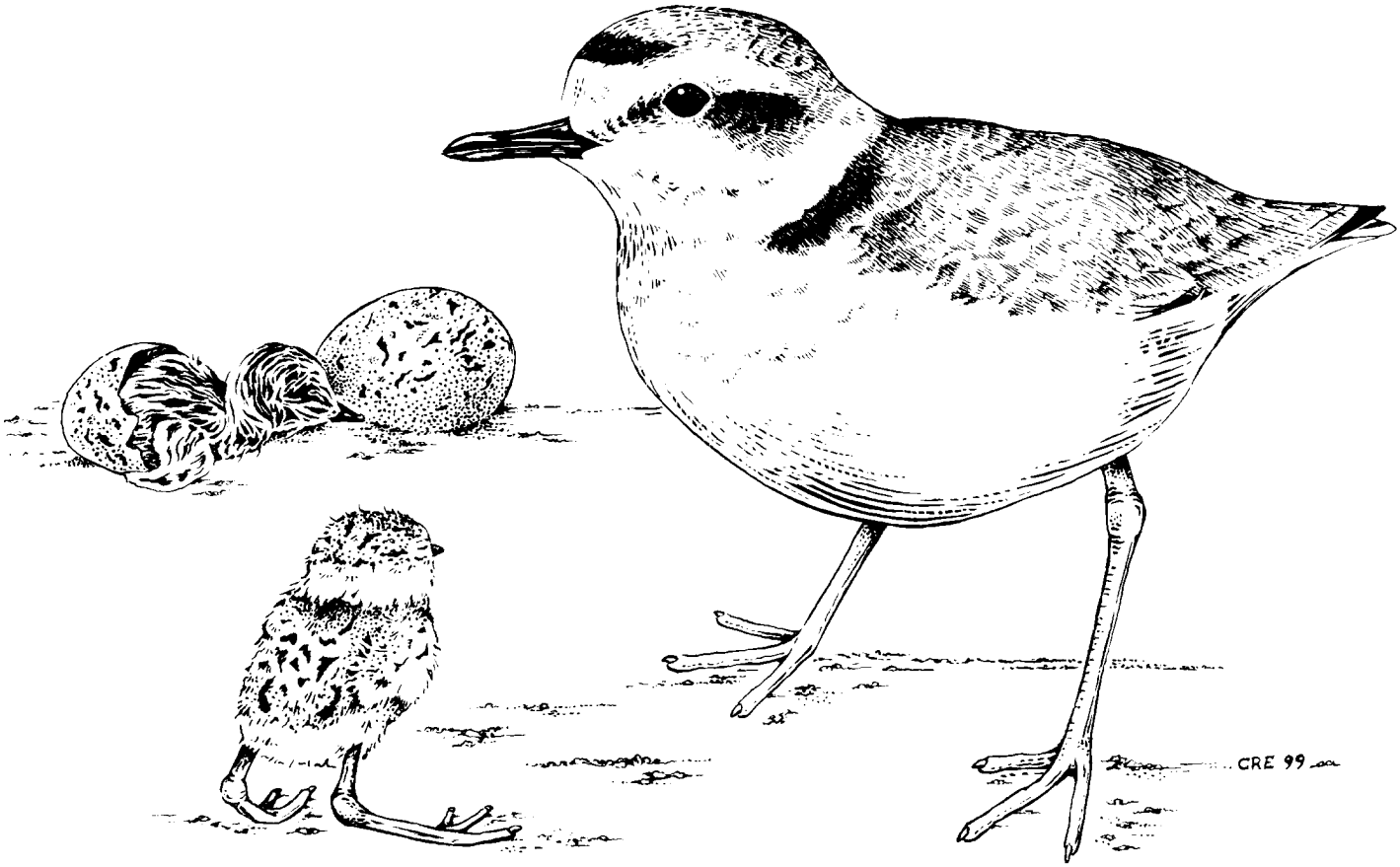
U.S. Fish & Wildlife Service

Western Snowy Plover
(Charadrius alexandrinus nivosus)
Pacific Coast Population Recovery Plan



Volume 1

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Santa Cruz, California

Recovery Plan for the

Pacific Coast Population of the

Western Snowy Plover

(*Charadrius alexandrinus nivosus*)

Volume 1: Recovery Plan

California/Nevada Operations Office
U.S. Fish and Wildlife Service
Sacramento, California

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We gratefully acknowledge the efforts of the Pacific Coast Western Snowy Plover Recovery Team in preparing this recovery plan. Special acknowledgment is also given to Nadav Nur, Point Reyes Bird Observatory, Stinson Beach, California, for his work on the population viability analysis.

DISCLAIMER

Recovery plans delineate reasonable actions that are believed to be required to recover and/or protect listed species. We, the U.S. Fish and Wildlife Service, publish recovery plans, sometimes preparing them with the assistance of recovery teams, contractors, State agencies, and others. Recovery teams serve as independent advisors to the U.S. Fish and Wildlife Service. Objectives of the recovery plan will be attained and necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not obligate other parties to undertake specific actions, and may not represent the views or the official positions or approval of any individuals or agencies involved in the recovery plan formulation other than our own. They represent our official position **only** after they have been signed by the Director, Regional Director, or Operations Manager as **approved**. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery actions.

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An electronic version of this recovery plan also will be made available at http://www.fws.gov/cno/es/recoveryplans.html and http://endangered.fws.gov/recovery/index.html#plans

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EXECUTIVE SUMMARY

CURRENT SPECIES STATUS: The Pacific coast population of the western snowy plover (*Charadrius alexandrinus nivosus*) (western snowy plover) is federally listed as threatened. The current Pacific coast breeding population extends from Damon Point, Washington, south to Bahia Magdalena, Baja California, Mexico (including both Pacific and Gulf of California coasts). The western snowy plover winters mainly in coastal areas from southern Washington to Central America.

HABITAT REQUIREMENTS AND LIMITING FACTORS: The Pacific coast population of the western snowy plover breeds primarily above the high tide line on coastal beaches, sand spits, dune-backed beaches, sparsely-vegetated dunes, beaches at creek and river mouths, and salt pans at lagoons and estuaries. Less common nesting habitats include bluff-backed beaches, dredged material disposal sites, salt pond levees, dry salt ponds, and river bars. In winter, western snowy plovers are found on many of the beaches used for nesting as well as on beaches where they do not nest, in man-made salt ponds, and on estuarine sand and mud flats.

Habitat degradation caused by human disturbance, urban development, introduced beachgrass (*Ammophila* spp.), and expanding predator populations have resulted in a decline in active nesting areas and in the size of the breeding and wintering populations.

RECOVERY OBJECTIVE: The primary objective of this recovery plan is to remove the Pacific coast population of the western snowy plover from the *List of Endangered and Threatened Wildlife and Plants* by: (1) increasing population numbers distributed across the range of the Pacific coast population of the western snowy plover; (2) conducting intensive ongoing management for the species and its habitat and developing mechanisms to ensure management in perpetuity; and (3) monitoring western snowy plover populations and threats to determine success of recovery actions and refine management actions.

RECOVERY PRIORITY: 3C, per criteria published by Federal Register Notice (U.S. Fish and Wildlife Service 1983).

RECOVERY CRITERIA: The Pacific coast population of the western snowy plover will be considered for delisting when the following criteria have been met:

1. An average of 3,000 breeding adults has been maintained for 10 years, distributed among 6 recovery units as follows: Washington and Oregon, 250 breeding adults; Del Norte to Mendocino Counties, California, 150 breeding adults; San Francisco Bay, California, 500 breeding adults; Sonoma to Monterey Counties, California, 400 breeding adults; San Luis Obispo to Ventura Counties, California, 1,200 breeding adults; and Los Angeles to San Diego Counties, California, 500 breeding adults. This criterion also includes implementing monitoring of site-specific threats, incorporation of management activities into management plans to ameliorate or eliminate those threats, completion of research necessary to modify management and monitoring actions, and development of a post-delisting monitoring plan.

2. A yearly average productivity of at least one (1.0) fledged chick per male has been maintained in each recovery unit in the last 5 years prior to delisting.

3. Mechanisms have been developed and implemented to assure long-term protection and management of breeding, wintering, and migration areas to maintain the subpopulation sizes and average productivity specified in Criteria 1 and 2. These mechanisms include establishment of recovery unit working groups, development and implementation of participation plans, development and implementation of management plans for Federal and State lands, protection and management of private lands, and public outreach and education.

ACTIONS NEEDED:

1. Monitor breeding and wintering populations and habitats of the Pacific coast population of the western snowy plover to determine progress of recovery actions to maximize survival and productivity.

2. Manage breeding and wintering habitat of the Pacific coast population of the western snowy plover to ameliorate or eliminate threats and maximize survival and productivity.

3. Develop mechanisms for long-term management and protection of western snowy plovers and their breeding and wintering habitat.

4. Conduct scientific investigations that facilitate the recovery of the western snowy plover.

5. Conduct public information and education programs about the western snowy plover.

6. Review progress towards recovery of the western snowy plover and revise recovery efforts, as appropriate.

7. Dedicate U.S. Fish and Wildlife Service staff to allow the Arcata Fish and Wildlife Office to coordinate western snowy plover recovery implementation.

8. Establish an international conservation program with the government of Mexico to protect western snowy plovers and their breeding and wintering locations in Mexico.

Appendices B and C address Actions 1 and 2, providing site-specific recommendations for breeding numbers and management actions. Appendix J addresses Action 1, providing guidelines for monitoring western snowy plovers during the breeding and wintering seasons. Appendix K addresses Action 5, providing a public information and education plan.

ESTIMATED COST OF RECOVERY: $149,946,000 plus additional costs that cannot be estimated at this time.

DATE OF RECOVERY: Delisting could occur by 2047 if the recovery criteria above have been met.

TABLE OF CONTENTS

I. INTRODUCTION 1
A. DESCRIPTION AND TAXONOMY 4
B. LIFE HISTORY AND ECOLOGY 7
1. Breeding 7
a. Population Size and Distribution 8
b. Arrival and Courtship 10
c. Duration of Breeding Season 11
d. Nests and Nest Sites 11
e. Egg Laying, Clutch Size, and Incubation 12
f. Clutch Hatching Success 14
g. Brood-rearing 14
h. Fledging success 15
i. Productivity 16
j. Survival 17
2. Feeding Habitat and Habits 17
3. Migration 18
4. Wintering 19
a. Distribution and Abundance 19
b. Site Fidelity 20
c. Behavior 20
C. POPULATION STATUS AND TRENDS 21
1. Historical Trends 21
a. Washington Coast 21
i. Grays Harbor County 21
ii. Pacific County 22
b. Oregon Coast 24
c. California Coast 27
i. Coastwide Perspective 27
ii. Regional Perspective 29
2. Current Breeding Distribution 32
3. Habitat Carrying Capacity 32
D. REASONS FOR DECLINE AND CONTINUING THREATS 33

1. The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range 33
a. Shoreline Stabilization and Development 33
b. Resource Extraction 34
i. Sand Removal and Beach Nourishment 34
ii. Dredging and Disposal of Dredged Materials 36
iii. Driftwood Removal 36
iv. Beach Fires and Camping 37
v. Watercourse Diversion, Impoundment, or Stabilization 37
vi. Operation of Salt Ponds 38
c. Encroachment of Introduced Beachgrass and Other Nonnative Vegetation 38
d. Habitat Conversion for Other Special Status Species 42
2. Overutilization for Commercial, Recreational, Scientific, or Education Purposes 45
3. Disease or Predation 47
4. The Inadequacy of Existing Regulatory Mechanisms 55
5. Other Natural or Manmade Factors Affecting Their Continued Existence 56
a. Natural Events 56
b. Disturbance of Breeding Plovers by Humans and Domestic Animals 57
i. Pedestrians 58
ii. Dogs 63
iii. Motorized Vehicles 65
iv. Beach Cleaning 67
v. Equestrian Traffic 67
vi. Fishing 68
vii. Fireworks 69
viii. Kite Flying and Model Airplanes 70
ix. Aircraft Overflights 70
x. Special Events 71

xi. Coastal Access 72
xii. Livestock Grazing 72
c. Oil Spills 72
d. Contaminants 75
e. Litter, Garbage, and Debris 76
f. Water Quality and Urban Run-off 77
g. Management for Other Special Status Species 78
E. IMPLICATIONS FOR THE COASTAL BEACH-DUNE ECOSYSTEM 78
1. Description of Coastal Beach-Dune Ecosystem 79
2. Sensitive Species of the Coastal Beach-Dune Ecosystem . . . 81
F. CONSERVATION EFFORTS 83
1. Conservation Planning on Federal and State Lands 84
2. Conservation Efforts on Federal and State Lands 87
a. Exclosures, Symbolic Fencing, and Signs 87
b. Law Enforcement 90
c. Predator Control 90
d. European Beachgrass Control 93
e. Off-Road Vehicle Restrictions and Management 99
f. Population Monitoring 101
g. Salt Pond Management 102
h. Habitat Acquisition 103
i. Use of Volunteers 103
j. Public Outreach and Education 104
k. Section 6 Cooperative Agreements 105
3. Conservation Efforts on Private Lands 106
4. Federal Regulatory Program 106
a. Critical Habitat 106
b. Section 9 Take Prohibitions 110
c. Section 10 Permits 111
d. Section 7 Requirements and Consultations 112
e. Other Federal Regulations, Executive Orders, and Agreements 112
5. State Regulatory Protection, Policies, and Agreements 115

