The success of this regional conservation effort has provided unique opportunities to enhance recovery of seabird populations within the California Coastal Current. Nevertheless, human disturbance remains "a major obstacle in the recovery and re-establishment of seabird colonies on these islands" (Gress et al. 2005).

The Mexican government owns these islands and controls access to them. Because these islands support globally important populations of marine birds, Mexico's federal government recognizes these islands as critical habitat. Visitors to the islands must obtain permits from the government. Several of the breeding seabird species, including the Cassin's Auklet, are listed as endangered or threatened under the Norma Oficial Mexicana 059, Mexico's equivalent of the U.S. Endangered Species Act.

Three of the islands, Natividad, San Roque, and Asunción, have been protected as part of the Vizcaino Biosphere Reserve since 1988. The other three, San Martín, San Jeronimo, and San Benito, are currently in the process of being declared a Biosphere Reserve. Along with several other islands to the south and Guadalupe Island, another important island for seabirds in the region, which was designated a Biosphere Reserve in June 2005, all of the islands along the Pacific coast of Baja California will now be protected at the highest level. The designation of these islands as Biosphere Reserves create additional legal infrastructure for enforcing regulations and developing management plans.

Natural resources at the islands are also protected by several other Mexican laws, including the General Wildlife Law of 2000 and General Law of Ecological Balance and Environmental Protection (LGEEPA) of 1988. The General Wildlife Law is implemented primarily by the Secretary of the Environment and Natural Resources (SEMARNAT) Wildlife Directorate General, and provides general authority for conservation of migratory species and species restoration, as well as more detailed regulation of wildlife management and use. The LGEEPA focuses on the preservation and restoration of

ecological balance, and addresses the issues of Natural Protected Areas, jurisdiction, ecological zoning, and enforcement.

The specific restoration actions to be conducted on each island are described below. While these actions are the primary focus of the restoration efforts, the presence of restoration project biologists regularly visiting the islands will allow for adaptive management and additional intervention, as appropriate. In the past, the regular presence of biologists, working with government officials and locals, has been a critical component in protecting seabirds and identifying potential threats to the colonies as they arise.

San Martín Island

San Martín Island is 741 acres in size and is located 3.1 miles offshore from San Quintin, Mexico. Cliffs dominate this rugged volcanic island, except on the northeast side where a small sandy beach and tidal lagoon occur. Vegetation on the island consists of dense Californian coastal scrub. In addition to six species of breeding seabirds, San Martín also supports three endemic reptiles and one endemic mammal. A permanent fishing camp exists on the island as well as two automated navigational lights that receive at least bi-annual maintenance by personnel of the Secretary of Communications and Transportation.

San Martín historically supported a large mixed colony of Brown Pelicans, Double-crested Cormorants, and Brandt's Cormorants from at least 1913 until the late 1960's (Palacios and Mellink 2000). This colony was the largest historic Double-crested Cormorant colony in North America, estimated at close to 350,000 nests (Gress et al. 1973, Wright 1913). Although this is thought to be an overestimate (Carter et al. 1995), San Martín clearly supported an important breeding colony. In 1969 and 1971, approximately 5,000 Double-crested Cormorants were documented in the colony. During the 1970s, human disturbance and contaminants that caused thin-shelled eggs were thought to be the principal factors in the decline of these colonies (Anderson and Keith 1980, Jehl 1973, Gress et al. 2005), which were also heavily impacted by introduced cats, fisherman, and egg harvesters (Everett and Anderson 1991). Consequently, it was believed that this colony was essentially abandoned in 1987 and 1988 (Everett and Anderson 1991).

In recent years, efforts have been taken to protect and conserve San Martín, including the removal of feral cats in 1999-2000. A survey in 1999 documented the reoccupation of this regionally important seabird colony, including 600 occupied cormorant and 35 Brown Pelican nests (Palacios and Mellink 2000). In 2002, over 200 pelican nests were counted and productivity was estimated to be relatively high for this species (Gress et al 2005). The island has also become an important post-breeding roost for foraging pelicans, with over 10,000 birds present in late summer 2002 (Gress et al. 2005). The same survey counted over 500 Double-crested Cormorant nests in 2002 and 2003, making it the largest such colony in the Southern California Bight, and over 120 Brandt's Cormorant nests in 2003. No Pelagic Cormorant nests have been found in recent years. Additional nesting seabirds on San Martín Island may include Western Gulls, Cassin's Auklets, and Xantus's Murrelets (Wolf 2002). With the removal of feral cats and the

recent reoccupation of the cormorant/pelican colony, opportunity exists to facilitate further recovery of these important colonies with relatively simple management actions (Gress et al 2005).

Activities on San Martín will focus on restoring the pelican and cormorant colonies by reducing human disturbance through signage, public education, and a redesign of the trail system to avoid disturbance of the colonies.

Restoration activities at San Martin Island are:

- Re-design and establish a new trail system to reduce/stop disturbance of seabird colonies by fishermen walking near the colonies;
- Develop and install signs to restrict areas of the island from human access;
- Education to keep introduced predators off the island; and
- Education to reduce human disturbance.

San Jeronimo Island

San Jeronimo is 165 acres in size and has historically supported large colonies of Brandt's Cormorants and Cassin's Auklets (Everett and Anderson 1991). A permanent fishing camp exists on the island with up to 40 residents during peak fishing seasons. A lighthouse keeper is permanently stationed on the island. The Brandt's Cormorant colony was displaced and large sections of the Cassin's Auklet colony were destroyed during an unauthorized guano mining operation in 1999 (Wolf 2002). Since that time, all guano mining operation has been stopped on the island (B. Keitt, pers.comm.).

Figure 8: The construction of an outhouse and signs designating trails have reduced human destruction of Cassin's Auklet burrows surrounding the fishing camp on San Jeronimo Island (left). However, a historical nesting colony of Brown Pelicans and Brandt's Cormorants was extirpated by a guano mining operation on the north end of the island in 1999 (center). Daily flushing by humans has prevented the birds from re-colonizing. Fisherman also cross the extremely dense Cassin's Auklet colony on a daily basis, crushing fragile nesting burrows and destroying nesting attempts (right).

Efforts to remove introduced animals have also been undertaken on this island. Feral cats were eradicated in 2000. However, nesting birds are still at risk from a number of human-induced disturbances. Without a single trail, fishermen regularly crush nest burrows by walking through the colony. Some birds nest in abandoned houses within the fishing camp, where they are subject to disturbance. Others become disoriented by lights at night and collide with buildings. Seabirds currently nesting on San Jeronimo Island include the Double-crested Cormorant, Western Gull, Cassin's Auklet, and Xantus's Murrelet (Wolf 2002). Of these, the Cassin's Auklet colony is the largest. After the unauthorized guano

mining operation, Brandt's Cormorants did not re-nest in 2002. Their population continues to be well below its historical numbers.

Restoration activities at San Jeronimo Island are:

- Restore the extirpated Brandt's Cormorant colony through social attraction efforts (e.g., using decoys);
- Build and install boardwalks to stop destruction of auklet burrows by fishermen walking through the colony;
- Develop and install signs to restrict areas of the island from human access;
- Build and install nest boxes to protect birds that are prone to nesting in high-use areas around buildings and the town dump (these nest boxes will also be valuable for education and monitoring);
- Shield light sources to minimize collision deaths by disoriented birds;
- Education to keep introduced predators off the island; cats have been eradicated but on occasion fishermen have brought pet cats and dogs to the island after this effort; and
- Education to reduce human disturbance.

San Benito Island

San Benito Island actually consists of three small islands (East, Middle, and West) with a combined area of approximately 1,581 acres and is located 40 miles west of Punta Eugenia at the tip of the Vizcaíno peninsula. Permanent fishing camps exist on West Benito Island.

San Benito supports one of the largest and most diverse seabird colonies of the entire California Current. The islets host approximately 2 million breeding seabirds of 12 species, including Brown Pelican, Western Gull, Double-crested Cormorant, Brandt's Cormorant, and Cassin's Auklet (Wolf 2002).

Recent eradication efforts have been undertaken to restore the island ecosystem. In 1998, feral goats and rabbits were removed. Donkeys were removed in 2004. The presence of biologists on the island resulted in additional conservation gains. When an algae harvest company began drying their product in the middle of a dense Cassin's Auklet colony, the biologists worked with government agencies to restrict algae drying to a designated zone outside the colony. Biologists have also worked to establish guidelines for the construction of a new lighthouse, including the location of the structure, clean up of the old lighthouse and discarded batteries, use of access roads to the construction site, and limits on materials brought to the island to reduce likelihood of introductions of rodents, plants, and insects.

Seabirds continue to be threatened by unshielded light sources in the fishing community, and expansion of fishing community activities into adjacent seabird colonies. Additionally, seabird nesting habitat had been severely degraded, particularly on West Benito Island, due to the past presence of goats, rabbits, and donkeys.

Restoration actions will focus on West San Benito Island, which supports considerably lower densities of seabirds than Middle or East Islands. Restoration activities for San Benito Island are:

- Removal of exotic plant species and restoration of native plant communities disturbed by human activities and donkeys;
- Shield light sources to minimize collision deaths by disoriented birds;
- Education to keep introduced non-native animals off the island; and
- Education to reduce human disturbance.

Natividad Island

Natividad Island is 2,592 acres in size and is located 4 miles off Punta Eugenia. There is a town of 400 permanent residents on the south end of the island and most inhabitants are members of a fishing cooperative.

It is estimated that Natividad supports approximately 160,000 breeding seabirds of 5 species, including the Brown Pelican, Double-crested Cormorant, Brandt's Cormorant, and Western Gull (Wolf 2002). Cassin's Auklets are thought to have been extirpated by cat predation (B. Keitt, pers. comm.).

Recent eradication efforts have removed feral cats, goats, domestic pigs, rabbits, and sheep from the island. These efforts were done with the cooperation of the island's fishing community. Cat eradication was initiated in 1998 in response to the large number (more than 1,000) of dead shearwaters found in the colony each month (Keitt et al. 2002). Despite the removal of cats, Cassin's Auklets are not known to have re-colonized Natividad (Keitt 2000).

Re-introduction of cats and rodents remains a threat. In addition, unregulated road building, off-road vehicle use, and disturbance of pelican and cormorant breeding and roosting sites by island residents and tourists continue to limit the number of breeding seabirds on Natividad Island.

Restoration activities for Natividad Island are:

- Restore the historic Cassin's Auklet colony by using playback systems and artificial burrows;
- Protection of cormorant, pelican, and other nesting seabird colonies through signage and the closing of some access trails and roads;
- Shield light sources to minimize collision deaths by disoriented birds;
- Education to keep introduced non-native animals off the island; and
- Education to reduce human disturbance.

San Roque Island and Asunción Island

San Roque (195 acres) and Asunción (165 acres) Islands are located inside Asunción Bay. There are no permanent settlements on these islands, although there is regular visitation by people from the nearby town on the mainland.

These islands once supported large nesting colonies of seabirds, including Cassin's Auklets and Brandt's Cormorants (Everett and Anderson 1991; Drost and Lewis 1995; Wilbur 1987). These represented the southernmost breeding colonies of Cassin's Auklet (Kaeding 1905). However, predation by cats extirpated the large populations of Cassin's Auklets on these islands by 1992 (McChesney and Tershy 1998). Human disturbance has caused the abandonment of the cormorant colonies on San Roque and the Brown Pelican colony on Asunción Island on repeated occasions. Ongoing human disturbance keeps populations of these species well below historic numbers.

Within the last 10 years, efforts have been made to restore the ecosystem on these islands. In 1994, feral cats and rats were removed and human visitation to the islands was temporarily stopped through education and placement of signs. These actions resulted in secure roosting habitat for thousands of pelicans and cormorants. In 1996, playback devices were used to encourage the return of the Cassin's Auklet and Leach's Storm-Petrel (*O. leucorhoa*). In 2004, Cassin's Auklets were documented using artificial burrows on the island; however, it is unknown whether breeding occurred (B. Keitt, pers. comm.). In 2001, Brandt's Cormorants (more than 2,000 nests) and Brown Pelicans (approximately10 nests) had begun breeding again on San Roque Island (B. Keitt, pers. comm.). However, in 2002 after a long lapse in education efforts, local fishermen began visiting the island again on a regular basis and virtually all of the cormorants and pelicans abandoned their breeding efforts.

The goal of restoration actions on these islands is to facilitate the re-colonization and recovery of seabird populations. Restoration activities for San Roque and Asunción Islands are:

- Restore the historic Cassin's Auklet colony by using playback systems and artificial burrows;
- Restore the cormorant colonies by using decoys; and
- Education to reduce human disturbance.

Table 5 shows which seabird species are breeding on the six islands that are the focus of this restoration project, as well as the primary restoration actions on each island.

Table 5: Breeding Species and Restoration Actions by Island

ISLAND	BREEDING SPECIES	RESTORATION ACTIONS
San Martín	**Brown Pelican, Double-crested Cormorant, Brandt's Cormorant, Western Gull, Cassin's Auklet**, Xantus's Murrelet	• New trail system • Signs • Education and outreach
San Jeronimo	**Double-crested Cormorant, Western Gull, Cassin's Auklet**, Xantus's Murrelet	• Social attraction (decoys) • New boardwalk • Nest boxes • Light shielding • Signs • Education and outreach
San Benito	**Brown Pelican, Double-crested Cormorant, Brandt's Cormorant, Western Gull, Cassin's Auklet**, Leach's Storm-Petrel, Black Storm-Petrel, Least Storm-Petrel, Heermann's Gull, Xantus's Murrelet, Craveri's Murrelet	• Vegetation restoration • Light shielding • Signs • Education and outreach
Natividad	**Brown Pelican, Double-crested Cormorant, Brandt's Cormorant, Western Gull**, Black-vented Shearwater	• Social attraction (audio) • Light shielding • Signs • Education and outreach
San Roque	**Double-crested Cormorant, Brandt's Cormorant, Western Gull**, Heermann's Gull	• Social attraction (audio) • Signs • Education and outreach
Asunción	**Brown Pelican, Brandt's Cormorant, Western Gull**	

Budget

The total budget to conduct these activities at these islands for six years is **$3,736,475**. Future years have been discounted to account for interest earned at an annual rate of 1.5 percent above inflation.

Scaling for Primary and Compensatory Restoration

The scaling for this project incorporated lost bird-years for pelicans, cormorants, and Cassin's Auklets, comparing them with the gained bird-years for these species. As described above, the total injury was 2,083 lost bird-years for Brown Pelicans and 7,070 lost bird-years for cormorants. The injury to Cassin's Auklets was 10,773 lost bird-years (see section 4.3.10).

The Trustees estimate that the project will create (or protect) nests on the six islands targeted for restoration efforts. Specifically, it is estimated that the project will lead to 240 new nests for pelicans, over 500 new nests for cormorants, and over 1,600 new or protected nests for Cassin's Auklets. These new nests will generate 99 percent of the compensation needed to offset injuries to pelicans, 97 percent of that required for cormorants, and 205 percent of that required for Cassin's Auklets. Given the uncertainty associated with these estimates, the Trustees concluded that this project, by addressing the needs of several species simultaneously, was the most cost-effective way to provide

the needed restoration. Appendix G provides additional details regarding the bird REA for this project.

Affected Environment

Although implemented by an American organization (and their Mexican affiliates), this project will be located at six relatively remote islands off the Pacific Coast of Baja California, Mexico. The islands, all part of a federal Mexican Biosphere Reserve, are described above. The project will comply with all relevant Mexican laws.

Environmental Consequences (Beneficial and Adverse)

The project combines several types of restoration activities that will provide long-term benefits to target seabirds. Social attraction efforts will facilitate the recolonization of islands after the removal of introduced species. These types of efforts will encourage seabirds to recolonize suitable and historically occupied habitats. Once attracted to the island, the presence of nest boxes will further encourage nesting in suitable habitat. The use of nest boxes will also allow biologists to effectively monitor the success of the restoration efforts. Although social attraction may only be used for a short time, the recolonization of a historically occupied colony will provide long-term benefits to seabird populations since the re-established presence of a colony of birds will likely serve as an ongoing natural attractant.

A reduction in human disturbance around colonies will significantly benefit roosting and breeding seabirds. Nesting seabirds, especially cormorants and pelicans, are sensitive to disturbance and should benefit substantially from a reduction in human disturbance. Construction of a boardwalk on San Jeronimo Island will greatly reduce the number of Cassin's Auklet burrows that are crushed by fisherman walking through the colony.

In addition to the target species, a host of other seabirds will benefit. These include Black-vented Shearwater, Leach's Storm-Petrels, Heermann's Gulls, Elegant Terns, and Xantus's Murrelet. Peregrine Falcons will also likely benefit from this project. Because Peregrine Falcons prey on smaller seabirds, increased seabird populations on these islands will benefit this species. In addition, some of the islands harbor endemic plants (one of which is restricted only to West San Benito), endemic landbirds, and or endemic lizards. These species may benefit as well.

Although there is the potential for mild soil disturbance impacts from the project activities, the Trustees have determined that these impacts will not be significant. Activities such as nest box and social attraction device placement, boardwalk construction, and vegetation restoration will be timed to minimize disturbance of birds.