6. Consultations, Habitat Conservation Plans, and Other Regulatory Actions 119
7. Regulatory Protection and Policies of Local Governments 125
8. Interagency Coordination 126

II. RECOVERY 129
A. RECOVERY STRATEGY 129
1. Recovery Strategy Components 129
2. Roles of Federal, State, Local, and Private Sectors 132
a. Role of Federal Lands 132
b. Role of State Lands 133
c. Roles of State and Local Governments 133
d. Role of Municipal Lands 134
e. Role of Private Lands 134
3. Conservation Tools and Strategies 134
4. Funding Sources 134
5. Coordination, Participation, and Working Groups 136
B. RECOVERY UNITS 137
C. RECOVERY GOALS AND OBJECTIVES 140
D. RECOVERY CRITERIA 141
E. RELATIONSHIP OF RECOVERY ACTIONS AND CRITERIA TO THREATS 147

III. NARRATIVE OUTLINE OF RECOVERY ACTIONS 155

IV. IMPLEMENTATION SCHEDULE 213

V. REFERENCES 239
A. Literature Cited 239
B. Personal Communications 266
C. *In Litt.* References 268

LIST OF APPENDICES
(See Volume 2)

Appendix A. Locations of Current or Historical Snowy Plover Breeding and Wintering Areas A-1
Appendix B. Information on Snowy Plover Breeding and Wintering Locations B-1
Appendix C. Summary of Current and Additional Needed Management Activities for Snowy Plover Breeding and Wintering Locations C-1
Appendix D. Population Viability Analysis for Pacific Coast Snowy Plovers D-1
Appendix E. Associated Sensitive Species of the Coastal Beach-Dune Ecosystem and Adjacent Habitats E-1
Appendix F. U.S. Fish and Wildlife Service Exclosure Protocols for Snowy Plover Nests, July 1999 . . . . . F-1
Appendix G. Priorities for Recovery of Threatened and Endangered Species G-1
Appendix H. Conservation Tools and Strategies H-1
Appendix I. Summary of Potential Funding Sources for Recovery Actions . I-1
Appendix J. Monitoring Guidelines for the Western Snowy Plover, U.S. Pacific Coast Population J-1
Appendix K. Information and Education Plan for the Western Snowy Plover, U.S. Pacific Coast Population K-1
Appendix L. Maps of Snowy Plover Sites L-1
Appendix M. Summary of Public Comments on Draft Recovery Plan and Service Responses M-1

LIST OF TABLES

Table 1. Status of western snowy plovers at three nesting sites in Washington (1993-2006) 24

Table 2. Number of adult western snowy plovers on window surveys of the Oregon coast during the breeding season (1978-2006) 25

Table 3. Comparison of breeding-season population estimates of adult western snowy plovers on the Oregon coast (1993-2006) based on three different measures of abundance 26

Table 4. Number of adult snowy plovers during breeding season window surveys on the California coast 28

Table 5. Breeding season surveys of snowy plover adults at selected sites along the coast of San Luis Obispo, Santa Barbara, and Ventura Counties 31

Table 6. Total number of nests at habitat restoration areas on the Oregon Coast 1994-2004 96

Table 7. Total number of fledged young at habitat restoration areas on the Oregon Coast 1994-2004 96

Table 8. Threats to the Pacific coast population of the western snowy plover and steps within the recovery plan to reduce or eliminate threats 149

LIST OF FIGURES

Figure 1. Map of known breeding and wintering distribution of Pacific Coast population of western snowy plover (*Charadrius alexandrinus nivosus*) 2
Figure 2. Adult male snowy plover 5
Figure 3. Oregon Dunes National Recreation Area 8
Figure 4. Western snowy plover clutch 13
Figure 5. New housing development next to beach at Monterey Bay, California 35
Figure 6. Recreationists at Salt Creek Beach, California 58
Figure 7. Equestrians on beach 68
Figure 8. Erecting western snowy plover exclosure 88
Figure 9. Symbolic fencing on beach at Monterey Bay, California 89
Figure 10. Banding western snowy plover chick 102
Figure 11. High school students removing European beachgrass 104
Figure 12. Chart of recovery planning and implementation efforts 190

I. INTRODUCTION

On March 5, 1993, the Pacific coast population of the western snowy plover (*Charadrius alexandrinus nivosus*) (western snowy plover) was listed as threatened under provisions of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*). The Pacific coast population is defined as those individuals that nest within 50 miles of the Pacific Ocean on the mainland coast, peninsulas, offshore islands, bays, estuaries, or rivers of the United States and Baja California, Mexico (U.S. Fish and Wildlife Service 1993*a*) (Figure 1). General locations of the western snowy plover's breeding and wintering locations in the United States are shown in Appendix A. Surveys, status reviews, and literature searches have identified 159 current or historical western snowy plover breeding or wintering locations on the U.S. Pacific coast. These localities include 6 in Washington, 19 in Oregon, and 134 in California (Appendix B). In Baja California, breeding western snowy plovers concentrate at coastal wetland complexes as far south as Bahia Magdalena, Mexico (Palacios *et al.* 1994). The locations listed in Appendix B are important for the recovery of the United States Pacific coast population of the western snowy plover because they represent important breeding, feeding, and sheltering habitat for the species.

In Washington, the western snowy plover was listed as endangered under Washington Department of Fish and Wildlife Policy #402 in 1981. In 1990 the Washington Fish and Wildlife Commission (Washington Administrative Code 232-12-014) reaffirmed the endangered status. In 1975, the Oregon Fish and Wildlife Commission listed the western snowy plover as threatened. Its threatened status was reaffirmed in 1989 under the Oregon Endangered Species Act and again in 1993 and 1998 by the Oregon Fish and Wildlife Commission as part of its periodic review process. Since 1978, the California Department of Fish and Game has classified both the inland and coastal population of western snowy plover as a "species of special concern." (Remsen 1978, California Natural Diversity Database 2001).

In August 2002, we received a petition from the Surf Ocean Beach Commission of Lompoc, California to delist the Pacific Coast population of the western snowy

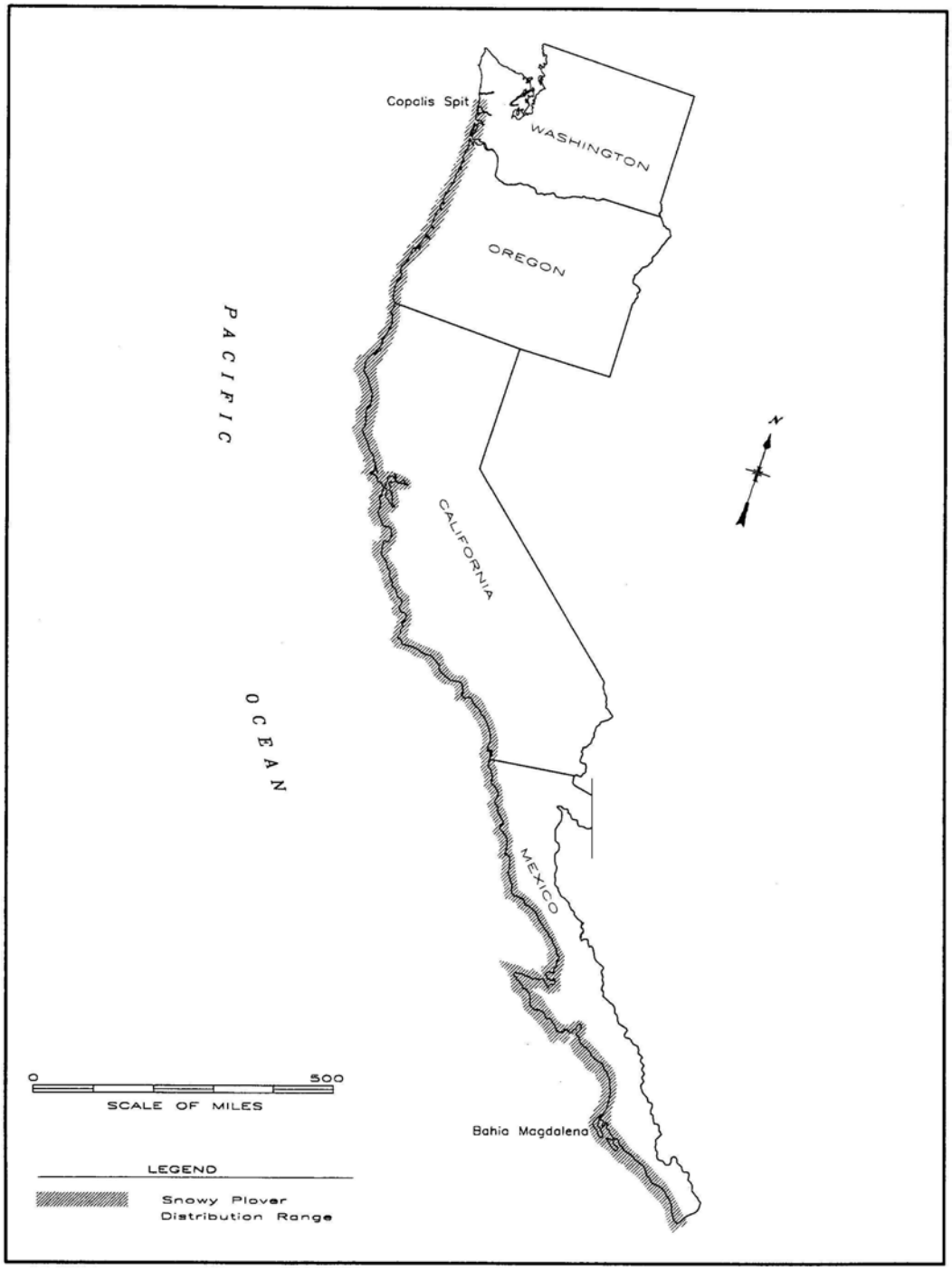

Figure 1. Map of known breeding and wintering distribution of the Pacific coast population of the western snowy plover.

plover. The City of Morro Bay, California submitted substantially the same petition dated May 30, 2003. On March 22, 2004, we published a notice that the petition presented substantial information to indicate that the delisting may be warranted (U.S. Fish and Wildlife Service 2004*a*). This notice also announced our initiation of a 5-year status review for the Pacific coast population of western snowy plover.

Under sections 4(b)(3)(B) and 4(c)(2) of the Endangered Species Act, we conducted a 5-year status review and evaluated whether the petitioned action was warranted. On April 21, 2006, we published a 12-month finding that concluded the petitioned action was not warranted (U.S. Fish and Wildlife Service 2006*a*). We also proposed a special rule pursuant to section 4(d) of the Endangered Species Act (U.S. Fish and Wildlife Service 2006*b*), which would exempt counties that have met western snowy plover recovery goals from most prohibitions on take as long as populations remain above recovery goals. The 5-year status review was completed on June 8, 2006.

Section 4 of the Endangered Species Act of 1973, as amended, requires us to develop a recovery plan for the conservation and survival of a species after it is federally listed as threatened or endangered, unless it is determined that such a plan will not promote the conservation of the species. Recovery is the process of reversing the decline of a listed species, eliminating threats, and ensuring the species' long-term survival. This recovery plan recommends actions necessary to satisfy the biological needs and assure recovery of the Pacific coast population of the western snowy plover. These actions include protection, enhancement, and restoration of all habitats deemed important for recovery; monitoring; research; and public outreach.

This recovery plan will serve as a guidance document for interested parties including Federal, State, and local agencies; private landowners; and the general public. It includes recommendations for western snowy plover management measures for all known breeding and wintering locations (Appendix C). These locations have been divided into six recovery units, as follows: (1) Oregon and Washington; (2) northern California (Del Norte, Humboldt, and Mendocino Counties); (3) San Francisco Bay (locations within Napa, Alameda, Santa Clara,

and San Mateo Counties); (4) Monterey Bay (including coastal areas along Monterey, Santa Cruz, San Mateo, San Francisco, Marin, and Sonoma Counties); (5) San Luis Obispo, Santa Barbara, and Ventura Counties; and (6) Los Angeles, Orange, and San Diego Counties. Designation of these locations and recovery units assists in identifying priority areas for conservation planning across the western snowy plover's breeding and wintering range.

This recovery plan emphasizes management on Federal and State lands, including opportunities to improve or expand upon current efforts. Because of this emphasis on public lands, the cost associated with this emphasis, and potential restrictions of public use on these lands, public support and involvement will be crucial to the recovery of the western snowy plover. Opportunities for public participation in recovery efforts are emphasized in Appendix K (Information and Education Plan).

A. DESCRIPTION AND TAXONOMY

The western snowy plover, a small shorebird in the family Charadriidae, weighs from 34 to 58 grams (1.2 to 2 ounces) and ranges in length from 15 to 17 centimeters (5.9 to 6.6 inches) (Page *et al.* 1995*a*). It is pale gray-brown above and white below, with a white hindneck collar and dark lateral breast patches, forehead bar, and eye patches (Figure 2). The bill and legs are blackish. In breeding plumage, males usually have black markings on the head and breast; in females, usually one or more of these markings are dark brown. Early in the breeding season a rufous crown may be evident on breeding males, but it is not typically seen on females. In non-breeding plumage, sexes cannot be distinguished because the breeding markings disappear. Fledged juveniles have buffy edges on their upper parts and can be distinguished from adults until approximately July through October, depending on when in the nesting season they hatched. After this period, molt and feather wear makes fledged juveniles indistinguishable from adults. Individual birds 1 year or older are considered to be breeding adults. The mean annual life span of western snowy plovers is estimated at about 3 years, but at least one individual was at least 15 years old when last seen (Page *et al.* 1995*a*).

Figure 2. Adult male western snowy plover (photo by Peter Knapp, with permission).

The species was first described in 1758 by Linnaeus (American Ornithologists' Union 1957). Two subspecies of the snowy plover have been recognized in North America (American Ornithologists' Union 1957): the western snowy plover (*Charadrius alexandrinus nivosus*) and the Cuban snowy plover (*C. a. tenuirostris*). The Pacific coast population of the western snowy plover breeds on the Pacific coast from southern Washington to southern Baja California, Mexico. Wintering birds may remain at their breeding sites or move north or south to other wintering sites along the Pacific coast. The interior population of the western snowy plover breeds in interior areas of Oregon, California, Nevada, Utah, New Mexico, Colorado, Kansas, Oklahoma, and north-central Texas, as well as coastal areas of extreme southern Texas, and possibly extreme northeastern Mexico (American Ornithologists' Union 1957). Although previously observed only as a migrant in Arizona, small numbers have bred there in recent years (Monson and Phillips 1981, Davis and Russell 1984). Interior population birds breeding east of the Rockies generally winter along the Gulf coast, while most interior population birds breeding west of the Rockies winter in coastal California and Baja

California, often intermingling with birds from the Pacific coast breeding population. The Cuban snowy plover breeds along the Gulf coast from Louisiana to western Florida and south through the Caribbean (American Ornithologists' Union 1957). More recent works recognize only subspecies *C. a. nivosus* for North America (Hayman *et al.* 1986, Binford 1989, Sibley and Monroe 1990).

A large amount of breeding data indicates that the Pacific coast population of the western snowy plover is distinct from western snowy plovers breeding in the interior (U.S. Fish and Wildlife Service 1993*a*, 2006*a*). A study conducted between 1977 and 1982 reported that western snowy plovers tend to exhibit breeding site fidelity (Warriner *et. al.* 1986). Banding and resighting data show that the Pacific Coast breeding populations and the western interior breeding populations experience limited or rare reproductive interchange (G. Page *in litt.* 2004*a*). Between 1984 and 1995, the period with the most extensive banding studies and search efforts, 907 plovers color-banded in coastal and interior populations were subsequently resighted (excluding birds banded on the coast during winter and birds resighted in their original region without evidence of nesting). Of these, 894 birds (98.6 percent) were observed during the breeding season using the same breeding range in which they were originally banded. Twelve birds (1.3 percent) were banded on the coast and later observed in the interior, only one of which was known to nest in the interior. Only one male (0.1 percent) was banded in the interior (without evidence of nesting) and later found nesting on the coast. Moreover, data from a period of less intensive surveys and banding from 1977 to 1983 corroborate this pattern (G. Page *in litt.* 2004*a*, U.S. Fish and Wildlife Service 2006*a*). During this period, of 400 birds banded in the interior, none were observed on the coast during breeding season, and of 599 birds banded on the coast only one was found nesting in the interior. Finally, 304 retrievals of numbered metal bands reported between 1969 and 2002 show no evidence of movement from interior to coast and only one bird (G. Goldsmith *in litt*. 2004, U.S. Fish and Wildlife Service 2006*a*) that moved from coast to interior (the dates being consistent with a bird from the interior population having been banded on the coast during the non-breeding season).

Thus, intensive banding and monitoring studies have documented only two clear instances of interbreeding between coastal and interior populations, and a few

cases of inter-population movement without confirmed breeding, among thousands of birds observed. These results illustrate that the amount of interchange between coastal and interior populations is likely to be extremely low, though not zero. Movement of birds from coastal to interior populations has been documented more often than the reverse (see also U.S. Fish and Wildlife Service 2006a).

Genetic studies using mitochondrial DNA and microsatellite DNA markers (Gorman 2000, Funk *et al.* 2006) have found no significant genetic differentiation between the Pacific coast and interior populations of the western snowy plover. However, because a small number of dispersing individuals per generation is sufficient to prevent genetic differentiation between two semi-isolated populations (Mills and Allendorf 1996, Funk *et al.* 2006), this result is consistent with the banding data reported above. Because the small number of dispersing individuals indicated by banding data appear insufficient to substantially affect rates of population growth or decline in either population, the two populations evidently function demographically as largely independent of one another. Moreover, the infrequency of observed dispersal from coast to interior further indicates that any declines in the coastal population are not likely to be effectively offset by immigration of interior birds to the coast. Consequently there is no evidence that existing unoccupied habitat along the Pacific coast is currently being or in future would be naturally colonized by birds from the interior population (Funk et al. 2006).

B. LIFE HISTORY AND ECOLOGY

1. Breeding

The Pacific coast population of the western snowy plover breeds primarily on coastal beaches from southern Washington to southern Baja California, Mexico (*e.g.*, Figure 3). Sand spits, dune-backed beaches, beaches at creek and river mouths, and salt pans at lagoons and estuaries are the main coastal habitats for nesting (Stenzel *et al*. 1981, Wilson 1980). This habitat is unstable because of

Figure 3. Coastal beach in Oregon Dunes National Recreational Area (photo by Ruth Pratt, with permission)

unconsolidated soils, high winds, storms, wave action, and colonization by plants. Less common nesting habitats include bluff-backed beaches, dredged material disposal sites, salt pond levees, dry salt ponds, and river bars (Wilson 1980, Page and Stenzel 1981, Powell *et al.* 1996, Tuttle *et al.* 1997).

a. Population Size and Distribution

Population estimates referenced below are based on window surveys as well as on more intensive studies involving repeated surveys of populations with individually identifiable color-banded birds. Window surveys are a one-time pass of a surveyor, or team of surveyors, through potential western snowy plover nesting habitat during May or June (see survey protocol in Appendix J). The surveyor counts all adult western snowy plovers in the habitat and identifies the adults as male or female, when possible. Because window surveys may not detect all birds, they are not directly comparable to more intensive studies. A correction factor can be estimated by comparing window survey data with concurrent population estimates from detailed studies of color-banded populations; currently the best

rangewide estimate of the correction factor is 1.3 (U.S. Fish and Wildlife Service 2006*a*), but it is preferable to determine corrections on a more specific regional or site basis if possible due to differences in survey efficiency in different habitats (see action 4.3.1).

Western snowy plovers concentrate in suitable habitat, with the number of adults at coastal breeding locations ranging from 1 to 315, depending in part, on the size of the area (Appendix B). The largest number of breeding birds occurs from south San Francisco Bay to southern Baja California (Page and Stenzel 1981, Palacios *et al.* 1994).

The locations of the following parenthetical references to western snowy plover breeding and wintering locations in Washington, Oregon, and California are shown in Figures A-1 through A-7 of Appendix A, and mapped in greater detail in Appendix L. Information on the numbers of breeding and wintering western snowy plovers at these locations is described in Appendix B.

Four breeding areas currently exist in southern Washington: Damon Point (Washington location 2 [WA-2]) in Grays Harbor; Midway Beach (WA-4); and Leadbetter Point (WA-5) and Graveyard Spit (discovered in 2006) in Willapa Bay. Prior to the 1998 breeding season, fewer than 25 western snowy plovers and 12 nests were found in Washington during regular, standardized surveys. However, surveys from 1998 through 2006 (Sundstrom 2003, 2005; Brennan and Fernandez 2004*a*, 2006; Pearson *et al.* 2006; Washington Department of Fish and Wildlife unpub. data) indicate greater numbers of western snowy plovers are nesting at Leadbetter Point (WA-5) and Midway Beach (WA-4), with a maximum estimated population of 70 western snowy plovers statewide in 2006.

In Oregon, nesting birds have been recorded at 14 sites since 1990 (Castelein *et al.* 2002, Lauten *et al.* 2006*a*, 2006*b*). Nesting has occurred most frequently at 9 sites, including Sutton (OR-8), Siltcoos (OR-10), Dunes Overlook (OR-10), Tahkenitch (OR-10), Tenmile Spits (OR-12), Coos Bay North Spit (OR-13), Bandon (OR-15), New River (OR-15), and Floras Lake (OR-15). An estimated 177-179 adult western snowy plovers were observed at Oregon sites during the 2006 breeding season. A total of 135 individuals were known to have nested in

2006, with 147 nests located. Individual nests have also been found between 1990 and 2002 at several other Oregon sites, including Necanicum (OR-1); Bayocean Spit (OR-3); North Siuslaw (OR-8); Threemile-Umpqua River (OR-11); and Menasha Spoils, North Bend.

Western snowy plover populations in California have fluctuated between roughly one thousand and two thousand birds over the past 30 years, as detailed in section I.C.1.c below. Eight geographic areas support over three-quarters of the California coastal breeding population: San Francisco Bay (CA-27 to CA-47), Monterey Bay (CA-63 to CA-65), Morro Bay (CA-79 to CA-81), the Callendar-Mussel Rock Dunes area (CA-83), the Point Sal to Point Conception area (CA-84 to CA-88), the Oxnard lowland (CA-96 to CA-99), Santa Rosa Island (CA-93), and San Nicolas Island (CA-100) (Page *et al.* 1991, G. Page *in litt.* 2005*a*).

A survey of breeding western snowy plovers along the Pacific coast of Baja California, Mexico between 1991 to 1992 found 1,344 adults, mostly at four coastal wetland complexes: Bahia San Quintin, Lagunas Ojo de Liebre and Guerrero Negro, Laguna San Ignacio, and Bahia Magdalena (Palacios *et al.* 1994).

b. Arrival and Courtship

Nesting western snowy plovers at coastal locations consist of both year-round residents and migrants (Warriner *et al.* 1986). Migrants begin arriving at breeding areas in southern Washington in early March (Widrig 1980) and in central California as early as January, although the main arrival is from early March to late April (Page *et al.* 1995*a*). Since some individuals nest at multiple locations during the same year, birds may continue arriving through June (Stenzel *et al.* 1994).

Mated birds from the previous breeding season frequently reunite. Pair bonds are associated with territorial defense by males and nest scraping behavior, but early in the season birds begin to associate with one another in pairs within and apart from roosting flocks before nest scraping activity is observed, suggesting that pair bonds can be established prior to overt displays (Warriner *et al.* 1986). A scrape is a depression in the sand or substrate that a male constructs by leaning forward

on his breast and scratching his feet while rotating his body axis (Page *et al.* 1995*a*). Copulations are associated with scraping behavior (Warriner *et al.* 1986). Females choose which scrape becomes the nest site by laying eggs in one of them. In California, pre-nesting bonds and courtship activities are observed as early as mid-February. Similar activities begin by March in Oregon. During courtship, males defend territories and usually make multiple scrapes.

c. Duration of Breeding Season

Along the west coast of the United States, the nesting season of the western snowy plover extends from early March through late September. Generally, the breeding season may be 2 to 4 weeks earlier in southern California than in Oregon and Washington. Fledging (reaching flying age) of late-season broods may extend into the third week of September throughout the breeding range.

The earliest nests on the California coast occur during the first week of March in some years and by the third week of March in most years (Page *et al.* 1995*a*). Peak initiation of nesting is from mid-April to mid-June (Warriner *et al.* 1986; Powell *et al.* 1997). Hatching lasts from early April through mid-August, with chicks reaching fledging age approximately 1 month after hatching (Powell *et al.* 1997). On the Oregon coast nesting may begin as early as mid-March, but most nests are initiated from mid-April through mid-July (Wilson-Jacobs and Meslow 1984); peak nest initiation occurs from mid-May to early July (Stern *et al.* 1990). In Oregon, hatching occurs from mid-April through mid-August, with chicks reaching fledging age as early as mid- to late May. Peak hatching occurs from May through July, and most fledging occurs from June through August. On the Washington coast, most adults arrive during late April, with maximum numbers present from mid-May to late June. Fledging occurs from late June through August (Washington Department of Fish and Wildlife 1995).

d. Nests and Nest Sites

Nests typically occur in flat, open areas with sandy or saline substrates; vegetation and driftwood are usually sparse or absent (Widrig 1980, Wilson 1980, Stenzel *et al.* 1981). Western snowy plovers also regularly nest on the gravel bars along the

Eel River in northern California. In southern California, western snowy plovers nest in areas with 6 to 18 percent vegetative cover and 1 to 14 percent inorganic cover; vegetation height is usually less than six centimeters (2.3 inches) (Powell *et al.* 1995, 1996). Nests consist of a shallow scrape or depression, sometimes lined with beach debris (*e.g.*, small pebbles, shell fragments, plant debris, and mud chips); nest lining increases as incubation progresses. Driftwood, kelp, and dune plants provide cover for chicks that crouch near objects to hide from predators. Invertebrates are often found near debris, so driftwood and kelp are also important for harboring western snowy plover food sources (Page *et al.* 1995*a*). Page and Stenzel (1981) found that nests were usually within 100 meters (328 feet) of water, but could be several hundred meters away when there was no vegetative barrier between the nest and water. They believed the absence of such a barrier is probably important for newly-hatched chicks to have access to the shore. Powell *et al.* (1995, 1996) also reported that nests from southern California were usually located within 100 meters (328 feet) of water, which could be either ocean, lagoon, or river mouth. Although the majority of western snowy plovers are site-faithful, returning to the same breeding area in subsequent breeding seasons, some also disperse within and between years (Warriner *et al.* 1986, Stenzel *et al.* 1994). Western snowy plovers occasionally nest in exactly the same location as the previous year (Warriner *et al.* 1986).

e. Egg Laying, Clutch Size, and Incubation

Initiation (eggs and laying) occurs from mid-February/early March through the third week of July (Wilson 1980, Warriner *et al.* 1986). The approximate periods required for nesting events are: scrape construction (in conjunction with courtship and mating), 3 days to more than a month; egg laying, usually 4 to 5 days; and incubation, 26 to 31 days (mean 27 days) (Warriner *et al.* 1986). The usual clutch size (*e.g.*, number of eggs in one nest) is three (Figure 4) with a range from two to six. (Warriner *et al.* 1986, Page *et al.* 1995*a*). Both sexes incubate the eggs, with the female tending to incubate during the day and the male at night (Warriner *et al.* 1986). Adult western snowy plovers frequently will attempt to lure people and predators from hatching eggs with alarm calls and distraction displays. Occasionally, adults behave similarly during the egg-laying period or

Figure 4. Western snowy plover clutch (photo by Bruce Casler, with permission).

incubation of completed clutches. More typical, however, is for the incubating adult to run away from the eggs without being seen. Incomplete clutches are those in which all eggs have not been laid. Partly-incubated clutches are those clutches having some degree (in days) of incubation.