This project also seeks to limit human disturbance near seabird colonies, but the Trustees have determined that there will be no significant human use impacts. This action will likely impact fisherman on the islands; however, alternative trails will be provided. This impact is not anticipated to be significant due to the minimal number of people that inhabit the islands and the provision of alternative trails to reach fishing locations. In the past (during the introduced animal eradications), biologists have developed a positive

working relationship with locals and it is expected that such relationships will be fostered during the implementation of this project. The project will not result in impacts to cultural resources, transportation, or health and safety.

Probability of Success

Social attraction efforts, including the use of playback systems and decoys, have been successfully used for a variety of seabirds, including terns, puffins, albatross, and petrels. The use of artificial nests has also proven to be successful for seabirds such as the Ashy Storm-Petrel, Leach's Storm-Petrel, Cassin's Auklet, and Pigeon Guillemot. Experts in the field of social attraction will be consulted during project planning and implementation to ensure that playback systems, decoys, and artificial nests are designed in a manner that maximizes success of the project. Long-term success of these projects will also be dependent on whether these islands remain free from introduced species. The education of island users about the impact of introduced species is critical to the success of these restoration projects.

Actions to reduce human disturbance (e.g., redesign of trails, posting signs, shielding lights) are feasible and will provide long-term benefits as long as measures are complied with and are enforced.

As discussed earlier, a concerted effort is underway by the government of Mexico to conserve and protect the Baja Pacific Islands. Part of that effort is the designation of the Baja Pacific Islands as a Biosphere Reserve, including San Martín, San Jeronimo, and San Benito Islands. Another part has been the Mexican government's support of previous seabird restoration actions on these islands, which included the removal of many non-native species (e.g., goats, dogs, cats, burros). Some of this work was funded by another American oil spill trustee council (American Trader). Past experience has also shown that the presence of a seabird biologist has been instrumental in reducing human disturbance and resolving conflicts with nesting seabirds. These actions also had the support of the local population. The restoration activities are both feasible and compatible with these ongoing efforts. In light of the successful efforts to remove non-native species from these islands and to reduce human disturbance, and the Trustees ability to contract with an American organization with a successful track record on international island restoration projects, the Trustees are confident that restoration activities undertaken on these islands will be successful and will result in long-term benefits to seabird populations in the California Current System.

Performance Criteria and Monitoring

The benefits of these restoration activities to seabirds will be evaluated by increases in colony size, recolonization of seabirds into previously occupied habitats, and reduced disturbance to seabird colonies. Protocols for seabird monitoring are well-established and standardized. Efforts to document baseline seabird populations and levels of human disturbance will be undertaken before project implementation to strategically plan project activities and to evaluate the project benefits.

Evaluation

The Trustees have evaluated this project against all screening and evaluation criteria and concluded that this project is consistent with and meets the objectives of these selection factors. The Trustees determined that this type and scale of project will provide benefits to pelicans, cormorants, gulls, and Cassin's Auklets and have selected it as a preferred alternative.

4.3.6 Snowy Plovers

Background

The Western Snowy Plover is a rare shorebird found along the west coast of North America and at estuarine alkaline ponds. Snowy Plovers rarely enter the water and spend most of their time foraging in the wrack or dry sand areas of the beach. During oil spill events, they routinely become oiled as they forage on the beach and in oily wrack deposited during high tides. Through exposure to oil in foraging areas, they may suffer from oil ingestion and decreased mobility as a result of oiling.

Conservation Issues

The Pacific coast population of the Western Snowy Plover is listed as federally threatened. The primary threats that warranted listing of the Pacific coast population include loss of nesting sites due to European beachgrass (*Ammophila arenaria*), encroachment and urban development, disturbance from human recreational activities, and predation exacerbated by human disturbance (U.S. Department of the Interior 1993). Recovery objectives in the recovery plan include (1) achieving well-distributed increases in numbers and productivity of breeding adult birds, and (2) providing for long-term protection of breeding and wintering plovers and their habitat (USFWS 2001). The species is also considered a Species of Special Concern by the state of California and is on the Red List of the National Audubon Society, the most at-risk category.

A 1999 report by researchers with PRBO estimated that 1,950 plovers exist in California, Oregon and Washington, but the 2003 summer breeding season survey of the California coast puts the population at only around 1,400, a sharp decline from the previous range-wide survey (G. Page, pers. comm). Only 28 nesting areas remain throughout their range.

The Point Reyes National Seashore (PRNS), which was oiled by the spills and where oiled plovers were observed, typically hosts a breeding population of 25 to 35 birds, although during winter the population is about 150 to 200 birds. Chicks and eggs have suffered from high predation rates from ravens. Additionally, elevated mercury levels in eggs have caused hatching failures in several nests during the 1990s (Schwarzbach et al., in press).

Plovers at PRNS have recently benefited from a variety of restoration actions aimed at protection, habitat restoration, and education. PRNS initiated a pilot project to remove non-native vegetation and restore dune habitat with funds from Cape Mohican Oil Spill Restoration Plan and the National Fish and Wildlife Foundation. As a result, four

successful broods occurred in a 50-acre restoration site at Abbotts Lagoon in 2005. Plovers are also relocating their broods, after hatching, to the restoration site where chicks can seek protection from predators under the restored, native vegetation (PRBO, pers. com.). Based on the success of this pilot project, PRNS will restore another 300 acres of coastal dune habitat with National Park Service funds at a cost of over $2.4 million over the next five years. Also, PRNS is working with PRBO and the USFWS on a predator management plan to address the immediate predation pressures from the Common Raven, after successfully reducing predation on plover eggs over the past 10 years with nest exclosures. PRNS has successfully reduced disturbance from dog-walkers through a docent education program which was initiated in 2002 and is ongoing. Finally, PRBO and PRNS continue to adaptively monitor the success of these management actions, and make adjustments to strategy accordingly, at an annual cost of about $100,000.

Injury Calculations

During the 1997-98 oil spill (the Point Reyes Tarball Incident), PRBO biologists documented 22 plovers that were directly oiled. These birds, which were alive when observed and were not captured, represent a conservative estimate of affected birds. Less information on the number of birds oiled during the other oil spill incidents exists; however, PRBO observed live oiled plovers during most events. Because no birds were collected live or dead, the Trustees cannot estimate mortality using the Beached Bird Model, as has been done for most other species. Although the status of these oiled birds is unknown, past oil spill experience has revealed that (1) not all oiled birds are located by observers, (2) not all oiled Snowy Plovers die, and (3) some oiled Snowy Plovers do eventually die. Taking these points into consideration, the Trustees conclude that approximately 30 Snowy Plovers died as a result of these incidents or were otherwise prevented from remaining as part of (or entering) the breeding population. This represents a sizeable portion of the Snowy Plover breeding population at PRNS. However, because the impacts occurred in winter, some of the impacted birds may have been wintering birds from other locations (e.g., northern California or Oregon).

Lost bird-years were calculated relying on the demographic characteristics of the Snowy Plover. See Appendix H for details. Because Snowy Plovers are declining due to limitations on suitable nest sites (Page et al. 1995), the Trustees applied the stepwise juvenile replacement approach to calculating lost bird-years as described in Appendix C**.**

Species	Total Collected	Total Estimated Dead	Total Lost Bird-Years
Snowy Plover	0	30	150

These lost bird-years represent the interim losses between the time of the spills and return of this population to pre-spill conditions. Thus, any restoration project benefiting this species should seek to replace **150** lost bird-years.

Restoration Alternatives

The table below lists the restoration concepts considered by the Trustees.

PROJECT CONCEPTS	BENEFITS
Dune Habitat Restoration at Point Reyes National Seashore	**Snowy Plover**
Corvid Management at Pt. Reyes National Seashore	Snowy Plover

The Trustees have selected dune restoration at Point Reyes as the preferred project to address injuries to this species. This project has the full support of PRNS, which has already implemented a small but successful pilot version of this project. The other project, developing a corvid management program to improve Snowy Plover nest productivity, is already being implemented by the NPS using other funds. Because the oiled Snowy Plovers from the spills were observed at PRNS and there were two feasible projects located there, no other projects were considered.

Final Selected Project

Dune Habitat Restoration at Point Reyes National Seashore

This restoration project seeks to restore Western Snowy Plover nesting habitat through eradication of non-native vegetation along the beach foredunes at Point Reyes National Seashore (PRNS). The project will involve systematic removal of non-native vegetation (European beachgrass (*Ammophila arenaria*) and iceplant, or Hottentot fig (*Carpobrotus edulis*) from 30 acres of dune habitat with heavy equipment with followup maintenance by contractors, park staff, and volunteers. Removal of European beachgrass and iceplant will facilitate recolonization by native plants and allow reestablishment of the natural processes controlling dune development.

PRNS contains some of the highest quality remaining coastal dune habitat in the nation and significant breeding and wintering habitat for the Western Snowy Plover. This habitat, however, is seriously threatened by the rapid encroachment of European beachgrass and iceplant. These plants often cover the dunes in thick masses, leaving almost no sand visible. Because Snowy Plovers prefer open expanses of sparsely vegetated dunes, these dense stands of non-native vegetation effectively destroy their nesting and chick-rearing habitat.

These plants were planted extensively in the late 19th century to stabilize the dune sand, primarily to prevent the filling of shallow harbors and burial of roads and railroad tracks. Past efforts to stabilize the dunes have adversely affected the survival and spread of native species, and altered the natural process of sand movement. European beachgrass affects dune formation and development by slowing sand movement and deposition, which result in large, stable dunes that form a ridge parallel to the beach. This ridge prohibits sand movement between the fore and rear dunes, which reduces the amount of habitat available for native dune species. Simultaneously, iceplant forms dense, monotypic mats across the dunes, holding sand in place and completely displacing native dune plant species.

PRNS has historically been an important nesting and wintering area for Western Snowy Plovers. The Final Draft Recovery Plan (USFWS 2001) identified protection and

management of all breeding and wintering locations at PRNS as a top priority for the recovery of the species. Recommendations of the plan include (1) building the PRNS population to 70 birds (about twice the current level), (2) minimizing disturbances, (3) developing a docent education program, (4) restoring habitat, and (5) preventing excessive predation.

PNRS has invested significant resources (financial and personnel) and taken major management actions to promote the recovery of the species over the past ten years. PRNS has ranked the protection and restoration of snowy plovers as the number one priority in the Resource Stewardship Plan and has taken aggressive steps over the past 10 years to restore the species, including (1) development of a Snowy Plover Management Plan (White and Allen 1999), (2) increased monitoring and protection efforts, (3) the use of wire exclosures around nests to exclude predators, (4) access restrictions on nesting beaches to dogs and people, (5) development of a predator management plan, and (6) the initiation of a docent education program. In 2003, after eight years of this effort, the number of birds rose from approximately 24 to approximately 35, producing 19 fledglings. Nevertheless, these intensive park service management efforts to build up the population were set back by oiling of the plovers during spills over the past 10 years.

The non-native plants will be removed primarily through the use of methods proven to be successful by the Nature Conservancy at Lanphere-Christensen dunes in Arcata, California (Pickart 1977) and at PRNS. The method relies on the use of heavy equipment to dig up and bury non-native vegetation. Pilot projects have shown this method to be more successful and cost-effective than the use of herbicide or removal by hand and shovel. Thus, this project builds on past successes for restoring Snowy Plover nesting habitat. In the pilot project, PRNS successfully restored 50 acres of plover habitat in the coastal strand in 2002-3 with restoration funds from the *Cape Mohican* oil spill and NPS sources. The following year four pairs of plovers successfully nested in the restored habitat (Peterlein 2004).

An additional component of the project includes continuing public education via a docent program at the Abbott's Lagoon Trailhead and other sites, targeting beach users and aiming to reduce human disturbance of nesting plovers and to increase compliance with restricted areas. Past experience has shown that public use of the beaches was impacting plover nest success, but that a docent program was successful in reducing the number of eggs and chicks lost due to disturbance (Ruhlen and White 1999; Abbott and Peterlein 2001). Maintaining this program will ensure that public disturbance does not compromise nest productivity in the restored area.

Budget

This project will build upon the previous pilot project and augment a larger NPS dune restoration project. The NPS has developed new methods for removal of non-native species that enable larger areas to be restored with long lasting results, and at cheaper costs than previously (J. Rodgers, pers. com.). Some of the monitoring costs will be offset by the Point Reyes National Seashore Association, which contributes annually to PRBO to monitor Snowy Plovers. Additionally, PRNS provides in-kind support in the

form of vehicles, housing, personnel time, volunteer habitat restoration actions, and office space. PRNS will continue management actions to protect plovers including the successful docent program to reduce disturbance, seasonal closures of areas on beaches where plovers nest, predator management and monitoring. The total cost of the project will be **$501,447**.

Scaling for Primary and Compensatory Restoration

As described above, the minimum total injury to Snowy Plovers was 150 lost bird-years. For restoration scaling, the Trustees relied on data from the pilot dune restoration project at PRNS, where 4 plover nests were found within the 50 acre restored area. The Trustees believe that a similar project would yield similar benefits. The Trustees calculated that a 30-acre project will generate approximately 107 percent of the bird-years required to offset the injury.

Appendix H provides additional details regarding the bird REA for this project.

Affected Environment

This project will be located at PRNS, which is described in section 2.0.

Environmental Consequences (Beneficial and Adverse)

This project will both enhance the natural dune habitat and improve nesting and foraging habitat for Snowy Plovers. By eliminating non-native vegetation, the dune habitat will return to a more natural state. Habitat restoration has several indirect and direct benefits to snowy plovers. Direct benefits include more habitat for foraging, nesting and raising chicks. Indirect benefits are more complex and include (1) more space to retreat from recreationists on beaches, (2) more space on beaches to forage and thereby avoid oiled patches along the intertidal zone, (3) more complex habitat (less linear) to avoid predators, and (4) protection from wind in back dune regions (high winds can bury clutches along highly linear beaches). Plovers are affected by any oil that washes ashore because they forage specifically along the intertidal zone of the shoreline where the oil typically deposits along with other marine debris. In areas where European beachgrass is absent, plovers are able to forage in the back dune also. Previous work at PRNS has shown that native vegetation has rapidly colonized restored areas.

A potential impact of this project is the temporary disturbance created by implementing the project, which requires the use of heavy equipment and the presence of many personnel on the beach. However, the Trustees have determined that this will not be a significant impact, as implementation of the project will be timed to avoid the plover nesting season and to minimize disruption to the birds.

Probability of Success

This project has a very high likelihood of success. Dune restoration projects have been successfully implemented at many sites along the west coast and within PRNS. Furthermore, a pilot version of this exact project was implemented along a portion of PRNS in 2002-3 and led to the successful nesting and rearing of chicks of Snowy Plovers within the project area. The Trustees expect that this project will produce similar positive

results. The NPS has also secured funds to restore another 300 acres of coastal dune over the next five years because of the success of the pilot project. This project will build upon the previous successful project and augment another project. The NPS has developed new methods for non-native plant removal using excavators that are more effective and require little follow up treatment (J. Rodgers, pers. com.).

Performance Criteria and Monitoring

This project will include monitoring of plover nesting areas and plover nests. The functioning of the protective fencing and the success of the nests will be documented. Successful fledging of chicks will be considered the goal of the project, but other measures will include number of nests in restored habitat, number of chicks reared in restored habitat, and number of total adult birds occurring in restored habitat. Additionally, restored areas will be monitored for native vegetation, particularly the federally endangered Beach Layia (*Layia carnosa*) and Tidestrom's Lupine (*Lupinus tidestromii*), and for the endangered Myrtle's Silverspot Butterfly (*Speyeria zerene myrtleae*).

Evaluation

The Trustees have evaluated this project against all initial and additional screening criteria developed to select restoration projects and concluded that this project is consistent with and meets the objectives of these selection factors. The Trustees determined that this type and scale of project will effectively provide appropriate compensation for injuries to Snowy Plovers that occurred as a result of the spills and have selected this project as a preferred alternative.

4.3.7 Other Shorebirds

Background

Shorebirds, colloquially referred to as "sandpipers," are found throughout the spill zone, predominantly in the winter months. Most species nest in alpine or Arctic tundra in Alaska and Canada, but migrate or winter along California beaches and mudflats. Some, such as the phalaropes, swim and forage on the water's surface, much like a duck.

One species, the Red Phalarope, accounts for 89 percent of the beachcast birds collected from this species group. This species breeds on coastal tundra around the Arctic Ocean and Bering Sea in summer, but is entirely pelagic the rest of the year. It occurs offshore of California in migration and in tropical and subtropical oceans in winter. Its preference for offshore waters and convergence zones associated with oceanic upwellings and current rips likely put it at greatest risk of oiling from the spills.

Conservation Issues

Because of its remote breeding locations and far offshore migration and wintering locations, little is known regarding the conservation concerns for the Red Phalarope. Several sources indicate a declining population, at least in some regions (Tracy et al. 2002). Ingestion of plastic particles at sea and disturbance at breeding grounds (locally) has been shown to cause problems.

Injury Calculations

A total of 47 shorebirds were collected during the spills that occurred between 1997 and 2003. Additional shorebirds were likely collected between 1990 and 1996, although species composition regarding collected birds is limited for this time period. The total estimated dead from all spills is 1,599. The high multiplier is a function of the small size and pelagic behavior of the Red Phalarope. Details on the number of birds collected during each spill event and the estimate of total mortality are in Appendix B and in Ford et al. (2006).