Western snowy plovers will re-nest after loss of their eggs (Wilson 1980, Warriner *et al.* 1986). Re-nesting occurs 2 to 14 days after failure of a clutch, and up to five re-nesting attempts have been observed for a pair (Warriner *et al.* 1986).

Double brooding with polyandry (meaning the female successfully hatches more than one brood [*i.e.* sibling chicks of a hatched nest] in a nesting season with different mates) is common in coastal California (Warriner *et al.* 1986) and Oregon (Wilson-Jacobs and Meslow 1984). On the California coast, the breeding season is long enough for some females to triple brood and for some males to double brood (Page *et al.* 1995*a*). Triple brooding in a male has, on rare occasion, been recorded; a male triple brooded at Moss Landing salt ponds in 2001 (D. George *in litt.* 2001). After losing a clutch or brood or successfully hatching a

nest, western snowy plovers may re-nest at the same site or move up to several hundred kilometers to nest at other sites (Stenzel *et al.* 1994, Powell *et al.* 1997).

f. Clutch Hatching Success

Widely varying clutch hatching success (percent of clutches hatching at least one egg) is reported in the literature. Clutch hatching success ranging from 0 to 90 percent has been recorded for coastal western snowy plovers (Widrig 1980, Wilson 1980, Saul 1982, Wilson-Jacobs and Dorsey 1985, Warriner *et al.* 1986, Wickham unpubl. data *in* Jacobs 1986). Low clutch hatching success has been attributed to a variety of factors, including predation, human disturbance, high tides, and inclement weather. Heavy recreational beach use coincides with the peak hatching period for western snowy plover eggs (Powell 2001), adding additional pressures to western snowy plover adults and chicks that are more exposed to human disturbance. Observed clutch hatching success ranged from 12.5 to 86.8 percent and averaged 50.6 percent in eight studies of coastal breeding western snowy plovers (Page *et al.* 1995*a*). In San Diego County, estimated nesting success ranged from 43 to 68 percent between 1994 and 1998, averaging 54 percent (Powell *et al.* 2002); nesting western snowy plovers in San Diego County likely benefitted from predator management efforts for snowy plovers and California least terns (*Sternula antillarum browni*) (A. Powell, U.S. Geological Survey, pers. comm. 1998). In Monterey Bay, hatching rate was significantly increased from 43 percent (during 1984-1990) to 68 percent (during 1991-1999) by intensive control of mammalian predators and use of nest exclosures (Neuman *et al.* 2004).

g. Brood-rearing

The first chick hatched remains in or near the nest until other eggs (or at least the second egg) hatch. The adult western snowy plover, while incubating the eggs, also broods the first chick. The non-incubating adult also may brood the first-born chick a short distance from the nest. If the third egg of a clutch is 24 to 48 hours behind the others in hatching, it may be deserted. Western snowy plover chicks are precocial, leaving the nest within hours after hatching to search for food. They are not able to fly (fledge) for approximately 1 month after hatching;

fledging requires 28 to 33 days (Warriner *et al.* 1986). Broods rarely remain in the nesting area until fledging (Warriner *et al.* 1986, Stern *et al.* 1990). Western snowy plover broods may travel along the beach as far as 6.4 kilometers (4 miles) from their natal area (Casler *et al.* 1993).

Adult western snowy plovers do not feed their chicks, but lead them to suitable feeding areas. Adults use distraction displays to lure predators and people away from chicks. With vocalizations, adult western snowy plovers signal the chicks to crouch as another way to protect them (Page *et al.* 1995*a*). They also may lead chicks, especially larger ones, away from predators. Warriner *et al.* (1986) reported that most chick mortality occurs within 6 days after hatching.

Females generally desert mates and broods by the sixth day after hatching and thereafter the chicks are typically accompanied by only the male. While males rear broods, females obtain new mates and initiate new nests (Page *et al.* 1995*a*). Females typically help rear the last brood of the season.

h. Fledging success

The fledging success of western snowy plovers (percentage of hatched young that reach flying age) varies greatly by location and year. Even western snowy plovers nesting on neighboring beach segments may exhibit quite different success in the same year. For example, the percentage of chicks fledged on different beach segments of Monterey Bay in 1997 varied from 11 to 59 percent (average 24 percent) (Page *et al.* 1997). During the prior 13 years, fledging success on Monterey Bay beaches averaged 39 percent (Page *et al.* 1997). From the former Moss Landing salt ponds (now known as the Moss Landing Wildlife Area) in Monterey Bay (CA-64), fledging success ranged from 13.2 percent to 57.1 percent from 1988 to 1997. In San Diego County, fledging success ranged from 32.6 to 51.4 percent (Powell *et al.* 1997). In Oregon, annual fledging success for 1992 to 2006, for all coastal sites combined, ranged from 26 to 55 percent (Lauten *et al.* 2006*a*, 2006*b*). As in California, there is considerable variation among sites within years. For example, in 2005, the fledging success ranged from 24 percent at New River (OR-15) to 70 percent at Coos Bay South Beach (OR-13). There also is variation at individual sites among years. At the Coos Bay North Spit

(OR-13), one of the larger nesting areas in coastal Oregon, annual fledging success for 1992 to 2006 ranged from 38 to 74 percent.

i. Productivity

The productivity information most useful for this recovery plan is reproductive success (the annual number of young fledged per adult male). For the population viability analysis (Appendix D), males were used in the model because their population parameters can be estimated with greater certainty than for females. In addition, it is reasonable to consider that the availability of males is limiting reproductive success because they are responsible for post-hatching parental care, and females can lay clutches for more than one male (Warriner *et al.* 1986).

Chicks are considered fledged at 28 to 33 days after hatching. Estimates of the number of young fledged per adult male are available for Oregon; northern California from Mendocino to Del Norte Counties; Monterey Bay, California; and San Diego County, California. Along the Oregon coast, the average number of young annually fledged per male during the period between 1992 and the initiation of predator management (2002 to 2004 depending on site) was estimated as 0.87 (Lauten *et al.* 2006*b*); this fledging success significantly increased to 1.44 since implementation of predator management. Male fledging success in Oregon has annually ranged between 0.70 and 1.64 (Lauten *et al.* 2006*a*). In northern California, fledging success ranged from 0.8 to 1.7 fledglings per male between 2001-2005, with birds nesting on river gravel bars consistently achieving greater success than those nesting on beaches (Colwell *et al.* 2005). At Monterey Bay, California, from 1984 to 1990, when little effort was made to protect chicks from predators and people, males averaged 0.86 fledglings annually. When intensive efforts were undertaken to control mammalian predators from 1993 to 1999, the number of young fledged per adult male initially increased above 1.1, then declined sharply as avian predation on chicks became increasingly significant (Neuman *et al.* 2004). After live trapping and removal of avian predators was initiated, fledging success again increased in target areas (G. Page *in litt.* 2004b). Over 16 years of study at Monterey Bay, the annual number of young fledged ranged from 0.32 to 1.23 per male (Neuman *et al.* 2004). In San Diego County from 1994 to 1998, an average of 0.15 to 0.44 young were fledged per male

(Powell et al. 2002). Fledging success in Washington cannot be accurately estimated due to lack of banded chicks and adults and variable monitoring effort prior to 2006 (S. Pearson *in litt.* 2006); however it was roughly estimated at between 0.76 and 1.45 young fledged per male in 2006, excluding Leadbetter Point which was insufficiently surveyed but may have had poorer fledging success (Pearson *et al.* 2006).

j. Survival

Annual survival rates for adult and juvenile western snowy plovers have been calculated from studies of color banded birds from the coast of Oregon (M. Stern unpubl. data), the shoreline of Monterey Bay, California (Point Reyes Bird Observatory unpublished data), and the coast of San Diego County, California (A. Powell and J. Terp unpublished data) using the program SURGE (Lebreton *et al.* 1992, Cooch *et al.* 1996). Annual juvenile survival rates for fledged young average 48.5 percent (1992-2002) from the Oregon coast, 45 percent from Monterey Bay, and 45 percent from the San Diego coast. Annual survival rates for adult females and males, respectively, averaged 75 and 75 percent from the Oregon coast, 69 and 75 percent from Monterey Bay, and 72 and 71 percent from the San Diego coast. Differences between males and females were statistically significant only for the Monterey Bay area. Appendix D explains how these survival rates were incorporated into the population viability analysis.

2. Feeding Habitat and Habits

Western snowy plovers are primarily visual foragers, using the run-stop-peck method of feeding typical of *Charadrius* species. They forage on invertebrates in the wet sand and amongst surf-cast kelp within the intertidal zone, in dry sand areas above the high tide, on salt pans, on spoil sites, and along the edges of salt marshes, salt ponds, and lagoons. They sometimes probe for prey in the sand and pick insects from low-growing plants. At the Bolsa Chica wetlands in California, western snowy plovers have been observed pecking small, flying insects from mid-air and shaking one foot in very shallow water to agitate potential prey (Fancher *et al.* 1998). Western snowy plover food consists of immature and adult forms of aquatic and terrestrial invertebrates. Little quantitative information is

available on food habits. In San Diego, California, invertebrates found in western snowy plover feces during the breeding season included rove beetles (Staphylinidae), long-legged flies (Dolichopodidae), shore flies (Ephydridae), water bugs (Saldidae), hymenopterans (Braconidae), and unidentified insect larvae (Tucker and Powell 1999). During the breeding season, Jacobs (1986) observed adult western snowy plovers feeding on sand hoppers (Orchestoidea) and small fish on the Oregon coast. Other food items reported for coastal western snowy plovers include Pacific mole crabs (*Emerita analoga*), striped shore crabs (*Pachygrapsus crassipes*), polychaetes (Neridae, *Lumbrineris zonata, Polydora socialis, Scoloplos acmaceps)*, amphipods (*Corophium* ssp., *Ampithoe* spp., *Allorchestes angustus*), tanadacians (*Leptochelia dubia*), shore flies (Ephydridae), beetles (Carabidae, Buprestidae, Tenebrionidae), clams (*Transenella* sp.), and ostracods (Page *et al.* 1995*a*). In salt evaporation ponds in San Francisco Bay, California, the following prey have been recorded: brine flies (*Ephydra cinerea*), beetles (*Tanarthrus occidentalis, Bembidion* sp.), moths (*Perizoma custodiata*), and lepidopteran caterpillars (Feeney and Maffei 1991). Opportunities for foraging are directly dependent on salinity levels. Specifically, salt ponds of medium salinity seem to provide the best quality foraging habitat (M. Kolar, San Francisco Bay National Wildlife Refuge, pers. comm. 2004).

3. Migration

While some western snowy plovers remain in their coastal breeding areas year-round, others migrate south or north for winter (Warriner *et al.* 1986, Page *et al.* 1995*a*, Powell *et al.* 1997). In Monterey Bay, California, 41 percent of nesting males and 24 percent of the females were consistent year-round residents (Warriner *et al.* 1986). At Marine Corps Base Camp Pendleton in San Diego County, California, about 30 percent of nesting birds stayed during winter (Powell *et al.* 1995, 1996, 1997). The migrants vacate California coastal nesting areas primarily from late June to late October (Page *et al.* 1995*a*). There is evidence of a late-summer (August/September) influx of western snowy plovers into Washington; it is suspected that these wandering birds are migrants (S. Richardson, Washington Department of Fish and Wildlife, pers. comm. 1998).

Most western snowy plovers that nest inland migrate to the coast for the winter (Page *et al.* 1986, 1995*b*). Thus, the flocks of non-breeding birds that begin forming along the U.S. Pacific coast in early July are a mixture of adult and hatching-year birds from both coastal and interior nesting areas. During migration and winter, these flocks range in size from a few individuals to up to 300 birds (Appendix B).

4. Wintering

a. Distribution and Abundance

In western North America, the western snowy plover winters (here defined as late October to mid-February) mainly in coastal areas from southern Washington to Central America (Page *et al.* 1995*a*). Both coastal and interior populations use coastal locations in winter. Small numbers of western snowy plovers occur at two locations on the Washington coast: Midway Beach (WA-4) (S. Richardson, pers. comm. 1998, J. Grettenberger, U.S. Fish and Wildlife Service, pers. comm. 2004), and Leadbetter Point (WA-5), Willapa Bay (Washington Department of Fish and Wildlife 1995), both in Pacific County. Increasing numbers of wintering western snowy plovers are being documented along the Washington coast, with 32 counted in 2005 (L. Kelly *in litt.* 2005). As many as 97 western snowy plovers were observed wintering on the Oregon coast in 2005 (L. Kelly *in litt.* 2005). During the survey period between 1990 and 2005, at least 9 Oregon locations (Appendix B) have been used by wintering plovers. Probably as many as 2,500 plovers overwinter along the mainland California coast, and hundreds more at San Francisco Bay and in the Channel Islands (Appendix B, Page *et al.* 1986). The majority of wintering western snowy plovers on the California coast are found from Bodega Bay, Sonoma County, southward (Page *et al.* 1986). Appendix B gives the range of years over which each state's data was collected as well as the minimum and maximum number of western snowy plovers inventoried.

Nesting western snowy plovers from the Oregon coast have wintered as far south as Monterey Bay, California; those from Monterey Bay in central California have wintered north to Bandon, Oregon, and south to Laguna Ojo de Liebre, Baja California, Mexico (Page *et al.* 1995*a*); and those from San Diego in southern

California have wintered north to Vandenberg Air Force Base in Santa Barbara County and south to Laguna Ojo de Liebre, Baja California, Mexico (Powell *et al.* 1995, 1996, 1997).

In winter, western snowy plovers are found on many of the beaches used for nesting, as well as some beaches where they do not nest (Appendix B). They also occur in man-made salt ponds and on estuarine sand and mud flats. In California, the majority of wintering western snowy plovers concentrate on sand spits and dune-backed beaches. Some also occur on urban and bluff-backed beaches, which are rarely used for nesting (Page *et al.* 1986). Pocket beaches at the mouths of creeks and rivers on otherwise rocky shorelines are used by wintering western snowy plovers south, but not north, of San Mateo County, California.

b. Site Fidelity

Western snowy plovers that breed on the coast and inland are very site faithful in winter (Point Reyes Bird Observatory unpublished data). For example, after 166 adults and 204 chicks were banded at Lake Abert, Oregon during summer, many were subsequently found along the California and Baja California, Mexico coasts. Of those for which a wintering location was identified, 67 percent of the adult males, 73 percent of the adult females, and 60 percent of the birds banded as chicks (immatures) were found at the same winter location in at least 2 consecutive years; and 33 percent of the males, 32 percent of the females, and 35 percent of the immatures for at least 3 years (Page *et al.* 1995*b*).

c. Behavior

Western snowy plovers are typically gregarious in winter. Although some individuals defend territories on beaches, most usually roost in loose flocks; frequently western snowy plovers also are observed foraging in loose flocks (Page *et al.* 1995*a*). Roosting western snowy plovers usually sit in small depressions in the sand, or in the lee of kelp, other debris, or small dunes (Page *et al.* 1995*a*). Sitting behind debris or in depressions provides some shelter from the wind and probably makes the birds more difficult for predators to detect. When roosting western snowy plovers are disturbed, they frequently run a few meters to a new

spot where they sometimes displace other individuals. Alternatively, the whole flock may fly to a new location.

C. POPULATION STATUS AND TRENDS

1. Historical Trends

Historical records indicate that nesting western snowy plovers were once more widely distributed and abundant in coastal Washington, Oregon, and California.

a. Washington Coast

In Washington, western snowy plovers formerly nested at five coastal locations (Washington Department of Fish and Wildlife 1995). Three of these sites have had active nesting in recent years, as summarized in Table 1. One new site was also recently discovered in 2006. Populations appear to have increased overall since the early 1990s, although consistent, intensive surveys have been conducted only since the mid-1990s. Quantitative comparisons prior to that are not possible because of the inconsistency in surveys. Estimated numbers of breeding adults (Table 1) substantially exceed window survey data (M. Jensen *in litt.* 2006), partially because of adverse weather during window survey periods in recent years.

i. Grays Harbor County

Copalis Spit (WA-1) held 6 to 12 western snowy plover pairs in the late 1950s or early 1960s (Washington Department of Fish and Wildlife 1995). No other information on breeding at Copalis Spit is available. Suitable habitat was judged capable of supporting four pairs in 1984 (Washington Department of Fish and Wildlife 1995). Periodic surveys since 1983 have revealed just a single western snowy plover (Washington Department of Fish and Wildlife unpubl. data). Two post season juvenile western snowy plovers were observed at Copalis Spit in 2001 (Sundstrom 2002*a*). There is no longer vehicle access to the site since the road washed out several years ago, which has reduced the potential for disturbance from recreational activities. Erosion caused by the northward shift of Connor

Creek has reduced the amount of habitat, but some suitable habitat remains at the end of the spit and the area has potential as a nesting site with habitat restoration and public education (U.S. Fish and Wildlife Service 2005, M. Jensen *in litt.* 2006).

Damon Point and Oyhut Wildlife Area (WA-2) lack western snowy plover records prior to 1971, but this is likely due to limited visitation rather than western snowy plover absence. Between 1971 and 1983, birders reported up to six western snowy plovers during infrequent visits-to Damon Point (Washington Department of Fish and Wildlife 1995). Western snowy plover research in 1985 and 1986 revealed up to 20 western snowy plovers and 8 nests at Damon Point (Anthony 1987). Although most of the locality is suitable habitat, increasing levels of public use have reduced the secure nesting areas to a small portion of the site that is difficult to access, and the breeding population has declined over the last two decades (M. Jensen *in litt.* 2006). From 1993 to 2006 the number of adults at Damon Point has ranged from 2 to 10 (Table 1). Only one nest was found in 2006 (Pearson *et al.* 2006).

Westport Spit (WA-3) held low numbers of western snowy plovers from before 1915 until at least 1968, and scientific collecting was concentrated there through 1934 (Washington Department of Fish and Wildlife 1995). A single nest, poorly documented, was reported in 1983 (Washington Department of Fish and Wildlife unpublished data). No other quantitative information on abundance or nesting is available for this site. Erosion of the site has rendered the beach too narrow to support successful nesting, and there is little opportunity for habitat restoration through beachgrass removal due to private ownership of upland dune habitat (M. Jensen *in litt.* 2006). Recreational use is also substantial. This location is no longer being surveyed due to lack of suitable habitat.

ii. Pacific County

Midway Beach (WA-4) and Cape Shoalwater once contained several hundred acres of suitable western snowy plover habitat, but the area lacks historical records of these birds except for specimens collected in 1914 and 1960 and labeled “Tokeland” (Washington Department of Fish and Wildlife 1995). In

recent years, Midway Beach has been accreting sand and creating high quality habitat. Recent nesting was first documented in 1998 (Richardson *et al.* 2000). Numbers of breeding adults have increased since 1998, and during 2003-2006 the numbers of adults during the breeding season have ranged from 23-33, with a peak number of 30 nests (M. Jensen *in litt.* 2006; Pearson *et al.* 2006). Approximately one third of the habitat is on State Park land with controlled access; on the privately owned land recreational disturbance is fairly high and contributes to high rates of nest failure.

In 2006, western snowy plovers were discovered nesting on Graveyard Spit in northern Willapa Bay, which is primarily on the Shoalwater Indian Reservation and State lands (M. Jensen *in litt.* 2006; Pearson *et al.* 2006). Three pairs of plovers used the spit in 2006 and produced three fledglings.

Leadbetter Point (WA-5) was rarely visited by western snowy plover observers prior to 1964. In the 1960s and 1970s, birders reported up to 35 western snowy plovers, with nesting confirmed in 1967 by the sighting of two chicks (Washington Department of Fish and Wildlife 1995). Western snowy plover numbers were estimated at up to 24 individuals and between 7 and 11 nests during surveys done between 1978 to 1997 (Widrig 1980, 1981; Willapa National Wildlife Refuge unpublished data; Williamson 1995, 1996, 1997). Numbers increased slightly from 1998-2006, with numbers ranging from 24 to 45 adults present (Table 1). The distribution of nesting by western snowy plovers has changed, however, with recent habitat loss from erosion on the tip of Leadbetter Point and shifting of nesting southwards. Since 2002 the refuge has cleared 25 hectares (63 acres) of non-native beachgrass and the habitat restoration site has been consistently used by nesting plovers. Western snowy plovers are also nesting in Leadbetter State Park and State-owned lands south of the Park. Use of predator exclosures at the refuge since 2004 has greatly improved hatching success in the habitat restoration area and outer beach. Gunpowder Sands Island became intertidal in 2001 and no longer is suitable for nesting western snowy plovers (K. Brennan *in litt.* 2006).

Table 1. Status of western snowy plovers at four nesting sites in Washington (Sundstrom-Bagley *et. al*. 2000; Jaques 2001; Sundstrom 2001, 2002*a*, 2002*b*, 2003, 2004, 2005; Brennan and Jaques 2002; Brennan 2003; Brennan and Fernandez 2004*a*, 2004*b*, 2006; Pearson *et al.* 2006).

Year	Estimated Number of Adults Present				
	Leadbetter Point	Midway Beach	Damon Point	Graveyard Spit	Total
1993	16	-	7	-	23
1994	13	-	6	-	19
1995	25	0	9	-	34
1996	19	0	4	-	23
1997	21	0	3	-	24
1998	45	6	5	-	56
1999	26	12	5	-	43
2000	25	21	4	-	50
2001	27	14	4	-	45
2002	32	23	4	-	59
2003	30	33	5	-	68
2004	24	19	10	-	53
2005	38	25	5	-	68
2006	39	23	2	6	70

b. Oregon Coast

In Oregon, western snowy plovers historically nested at over 20 sites on the coast. At present only seven core nesting sites are consistently used, with a few additional areas occupied during some years (Lauten *et al*. 2006*a*, 2006*b*). Annual window surveys of western snowy plovers in Oregon (Table 2), including both adults and young of the year, began in 1978, with counts ranging from a high of 139 at 13 sites (1981) to a low of 30 observed at 9 sites (1992). Populations reached a low from 1991 to 1993 with a mean of 33 individuals recorded annually. From 1994 to 2006 western snowy plover numbers have generally

Table 2. Number of adult western snowy plovers observed on window surveys of the Oregon coast during the breeding season (1978-2006). Window surveys record the number of birds seen during 1-day censuses in May to June (Lauten *et al.* 2006*a*, 2006*b*).

Year	Number	Year	Number
1978	93	1993	45
1979	100	1994	51
1980	80	1995	64
1981	139	1996	85
1982	78	1997	73
1983	52	1998	57
1984	46	1999	49
1985	48	2000	no surveys conducted
1986	73	2001	71
1987	61	2002	71
1988	53	2003	63
1989	58	2004	82
1990	59	2005	100
1991	35	2006	91
1992	30		

increased, with an average of 71 plovers observed. The increase in the numbers of plovers observed in recent years is believed to be related to intensive management that began at the time of Federal listing.

Since 1993, the population on the Oregon coast has been intensively monitored, with many of the adults and chicks being uniquely color-banded. The presence of marked birds has allowed for the development of two other means of estimating the population (Table 3, Lauten *et al.* 2006b). The number of western snowy plovers, as indicated by the three indices in Table 3, has increased between 1993 and 1997, declined in 1998/1999, then increased again through 2006. The trends

Table 3. Comparison of population estimates of adult western snowy plovers on the Oregon coast during the breeding season (1993 to 2005) based on three different measures of abundance (Lauten *et al.* 2006*a*, 2006*b*).

Year	Estimates		
	A	B	C
1993	45	55 to 61	72
1994	51	67	83
1995	64	94	120
1996	85	110 to 113	134 to 137
1997	73	106 to 110	141
1998	57	75	97
1999	45	77	95 to 96
2000	no survey	89	109
2001	71	79 to 80	111 to 113
2002	71	80	99 to 102
2003	63	93	102 to 107
2004	82	120	136 to 142
2005	100	104	153 to 158
2006	91	135	177 to 179

A = Window census.

B = Estimated number of breeding adults. This number is lower than those in column C because it is an estimate of the number of individual birds thought to be breeding birds.

C = Total number of individual adults present during breeding season (includes depredated adults).

for all three indices remained relatively consistent throughout that measurement period.

Management measures (Lauten *et al.* 2006a, 2006b) have included the use of exclosures to reduce predation, predator control measures, restoration of breeding habitat by removing European beachgrass (*Ammophila arenaria*), increased presence of law enforcement personnel, additional and improved signs, additional symbolic fencing (consisting of one or two strands of light-weight string or cable

tied between posts to delineate areas where pedestrians and vehicles should not enter), and increased efforts on public information and education.

c. California Coast

i. Coastwide Perspective

In California, there also has been a significant decline in breeding locations, especially in southern California. By the late 1970s, nesting western snowy plovers were absent from 33 of 53 locations with breeding records prior to 1970 (Page and Stenzel 1981). The first quantitative data on the abundance of western snowy plovers along the California coast came from window surveys conducted during the 1977 to 1980 breeding seasons by Point Reyes Bird Observatory (Page and Stenzel 1981). An estimated 1,593 adult western snowy plovers were seen on these pioneer surveys (Table 4). The surveys suggested that the western snowy plover had disappeared from significant parts of its coastal California breeding range by 1980. It no longer bred along the beach at Mission Bay or at Buena Vista Lagoon in San Diego County. In Orange County, the only remaining breeding location was the Bolsa Chica wetlands; historically, the western snowy plover was known to breed along the beach from Upper Newport Bay to Anaheim Bay. It was absent from Los Angeles County where it formerly nested along the shores of Santa Monica Bay. In Ventura County, it had ceased breeding on Ventura Beach (San Buenaventura Beach), and in Santa Barbara County on Carpinteria, Santa Barbara (East Beach), and Goleta Beaches. Nesting no longer occurred along the northernmost portion of Monterey Bay in Santa Cruz County or on Doran Beach at Bodega Harbor in Sonoma County.