Realizing that Red Phalaropes will benefit from the restoration project providing benefits for waterfowl and loons (protection of Kokechik Flats, Alaska, described in section 4.3.2), the Trustees did not consider any restoration projects specifically for these shorebirds. Thus, lost bird-years were not calculated, as such quantification was not necessary for project scaling.

Species	Total Collected*	Total Estimated Dead
Sanderling	1	**1,599**
Red-necked Phalarope	2	
Red Phalarope	42	
Shorebird, sp.	2	
TOTAL	**47**	

* 1997-2003 only. Prior to 1997, data regarding the species composition of collected birds are limited.

Restoration Alternatives

The Trustees did not specifically research or select a restoration project for this species group because Red Phalaropes will benefit substantially from the restoration project providing benefits for waterfowl and loons.

PROJECT CONCEPT	BENEFITS
Nest Protection at Kokechik Flats, Alaska	**Red Phalarope (also waterfowl and Pacific and Red-throated Loons)**

Final Selected Project

Nest Protection at Kokechik Flats, Alaska

This project is described in the loon section above (section 4.3.2).

4.3.8 Common Murres

Background

Common Murres are seabirds resembling ducks or penguins (although they are capable of flight). They are related to puffins and are members of the alcid family. 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 offshore rocks or remote headlands along the coast from Alaska to central California. Figure 9 illustrates the major colony complexes in California, along with the number of birds counted from aerial photographs in summer 2003.

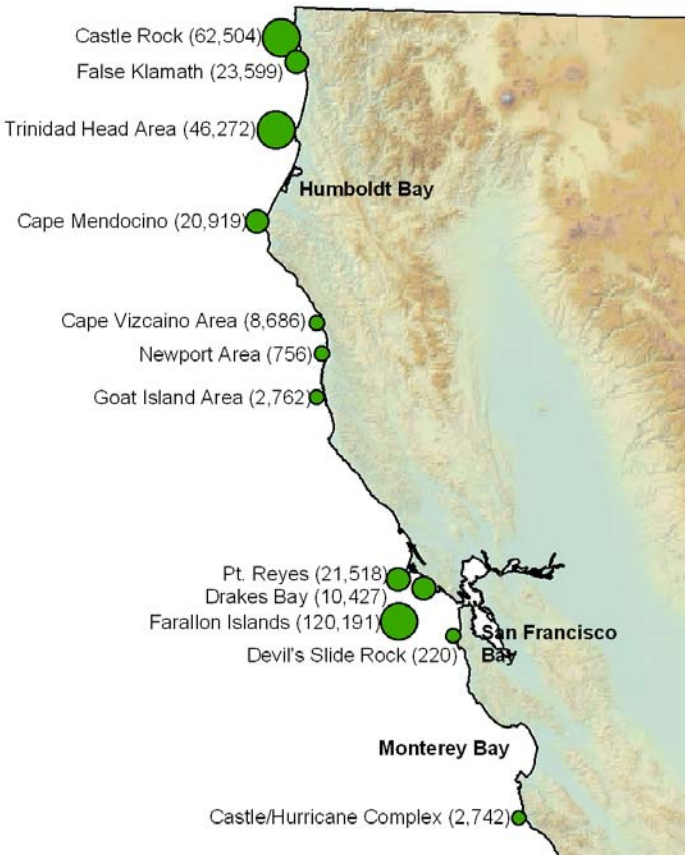
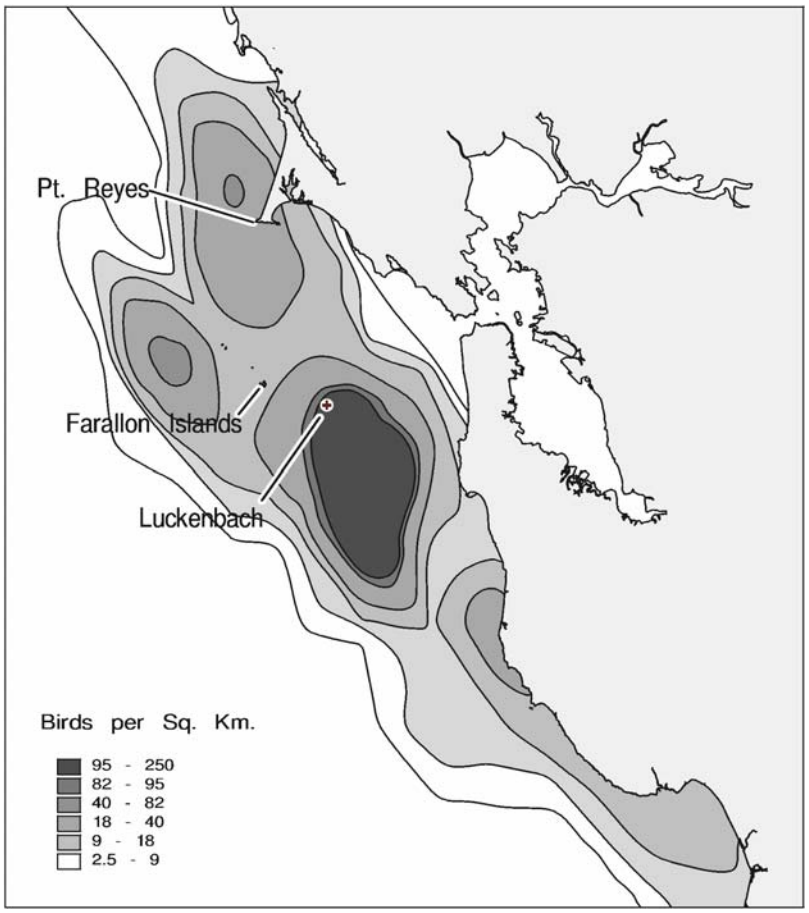


Figure 9: Common Murre Colonies in California.

The Common Murre winters in offshore waters, generally 5 to 30 miles offshore. Some birds will visit terrestrial breeding sites intermittently during the winter months. The murre was heavily impacted by the spills because the *Luckenbach* was located directly upwind of the area at sea where murres typically concentrate in winter months. The Common Murre accounts for 61 percent of all bird mortalities from the spills.



Source: Ecological Consulting (2001).

Figure 10: Common Murre at-sea densities, Nov-Feb, and location of *Luckenbach.*

Conservation Issues

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 islands. Since then, however, numbers have increased, although with some major setbacks due to oil spills and gill-netting, particularly in the mid-1980s (Page et al. 1990). Today, with gill-netting, hunting, and egging eliminated, the murre population throughout the state is steady or increasing on a long recovery towards historical levels. Because alcids are among the longest-lived (around 25 years) and slowest reproducing of all birds, laying only one egg a year (if they nest at all), recovery will continue to take many decades. One of the main conservation concerns facing murres in California is disturbance of nesting colonies by aircraft and boats. Such disturbance events cause birds to flush and allow gulls and ravens to come in and predate the eggs or chicks left at the colonies. At some colonies, excessive raven predation is also an issue.

Injury Calculations

A total of 3,865 Common Murres were collected during the spills that occurred between 1997 and 2003. Additional birds were collected between 1990 and 1996, although species composition regarding collected birds is limited for this time period. The total estimated dead from all spills is 31,806. Details on the number of birds collected during each spill event and the estimate of total mortality are in Appendix B and in Ford et al. (2006).

Species	Total Collected*	Total Estimated Dead	Total Lost Bird-Years
Common Murre	3,865	31,806	1,857,471

* 1997-2003 only. Prior to 1997, data regarding the species composition of collected birds are limited.

These lost bird-years represent the interim losses between the time of the spills and return of this population to pre-spill conditions. Thus, restoration projects benefiting this species should seek to replace **1,857,471** lost bird-years. Details regarding the injury modeling are presented in Appendix I.

Restoration Alternatives

Several potential restoration actions would benefit Common Murres. The Trustees relied upon the experiences of several projects already under way in California and Oregon, as well as meetings with other experts, to identify potential projects. Five projects considered for benefiting murres are listed in the table below.

PROJECT CONCEPTS	BENEFITS
Common Murre Colony Protection Project	**Common Murres**
Corvid Management at Point Reyes National Seashore	**Common Murres**
Reading Rock Common Murre Colony Restoration	**Common Murres**
Land acquisition at Cape Viscaino	Common Murres
Extending Devil's Slide Rock Murre Restoration Project	Common Murres

The Trustees have selected the three projects listed in bold as preferred. The murre colony protection project will provide the most benefits, protecting several of the largest colonies in the state from human disturbances. The corvid management at Point Reyes, consisting primarily of implementing land use changes at ranches at Point Reyes National Seashore, will protect an important murre colony from excessive depredation by ravens. Finally, the Reading Rock project, in northern California, already has partial funding. This proposal will contribute the remaining funds needed to allow the project to be implemented. With regard to the non-preferred projects, the feasibility of land acquisition at Cape Viscaino is uncertain. Moreover, at present those colonies are increasing and are not threatened with development. The Devil's Slide Rock project, created and funded from damages collected as a result of the *Apex Houston* oil spill, has been successful and needs little additional work.

Final Selected Project

Common Murre Colony Protection Project

The primary goal of this project is to improve the breeding success of the Common Murre by reducing disturbance events at their breeding colonies.

Breeding seabirds, particularly species like the Common Murre that nest on cliffs or offshore rocks, are highly susceptible to negative impacts caused by human disturbance (Manuwal 1978, Anderson and Keith 1980, Carney and Sydeman 1999, Thayer et al. 1999). When disturbance events occur in seabird colonies, the birds may flee from their nests, leaving their eggs and chicks unprotected from predators and adverse weather conditions. Ravens, gulls, and other predators may quickly move in and predate large numbers of eggs and chicks within a short time (e.g., less than an hour). Eggs and chicks can also be accidentally knocked off rocks by flushing events, or moved into another bird's territory where they may be attacked or killed. Disturbance also disrupts courtship, nest site defense, and colony prospecting, and can lead to site or colony abandonment before egg-laying even occurs.

Human disturbance in California takes numerous forms and includes, but is not limited to, disturbance by low-flying aircraft (private, commercial, and governmental), commercial and recreational fishing boats, sea kayakers, sport divers, surfers, hang gliders, ultralights, and human entrance onto colonies (Rojek and Parker 2000, Parker et al. 2001, Ainley et al. 2002). Due in part to insufficient agency attention and complex jurisdictional boundaries and the remoteness of sites, human disturbance threats have not been addressed or resolved through coordinated programs and remain one of the major impediments to the recovery of the Common Murre. Reduction of anthropogenic disturbance is essential for the complete recovery of the seabird colonies in central California (Parker et al. 2001).

The goal of this project is to reduce disturbance by implementing an educational program involving signs, buoys, and outreach materials designed to educate recreational and commercial users of the coast about the presence of nesting and roosting seabirds and ways to avoid disturbing these sensitive seabirds. In addition, this project will also include outreach to the Federal Aviation Administration, U.S. Coast Guard, and other agencies to educate their pilots about the sensitive nature of seabird colonies and their locations along the central California coast with the goal of reducing inadvertent disturbance of colonies. Coordination with enforcement officers from various agencies will also be part of the project. This project is modeled after a similar successful effort in Oregon and will build on a pilot project in California funded by the *Command* Oil Spill Trustee Council. Information on the pilot project is available at http://www.farallones.noaa.gov/ecosystemprotection/seabirdprotect.html. This project will last for 20 years.

While the project must necessarily have a regional focus in order to educate boaters and pilots, there are five complexes of colonies that will receive special focus: the Farallon Islands, Point Reyes, Drake's Bay, Devil's Slide Rock, and CastleRock/Hurricane Pt. Figure 11 provides a map of these colony locations, with the number of murres counted by the USFWS in summer 2003. This project will seek to protect these colonies during the pre-breeding and breeding season. Significant disturbance events have been recently documented at most of these colonies.

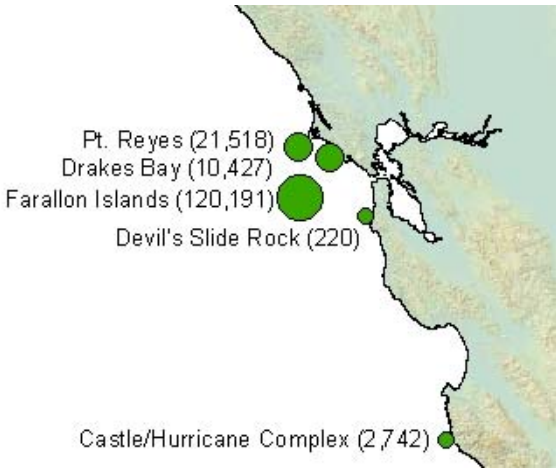


Figure 11: Common Murre Colonies within Project Area.

Specifically, some of the project elements include:

- Erecting signs at coastal launching ramps to educate sport and commercial fishermen, kayakers, surfers, and others about the sensitivity of nearby seabird colonies. Specially produced pamphlets will be distributed through marine supply stores and sporting goods stores.

- Placing anchored buoys with warnings around key colonies seasonally to establish protection zones and placing signs on selected offshore rocks and sensitive coastal trails. The goal is to protect a small buffer (e.g., ¼ mile) around the colonies described above for a few months during the breeding season.

- Continuing public outreach to promote awareness of seabird conservation needs will be accomplished through seasonal presentations to community groups and schools.

- Developing presentations for U.S. Coast Guard pilots, Highway Patrol, military pilots, and general aviation and ultra-light pilots to increase awareness and promote conformance with Department of Fish and Game Code Sections, National Marine Sanctuary regulations, and USFWS regulations prohibiting low altitude flights over State Ecological Reserves and Marine Sanctuaries. These presentations will be repeated regularly for all agencies because of staffing turnovers. Measures will be taken to encourage that aeronautical charts contain current information about altitude restrictions over sensitive colony sites. Project staff will monitor annual events involving aircraft, such as the Big Sur Marathon.

- Exploring the technical feasibility of video surveillance at key colonies.

- Developing wildlife interpretive programs and materials to promote public awareness and using these materials to provide seabird viewing opportunities at selected coastal vantage points.

- Educating sport fishing charter boat crews to encourage party boats to maintain an appropriate distance from colonies and to advise them on ways to reduce hooking and entanglement conflicts.

- Restoration project staff will coordinate with staff from the BLM California Coast National Monument, CDFG, National Marine Sanctuaries, PRNS, USFWS, California Coastal Commission, State Parks, and the California Coastal Conservancy to work towards accommodating the protection needs of seabird colonies and roost sites and in planning activities for public coastal access.

- Improving surveillance at key colonies to identify unauthorized actions, measure potential impacts upon the colonies, and prioritize future project actions. Coordination between the project staff and CDFG, USFWS, NPS, BLM and NOAA agents will promote more effective enforcement of state and federal regulations. Project staff will also explore the possibility of providing funds for additional enforcement time at select colonies.

- Monitoring compliance by the public and implementing appropriate modifications if necessary.

In addition to the outreach and education component, the program also includes a comprehensive adaptive management program. The results of each year of the project will be analyzed and evaluated prior to the next year's actions. At that time the program will consider alterations and improvements to existing components as well as augmenting the program with additional measures. One additional measure that will be evaluated and considered in the future is the limited removal of problem ravens as needed, primarily at the colonies shown in Figure 11 above. If this measure is determined to be appropriate it will be conducted in accordance with applicable environmental requirements, including a MBTA permit.

Budget

This project will cost approximately $563,207/year for outreach and education, buoy maintenance, surveillance, and monitoring. To fund the project for 20 years, the total cost (in 2007 dollars) will be **$9,526,603** (future years have been discounted to account for interest earned at an annual rate of 1.5% above inflation). Costs are based upon the pre-existing pilot project and similar work conducted on behalf of the *Apex Houston* Trustee Council.

Scaling for Primary and Compensatory Restoration

This project was scaled using a population model of the central California murre population, comparing the benefits of increasing nest success to the loss of breeding birds associated with the oil spills. Specifically, the modeling shows that a project that lasts 20 years, and increases fecundity by 5 percent, would compensate for 38 percent of the injuries to this species from the spill. Two other projects (described below) will seek to address the remaining injury.

Appendix I provides additional details regarding the bird REA for all projects associated with the Common Murre.

Affected Environment

This project will be located throughout the impacted area (from Pt. Sur to Pt. Reyes), which is described in section 2.0.

Environmental Consequences (Adverse and Beneficial)

The actions implemented by this project will increase public awareness of seabird habitat requirements and educate the public about the potential impacts of seabird/human interactions. By educating the public in ways to safely observe seabirds while engaged in recreation, the Trustees can reduce the impacts of disturbance to nesting populations of Common Murres and other seabirds, thereby aiding in the recovery of these populations to historical levels. Disturbance caused by planes, helicopters, and kayakers are known to have resulted in eggs and chicks being lost, and adult abandonment, from Common Murre colonies in central California. Decreasing or eliminating these disturbances will likely have a direct impact on the reproductive output of these colonies.