Subsequent coast-wide surveys by Point Reyes Bird Observatory in 1989 and 1991 indicated a further decline in numbers of breeding adult western snowy plovers during the decade after the 1977 to 1980 survey. Along the mainland coast, including the shores of the Channel Islands, western snowy plover populations had declined by about 5 percent, and in San Francisco Bay by about 44 percent (Table 4).

Table 4. Number of adult western snowy plovers observed during breeding season window surveys of the California coast.

Location	1977/80	1989	1991	1995	2000	2002	2003	2004	2005	2006
Del Norte County	11	8	3	0	0	0	0	0	0	0
Humboldt County	54	32	30	19	39	49	38	37	32	49
Mendocino County	15	2	0	-	1	0	1	3	9	3
Sonoma County	0	10	9	3	0	0	0	0	5	0
Marin County	40	24	25	8	21	25	17	26	22	16
San Mateo County (incl. SF beaches)	4	8	1	-	4	3	4	17	3	7
Northern Santa Cruz County	25	19	22	26	19	9	2	2	3	4
Monterey Bay	146	146	119	125	120	270	279	331	297	317
Point Sur	3	4	-	-	8	5	6	5	7	13
Northern San Luis Obispo County			9	-	1	3	0	3	12	15
Morro Bay Area	80	126	87	85	113	150	172	268	259	167
Pismo Beach/Santa Maria River	45	123	246	124	81	170	137	167	200	211
Vandenberg AFB	119	115	242	213	106	179	256	420	259	245
Jalama Beach	0	1	1	0	0	0	0	0	0	0
Hollister Ranch			8	-	-	-	-	-	-	-
Coal Oil Point (Devereaux) vicinity			-	-	-	8	26	30	30	39
Oxnard Lowland	136	175	105	69	107	164	80	119	110	125
Channel Islands	(288)[1]	217	200	196	89	79	90	82	99	115
Orange County	19	21	5	9	27	38	31	31	66	62
Northern San Diego County	160	72	48	49	63	80	145	159	107	141
Mission Beach			-	-	-	-	-	1	0	-
San Diego Bay	60	36	31	33	73	61	76	76	30	81
Tijuana Estuary	37	21	4	10	8	16	12	14	6	14
Subtotal	**1,242**	**1,160**	**1,195**	**969**	**880**	**1,309**	**1,372**	**1,791**	**1,556**	**1,624**
S San Francisco Bay	351	216	176	-	96	78	72	113	124	99
Total	**1,593**	**1,376**	**1,371**	**-**	**976**	**1,387**	**1,444**	**1,904**	**1,680**	**1,723**

[1] 260 adults during the survey; 28 additional adults extrapolated for unsurveyed portions of Santa Rosa Island.

The more recent coast-wide surveys, during the summers of 1995, 2000, and 2002-2006, were accomplished through the collaboration of researchers studying western snowy plovers along the California coast. Between the 1977 to 1980 surveys and the 1995 survey, western snowy plovers apparently ceased nesting at Los Penasquitos, and Agua Hedionda Lagoons in northern San Diego County (A. Powell, pers. comm. 1998). Nesting has been absent or sporadic at San Elijo Lagoon; Año Nuevo State Beach and Pescadero State Beach in San Mateo County; Bolinas Lagoon in Marin County; the south and north spits of Humboldt Bay and Big Lagoon in Humboldt County; and the Lake Talawa region of Del Norte County (Point Reyes Bird Observatory, unpublished data).

By 2000 populations had declined further to 71 percent of the 1977-1980 levels along the California coast and 27 percent of the 1977-1980 levels in San Francisco Bay. However, since then populations have grown substantially, roughly doubling along the coast while fluctuating irregularly in San Francisco Bay (Table 4). Recent population increases along the coast have been associated with implementation of management actions for the benefit of western snowy plovers and California least terns, including predator management and protection and restoration of habitat.

ii. Regional Perspective

Del Norte, Humboldt, and Mendocino Counties - Numbers of western snowy plover breeding adults declined and then somewhat rebounded in this northern California region since the initial Point Reyes Bird Observatory survey in 1977. In this region where there were 80 adults counted in 1977, a low of 19 were found in 1995 and 52 in 2006. In 1996, breeding was documented on the gravel bars of the Eel River, Humboldt County, and this area has continued to be a successful nesting site for western snowy plover breeding (Colwell *et al.* 2002, 2005). Even with the nest success at the gravel bars there is still a reduction in western snowy plovers from 1977; Del Norte County has no breeding birds, and Mendocino County has very few.

San Francisco Bay - As indicated in Table 4, western snowy plover numbers in San Francisco Bay declined markedly between the initial survey in 1978 and follow-up surveys. Western snowy plover numbers steadily declined over 26 years,

reaching a low of 72 in 2003, followed by a moderate but irregular increase (124 in 2005 surveys; 99 in 2006).

Recent surveys in South San Francisco Bay (Strong and Dakin 2004, Strong *et al.* 2004, Tucci *et al.* 2006) indicate that the largest breeding populations are concentrated at Eden Landing Ecological Reserve/Baumberg North (CA-33), managed by California Department of Fish and Game. Other population centers occur at Oliver Salt Ponds (CA-31), managed by Hayward Area Recreation District and East Bay Regional Parks District; and at Dumbarton (CA-36), Warm Springs (CA-39), Alviso (CA-41), and Ravenswood (CA-44), managed by Don Edwards San Francisco Bay National Wildlife Refuge. Foraging and nesting activities are concentrated in specific salt ponds within these areas. Small numbers of western snowy plovers have been observed at Ponds 7 and 7A in Napa County (CA-25 and vicinity), the only currently known nesting site in the North Bay.

Sonoma, Marin, San Francisco, San Mateo, Santa Cruz, and Monterey Counties - Along the segment of coastline from Sonoma County to Monterey Bay, numbers of western snowy plover adults during window surveys declined from 215 in 1977 to 162 in 1995, and subsequently increased to a maximum of 376 in 2004. The numbers of adults breeding on the beaches and salt ponds of Monterey Bay, and the beaches of northern Santa Cruz County, has increased dramatically since management actions have been undertaken to increase nesting success (Neuman *et al.* 2004; G. Page *in litt.* 2004*b*)

San Luis Obispo, Santa Barbara, and Ventura Counties, including Channel Islands - There is no clear evidence of an overall decline in the number of breeding western snowy plovers for this region from 1978/1980 to the present. Numbers of adults fluctuated between a high of 1089 and a low of 497 between 1978 and 2006. While numbers for the region may not have changed overall, there have been definite changes at specific locations (Table 5). Most notable are the decline and loss of the population on San Miguel Island from 1978 /1980 to 2000, the decline at Santa Rosa Island from 1991 to 2006, and the sudden increase in numbers at Vandenberg Air Force Base between 2000 and 2004 and at Coal Oil Point Reserve between 2002 and 2006 (Table 4).

Table 5. Breeding season window surveys of western snowy plover adults at selected sites along the coast of San Luis Obispo, Santa Barbara, and Ventura Counties.

Location	Year												
	1978 -80	**1989**	**1991**	**1995**	**1996**	**1997**	**1998**	**2000**	**2002**	**2003**	**2004**	**2005**	**2006**
Atascadero Beach	0	17	2	38	28	23	26	5	19	23	21	21	24
Morro Bay Spit	80	94	69	34	40	39	55	87	93	114	203	205	120
Vandenberg AFB [1]	119	115	242	213	230	238	130	106	179	256	420	259	245
Ormond Beach	25	24	34	20	19	34	19	10	35	19	28	21	22
Naval Base Ventura County (Pt. Mugu)	82	81	59	40	49	26	47	81	85	51	75	83	79
Santa Rosa Island [2]	84	91	103	71	78	79	76	17	10	---	---	37	19
San Miguel Island [2]	133	36	19	9	3	5	1	0	0	0	0	---	0
San Nicolas Island [3]	71	90	78	116	104	91	90	72	69	90	79	62	96
Total	594	548	606	541	551	535	444	378	490	553	826	688	605

Unless footnoted, the source of all data is Point Reyes Bird Observatory.

[1] The source of this data is the U.S. Air Force (Phil Persons)

[2] The source of this data is the National Park Service

[3] The source of this data is the U.S. Navy

Los Angeles, Orange, and San Diego Counties - Western snowy plover numbers detected during window surveys declined from the 276 adults tallied during the 1978 Point Reyes Bird Observatory survey to 88 during the 1991 survey. Subsequently the population has increased to 298 in 2006.

2. Current Breeding Distribution

The current Pacific coast breeding range of the western snowy plover extends from Damon Point, Washington, to Bahia Magdelena, Baja California, Mexico. The population is sparse in Washington, Oregon, and northern California. In 2006, estimated populations were 70 adults along the Washington coast (Pearson *et al*. 2006), 177-179 adults along coastal Oregon (Lauten *et al.* 2006*b*), and 2,231 adults in coastal California and San Francisco Bay (window survey including correction factor: G. Page *in litt.* 2006, U.S. Fish and Wildlife Service 2006*a*). Approximately 7 percent of the California population was observed in San Francisco Bay, and 4 percent in northern California north of the Golden Gate bridge. Along the coast of Baja California, Mexico, most nesting western snowy plovers are associated with the largest wetlands, especially Bahia San Quintin, Laguna Ojo de Liebre, and Bahia Magdelena (Palacios *et al.* 1994). No recent quantitative data exist on the western snowy plover population in Baja California, but it is probably roughly similar in size to the U.S. Pacific coast population.

3. Habitat Carrying Capacity

There is no quantitative information on carrying capacity of beaches for western snowy plovers. Determining carrying capacity of beaches is confounded by human use that affects the numbers of snowy plovers using the beaches. Beaches vary substantially in their structure, width, vegetation, and level of human use, complicating such a measurement.

The maximum reported breeding density of western snowy plovers is associated with the Moss Landing Wildlife Area, where since 1995 Point Reyes Bird Observatory staff have conducted intensive management specifically for western snowy plovers. These measures include predator control, removal of excessive vegetation, and operation of water control structures to maintain desired water

levels. With extensive management of approximately 55 hectares (138 acres) of mostly dried ponds in the Moss Landing Wildlife Area, 25 active nests, 3 pairs within 5 days of initiating nests, and 10 broods have been documented simultaneously; thus a peak of 76 nesting adults was accommodated simultaneously by 55 hectares (138 acres) of playa, or 1.4 hectares (3.6 acres) per functional pair (some of the broods were only being cared for by males) (D. George, Point Reyes Bird Observatory, pers. comm.). However, the numbers of nesting western snowy plovers at the Moss Landing Wildlife Area cannot be applied to beach areas because of the physical differences between salt pond and beach habitats and because beach habitats are typically subject to much more human disturbance. Neither can these numbers necessarily be applied to other salt ponds (*e.g.*, San Francisco Bay) because habitat and management opportunities differ.

D. REASONS FOR DECLINE AND CONTINUING THREATS

Overall, western snowy plover numbers have declined on the U.S. Pacific coast over the past century (see Population Status and Trends section). The subspecies faces multiple threats throughout its Pacific coast range. The reasons for decline and degree of threats vary by geographic location; however, the primary threat is habitat destruction and degradation. Habitat loss and degradation can be primarily attributed to human disturbance, urban development, introduced beachgrass (*Ammophila* spp.), and expanding predator populations. Natural factors, such as inclement weather, have also affected the quality and quantity of western snowy plover habitat (U.S. Fish and Wildlife Service 1993*a*). The following discussion is organized according to the five listing criteria under section 4(a)(1) of the Endangered Species Act.

1. The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

a. Shoreline Stabilization and Development

The wide, flat, sparsely-vegetated beach strands preferred by western snowy plovers are an unstable habitat, subject to the dynamic processes of accretion and erosion of sand, and dependent on natural forces for replenishment and renewal. These

habitats are highly susceptible to degradation by construction of seawalls, breakwaters, jetties, piers, homes, hotels, parking lots, access roads, trails, bike paths, day-use parks, marinas, ferry terminals, recreational facilities, and support services that may cause direct and indirect losses of breeding and wintering habitat for the western snowy plover.