In addition, this project may benefit Brown Pelicans and other seabird species by enhancing important non-breeding habitat. Although Brown Pelicans do not breed in this area, this project will protect some coastal roosts along the California mainland. Improvements in the existing network of communal roosts along the coast will have a positive influence on the energy budgets of pelicans and other seabirds by reducing energy costs associated with: (1) commuting between foraging areas and roosts, (2) flushing and relocating due to human disturbance, and (3) use of suboptimal microclimates within roosts. Pelicans migrating along the California mainland will also benefit from increased availability, quality, and capacity of stopover sites. Additionally, some cormorants nest among or in the vicinity of the murre colonies and will also benefit from colony protection.

This proposed action is not expected to result in any significant adverse impacts. The restriction of recreational activities around sensitive areas may be perceived by some to limit the enjoyment and scope of the public's recreational experience. However, given the small number of seabird colonies in the region and the limited nesting season, the actual size and time of any restrictions is expected to be minimal. Wherever these colonies are located, there exist similar recreational opportunities nearby that do not have seabird colonies and that may be utilized by anglers, kayakers, and other ocean users. Signs used in any of the above projects will be carefully designed and placed so as not to detract from the natural aesthetics of any area.

Probability of Success

The Trustees expect this project will mirror the success of the similar Oregon project to protect nesting seabirds at Three Arches National Wildlife Refuge. Monitoring during the breeding season following the implementation of the disturbance reduction program

(using a 500-foot buffer closure during the breeding season) revealed a 39 percent reduction in disturbance events (Reimer and Brown 1997).

Performance Criteria and Monitoring

The impact of the program will be monitored through ground-based surveys in conjunction with the surveillance for disturbance events. Monitoring methods will build upon those developed by the *Apex Houston* Trustee Council project and will include the following:

- Seabird population size, breeding success, and attendance patterns at colonies and roosts will be monitored before and during implementation of the project to evaluate effectiveness and guide project efforts.

- The types and degree of human disturbance throughout the restoration area will be documented in order to identify specific colonies and roost sites that require specific protection and educational outreach efforts, and to measure levels of annual change in disturbance levels.

Evaluation

Implementation of this project should result in positive benefits to Common Murres by reducing the impact of human disturbance to their nesting colonies. The Trustees have evaluated this project against all threshold and additional screening criteria developed to select restoration projects and concluded that this project is consistent with and meets the objectives of these selection factors. The Trustees determined that this type and scale of project will provide appropriate compensation (in part) for the Common Murres injured as a result of the spills and have selected this project as a preferred alternative.

Final Selected Project

Corvid Management at Point Reyes National Seashore

The Common Murre colonies at the Point Reyes Headlands are one of the largest colony complexes in California, with over 20,000 pairs. However, these colonies have been subject to regular egg and chick predation by Common Ravens (Knechtel et al. 2003). Moreover, some of the smaller sub-colonies have been abandoned after raven predation events (Roth et al. 1999; McChesney, pers. comm.). Ravens have been observed working in pairs. For example, while one raven shoves a murre off its egg, or pulls its tail, the other raven takes the egg. For several recent years for which data are available, Common Murre nest productivity at study plots in the Point Reyes Headlands has been less than that of murre colonies at the Farallon Islands or at Devil's Slide Rock (Parker et al. 2000; Parker et al. 2001; Knechtel et al. 2003). High levels of nest predation by ravens appear to be a primary factor.

A recent raven telemetry study at Point Reyes National Seashore (PRNS) demonstrated that the ravens responsible for the colony predation are strongly affiliated with nearby cattle ranches, where they feed on grain and carcasses from ranch operations (Roth et al. 1999). The ranches, which are dairy farms with free range cattle, pre-date the national seashore and continue to function under lease agreements made during the creation of

PRNS. Raven densities around these ranches are the highest in the Bay Area (Kelly and Etienne 2002) and possibly the state. The telemetry report describes the ravens as "subsidized" predators: their populations are inflated by anthropogenic food sources, which in turn lead to unnaturally high levels of predation on other species (e.g., the Common Murre). The report concludes that "changes in land-use practices… preventing ravens' access to food resources at ranches may be the most viable and lasting way to reduce numbers of ravens."

This project seeks to implement the recommendation of the telemetry report with regard to land management, as well as other components of PRNS's raven management efforts. The project will be implemented by PRNS. Specifically, this project will include the following components:

- Development of voluntary land management alternatives at dairy ranches (e.g. reduced silage acreage, reduced cattle, and/or changes in cattle feeding practices); and
- Removal of non-native trees near the head of Drake's Estero that are used by over 400 roosting ravens.

As a form of adaptive management, the possible removal of certain ravens known to specialize in depredation of murre colonies will be evaluated and considered after the project implementation has commenced. The specific method of raven removal and any required permits or environmental compliance will be completed by the implementing agency (PRNS).

Budget

Sufficient funds to compensate ranchers for changes in land use will be required to implement this project. Thus, the cost is subject to negotiations with willing participants; no specific terms have been agreed upon at this time. The costs of the tree and raven removal, which can be estimated with greater certainty, are relatively small components of the total project cost. Based on current knowledge of the value of the dairy operations, the Trustees estimate that **$500,000** may be necessary to implement the entire project.

Scaling for Primary and Compensatory Restoration

As described above, the injury to Common Murres was calculated using a population model of the central California murre population. This project, which may increase nest success approximately 10 percent at the Point Reyes Headlands, would compensate for 21 percent of the injuries to this species from the spill. Two other projects (described above and below) address the remaining injury.

Appendix I provides additional details regarding the bird REA for all projects associated with the Common Murre.

Affected Environment

This project will be located at PRNS, which is described in section 2.0.

Environmental Consequences (Adverse and Beneficial)

By restoring ranchland at PRNS to a more natural system, the Trustees can reduce the raven population to more natural levels and thereby reduce predation of Common Murre eggs and chicks. This, in turn, will help speed the recovery of the murre population to historical levels. Predation by ravens is known to have a negative impact on the Common Murre nesting colony at Point Reyes. Decreasing or eliminating this predation will likely have a direct impact on the reproductive output of this colony.

In addition, this project will benefit other species and the habitat as a whole. Several other species of seabirds nest at Point Reyes Headlands that may also benefit from raven reduction. These include cormorants, Black Oystercatchers, and Pigeon Guillemots. To the extent that dairy operations are modified, other benefits include reduced erosion, improved water quality, and native habitat recovery.

Snowy Plovers at PRNS are also subject to high levels of raven predation. The Trustees examined the extent to which this project may simultaneously benefit plovers. Raven telemetry studies have identified that most of the ravens that depredate plover nests originate from northern Point Reyes (i.e., the McClure's and Abbotts Lagoon region). Unfortunately, land-use changes in that region are not feasible at this time. Thus, this project will likely have a minimal effect on those ravens and provide minimal benefits to Snowy Plovers.

This proposed action is not expected to result in any significant adverse impacts. The Monterey pine trees to be removed are from an old Christmas tree farm. They are located adjacent to Home Bay within Drake's Estero. Their removal is consistent with PRNS goals and ongoing efforts. Under any scenario, the houses and cypress trees associated with the ranches at PRNS will remain, as these are historical landmarks. The historical trees around the ranch houses also provide shelter for migrating birds, as well as significant recreation value for birdwatchers, as these trees are well-known for attracting species that are not usually found in the western United States. This project will not affect those trees.

To the extent that cattle feed is removed, birds that frequent the cattle feed will be forced to forage elsewhere. While this intentionally includes Common Ravens, it may also include others, such as Brewer's, Red-winged, and Tricolored Blackbirds, and various species of sparrows. However, such impacts are expected to be minor because all of these species will find similar habitat at other dairy ranches at PRNS or elsewhere in Marin County that are not included in this project and are farther from the murre colonies.

It is possible that removal of a few ravens that specialize in murre colony depredation will become necessary to supplement the other activities, although this is a deferred component of the project. Given that ravens are abundant in California, any such small-scale removal will not adversely impact any regional raven populations. Because ravens are protected under the Migratory Bird Treaty Act, appropriate permits from the USFWS Migratory Bird Permit Office are required prior to any raven removal. It will be the

responsibility of PRNS to secure any necessary permits and to comply with other applicable environmental requirements.

Probability of Success

Because of the telemetry study, the Trustees have a detailed understanding of raven behavior, territories, and movements at PRNS. This will enable PRNS to target efforts in the most effective ways, with a clear understanding of the likely impact on ravens and murres. A key component of this project involves reaching agreements with local ranchers on changes in land use and feeding practices. Assuming that can be done, the Trustees expect this project to be successful and for raven predation at the murre colony to substantially decrease.

Performance Criteria and Monitoring

The impact of the program will be monitored through surveys for the Murre Colony Protection Project described above. Thus, the monitoring for that project will simultaneously cover this project as well.

Evaluation

Implementation of this project should result in positive benefits to Common Murres by reducing the impact of raven predation on their nesting colonies along the Point Reyes Headlands. The Trustees have evaluated this project against all threshold and additional screening criteria developed to select restoration projects and concluded that this project is consistent with and meets the objectives of these selection factors. The Trustees determined that this type and scale of project will provide appropriate compensation (in part) for the Common Murres injured as a result of the spills and have selected this project as a preferred alternative.

Final Selected Project

Reading Rock Common Murre Colony Restoration

This project will restore a depleted Common Murre colony on Reading Rock (also spelled 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. Common Murres nest on the rock, and California and Steller Sea Lions haul out on the rock. While murre numbers at most colonies in northern California have been stable or increasing, Reading Rock is a notable exception. Numbers of breeding murres were variable between 1979 and 1989 (ranging from 800 to 2,100 birds; Carter et al. 2001) but have declined since 1995. By 2002, numbers were reduced to less than a hundred birds (G. McChesney, pers. comm.).

The depletion of the colony is thought to be a result of the following: human disturbance by U.S. Coast Guard (USCG) personnel servicing an 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.

Figure 12: Reading Rock viewed from above. The dark brown objects are California Sea Lions.

Restoration actions may include:

- Cooperation between USCG, FAA, CDFG, and other state and federal agencies, as well as the Yurok Tribe, to prevent human disturbance of murres during the nesting season (possibly including restrictions on landing and low overflights and the installation of buoys to mark boat closures within approximately 200 m of the rock);
- Use of social attraction techniques (e.g., decoys, recorded vocalizations, and mirrors) to attract murres to Reading Rock (especially recent breeders that are more likely to rapidly re-colonize);
- 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 Reading Rock would assist their effectiveness).

The education and outreach regarding disturbance at the rock may also include other murre breeding rocks in the vicinity.

Budget

The total cost is estimated at $1,200,000, assuming social attraction will be employed. However, approximately $950,000 is expected to come from other sources of funding. The total project cost associated with this plan is estimated at **$225,307**.

Scaling for Primary and Compensatory Restoration

For restoration scaling, the Trustees relied on data from the Devil's Slide Rock Common Murre Recolonization Project off the Central California coast. This project has many similarities to the Reading 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 used are similar. Using data from the first nine years (1996-2004) of the Devil's Slide Rock project (Knechtel et al. 2003), and assuming continued growth (at

5% per year) in colony size until maximum colony size (1,800 nests) is reached, such a project would generate 53,772 additional bird-years over the course of 100 years. Given that this project will contribute 19 percent of the funding, 19 percent of the gained bird years (i.e., 10,217 bird-years) are credited toward compensating for the injuries from the spills.

Appendix I provides additional details regarding the bird REA for all projects associated with the Common Murre.

Affected Environment

This project will be located at Reading Rock in Humboldt County, which is described above. The general marine environment is similar to the impacted area, described in section 2.0. Reading Rock is also of cultural importance to the Yurok Tribe, which traditionally hunted sea lions there. Today, the Yurok Tribe and BLM have a Stewardship Agreement regarding cooperation in management of the rock.

Environmental Consequences (Adverse and Beneficial)

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. Education of government agencies and the public will also be achieved as part of this project, which may lead to greater awareness regarding human disturbances at other seabird colonies in the vicinity.

This proposed action is not expected to result in any significant adverse impacts. 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. Sea lions will continue to have access to much of the lower reaches of the rock, where the majority of them haul out. Any restriction of recreational fishing around the rock will be small and limited to the nesting season. 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.

Probability of Success

Social attraction techniques (e.g., the use of decoys) to reestablish a murre colony have been successfully used in central California (McChesney et al. 2005). This project will replicate those techniques. Because murres have used Reading 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 draw on materials and methods developed for a successful human disturbance reduction project in Oregon (and described in the Common Murre colony protection project above).

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.

Performance Criteria and Monitoring

The project will include 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. This is a standard method for documenting murre breeding population sizes. The use of a remote video-based monitoring approach may be evaluated as well.

Evaluation

Implementation of this project should result in positive benefits to Common Murres by restoring a depleted nesting colony. The Trustees have evaluated this project against all threshold and additional screening criteria and concluded that this project is consistent with and meets the objectives of these selection factors. The Trustees determined that this type and scale of project will provide appropriate compensation (in part) for the Common Murres injured as a result of the spills and have selected this project as a preferred alternative.

4.3.9 Marbled Murrelets

Background

The Marbled Murrelet is a small 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 (*Sequoia sempervirens*) greater than 200 years old (Nelson 1997). Like most alcids, the Marbled Murrelet is a long-lived slow-reproducing species, laying only one egg per year.

Conservation Issues

The Marbled Murrelet is listed as a federally threatened and state endangered species. The North American Waterbird Conservation Plan considers it a species of "high concern," while the National Audubon Society has placed it on its "red list." In California, fewer than 5,000 birds nest in Humboldt and Del Norte Counties, while a small population of approximately 500 birds nests in the Santa Cruz Mountains south of the San Francisco Bay area.

Figure 13: Marbled Murrelet breeding range in California.

Excessive timber harvest in nesting habitat was the primary reason for listing the species (Miller et al. 1997). In addition to logging, potential causes of murrelet decline include nest predation by corvids (ravens, jays) and other predators, oil spills; marine pollution, and possibly prey availability as a function of oceanographic events (Miller et al. 1997; Nelson 1997). Predation of eggs and chicks by corvids (e.g. ravens and jays) is a major cause of nest failure (Nelson and Hamer 1995; Nelson 1997, Peery et al. 2004). Nelson and Hamer (1995) further predict that even small increases in predation can have deleterious effects to population viability due to the murrelet's low reproductive rate.

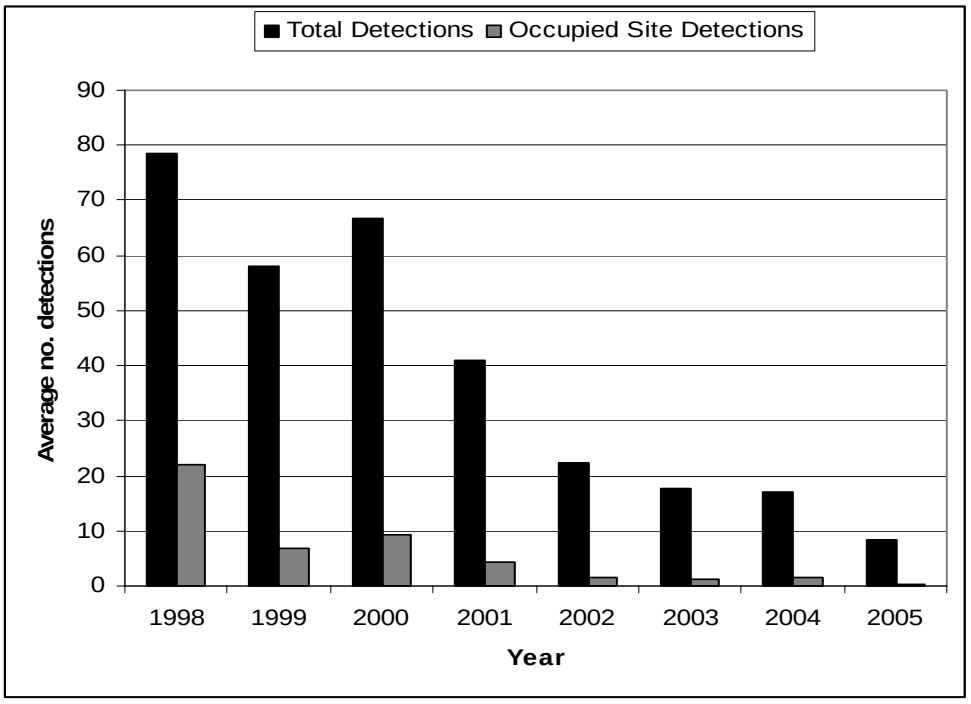


Figure 14: Average number of Marbled Murrelet detections on dawn surveys at Redwood Meadow/Big Basin State Park Headquarters for 1998-2005.

In the Santa Cruz Mountains, the decline in murrelets at certain breeding sites has been pronounced. At-sea surveys have shown relatively stable population numbers, although very few juveniles were present (Peery et al. 2005).

The reason for the current decline is thought to be low reproductive success, likely compounded by low reproductive effort during years when foraging conditions are poor. Marbled Murrelets lay a single egg per year, though they may re-nest if they suffer an early nest failure. Recent studies of the Santa Cruz Mountain population suggest that reproductive success has fallen to near zero. Peery et al. (2005) estimates annual fecundity at 0.04, implying that only 4 young are produced per 100 pairs each year. Given that the species' adult annual survival rate is likely between 87 percent and 90 percent (Peery et al. 2005), the Santa Cruz Mountain population, without immigration from other populations, will be extirpated within 25 years. The most recent review of the species, requested by the USFWS, concluded that there was a 100 percent chance that the Santa Cruz Mountain sub-population would be extinct within 40 years, given current trends (McShane et al. 2004).

In an effort to counter current trends, several Trustee agencies have implemented a corvid management program to improve murrelet nest productivity (*Command* Trustee Council 2004; see also *Stuyvesant* Trustee Council 2004). Preservation of old growth habitat in the Santa Cruz Mountains also remains a conservation goal. In some cases, murrelet nesting habitat in private lands is especially important because it is located far from campgrounds and may have lower corvid densities.

Injury Calculations

A total of 3 Marbled Murrelets were collected during the spills that occurred from 1997 to 2003. Another oiled bird was sighted during this period but was unable to be captured. It is not known if additional birds were collected from 1990 to 1996 because species composition regarding collected birds is limited for this period.

Because so few birds were collected, the results of the Beached Bird Model are subject to considerable uncertainty. Instead, the Trustees relied upon a Swept-Through Model that estimated the number of oiled birds from the number of birds that were present in the path of the oil. Extensive aerial and boat surveys for this species provided the data for the number of birds in the area. The estimated oiling rate for Marbled Murrelets (i.e., the percentage of birds in the path of the oil that are likely to become oiled) was extrapolated from data on Western Grebes. Western Grebes occur in large numbers in the same regions of the ocean as Marbled Murrelets (usually outside the breaking waves but within 5 km of the shore). This is an important consideration, given that the source of the oil was far at sea. By the time the oil drifted into the areas of Western Grebe and Marbled Murrelet concentrations, it had spread into widely dispersed tar patties, thus reducing the oiling rate for these nearshore species. The surveys for Marbled Murrelets also recorded grebes, providing data on their numbers in the vicinity. Because so many grebes were collected, the Beached Bird Model provided a reasonable estimate of the proportion of grebes impacted in the area. This proportion was then applied to the number of Marbled Murrelets in the area. The total estimated dead from all spills is 45. Details on the number of birds collected during each spill event are in Appendix B and in Ford et al. (2006).

Lost bird-years were calculated relying on the demographic characteristics of the Marbled Murrelet (e.g., annual survival, reproductive success), focusing on data from the Santa Cruz Mountains population when possible. See Appendix J for details. Because Marbled Murrelets are a declining species, the Trustees applied specialized population model to calculate lost bird-years.

Species	Total Collected*	Total Estimated Dead
Marbled Murrelet	3	45

* 1997-2003 only. Prior to 1997, data regarding the species composition of collected birds are limited.

Lost bird-years were calculated within the model simultaneously with restoration project benefits (gained bird-years). Because multiple simulations of the model were used (i.e., Monte Carlo simulations), there is no single estimate of lost bird-years.

Restoration Alternatives

Although many potential projects to restore Marbled Murrelets have been suggested over the years, few have been tried, largely due to feasibility concerns. The primary goal by Trustee agencies has been the protection of nesting habitat via acquisition of old-growth forests in danger of being logged. Additionally, there are some projects that seek to minimize corvid predation of murrelet nests by managing corvid populations around

human habitations and campgrounds. The table below lists the restoration concepts considered by the Trustees.

PROJECT CONCEPTS	BENEFITS
Old-growth Forest Acquisition and Protection	**Marbled Murrelet**
Corvid Management in the Santa Cruz Mountains	**Marbled Murrelet**
Silviculture of second growth forest to create nesting habitat	Marbled Murrelet
Captive breeding	Marbled Murrelet
Artificial nest platforms	Marbled Murrelet

The Trustees have selected two projects as preferred: The corvid management program will extend a current project with limited funds, and the old growth acquisition project will seek to protect important murrelet nesting habitat. Both of these projects have been identified by experts as critical to the survival of the species in central California (see discussion of public comments regarding this issue in Appendix N). The silviculture project was not selected because it would not begin to provide benefits for over a hundred years. By this time, much other second-growth habitat, already in conservation hands, should be suitable for murrelet nesting. Captive breeding and a project to create artificial nest platforms were not selected because these actions have never been done with this species and have large feasibility concerns.

Final Selected Project

Old-growth Forest Acquisition and Protection

The goal of this project is to protect and enhance nesting habitat of the Marbled Murrelet in the Santa Cruz Mountains of central California. The status of the Marbled Murrelet in the Santa Cruz Mountains is explained in detail in the Corvid Management Project description below. In that section, it is noted that historic logging of old growth redwoods has severely reduced available nesting habitat in the Santa Cruz Mountains. This habitat loss has severely restricted the number of Marbled Murrelets that this region can support. Moreover, the habitat loss has caused the remaining Marbled Murrelets to nest in smaller and more marginal parcels, possibly subjecting them to greater nest predation and lower fecundity. Although the Corvid Management Project aims to address immediate needs and recent trends regarding nest productivity, this project focuses on the long-term needs of the species to have suitable nesting habitat. Protection of old growth forest is recommended as a primary goal toward the long-term survival of the Marbled Murrelet in the Santa Cruz Mountain (Baker et al. 2005).

Given that habitat loss is a major cause of the long-term decline of Marbled Murrelets in the Santa Cruz Mountains, this project will protect and enhance Marbled Murrelet nesting habitat through the acquisition and management of up to 140 acres of forest land that supports nesting Marbled Murrelets. Surveys indicate that there are no remaining parcels in private hands that contain 100 percent virgin old growth. However, there are some parcels that contain some uncut old growth suitable for Marbled Murrelet nesting and that have been confirmed to host Marbled Murrelets. A recent study of murrelet nests in the Santa Cruz Mountains found that 24 percent were on private property (Baker et al. 2005).

This project has no pre-identified parcels selected for acquisition and protection. Based on current research and the past experiences of other oil spill trustee councils, opportunities to acquire property containing Marbled Murrelet nesting habitat are extremely limited and unpredictable. This lack of availability is due to a number of factors. These include, for example, the highly specialized nature of habitat (e.g., old growth forests), limited suitability of location (e.g., sufficiently near current populations of Marbled Murrelets to serve as breeding habitat) and infrequency with which such properties are made available for acquisition (e.g., willing sellers). Working within these limitations, this project seeks to set aside funds from the NPFC for a period of five years for the purpose of acquiring appropriate habitat. Should land with suitable Marbled Murrelet nesting habitat become available, the Trustees will use the funds to acquire and protect the land. Should the five years elapse with no acquisition opportunities, the project will be deemed infeasible and the funds returned to (or remain with) the NPFC. The five-year period shall begin upon NPFC approval of this project.

Should suitable land become available, the funds may be used for the following tasks: (1) acquisition of fee title or conservation easement by a Trustee agency or other entity in accordance with habitat management guidelines for managing the parcel to protect and enhance Marbled Murrelet habitat; (2) development of the habitat management guidelines; (3) periodic monitoring of the habitat to ensure that all management guidelines are implemented and enforced and for the presence of murrelets; and (4) enforcement of the management guidelines and/or terms of the conservation easement, as necessary.

Budget

The Trustees have estimated the cost for this project to protect 140 acres. Assuming an average acquisition cost of $12,000/acre, plus $50,000 for five years of monitoring and $15,000 for the development of a habitat management plan, the total cost of this project will be **$1,745,000**. Changing land values may necessitate a revised budget in the future.

Scaling for Primary and Compensatory Restoration

This project was scaled using a population model of the Santa Cruz Mountains Marbled Murrelet population, examining the benefits of protecting nests from logging or other incompatible uses. To account for uncertainty in some parameters, the model used multiple simulations (i.e., a Monte Carlo approach) to explore the range of results from a range of parameters. The results (between the 25^{th} and 75^{th} percentiles) show that 5.7 to 7.7 nests should be protected to compensate for the injury. Assuming an average of 20 acres/nest (Conroy et al. 2002), 114 to 154 acres of nesting habitat would be needed. The Trustees' goal is to protect 140 acres. Appendix J provides additional details regarding the bird REA for this project.

Affected Environment

This project will be located in the Santa Cruz Mountains, immediately inland from the impacted area described in section 2.0. The Santa Cruz Mountains rise from the Pacific Coast in southern San Mateo and northern Santa Cruz Counties. The entire mountain range is approximately 80 miles long and 10 to 20 miles wide, with a maximum elevation

of 3,806 feet at Loma Prieta Peak. The habitats include mixed coniferous forests (including Coast Redwood and Douglas-Fir) as well as riparian corridors and some open grassland. Much of the forests have been historically logged, such that relatively little old growth forest remains. Although much of the range is protected by state and county parks or is otherwise undeveloped, there are small towns, roads, and a scattering of homesteads, private and public campgrounds, and retreat centers located throughout the range. Many parts of the range have been declared critical habitat for the Marbled Murrelet.

Environmental Consequences (Beneficial and Adverse)

This project will protect nesting Marbled Murrelet habitat and guarantee that it remains in existence into the future. Because the project focuses on the entire habitat, all other species associated with old growth forests should benefit as well.

This proposed action is not expected to result in any significant adverse impacts. Given that only parcels currently in private hands will be considered, there are currently no public uses and thus there will be limited adverse impacts to recreational uses.

Probability of Success

The success of this project is uncertain because it depends on the availability of suitable land from a willing seller. Although the number of privately-held parcels is not high, there are several potential parcels with suitable habitat. The Trustees are optimistic that some protection can be achieved over a five-year period. Once acquisition is achieved, the likelihood of success in protecting murrelet nests is quite high. Such land acquisitions have been done in the past (e.g., by the *Apex Houston* and *Command* Oil Spill Trustee Councils) and such lands remain protected and still contain nesting Marbled Murrelets (see discussion of public comments regarding this issue in Appendix N). There is no reason to expect Marbled Murrelets to abandon suitable nesting habitat.

Performance Criteria and Monitoring

If acquisition is achieved, the land will be monitored annually for several years for the presence of Marbled Murrelets, as well as for the status of the habitat and the implementation of the habitat management guidelines.

Evaluation

Habitat acquisition is an effective and practical method to achieve the restoration of injured Marbled Murrelets. However, opportunities to acquire property containing Marbled Murrelet nesting habitat are extremely limited and make opportunities for Marbled Murrelet habitat acquisition unpredictable.

The Trustees have evaluated this project against all threshold and additional screening criteria and concluded that this project is consistent with and meets the objectives of these selection factors. The Trustees determined that this type and scale of project will effectively provide appropriate compensation (in part) for Marbled Murrelets injured as a result of the spills and have selected this project as a preferred alternative.

Final Selected Project

Corvid Management in the Santa Cruz Mountains

This project is designed to extend a current project to increase Marbled Murrelet productivity in the Santa Cruz Mountains by managing corvid populations (i.e., ravens and jays) in certain campgrounds where breeding murrelets, human trash, and corvids coincide. That project is described in *Command* Trustee Council (2004). Funding for that project will continue through 2009. This project will continue it.

The Marbled Murrelet population of the Santa Cruz Mountains is small, isolated, and declining. At present, their rate of reproduction is insufficient to sustain the population. Nesting is largely limited to five adjacent watersheds: Pescadero Creek, Butano Creek, Gazos Creek, Waddell Creek, and Scott Creek. The nesting area thus encompasses approximately 15 miles from north to south and 10 miles from east to west. Within this area, most nesting is thought to occur in five public parks or on adjacent private lands where suitable habitat still exists (Baker et al. 2005). The five parks are Big Basin Redwoods State Park, Butano State Park, Portola State Park, Memorial County Park, and Pescadero Creek County Park (Figure 15). Campgrounds are located within all but the last park.

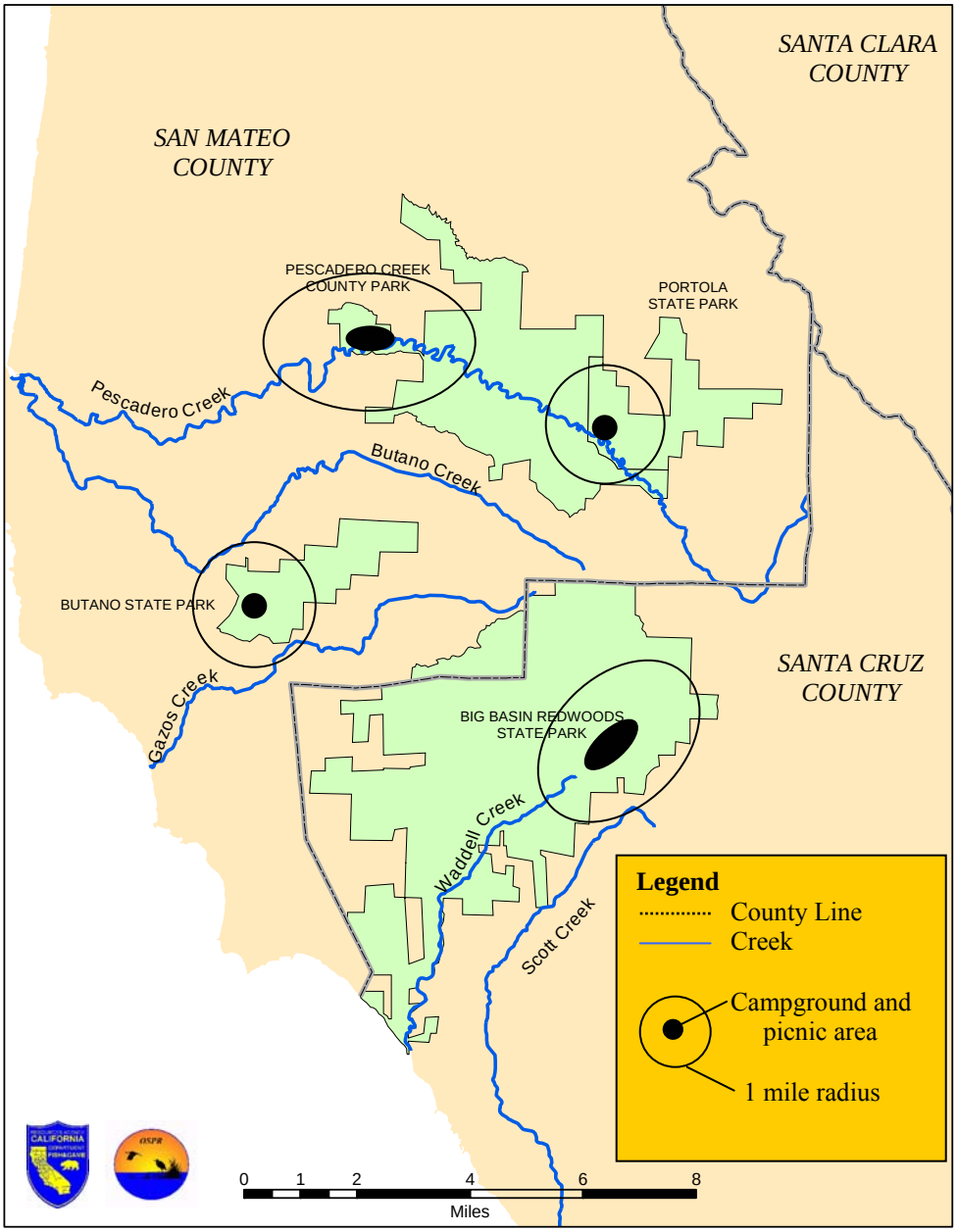


Figure 15: Location of campgrounds with a one-mile radius where corvids may range while foraging.