Beach stabilization efforts may interfere with coastal dune formation and cause beach erosion and loss of western snowy plover nesting and wintering habitat. Shoreline stabilization features such as jetties and groins may cause significant habitat degradation by robbing sand from the downdrift shoreline (U.S. Fish and Wildlife Service 1996*a*). However, jetties also can redirect sand deposition, causing an increase in available habitat. Construction of homes, resorts, and parking lots on coastal sand dunes constitutes irrevocable loss of habitat for western snowy plovers. Urban development has permanently eliminated valuable nesting habitat on beaches in southern Washington (Brittell *et al.* 1976), Oregon (Oregon Department of Fish and Wildlife 1994), and California (Page and Stenzel 1981). In addition to causing direct loss of habitat, there are additional potential adverse impacts to western snowy plovers from urban development (Figure 5). Increased development increases human use of the beach, thereby increasing disturbance to nesting plovers. When urban areas interface with natural habitat areas, the value of breeding and wintering habitat to native species may be diminished by increased levels of illumination at night (*e.g.*, building and parking lot lights); increased sound and vibration levels; and pollution drift (*e.g.*, pesticides) (Kelly and Rotenberry 1996/1997). Beach raking removes habitat features for both plovers and their prey, and precludes nests from being established. Also, construction of residential development in or near western snowy plover habitat attracts predators, including domestic cats.

b. Resource Extraction

i. Sand Removal and Beach Nourishment

Sand is mined in coastal areas such as Monterey Bay. Mining sand from the coastal mid-dunes and surf zone can cause erosion and loss of western snowy plover breeding and wintering habitat. Sand removal by heavy machinery can disturb

Figure 5. New housing development next to beach at Monterey Bay, California (photo by Peter Baye, with permission).

incubating western snowy plovers, destroy their nests or chicks, and result in the loss of invertebrates and natural wave-cast kelp and other debris that western snowy plovers use for foraging. Mining of surface sand from the 1930s through the 1970s at Spanish Bay in Monterey County degraded a network of dunes by lowering the surface elevations, removing sand to granite bedrock in many locations, and creating impervious surfaces that supported little to no native vegetation (Guinon 1988).

Beach nourishment with sand can be beneficial for the western snowy plover if it results in an increase in habitat. However, unless beach nourishment projects are properly designed, they can result in changes to beach slope from redeposition of sediments by storm waves, and result in the loss of western snowy plover breeding and wintering habitat. For example, if an inappropriate size class of sand (*e.g.*, coarser-grained sand) and range of minerals are introduced that are different from the current composition of native sand on a beach, it can alter dune slope (making it steeper or narrower), affect mobility and color of sand, decrease the abundance of beach invertebrates, and facilitate establishment of invasive exotic plants that may

have a competitive advantage over native plants. Feeney and Maffei (1991) investigated the color hues of the ground surface within San Francisco Bay salt ponds used as western snowy plover nesting habitat. Predominant soils were silty clay with varying amounts of humus, salt crystals, and shell fragments. They found a strong similarity between the color of the substrate in habitat preferred by western snowy plovers and the color of western snowy plover mantles (upper parts).

ii. Dredging and Disposal of Dredged Materials

Dredging is detrimental to western snowy plovers when it eliminates habitat or alters natural patterns of beach erosion and deposition that maintain habitat. Disturbances associated with dredging, such as placement of pipes, disposal of dredged materials, or noise, also may negatively affect breeding and wintering western snowy plovers. Dredging also is detrimental when it promotes water-oriented developments that increase recreational access to western snowy plover habitat (*e.g.*, marinas, boat ramps, or other facilities to support water-based recreation). In some cases, however, dredged materials may provide important nesting habitat for western snowy plovers such as those at Coos Bay, Oregon (Wilson-Jacobs and Dorsey 1985). Western snowy plovers also have been observed using dredged material during the winter; however, these areas are not used nearly as often as the adjacent ocean beach (E.Y. Zielinski and R.W. Williams *in litt.* 1999).

iii. Driftwood Removal

Driftwood can be an important component of western snowy plover breeding and wintering habitat. Driftwood contributes to dune-building and adds organic matter to the sand as it decays (Washington Department of Fish and Wildlife 1995). Additionally, driftwood provides western snowy plovers with year-round protection from wind and blowing sand. Often, western snowy plovers build nests beside driftwood, so its removal may reduce the number of suitable nesting sites.

Driftwood removed for firewood or decorative items can result in destruction of nests and newly-hatched chicks that frequently crouch by driftwood to hide from predators and people. Chainsaw noise may disrupt nesting, and vehicles used to

haul wood may crush nests and chicks. Removal of driftwood has been documented as a source of nest destruction at Vandenberg Air Force Base where two nests were crushed beneath driftwood dragged to beach fire sites (Persons 1994). Also, driftwood beach structures built by visitors are used by avian predators of western snowy plover chicks such as loggerhead shrikes (*Lanius ludovicianus*) and American kestrels (*Falco sparverius*), and predators of adults such as merlins (*Falco columbarius*) and peregrine falcons (*Falco peregrinus*).

Although driftwood is an important component of western snowy plover habitat, too much driftwood on a beach, which may occur after frequent and prolonged storm events, can be detrimental if there is not sufficient open habitat to induce the birds to nest.

iv. Beach Fires and Camping

Beach fires and camping may be harmful to nesting western snowy plovers when valuable driftwood is destroyed, as described above. Camping near breeding locations can cause greater impacts due to the prolonged disturbance and increased chance for possible direct mortality from associated dogs and children (S. Richardson *in litt*. 2001). Nighttime collecting of wood increases the risk of stepping on nests and chicks, which are difficult to see even during daylight hours. Fires near a western snowy plover nest could cause nest abandonment due to disturbance from human activities, light, and smoke. Fires have the potential to attract large groups of people and result in an increase of garbage, which attracts scavengers such as gulls (*Larus* spp.) and predators such as coyotes (*Canis latrans*), American crows (*Corvus brachyrhynchos*), and common ravens (*Corvus corax*). Also, after fires are abandoned, predators such as coyotes may be attracted into the area by odors lingering from the fire, particularly if it was used for cooking. Occasionally fires escape into nearby driftwood; fire suppression activities may disturb and threaten western snowy plover nests and chicks.

v. Watercourse Diversion, Impoundment, or Stabilization

Water diversion and impoundment of creeks and rivers may negatively affect western snowy plover habitat by reducing sand delivery to beaches and degrading

water quality. Water diversions are a major threat to western snowy plovers when they impair hydrologic processes (such as migration of creek and river mouths) that maintain open habitat at river and creek mouths by retarding the spread of introduced beachgrass (*Ammophila* spp.) and other vegetation. Water diversion, impoundment, or stabilization activities could include construction of dams and irrigation, flood control, and municipal water development projects (Powell *et al.* 2002).

vi. Operation of Salt Ponds

Salt ponds of San Francisco Bay and San Diego Bay, which are filled and drained as part of the salt production process, provide breeding and wintering habitat for western snowy plovers. Dry salt ponds and unvegetated salt pond levees are used as western snowy plover nesting habitat. Ponds with shallow water provide important foraging habitat for western snowy plovers, with ponds of low and medium salinity providing the highest invertebrate densities. Ponds of high salinity have reduced invertebrate densities and therefore provide lower quality foraging habitat. Nesting western snowy plovers can be attracted to an area when ponds are drained during the breeding season, but flooding can then destroy the nests when the ponds are refilled. Also, human disturbance resulting from maintenance activities associated with the operation of commercial salt ponds can result in the loss of western snowy plovers and disturbance of their habitat. If conducted during the western snowy plover breeding season, reconstruction of salt pond levees could destroy western snowy plover nests. Maintenance activities that are conducted by vehicles, on foot, or through the use of dredging equipment could result in direct mortality or harassment of western snowy plovers (See Dredging, Pedestrian, and Motorized Vehicle sections).

c. Encroachment of Introduced Beachgrass and Other Nonnative Vegetation

One of the most significant causes of habitat loss for coastal breeding western snowy plovers has been the encroachment of introduced European beachgrass (*Ammophila arenaria*) and American beachgrass (*Ammophila breviligulata*). Foredunes dominated by introduced beachgrass have replaced the original low, rounded, open mounds formed by the native American dunegrass (*Leymus mollis*)

and other beach plants. Native dune plants do not bind sand like *Ammophila* spp., and thus allow for sand movement and regenerating open expanses of sand. However, *Ammophila* spp. forms a dense cover that excludes many native taxa. On beaches dominated by this invasive grass, species richness of vegetation is halved, in comparison with foredunes dominated by native dune grass (Barbour and Major 1990). Similarly, American beachgrass greatly depresses the diversity of native dune plant species (Seabloom and Wiedemann 1994).

European beachgrass was introduced to the west coast around 1898 to stabilize dunes (Wiedemann 1987). Since then, it has spread up and down the coast and now is found from British Columbia to Ventura County in southern California. This invasive species is a rhizomatous grass that sprouts from root segments, with a natural ability to spread rapidly. Its most vigorous growth occurs in areas of wind-blown sand, primarily just above the high-tide line, and it thrives on burial under shifting sand. In 1988, European beachgrass was considered a major dune plant at about 50 percent of western snowy plover breeding areas in California and all of those in Oregon and Washington (J. Myers *in litt.* 1988).

American beachgrass is native to the East coast and Great Lakes region of North America. The densest populations of American beachgrass on the Pacific coast are currently located between the mouth of the Columbia River and Westport, Washington. Like European beachgrass, American beachgrass is dominant on the mobile sands of the foredune and rapidly spreads through rhizome fragments. American beachgrass occurs along the entire coast of Washington, ranging from Shi Shi Beach, Washington, in the north, to Sand Lake, Oregon, in the south, although its frequency decreases markedly at the northern and southern limits of this range. Currently, American beachgrass is the dominant introduced beachgrass species in much of the western snowy plover range in the State of Washington (Seabloom and Wiedemann 1994).

Stabilizing sand dunes with introduced beachgrass has reduced the amount of unvegetated area above the tideline, decreased the width of the beach, and increased its slope (Wiedemann 1987). These changes have reduced the amount of potential western snowy plover nesting habitat on many beaches and may hamper brood movements. In Oregon, the beachgrass community may provide habitat for western

snowy plover predators (*e.g.*, skunks [*Mephitis* spp.], weasels [*Mustela* spp.], coyotes [*Canis latrans*], foxes [*Urocyon cinereoargenteus* and *Vulpes vulpes*.], raccoons [*Procyon lotor*], and feral cats [*Felis domesticus*]) that historically would have been largely precluded by the lack of cover in the dune community (Stern *et al.* 1991; K. Palermo, U.S. Forest Service, pers. comm. 1998).

In areas with European beachgrass, it has caused the development of a vegetated foredune that effectively blocks movement of sand inland and creates conditions favorable to the establishment of dense vegetation in the deflation plain, which occurs behind the foredunes (Wiedemann *et al.* 1969). In natural sand dunes, deflation plains consist of open sand ridges and flat plains at or near the water table. Thus, in areas with European beachgrass, the open features that characterize western snowy plover breeding habitat are destroyed. The establishment of European beachgrass has also caused sand spits at the mouths of small creeks and rivers to become more stable than those without vegetation because of the creation of an elevated beach profile. This elevated profile, in effect, reduces the scouring of spits during periods of high run-off and storms. A secondary effect of dune stabilization has been human development of beaches and surrounding areas (Oregon Department of Fish and Wildlife 1994). This development, in turn, has reduced available beach habitat and focused human activities on a smaller area that must be shared with western snowy plovers and other shorebirds.

On the Oregon coast, the establishment of European beachgrass has produced dramatic changes in the landscape (Oregon Department of Fish and Wildlife 1994). The spread of this nonnative species was greatly enhanced by aggressive stabilization programs in Oregon in the 1930s and 1940s (Wiedemann 1987). European beachgrass spread profusely along the Washington coast, and was well established by the 1950s (Washington Department of Fish and Wildlife 1995). In 1988, the spread of beachgrass was termed an “increasing threat” to traditional western snowy plover nesting areas at Leadbetter Point, Washington, having become established where absent only 4 years earlier (Willapa National Wildlife Refuge 1988).

In California, there are many beaches where European beachgrass has established a foothold. These beaches include the dunes at Lake Earl, Humboldt Bay (from

Trinidad to Centerville Beach), MacKerricher State Beach/Ten Mile Dunes Preserve, Manchester State Beach, Bodega Bay, Point Reyes National Seashore, Golden Gate National Recreation Area, Monterey Bay, Morro Bay Beach, Guadalupe-Nipomo Dunes, and Vandenberg Air Force Base (A. Pickart *in litt.* 1996). Chestnut (1997) studied the spread of European beachgrass at the Guadalupe-Nipomo Dunes in San Luis Obispo County. He documented an increase in beachgrass from approximately 8 to 109 hectares (20 to 270 acres) between 1969 and 1997, and found that its rapid spread through native vegetation posed a serious threat to nesting western snowy plovers and rare plants.

In addition to the loss of nesting habitat, introduced beachgrass also may adversely affect western snowy plover food sources. Slobodchikoff and Doyen (1977) found that beachgrass markedly depressed the diversity and abundance of sand-burrowing arthropods at coastal dune sites in central California. Because western snowy plovers often feed on insects well above the high-tide line, the presence of this invasive grass may also result in loss of food supplies for plovers (Stenzel *et al.* 1981).

In some areas of California, such as the Santa Margarita River in San Diego County, and the Santa Clara and Ventura Rivers in Ventura County, giant reed (*Arundo donax*) has become a problem along riparian zones. During winter storms, giant reed is washed downstream and deposited at the river mouths where western snowy plovers nest (Powell *et al.* 1997). Large piles of dead and sprouting giant reed eliminate nesting sites and increase the presence of predators, which use it as perches and prey on rodents in the piles of vegetation.