Nest predation by corvids is thought to be one of the primary causes for the lack of reproduction of the Santa Cruz Mountains Marbled Murrelets. In the Santa Cruz Mountains, both Steller's Jays and Common Ravens are common. Although the former have been present historically, the latter were apparently absent from the region until the mid-1970s. Raven numbers began to increase markedly by the late 1980s, and the raven population exploded in the 1990s to the point where the species has become very numerous and widespread (Suddjian pers. com., Figure 16)

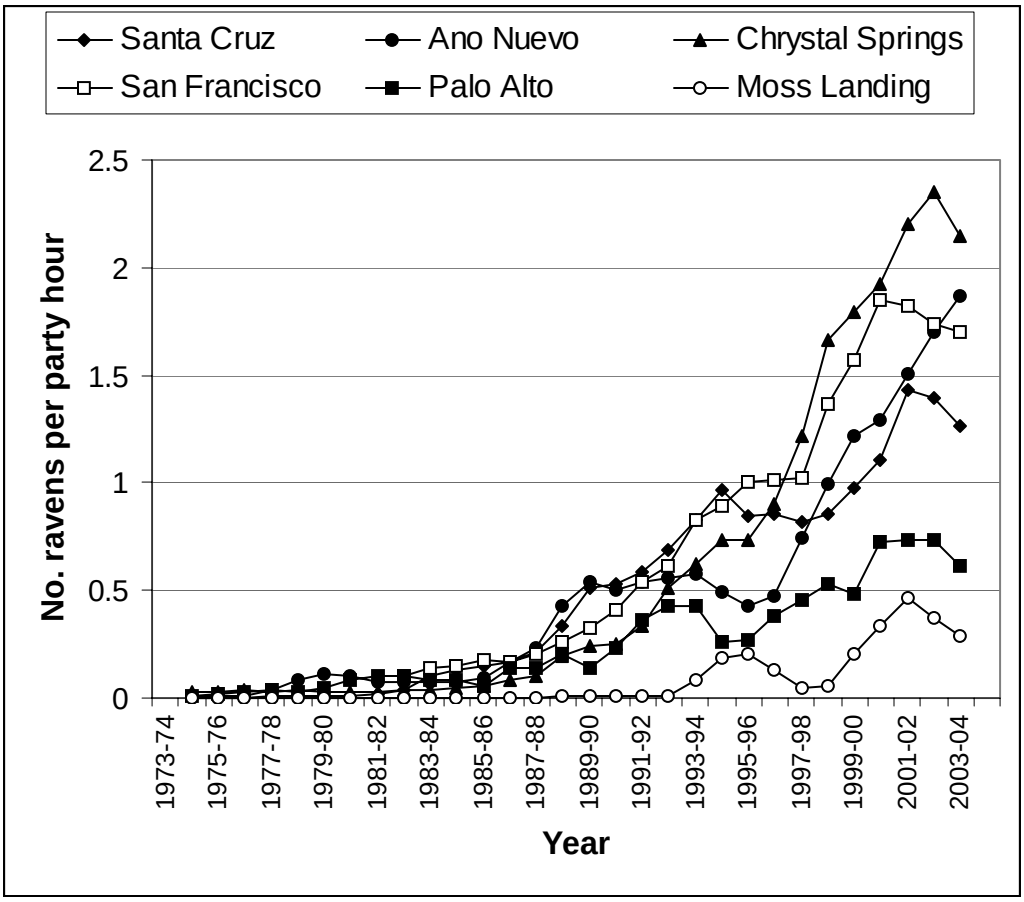


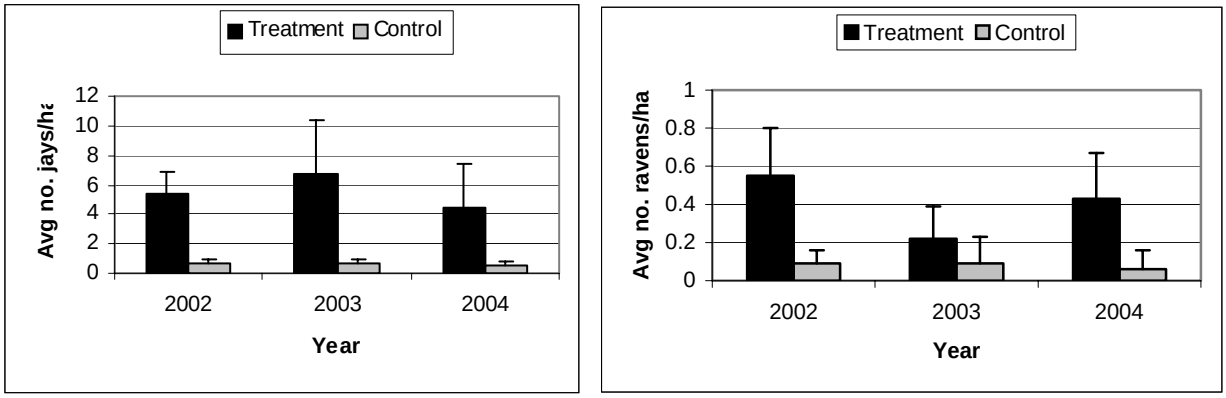
Figure 16: Common Ravens have increased dramatically in all six Christmas Bird Count circles in the Santa Cruz Mountains region. (Note: Data presented as a 3-year running mean.) (Figure from Suddjian 2005b).

It is suspected that the recent increase in ravens, especially around campgrounds within the parks where Marbled Murrelets nest, is a significant reason for the decline in the Marbled Murrelet population. Within the small region where nesting occurs, four public campgrounds (or complexes of adjacent campgrounds) are located, one within each of the public parks (not including Pescadero Creek County Park) (Figure 15 and Table 6). These campgrounds are also located within stands of old growth trees suitable for Marbled Murrelet nesting. In addition to the campgrounds, there are some private youth and group camps located in the area.

Table 6: Santa Cruz Mountains Campgrounds by Park

PARK	REGULAR CAMPSITES	GROUP SITES	PICNIC AREAS
Butano State Park	38	0	1
Memorial County Park	153	5	13
Portola State Park	67	4	4
Big Basin Redwoods State Park	183	2	4

Surveys from 2002 to 2005 have demonstrated that corvid density is especially elevated in campgrounds (Figure 16). Jay densities are 8 to 10 times higher in the campgrounds than at control sites in the forest, while raven densities have been 2 to 6 times higher (Suddjian 2005b). These findings come as no surprise because these species readily scavenge human garbage, discarded food, and spilled food around picnic tables and other outdoor locations (Liebezeit and George 2002). Although trash receptacles are accessible to raccoons, squirrels, and foxes, corvids may feed off spilled food or directly from the trash cans. As a result, ravens have been termed "classic subsidized predators" (Boarman 2002).



Steller's Jay **Common Raven**

Figure 17: Average relative abundance of corvids in campgrounds ("treatment") and away from campgrounds ("control") at Big Basin, Butano, Portola, and Memorial Parks combined (Figures from Suddjian 2005b).

Corvid predation of Marbled Murrelet chicks and eggs around the campgrounds in the Santa Cruz Mountains has been witnessed on several occasions (Singer et al. 1991; Suddjian 2003). Given the difficulty in observing such an event, it is likely that these few observations are symptomatic of regular occurrences, rather than chance observations of unusual events. Recent research in Redwood National Park has demonstrated that corvid predation of Marbled Murrelet nests is a serious problem (R. Golightly, pers. com.).

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. 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). Corvid management projects specifically designed to benefit Marbled Murrelets have been implemented at Redwood National Park, Prairie Creek Redwoods State Park, Jedediah Smith Redwoods State Park, and Mill Creek State Park beginning in 2003.

This project builds upon a current project already being implemented by the California Department of Parks and Recreations (*Command* Trustee Council 2004). It takes advantage of several restoration actions that have already been implemented. These include improved garbage collection systems and new garbage bins at several campgrounds; the development of education materials; staff training and the hiring of a project administrator; and targeted raven removal.

This project will continue these efforts. Specifically, restoration actions will include the following:

Public education. This task includes the ongoing use of educational materials for campground users, explaining the problems associated with human waste, corvids and other wildlife, and Marbled Murrelets, and offering instructions on how to keep food and garbage from animals. These materials include (1) a brochure for campers and picnickers; (2) signs posted on picnic tables, storage lockers, trash disposal areas, and elsewhere; and (3) a short video and presentation devices for use in visitor centers. Additionally, this task will include continual training of park staff regarding these issues, such that park staff may develop campfire programs on the topic as well as answer questions from the public.

Augmented seasonal staff. Despite educational materials and improved trash receptacles, campers and picnickers will need reminding about proper food storage and waste disposal. This task includes the hiring of seasonal campground staff between Memorial Day and Labor Day. These staff will walk the campgrounds and picnic areas daily, monitoring for compliance of camping regulations and educating the public with regard to food storage and wildlife impacts from human actions. The project will fund two full-time seasonal staff both at Big Basin and at Memorial Park, and partially fund a position at Portola and Butano.

Removal of ravens and nests. Based on field observations, it is estimated that approximately one pair of ravens is associated with each campground. It is thought that these ravens, which reside primarily among Marbled Murrelet nesting habitat, are the primary sources of nest predation. This task involves the removal of ravens and is intended to remove only those ravens immediately associated with the campgrounds. The specific method of raven removal and any required permits or environmental compliance will be completed by the implementing agency (CDPR). Because ravens are long-lived species, this component of the plan is necessary to achieve benefits in the short term (see Liebezeit and George 2002). It is hoped that, by combining this action with the other program components that limit human food waste, immigration of "replacement" ravens into the campgrounds will be minimized. Because the Memorial

Park and Big Basin campgrounds are actually a complex of several adjacent campgrounds, more than one pair of ravens may be present at these sites. Removal of ravens will likely achieve considerable benefits. In the Mojave Desert, it was determined that nesting ravens spend most of their time foraging within 0.8 km of their nests (Sherman 1993). Likewise, evidence from the Mojave Desert suggested that certain ravens were responsible for taking relatively large numbers of tortoises (Boarman 2002). Removal of any nests of ravens that immigrate into the campgrounds will also be done to the extent feasible. Removal of nests with eggs is likely to discourage re-nesting or reduce nest success (Boarman 2002). Nest removal will include all areas within an appropriate radius of Marbled Murrelet nesting habitat near the campgrounds. Thus far, raven removal has been limited to Big Basin State Park. This project will continue that plan as needed. Raven removal at any of the other parks or campgrounds will be evaluated later as part of adaptive management.

Additional measures may include:

- improvements to camper education and food waste control efforts
- installation of food waste receptacles at water spigots (grates)
- improved garbage protection at Butano State Park
- improved food storage lockers
- additional removal of ravens at parks other than Big Basin State Park
- efforts to limit corvid use of landfills
- expansion of education and other project components to private camps

Budget

This project will cost an estimated $149,788/year for five years, commencing in 2010, for a total of **$695,363** (future years have been discounted to account for interest earned at an annual rate of 1.5% above inflation).

Scaling for Primary and Compensatory Restoration

Because of limited data, project-specific scaling was not directly done for this project. Rather, the implementation of this project simultaneously with the land acquisition project was used to support certain assumptions in the scaling of the land acquisition project. Specifically, the land acquisition scaling assumes that the nests protected will be "good nests" (i.e., they will produce enough fledglings to support nesting pairs at these sites over a long time horizon). The corvid management project, by improving nest productivity, addresses this critical assumption regarding nest success in the land acquisition scaling. The Trustees may seek other sources of funding for the project to continue beyond the five-year period of this project.

Appendix J provides additional details regarding the bird REA for Marbled Murrelets.

Affected Environment

This project will be located in the Santa Cruz Mountains, in the campground areas described above. See the previous project for more description of this area.

Environmental Consequences (Beneficial and Adverse)

This project is intended to improve Marbled Murrelet nest success through a decrease in predation caused by jays and ravens. Any improvement in nest success will help forestall the extirpation of the Marbled Murrelet from the Santa Cruz Mountains. Sustaining the Marbled Murrelet population through the next few decades will enable future Marbled Murrelets to access increasing amounts of protected old growth forest and second growth forest as it matures into suitable nesting habitat.

The educational components of the 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 in the Santa Cruz Mountains (e.g., conference centers and private camps), resulting in increased awareness at those locations as well.

This project will have direct impacts upon both campers at these four campground areas and upon jays, ravens, and possibly other animals that scavenge food waste at campgrounds. However, this project is not expected to result in any significant adverse impacts.

Campers may experience more rules and restrictions upon their food management and may be subject to an enforcement action should they fail to comply. Although this may inconvenience some campers, such measures are commonplace in campgrounds where bears pose a threat to campers (e.g., Yosemite National Park, Redwood National Park, Olympic National Park) and do not impact abundance of or access to recreational opportunities. Because locations with bear problems are popular camping destinations, most campers are accustomed to dealing with the inconveniences associated with food management restrictions. As it is most effective to address the root causes of raven predation pressure rather than to simply remove ravens, efforts to control anthropogenic food sources are critical in the long term (Goodrich and Buskirk 1995).

Ravens will experience the most direct impacts. However, the overall raven population in Santa Cruz and San Mateo Counties will not be significantly affected. Because ravens are protected under the Migratory Bird Treaty Act, appropriate permits from the USFWS Migratory Bird Permit Office will be required for removal. Although jays and other animals such as raccoons will not be trapped and removed, they will likely experience a reduction in their available food supply. For jays, this may lead to decreased fledgling survival and lower reproductive success. It may also cause jays to wander and leave the area, possibly subjecting them to increased predation and lower nesting success. These potential adverse impacts are an inevitable part of the lowering of artificially elevated population levels to more natural population levels. But the overall jay populations in

Santa Cruz and San Mateo Counties should not be significantly affected. Jays, raccoons, and other animals living outside of the campgrounds will not be impacted.

Experience gained from the first two years of implementation of corvid management programs in summer 2005 and 2006 revealed no adverse consequences and no public complaints.

Probability of Success

The success of this project relies 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 severely limits 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, pers. com.).

Additionally, the elevated corvid levels already demonstrated in the Santa Cruz Mountains campgrounds suggest that corvids do 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 because 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.

Preliminary results from the first year of the *Command* Trustee Council funded project in summer 2005 are inconclusive. Corvid numbers appear unchanged from previous years, although some project elements (e.g., new dumpsters at Big Basin and new garbage cans at Memorial Park) were not implemented due to unexpected delays. Targeted raven removal may have been responsible for low raven nest success (D. Suddjian, pers. comm.). Data from summer 2006 is not yet available.

Performance Criteria and Monitoring

Because Marbled Murrelet nests are so difficult to find, and nest predation so difficult to study directly, the success of the project will be monitored through Marbled Murrelet surveys, corvid surveys, and annual progress reports from State Parks on the implementation of the corvid management tasks.

To build on existing data sets and confirm the presence of nesting murrelets, audio/visual Marbled Murrelet surveys will be done at Big Basin Redwoods State Park, Butano State Park, Portola State Park, and Memorial County Park (see Suddjian 2005a for an example of the current murrelet monitoring).

Jay and raven surveys will also be conducted at all four campground areas (see Suddjian 2005b for an example of the current corvid monitoring). To identify problem areas and monitor the success of the project, there will be a number of survey sites in high human activity areas plus several control sites spread through the parks where feasible. These surveys will be conducted several times per summer, approximately every month from May through August.

The quantitative results of the surveys and monitoring studies described above will be evaluated. If the ratio of corvid densities within the campgrounds relative to the control sites decreases significantly, the project will be considered to be making progress.

Evaluation

The Trustees have evaluated this project against all initial and additional screening criteria and concluded that this project is consistent with and meets the objectives of these selection factors. The trustees determined that this type and scale of project will effectively provide appropriate compensation (in part) for injuries to Marbled Murrelets that occurred as a result of the spills and have selected this project as a preferred alternative.

4.3.10 Other Alcids

Background

In addition to the Common Murre and Marbled Murrelet, three other species of small alcids were significantly impacted by the spills: Ancient Murrelet, Cassin's Auklet, and Rhinoceros Auklet. Very small numbers of Pigeon Guillemots and Tufted Puffins were also impacted. Like other alcids, these are long-lived, slow-reproducing species that spend much of their lives at sea where they dive for fish. They come ashore only to nest, typically on remote offshore islands, where they nest in soil burrows, in rock crevices, and in caves or under structures such as logs.

These species occur regularly along the California coast, primarily offshore and beyond sight of land. Ancient Murrelets only nest from the northern Asian Pacific Coast to British Columbia, while the auklets' breeding range includes California.

Conservation Issues

In recent decades, Ancient Murrelet populations have been reduced by more than half due to predation by introduced mammalian predators (e.g., rats, foxes, raccoons) on their nesting islands (Gaston 1994). Human disturbance and light pollution are also considered significant threats. The Ancient Murrelet is classified as "vulnerable" in Canada and considered a species of "high concern" by the North American Waterbird Conservation Plan.

The Cassin's Auklet is perhaps the most flexible alcid, nesting from Baja California to Alaska. Nevertheless, it too has been much reduced in recent years due to impacts on nesting islands and oceanographic conditions affecting the dynamics of prey populations (i.e., krill). Declines have been noted at the Farallon Islands (Pyle 2001) as well as in Baja California. It is proposed to be listed as a California Species of Special Concern.

The Rhinoceros Auklet is a scarce breeder in California, nesting at scattered locations from the Farallon Islands to San Miguel Island. It has only recolonized these areas since the 1970s, after largely disappearing as a breeding species for over a century, presumably due to disturbance and egging. Nevertheless, the species remains vulnerable to human disturbance, trampling, and non-native predators on islands. It is currently considered a California Species of Special Concern.

Injury Calculations

A total of 96 small alcids were collected during the spills that occurred from 1997 to 2003. It is not known if additional birds were collected from 1990 to 1996, because species composition regarding collected birds is limited for this period. The total estimated dead from all spills is 2,763. The dead bird multiplier for these species is high because they are small species that primarily occur far offshore. Thus, there is a low probability of discovering their carcasses. Details on the number of birds collected during each spill event and the estimate of total mortality are in Appendix B and in Ford et al. (2006). Details regarding the calculation of lost bird-years are presented in Appendix G for Cassin's Auklet, in Appendix K for Ancient Murrelets, and in Appendix L for Rhinoceros Auklets.

Species	Total Collected*	Total Estimated Dead	Total Lost Bird-Years
Ancient Murrelet	21	428	1,867
Cassin's Auklet	36	1,509	10,773
Rhinoceros Auklet	37	593	4,095
other alcids	13	233	

* 1997-2003 only. Prior to 1997, data regarding the species composition of collected birds are limited.

These lost bird-years represent the interim losses from the time of the spills to the return of this population to pre-spill conditions. Thus, any restoration project benefiting these species should seek to replace 1,867 lost bird-years for Ancient Murrelets, 10,773 lost bird-years for Cassin's Auklets, and 4,095 lost bird-years for Rhinoceros Auklets.

Restoration Alternatives

Restoration for these species primarily involves their breeding grounds. Protection from disturbance, habitat loss, and non-native introduced predators are top priorities. Regarding Ancient Murrelets, the Trustees used outside experts to assist in identifying the most cost-effective projects, focusing on at-risk colonies in British Columbia and Alaska. The table below provides a list of restoration concepts considered by the Trustees.

PROJECT CONCEPTS	BENEFITS
ANCIENT MURRELETS	
Rat Eradication in the Queen Charlotte Islands, Canada	**Ancient Murrelets**
Saunders Island (Canada) raccoon eradication	Ancient Murrelets
Murchison and Faraday Islands (Canada) rat eradication	Ancient Murrelets (also Cassin's Auklets, Pigeon Guillemots, Pelagic Cormorants, Glaucous-winged Gulls)
Rat Island (Alaska) rat eradication	Ancient Murrelets (also Cassin's Auklet, Leach's Storm-Petrel)
Langara Island (Canada) rat quarantine project	Ancient Murrelets
CASSIN'S AUKLETS	
Seabird Colony Restoration on Baja California Islands, Mexico	**Cassin's Auklet (also Brown Pelican, Brandt's and Double-crested Cormorants, and Western Gull)**
Habitat improvements at the Farallon Islands	Cassin's Auklet, Ashy Storm-Petrel
RHINOCEROS AUKLETS	
Nesting Habitat Restoration on Año Nuevo Island	**Rhinoceros Auklet (also Western Gull)**

The Trustees have selected one project that will benefit Ancient Murrelets, one that will benefit Cassin's Auklets, and one that will benefit Rhinoceros Auklets.

For Ancient Murrelets, the Ellen and Bischof Islands project was compared with the other projects from Canada and Alaska, all of which were proposed for the Trustees by outside experts conducting a restoration planning study. The Murchison/Faraday and Rat Island projects are quite large and expensive and exceed what is necessary to compensate for the injury from the spills. After a site visit, the Saunders Island project was ruled out because the risk of recolonization by raccoons is high and monitoring the island is difficult due to its remote location. The Langara Island project aims to protect an earlier rat eradication project (see Taylor et al. 2000) by installing quarantine measures to prevent reintroduction of rats. This project was less-preferred because it stands a higher chance of obtaining alternative funding. Ellen Island and Bischof Islands were selected because of their ease of access for implementation and monitoring, opportunities for partnership in monitoring from Gwaii Haanas National Park Reserve rangers, and relatively low cost. Both Ellen and the Bischofs were selected because each alone is too small to provide sufficient benefits. Additionally, because of their proximity, cost-savings will be realized by implementing them together.

Cassin's Auklets potentially benefit from some of the projects considered above. The Trustees concluded that the Baja California islands project, which also benefits pelicans and cormorants, provides sufficient compensation for Cassin's Auklet and is the most cost effective. The Año Nuevo Island project and the Farallon Island projects, while benefiting Cassin's Auklets, do not provide sufficient restoration to address the degree of injury.

Because Rhinoceros Auklets nest at only a few sites in California, restoration options within the state are limited. The Trustees have been aware of the ongoing restoration efforts for this species at Año Nuevo Island, which is located in the middle of the oil spill

zone. Since this project met all threshold and selection criteria and no other viable projects were known, the Trustees did not seek out alternative projects for this species.

While no Xantus's Murrelets were collected during the spill response, they may have been present in the spill area in small numbers and subject to impacts. While no Xantus's Murrelet mortality was modeled and no restoration projects were selected that target this species, Xantus's Murrelet will benefit in several ways from the Baja California islands project. Additional details on how Xantus's Murrelets may benefit from the project are in Appendices N and O.

Final Selected Project for Ancient Murrelets

Rat Eradication in the Queen Charlotte Islands, Canada

This project will remove non-native Norway rats from Ellen Island and the Bischof Islands, Canada, to enable Ancient Murrelets to recolonize these islands for nesting. Ellen Island (approximately 50 acres) and the small archipelago of the Bischof Islands (approximately 160 acres) are small forested islands along the western coast of the Queen Charlotte Islands (also known as Haida Gwaii), British Columbia. The Queen Charlottes support as much as 25 percent to 50 percent of the total population (Gaston 1994).

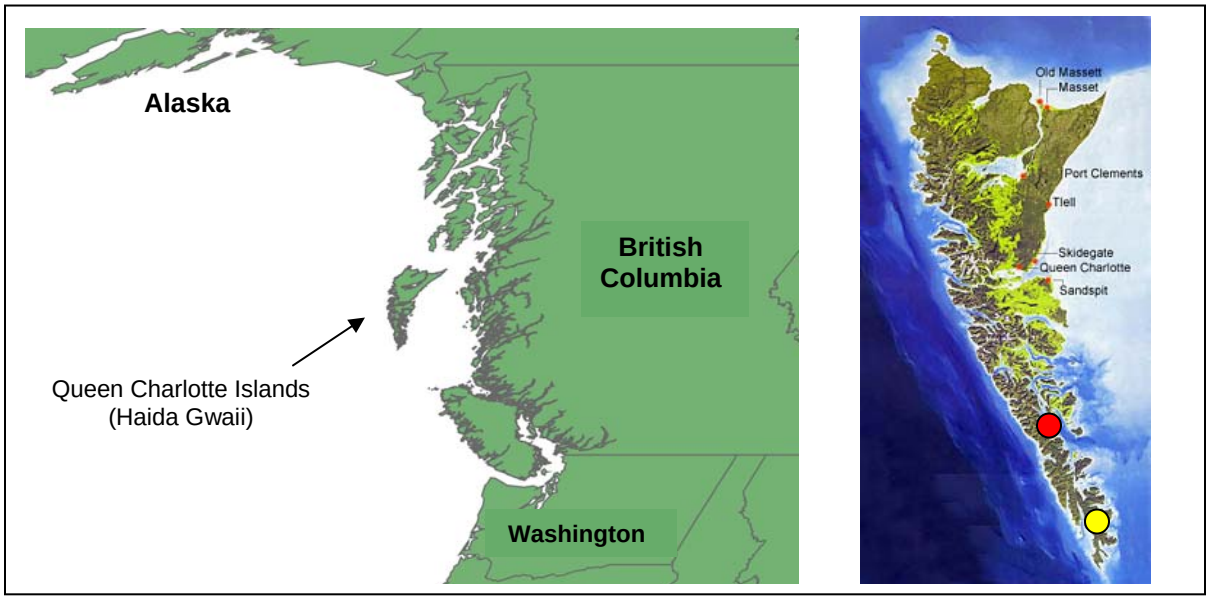


Figure 18: The approximate locations of Ellen Island (yellow dot) and the Bischof Islands (red dot).

Norway rats are not native to any of the Queen Charlotte Islands. They have spread to islands worldwide through transport on ships and boats. Throughout the Queen Charlottes, non-native mammalian predators have devastated seabird colonies, depredating eggs, chicks, and adults. The *Birds of North America* species account for the Ancient Murrelet (Gaston 1994) describes control of introduced predators in the Queen Charlotte Islands as "the most urgent issue for the species' conservation." At Ellen Island and the Bischof Islands, Ancient Murrelets formerly nested, but have been extirpated. Because many murrelets still nest on other nearby islands, it is thought they will recolonize these islands once the rats are removed (B. Keitt, pers. comm.).

This project will involve one field season of eradication (using boxes with poisoned bait) followed by monitoring the next two years to ensure successful eradication. Additional bait boxes could then be used if necessary.

These islands are within the Gwaii Haanas National Park Reserve, with joint oversight by the Council of the Haida Nation and the Government of Canada. Prior to selecting this project for this restoration plan, the Trustees consulted the park reserve and the Council of the Haida Nation. Eradicating non-native species and restoring the natural resources of these islands are consistent with the goals of the park reserve and the Council of the Haida Nation, both of whom are supportive of the project (see public comment letter from Parks Canada in Appendix O).

Budget

The total cost of this project is estimated at **$188,405**, discounted to present-value 2007 dollars. This includes additional project planning and permitting, implementation, and post-eradication monitoring. The Gwaii Haanas National Park Reserve will contribute in-kind services to assist in monitoring.

Scaling for Primary and Compensatory Restoration

As described above, the total injury to Ancient Murrelets was 1,867 lost bird-years. For restoration scaling, the Trustees calculated that if the elimination of rat predation results in recolonization from adjacent colonies at a rate of just 2 nests per year, beginning in the year 2010 and continuing through 2100, full compensation for the injury would be achieved. This calculation also assumes a 1 percent annual risk of rat reintroduction for the first 10 years, increasing by 1 percent in each of the following decades. This effectively incorporates uncertainty into the discount rate. It is possible that benefits will be greater than this, which would then compensate for injuries to other alcids (e.g., Tufted Puffin, which nest in the area) for which no specific restoration project is planned.

Appendix K provides additional details regarding the bird REA for this project.

Affected Environment

Although implemented by an American company (with Canadian partners), this project will be located at several relatively remote islands within the Queen Charlotte Islands, Canada. The islands, all part of the Gwaii Haanas National Park Reserve, are briefly described above. The project will comply with all applicable local laws.

Environmental Consequences (Beneficial and Adverse)

This project is anticipated to have a significant beneficial effect on Ancient Murrelets. Consistent with past experiences in removing non-native predators from seabird nesting islands, the Trustees expect the murrelets to respond quickly in terms of increased nests and breeding success in the years after rat removal. Historically (i.e., 1974), there were at least 500 nests on the Bischofs, and probably similar numbers on Ellen Island. Thus, over time, murrelets are expected to gain from traditional breeding habitat re-opened for use.

This proposed action is not expected to result in any significant adverse impacts. Because of the small size of these islands and because bait boxes specially targeted for rats will be used, there is little risk of impacting non-target species. Other species will have difficulty accessing the poison bait, and past experience has shown that most of the rats die in their burrows. Thus, no adverse impacts are anticipated.

Probability of Success

In the past few decades, conservation biologists have successfully eradicated non-native mammalian predators (e.g., rats, mice, cats, raccoons) from over 200 islands around the world (Taylor et al. 2000; B. Tershy, pers. comm.). Because of the small size of these islands, this project represents a relatively "easy" introduced species removal project. The Trustees expect it to be successful.

Past efforts to restore Ancient Murrelets and remove non-native predators from their nesting islands have been successful. Almost all major islands in the Aleutians have been cleared of foxes, where Ancient Murrelet populations recovered quickly on islands where they still occurred (Gaston 1994). In Canada, efforts to eradicate rats and raccoons have also had success.

Ellen Island will likely be recolonized with birds from Anthony Island (Sgaang Gwaii), six miles away, where 400 birds nest, and Rankine Island, eight miles away, where 52,000 birds nest. The Bischofs are likely to be recolonized from Ramsay Island, five miles away, where 36,400 birds nest.

Because both islands are within the Gwaii Haanas National Park Reserve and have easy ranger access, monitoring for rat reintroduction and murrelet nesting will be easy. The park reserve has informed the Trustees that removing non-native species is part of their mandate and has volunteered in-kind services to support the project and assist with monitoring.

Performance Criteria and Monitoring

There are two performance goals: (1) the removal of rats; and (2) the recovery of Ancient Murrelets. Specifically, the criterion for the first goal is 100 percent removal. For the second goal, commensurate with the project scaling, the goal is recolonization by the year 2010 with an annual increase of at least three nests. The monitoring plan calls for a follow-up visit the year after the removal to check for the presence of rats. Continued monitoring for murrelets will be done by the Gwaii Haanas National Park Reserve.

Evaluation

The Trustees have evaluated this project against all initial and additional screening criteria and concluded that this project is consistent with these selection factors. The trustees determined that this type and scale of project will effectively provide appropriate compensation for injuries to Ancient Murrelets that occurred as a result of the spills and have selected this project as a preferred alternative.

Final Selected Project for Cassin's Auklets

Seabird Colony Restoration on Baja California Islands, Mexico

This project is described in the pelican, cormorant, and gull section above (section 4.3.5).

Final Selected Project for Rhinoceros Auklets

Nesting Habitat Restoration on Año Nuevo Island

The main goal of this restoration project is to continue and expand ongoing efforts to restore native vegetation on Año Nuevo Island to protect and expand breeding habitat for Rhinoceros Auklets. Año Nuevo Island is located about a half mile offshore at the southern end of San Mateo County and is part of Año Nuevo State Reserve. The small island is a valuable site for many seabirds and marine mammals.

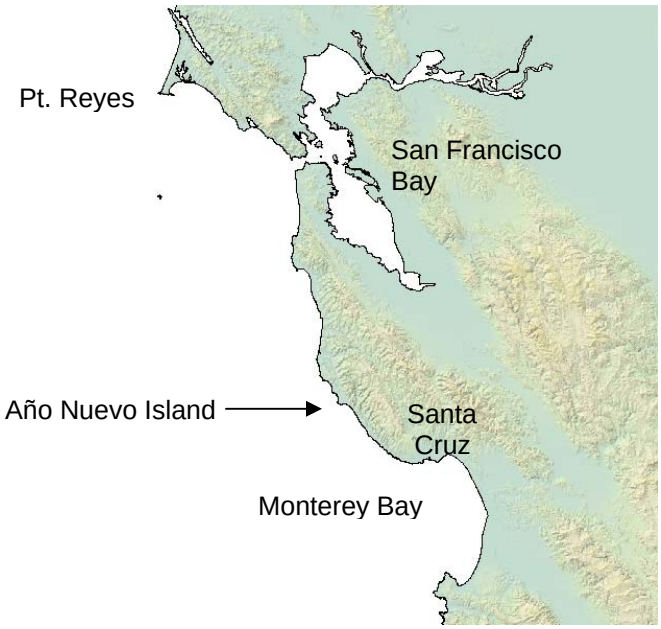


Figure 19: Location of Año Nuevo Island.

Rhinoceros Auklets were extirpated as breeders in California in the 1800s. Since the early 1970s, they have begun to recolonize island habitats. Año Nuevo Island represents one of the few nesting sites for Rhinoceros Auklets in the state. In 2005, there were approximately 106 breeding pairs (PRBO, pers. comm.). They burrow in the island's topsoil among plants. However, the future of this colony is tenuous.

When Rhinoceros Auklets began colonizing the island in the early 1980s, the central marine terrace was dense with vegetation, mainly exotic species (Lewis and Tyler 1987). Heavy use of the island for government facilities (e.g., a lighthouse) for over a century had changed the vegetation community. After evaluating the condition of island natural resources, the Año Nuevo State Reserve management plan recommended revegetation with native plants to provide additional bird habitat and slow topsoil erosion (Lewis and Tyler 1987). However, no habitat restoration or direct erosion control was implemented. By the mid 1990s, the density of vegetation began to thin and was dominated by exotic *Malva* and *Tetragonia* species in areas used by burrowing auklets (Hester 1998).

These plant species have proved poorly adapted to extreme variations in climate and wildlife use. Weather conditions brought on by the 1998 El Niño (a dry summer followed by heavy winter rains that washed away the remaining seed bank) resulted in a massive die-off of these non-native plants. As a result, there was a rapid increase in erosion and an almost complete disappearance of vegetation in auklet breeding areas. In addition, the non-native plants were not adapted to sporadic seasonal trampling by California sea lions and roosting Brown Pelicans, which often occurs during warm-water conditions such as El Niños.

Massive soil erosion then threatened the auklet colony. The number of auklet burrows that collapsed due to soil erosion during the nesting season increased from 11 percent in 1997 to 56 percent in 2001 (J. Thayer, pers. comm.). Some collapses caused adults and chicks to be trapped underground, resulting in death. The amount of effort currently expended by researchers repairing and stabilizing collapsing burrows during the breeding season is not sustainable. It is clear that the auklet colonies will decline due to loss of soil if action is not taken promptly. In many areas, soil is eroding at a rate of 6 inches per year. At this rate, virtually all the topsoil will be gone within 10 years. At present, the population has been aided by the maintenance of artificial nest boxes. The breeding population in natural burrows, however, has not increased since 1996 (PRBO unpubl. data). Unfortunately, no other predator-free habitat exists in the region to support the burrowing seabirds if current nesting areas become uninhabitable.

The main goal of this restoration project is to revegetate the central marine terrace, the main habitat for burrowing auklets, with a diversity of native grasses, dune plants, and possibly shrubs. The vegetation provides protective cover for the burrows, stabilizes the soil with roots to allow digging tunnels and protects the topsoil from erosion.

Figure 20: Revegetation area, on the left, is protected by young plants and protective burlap. On the far right, wind erosion has resulted in the loss of several inches of topsoil in the course of one year. Breeding Western Gulls are present in this photo.

Figure 21: A Rhinoceros Auklet is weighed and measured at an artificial burrow. Even these nest boxes require topsoil to secure them and protect them from over-heating.

Revegetation efforts will benefit nesting Western Gulls, as well as protect the auklets from them. Improved gull habitat translates into a reduced need for aggressive territoriality that result in death of near-fledging auklet chicks entering gull territories on their excursions outside burrows and transits to and from the sea. Given the current condition of a denuded marine terrace, almost every board and piece of debris on the island attracts auklets, providing some structure they can dig under, and nesting gulls, protecting them from wind. Gulls often build nests at auklet tunnel entrances due to the lack of any other habitat structure. Particularly on clear moon-lit nights, the majority of Rhinoceros Auklets arriving with bill-loads full of fish are chased and/or kleptoparasitized by gulls (Hester pers. obs.). On other islands, differences in kleptoparasitism rates, auklet chick growth, timing of breeding, and attendance patterns have been found between vegetated and denuded plots demonstrating that ground-nesting gulls and burrowing auklets can coexist with limited negative interactions in vegetated habitats (Watanuki 1990; Wilson 1993; Miyazaki 1996; and Finney et al. 2001).

In these ways, the vegetation restoration efforts will directly prevent the loss of topsoil and nesting habitat, as well as enhance and increase the habitat available for breeding, thereby potentially increasing the number of chicks fledged.

This project builds upon several years of restoration actions, which began in 2002. This preliminary work accomplished field testing for appropriate plant species and erosion control methods. Some of the specific methods developed are described below:

- Plant selected mature native plants (salt grass *Distichlis spicata,* American dune grass *Leymus mollis*) with a density of 2 feet on center;
- Spread site-specific native seed (beach bur *Ambrosia chamissonis*, lizardtail *Eriophyllum staechadifolium*) collected from the mainland northern elephant seal colony, between mature plants;
- Distribute straw over seed and between mature plants, to hold moisture, provide temporary structure, and provide an alternative source of nesting material for Western Gulls;
- Wrap erosion control matting on top of the plant and seed layers, stapled down securely;
- Design areas to encourage new burrowing (recruitment); and
- Open entrances to burrows occupied by auklets in previous years.

Efforts have resulted in reduced erosion and encouraging survival of three native plant species: salt grass *Distichlis spicata,* American dune grass *Leymus mollis*, and beach bur *Ambrosia chamissonis*. Based on the success of the habitat work thus far, significant improvements can be accomplished with intensive planting and erosion control, as well as adaptive upkeep.

Budget

The project will fund additional vegetation restoration for two years, followed by eight years of adaptive management and monitoring, to ensure the survival of the plants. The

total cost of the project is estimated at **$974,037**. Future years have been discounted to account for interest earned at an annual rate of 1.5 percent above inflation.

Scaling for Primary and Compensatory Restoration

As described above, the total injury to Rhinoceros Auklets was 4,095 lost bird-years. For restoration scaling, the Trustees assumed that, without the project, the colony will be completely lost to erosion in approximately 20 years. With the project, the colony would be maintained and the number of nests would increase slightly. Thus, the restoration benefits derive from the difference between modest colony growth with the project and total loss of the colony without the project.

Appendix L provides additional details regarding the bird REA for this project.

Affected Environment

This project will be located at Año Nuevo Island, which is within the impacted area described in section 2.0.

Environmental Consequences (Beneficial and Adverse)

Establishing an island marine terrace plant community will improve soil stability, reduce erosion and potentially increase protective cover from predators. This should decrease the loss of nesting areas and increase the amount of suitable habitat for additional colony growth. This should result in an increased number of chicks fledged from the island. Upon establishment of a native plant community in these areas, the number of Rhinoceros Auklet nests may potentially double in size.

Restoring the plant community on a portion of Año Nuevo Island has numerous additional benefits beyond the Rhinoceros Auklet. A small number of Cassin's Auklets also nest at the island and may benefit as well. The restored area may also provide songbirds, shorebirds, and other species nesting and migratory stop-over habitat free from exotic predators. White-crowned Sparrows and Killdeer (Le Boeuf and Kaza 1981) once bred on the island before vegetation disappeared. Other benefits may include increasing habitat for amphibians, pollinators, and other terrestrial invertebrates that once inhabited the island.

This proposed action is not expected to result in any significant adverse impacts. Pinnipeds do not pup on the central terrace, but use the beaches and rock islets. Habitat restoration will not reduce the space currently available for roosting Brown Pelicans and cormorant species.

Probability of Success

Due to logistical difficulties with access and transport, as well as extreme weather conditions, islands pose unique challenges for vegetation restoration. Nevertheless, restoration efforts thus far at Año Nuevo Island have demonstrated the techniques that are successful (as well as others that have not been successful). Initial results have suggested that an aggressive approach with grown plants in dense concentrations and erosion

control material is the best way to succeed at establishing a native plant community on island.

Pinnipeds (e.g., sea lions, harbor seals, and elephant seals) are a concern and are often the first to be blamed for the loss of vegetation. The northern and southern portions of the island, which are easily accessible to sea lions, are heavily used by them seasonally and bare of vegetation. However, recent field work and long-term pinniped census data indicate that the central portion of the marine terrace, where the project will occur, is not regularly used by seals or sea lions. Nevertheless, because California sea lion density and distribution can be sporadic and unpredictable, contingency plans for potential sea lion exclusion are in development.

As the jewel of Año Nuevo State Reserve, the island is protected (with access only allowed for researchers), and this project has the support of the management.

Performance Criteria and Monitoring

Success of this project will be measured by auklet nesting success and vegetation and soil characteristics. The monitoring period will extend for 10 years. Some of the parameters to be evaluated are listed below.

- The proportion of occupied auklet burrows that collapse will be measured annually and compared with proportions from 1993 to present.
- Auklet burrows and gull nests will be mapped to determine distribution and density of breeding birds relative to habitat characteristics.
- The proportion of auklet burrows occupied by breeding pairs will be determined with a burrow camera to quantify breeding population size and prospecting activity.
- The density and distribution of plant species will be documented.
- Changes in topsoil will be measured at standardized locations.
- Auklet chick growth rates in relation to proximity to gulls and habitat structures will be measured.

Evaluation

The Trustees have evaluated this project against all initial and additional screening criteria and concluded that this project is consistent with and meets the objectives of these selection factors. The trustees determined that this type and scale of project will effectively provide appropriate compensation for injuries to Rhinoceros Auklets that occurred as a result of the spills and have selected this project as a preferred alternative.

4.3.11 Sea Otters

Background

Sea Otters are perhaps the most charismatic and beloved marine mammal in California. Hunted nearly to extinction from 1741 to 1900, Sea Otters in California have since rebounded from fewer than 100 to approximately 2,500 individuals today. The historical population has been estimated at 20,000 individuals. They occur in nearshore waters off the central California coast, typically from Half Moon Bay south to Point Conception. A

small population has also been re-established off San Nicolas Island. Because Sea Otters rely on their fur rather than blubber for insulation from cold ocean water, they are at far greater risk of death from oiling than sea lions or seals.

Conservation Issues

In California, the Sea Otter is listed as a threatened species under the federal Endangered Species Act and as a "fully protected" species by the state of California. Despite steady population increases through much of the 20th century, the rate of population growth has been less than that of other recovering otter populations (e.g., in Alaska) (Estes 1990), and the population actually declined between 1995 and 1999 (Gerber et al. 2004). This has put the recovery of the Sea Otter in California in jeopardy and resulted in considerable research regarding why the population is currently stalled. California Sea Otters apparently suffer from higher juvenile and adult mortality rates than Sea Otters in Alaska (T. Tinker, pers. comm.). Modeling has demonstrated that this, especially with regard to adult females, is an important factor in slowing population growth.

A recent analysis of causes of otter mortality in California concluded that many of the most significant causes appear to be related to human activities. These include introduced disease causing organisms (pathogen pollution), primarily protozoa like *Toxoplasma gondii* and *Sarcocystis neurona*, fecal bacteria and parasites, chemicals and contaminants, and to a lesser degree various forms of direct take such as boat strikes, shooting, and entanglement in fishing gear (Gerber et al. 2004). A significant and growing body of evidence shows that many of these diseases and chemicals are coming from the land, probably via runoff, and are tied to human activities (Miller et al. 2002, Jessup et al. 2004).

Injury Calculations

During the spills, four dead oiled Sea Otters were found on beaches. All of these came from similar locations and times that oiled birds were collected. Because of the tenuous status of the Sea Otter in California, all Sea Otter carcasses reported on beaches throughout the state are collected and analyzed as a matter of routine work by the California Department of Fish and Game. At the same time, the population is closely monitored. Analyses of carcass recovery data on otter carcasses shows that approximately 46 percent of the otters expected to die each year are recovered (Gerber et al. 2004). Thus, if four Sea Otters were detected as having died from oil exposure, it is likely that approximately 8 were actually similarly effected.

Species	Total Collected	Total Estimated Dead
Sea Otter	4	8

Restoration Alternatives

The Trustees consulted with well-known Sea Otter researchers to select and design an appropriate restoration project. They suggested the project listed in the table below.

PROJECT CONCEPTS	BENEFITS
Sea Otter Pathogens Education and Outreach	**Sea Otters**

The Trustees selected this project because it addresses the leading anthropogenic cause of otter mortality, and thus one of the primary factors impacting Sea Otter recovery. Many of the problems with fishing gear entanglement have already been addressed in recent years through new restrictions on commercial fishing activities in Monterey Bay and elsewhere.

Final Selected Project

Sea Otter Pathogens Education and Outreach

This project aims to educate the public regarding the connection between anthropogenic sources of pollution, Sea Otter diseases and mortality, and Sea Otter population recovery. Since the discovery of the connection between these pollution sources and otter mortality (in 2002), this will be the first large-scale coordinated attempt to enlist the cooperation and support of the public regarding this issue.

Dairy farmers, boat owners, homeowners, and cat owners are examples of those who will be targeted with educational messages. Some examples of the messages include the following:

- Domestic house cat feces contain pathogens that cause fatal diseases in Sea Otters; do not dispose of cat feces or kitty litter in locations where it can enter waterways (e.g., the toilet).
- Human feces may contain pathogens that can cause gastrointestinal illness and death in Sea Otters; direct discharge of sewage from boats, leaking septic systems, and inadequately treated municipal sewage are potential sources of problems.
- Dairy wastes may contain organisms that are potentially harmful to Sea Otters; best management practices (BMP's), improved monitoring, and improvement of existing infrastructure on coastal farms and dairies may improve Sea Otter health.
- Nutrients and elemental pollution from non-point sources may facilitate harmful algal blooms that kill Sea Otters and other marine mammals; improved handling of agricultural, storm, and street runoff could improve this situation.

Specifically, the project will include the following elements:

- Synthesize existing data on non-point source pollution (pathogens and chemicals) and other causes of mortality in Sea Otters;
- Use the information to create graphic and multimedia educational materials for public outreach, such as:
    - improvements and additions which cover pollution and direct take to the website *www.seaotterresearch.org*, which already has excellent general information on Sea Otter biology and health, as well as pictures and films of otters;
    - creation of a public display kiosk at the Long Marine Lab Seymore Marine Discovery Center in Santa Cruz, which has 50,000 visitors per year;
    - hosting two half-day symposiums (in cooperation with Defenders of Wildlife-Sea Otter Awareness Week 2006 and 2007) and participate in up to six public outreach town hall meetings;

- distribution of hard copy and electronic information, data tables, graphics and maps (such as those shown in attachment A) to organizations such as the Monterey Bay Aquarium, UCSC-Seymore Marine Discovery Center, Elkhorn Slough National Estuarian Sanctuary, as well as to other conservation organizations that focus on Sea Otters and marine issues (e.g., Defenders of Wildlife, Friends of the Sea Otter, Otter Project); and
- publication of a full color article in "Outdoor California" and perhaps in other outdoor-focused magazines.

Through this coordinated approach involving other organizations, the project should reach several million people.

Budget

The budget for this project is estimated at **$121,155**.

Scaling for Primary and Compensatory Restoration

Because the restoration project aims to save otters of the same demographic age classes as those lost in the spills (i.e., all age classes), there is no need to resort to otter-years as a metric for comparing injuries and benefits. Instead, lost and gained otters (discounted to 2006) are compared. To compensate for the injury to 8 Sea Otters, this project must save two Sea Otters per year for six years that would otherwise die from diseases related to human pollution. The Trustees have calculated that this goal can be achieved if the pollution-related mortality of Sea Otters was reduced by just 4 percent per year. The Trustees believe this project can achieve this goal.

Appendix M provides additional details regarding the otter REA for this project.

Affected Environment

This project will be located in the Monterey Bay area, which is within the impacted area described in section 2.0.

Environmental Consequences (Beneficial and Adverse)

Reducing disease-related mortality associated with terrestrial sources of pathogens and pollutants is thought to be one of the most significant ways to facilitate Sea Otter population recovery (Gerber et al. 2004). Reducing pathogens and pollution in the environment will likely benefit other species as well.

Because this is an education and outreach project that relies upon voluntary actions by the public to reduce pollution, this proposed action is not expected to result in any significant adverse impacts.

Probability of Success

The project will be implemented by the California Department of Fish and Game in cooperation with several other agencies and organizations (such as the U.S. Geological Survey, the UC Davis Wildlife Health Center, UC Santa Cruz, and the Monterey Bay Aquarium). These organizations have a history of working together on Sea Otter issues.

Thus, the Trustees anticipate that there will be no problems in implementing the outreach components of the project.

The probability of success with regard to changes in pathogens and pollutants in the environment, and changes in Sea Otter mortality rates, has greater uncertainty. The Trustees have taken this into account and made conservative assumptions regarding the benefits in project scaling (see above and Appendix M).

Performance Criteria and Monitoring

Because this project focuses on public outreach, its effectiveness will be measured by the number of people to whom the message is delivered. This can be done by totaling the numbers of recipients of hardcopy information, numbers of "hits" to the website (and comparison with previous years), and numbers of patrons visiting facilities where graphic displays and verbal presentations of this information are provided. Monitoring of water quality in Monterey Bay and monitoring of Sea Otter populations and causes of mortality are ongoing through other agencies and funding mechanisms and need not be included as a component of this project. The Trustees will review the results of these monitoring efforts to evaluate the success of the project.

Evaluation

The Trustees have evaluated this project against all initial and additional screening criteria and concluded that this project is consistent with and meets the objectives of these selection factors. The trustees determined that this type and scale of project will effectively provide appropriate compensation for injuries to Sea Otters that occurred as a result of the spills and have selected this project as a preferred alternative.

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 alternative. Under this alternative, the Trustees would take no direct action to restore injured natural resources or to compensate for lost services. 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. However, while natural recovery may occur over time for many of the injured resources, the interim losses suffered by those resources would not be compensated 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 recovery from the spills. Furthermore, technically feasible project alternatives exist to compensate for these losses. Thus, the Trustees reject the "no action" alternative and instead have selected the appropriately scaled restoration projects described above as the preferred alternatives.

4.5 Cumulative Impacts

The Trustees examined a variety of alternatives to restore resources and/or services lost as a result of the *Luckenbach* releases. Anticipated environmental consequences arising from each of the selected projects are provided in section 4.3. As required by NEPA, this section addresses the potential overall cumulative 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)).

Seabirds

The Trustees believe that 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 beneficial impact on seabird populations.

Corvids

The Trustees have selected three projects that will affect local jay and raven numbers near seabird nesting and roosting sites in and around PRNS, the Santa Cruz Mountains, and Common Murre colonies south of Point Reyes. Project components include (1) public education and outreach, (2) removing anthropogenic food sources, (3) removing raven roosting or nesting areas, and (4) lethally removing a small number of Common Ravens.

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

The corvid management project in the Santa Cruz Mountains, when considered in conjunction with an on-going project that it will supplement, is expected to have local, medium term, minor negative effects on corvids in the Santa Cruz region. Likewise, the corvid management project at PRNS will control Common Ravens in the vicinity of the seabird colonies near the Point Reyes Lighthouse. Common Ravens are abundant throughout the Point Reyes area and continue to increase slightly. The project, in conjunction with ongoing efforts to control the Raven population, is expected to have a minor, local, medium term negative impact on this species. The Seabird Colony Protection Project also includes a small component to remove specific "problem" ravens

around murre colonies (e.g. at Castle Rock/Hurricane Point, Devil's Slide, and at PRNS). It also is expected to have a local, medium term, minor negative impact on ravens.

Because the selected projects are focused on relatively small geographical regions (e.g. four campground areas in the Santa Cruz Mountains, the outer point of the Point Reyes Penninsula, and some scattered murre colonies), and because only small numbers of Common Ravens would be removed relative to their regional populations levels, the Trustees believe that these alternatives will have a minor, medium term negative impact on the local and regional population of corvids.

House Mice

The Trustees are unaware of any other past or reasonably foreseeable projects that will impact the House Mouse, and therefore do not believe there are cumulative effects to be considered regarding this species. However, as discussed previously, since this project will undergo further environmental review, should other projects become known, the cumulative effects may be addressed in that subsequent NEPA process.

Human Use

The Trustees have selected six projects that may limit or change human use of natural resources in Monterey Bay, Santa Cruz Mountains, various northern California lakes, Kokechik Flats, Alaska, and on islands off Baja California, Mexico. Project components include (1) public education and outreach, and (2) limiting access to sensitive areas.

The selected alternatives occurring in Monterey Bay, the Santa Cruz Mountains, and Kokechik Flats areas will augment existing restoration projects and will therefore expand or extend, the local, minor negative impacts on human use arising from those existing projects.

The selected project at northern California lakes will involve education and outreach and create a few small exclusions 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, and minor impacts.

In summary, these projects are expected to have only localized, minor, negative impacts on recreational opportunities given that extensive alternate areas for human recreation are available in the immediate proximity to each of them.

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, as well as short term, minor negative impacts to human recreation.

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