Other nonnative vegetation that has invaded coastal dunes, thereby reducing western snowy plover breeding habitat, includes Scotch broom (*Cytisus scoparius*), gorse (*Ulex europaeus*), South African iceplant (*Carpobrotus edulis*), pampas grass (*Cortaderia jubata* and *Cortaderia selloana*) and iceplant (*Mesembryanthemum* sp.); shore pine (*Pinus contorta*) is a native plant species that has invaded coastal dunes and resulted in similar impacts to western snowy plovers (Schwendiman 1975, California Native Plant Society 1996, Powell 1996). Many nonnative weed species also occur on and along San Francisco Bay salt pond levees, resulting in unsuitable nesting habitat for western snowy plovers (J. Albertson *in litt.* 1999).

d. Habitat Conversion for Other Special Status Species

It is not known whether western snowy plovers historically nested in San Francisco Bay prior to the construction of salt evaporator ponds beginning in 1860 (Ryan and Parkin 1998). However, western snowy plovers have wintered on the San Francisco Bay since at least the late 1800's, as indicated by a specimen dated November 8, 1889, in the Califomia Museum of Vertebrate Zoology (Grinnell *et al.* 1918). It is possible that natural salt ponds in the vicinity of San Lorenzo once supported nesting birds, but insufficient data exist to assess this possibility (U.S. Fish and Wildlife Service 1992). Today, however, the San Francisco Bay recovery unit supports an important western snowy plover source population, representing approximately 5 to 10 percent of the total breeding population. Feeney and Maffei (1991) observed a sizable population of western snowy plovers at the Baumberg and Oliver salt ponds during the breeding and nonbreeding seasons, suggesting that these ponds are important to western snowy plovers throughout the year. They suspected that these ponds are used by western snowy plovers as both a pre-breeding and post-breeding staging area, based on the high numbers of plovers in mid-February and in late August/September, respectively.

As part of the Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (U.S. Fish and Wildlife Service, in preparation), extensive tidal marsh restoration is identified as a recovery action for listed and other sensitive species of tidal salt marshes including the California clapper rail (*Rallus longirostris obsoletus*) and salt marsh harvest mouse (*Reithrodontomys raviventris*). A large area of San Francisco Bay salt ponds, especially within the South Bay, are proposed for tidal marsh restoration for the benefit of federally listed tidal marsh species. Salt ponds are large, persistent hypersaline ponds that are intermittently flooded with South Bay water. Some of these ponds currently provide valuable breeding and wintering habitat for western snowy plovers. However, they occur within the historical areas of tidal salt marsh, which once dominated San Francisco Bay. Endangered tidal marsh species would benefit from conversion of these ponds back to salt marsh; however, western snowy plovers would lose suitable nesting and wintering areas.

The Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California will focus primarily on management of tidal marsh species, but will also provide for some areas to be maintained as managed ponds that would provide habitat for western snowy plovers and California least terns (*Sternula antillarum browni*). The South Bay Salt Pond Restoration Project (Philip Williams & Associates *et al.* 2006) has identified sites on National Wildlife Refuge and California Department of Fish and Game lands with potential for salt marsh restoration and managed ponds under a range of alternatives; the projected area of managed ponds ranges from 647 to 3,035 hectares (1,600 to 7,500 acres). Six of the plover locations identified in Appendices B and L (CA-33, CA-34, CA-39, CA-40, CA-41, CA-44) occur within the South Bay Salt Pond Restoration Project area. These six locations comprise about 60 percent of the western snowy plover locations in San Francisco Bay by area, and currently support over 90 percent of the western snowy plover population in San Francisco Bay (Strong *et al.* 2004, Tucci *et al.* 2006). In particular, several salt ponds at Eden Landing (location CA-33 and vicinity) currently support the largest population of western snowy plovers in San Francisco Bay. Distribution of plover populations and nesting sites within San Francisco Bay can fluctuate with salt pond management and availability of appropriate habitat, such that some locations identified in Appendix L are not currently occupied and other locations not mapped in Appendix L may nonetheless support breeding birds as management practices change. Thus the boundaries of San Francisco Bay locations as mapped in Appendix L reflect current and historical conditions and should be considered as flexible in the context of planning for future tidal marsh restoration. Specific localities to be managed for plovers should be coordinated with tidal marsh restoration in an integrated fashion, and thus may not be identical with the current or historical localities identified in this recovery plan.

Thus intensive management of designated ponds within the South Bay Salt Pond Restoration Project area will be crucial to achieving success in meeting western snowy plover recovery goals in San Francisco Bay. However, establishing western snowy plover populations at a variety of sites in San Francisco Bay, both within and outside the South Bay Salt Pond Restoration Project area, is advisable to minimize their vulnerability to loss (L. Trulio *in litt.* 2007). Potential western snowy plover habitat in San Francisco Bay outside of the South Bay Salt Pond Restoration Project area includes several sites around Alameda, Napa County, Hayward Shoreline, and

Crissy Field. In addition, large salt pond tracts in the South Bay remain under the ownership of Cargill; certain areas are still managed for salt production and could incidentally provide habitat for western snowy plovers, while approximately 600 hectares (1,400 acres) of ponds near Redwood City are no longer in salt production and provide an opportunity for significantly increasing western snowy plover habitat through active management. If these locations can be managed to encourage western snowy plover nesting, they may contribute substantially to meeting the overall goal of 500 breeding birds in San Francisco Bay. Western snowy plover management targets for the South Bay Salt Pond Restoration Project should take into account the habitat quality and management potential of plover habitat elsewhere in San Francisco Bay to meet overall goals for the recovery unit.

Don Edwards San Francisco Bay National Wildlife Refuge is currently planning pilot studies to assess how best to manage salt ponds for high densities of breeding western snowy plovers. Special management for western snowy plover may include intensive control of avian predators (*e.g.*, California gull colonies, ravens); active management of water levels to control vegetation, maintain optimal salinity, and produce brine flies; timing of inundation to avoid flooding nests; and reconfiguration of shallow salt ponds with isolated islands and furrowed areas. Locations of managed salt ponds should be planned to minimize the proximity of western snowy plover populations to landfills, gull colonies, and areas with high predator densities. Intensive management of salt ponds for western snowy plovers generally appears feasible, and plovers have been observed to opportunistically disperse among sites and use habitat that becomes suitable (V. Bloom *in litt.* 2005), so we expect relocation of plover nesting concentrations away from tidal marsh restoration areas to be possible, but management success should be carefully evaluated. Those alternatives with greater acreages of tidal marsh restoration (e.g., Alternative C at 90 percent tidal habitat) would require correspondingly more intensive management and reconfiguration of the remaining salt ponds (Philip Williams & Associates *et al.* 2006), and should be implemented gradually in conjunction with evaluation of management effectiveness for western snowy plovers.

Thus, we believe tidal marsh restoration can be compatible with the recovery of western snowy plovers and should not preclude meeting a goal of 500 breeding

birds in San Francisco Bay. As described below under Recovery Action 2.6, occupied salt ponds should initially be conserved. Salt marsh restoration in occupied plover habitat, particularly at densely populated sites, should be phased in after intensive adaptive management of other compensating salt pond habitat has demonstrated success in increasing plover populations. Thus habitat quality should be continually assessed so that overall western snowy plover populations in San Francisco Bay are not adversely affected by the restoration project and can increase to meet the management goal for this recovery unit.

In southern California, unless carefully planned, conversion of western snowy plover habitat to tidal salt marsh may result in loss of western snowy plover habitat. The light-footed clapper rail (*Rallus longirostris levipes*) inhabits coastal tidal marshes from Santa Barbara County south to Baja California, Mexico. Several locations in Ventura, Orange, and San Diego Counties provide nesting and/or wintering habitat for western snowy plovers, but also provide high quality light-footed clapper rail habitat or represent high priority tidal marsh restoration sites in the recovery plan for the light-footed clapper rail (U.S. Fish and Wildlife Service 1985). These sites include Bolsa Chica, Agua Hedionda Lagoon, San Elijo Lagoon, San Dieguito Lagoon, and Los Penasquitos Lagoon. The Bolsa Chica wetlands were opened to tidal action in 2006, in a project combining tidal restoration work with construction of islands and sand flats for nesting of shorebirds and California least terns.

2. Overutilization for Commercial, Recreational, Scientific, or Education Purposes

Biologists and agency personnel monitor western snowy plovers to assess population status and evaluate management techniques. Additionally, nest searches at some sites allow for placement of predator exclosures that aid in hatching success. Measures to minimize disturbance from these activities include: time limits for surveys, exclosure construction and sign/rope maintenance; conducting walking surveys where feasible; and limited entries.

Egg collecting has been observed at several California nesting colonies (Stenzel *et al.* 1981, Warriner *et al.* 1986). Occasionally recreational birdwatchers also may

harass western snowy plovers. The significance of these factors to nesting success is uncertain but probably relatively minor.

Qualified individuals may obtain permits to conduct scientific research and population census activities on western snowy plovers under section 10(a)(1)(A) of the Endangered Species Act. Specific activities that may be authorized include: population censuses and presence/absence surveys; monitoring of nesting activity; capturing, handling, weighing, measuring, banding, and color-marking of young and adults on breeding and wintering grounds; radio-telemetry studies; translocation studies; genetic studies; contaminant studies; behavioral, ecological, and life history studies; and placing predator exclosures around active nests. Short-term impacts of these activities may include harassment and possible accidental injury or death of a limited number of individual western snowy plovers. The long-term impacts will be to contribute to recovery of the species by facilitating development of more precise scientific information on status, life history, and ecology (U.S. Fish and Wildlife Service 1993*b*).

Banding birds with metal and plastic bands to identify individuals and to monitor bird populations is a common practice. However, a number of leg injuries to western snowy plovers, possibly resulting from banding, have been reported (G. Page *in litt.* 2005*b*). These injuries include swelling and abrasion of legs possibly from sand or other particles becoming lodged between the bands and the leg. Some banding injuries appear to have resulted in foot loss and in a few instances, death of the bird. Similar injuries have been observed in piping plovers (*Charadrius melodus*) banded on the Atlantic coast and interior U.S., and resulted in a moratorium on banding of that species (Lingle *et. al.* 1999, U.S. Fish and Wildlife Service 1996*a*, U.S. Fish and Wildlife Service 2002). Despite leg injuries, several piping plovers were observed to successfully breed and fledge young (Lingle *et. al.* 1999). However, these injuries may contribute directly or indirectly to mortalities or reduce breeding performance. It should be noted that incidents of foot loss in Pacific coast western snowy plovers usually appear to result from fine fibers wrapping around the bird's ankle, and have occurred in unbanded as well as banded individuals (J. Watkins, pers. comm. 2006). Despite risk of injuries, banding remains the best technique to study population traits such as survival, recruitment, and dispersal, and may be the most effective way to monitor populations of the

western snowy plover to determine effectiveness of management strategies. Currently the percentage of banded birds range-wide that become injured from banding and the impacts of banding injuries on populations of the western snowy plover are unknown; a study was initiated in 2005 by Point Reyes Bird Observatory to assess the effectiveness of alternative banding techniques in reducing injuries and band loss (G. Page *in litt.* 2005*b*).

Concerns that color bands increase the vulnerability of western snowy plovers to predation by reducing effectiveness of camouflage do not appear to be supported by existing evidence. Because western snowy plovers crouch and flatten to the sand at the approach of avian predators, color bands are typically hidden from sight; terrestrial predators are evaded by running or taking flight at their approach (J. Watkins, pers. comm. 2006).

3. Disease or Predation

West Nile virus, a mosquito-borne disease which can infect birds, reptiles, and mammals, has spread rapidly across the United States from the initial introduction in New England (National Audubon Society 2006). The disease has killed birds of various species in all coastal California counties since its arrival in the state in 2003 (U.S. Geological Survey 2006). In 2004 to 2006 the disease was reported from two coastal counties (Lane and Lincoln) in Oregon but has not been reported from any coastal counties in Washington (U.S. Geological Survey 2006). The deadliness of the disease varies by species; however, the virus has been identified in dead piping plovers (*Charadrius melodus*) and killdeer (*C. vociferus*), both closely related to the western snowy plover (Center for Disease Control 2004).

Since 2004 numerous western snowy plovers in southern California have been found dead or exhibited neurological signs consistent with avian botulism (M. Long *in litt.* 2006). Confirmation of disease diagnosis is currently pending availability of specimens for autopsy. We are currently coordinating with the USGS National Wildlife Health Center to better understand the causes of these mortalities and to develop a program for treatment of ill birds diagnosed with botulism. Additionally, 32 western snowy plovers died in 2006 from unknown causes in San Diego County (U.S. Navy *in litt.* 2007).

Predator density is a significant factor affecting the quality of western snowy plover nesting habitat (Stenzel *et al.* 1994). Predation can result in the loss of adults, chicks, or eggs; separation of chicks from adults is also caused by the presence of predators. Powell *et al.* (2002) found that predation accounted for most nest failures in 1994, 1996, and 1997, in San Diego County, California. Western snowy plovers generally cannot defend themselves or their nests against predation but must rely on antipredator adaptation, including (1) pale coloration of adults, eggs, and young, which acts as camouflage against detection by predators; (2) a skulking retreat from the nest at a predator's approach; (3) extreme mobility and elusiveness of precocial young and; (4) maintenance of low nesting density (Page *et al.* 1983). In natural ecosystems, there is a co-evolution of the predator-prey relationship, where prey species slowly evolve with evading behavior as predator species slowly evolve effective prey-capturing behavior. However, when exotic predators are introduced into the ecosystem and thrive there, they frequently occur in much higher densities and possess more effective strategies than native predators and, hence, usually have a more severe effect.

Predation, by both native and nonnative species, has been identified as a major factor limiting western snowy plover reproductive success at many Pacific coast sites. Known mammalian and avian predators of western snowy plover eggs, chicks, or adults include the following native species: gray foxes (*Urocyon cinereoargenteus*), Santa Rosa Island foxes (*Urocyon littoralis santarosae*), coyotes, striped skunks (*Mephitis mephitis*), spotted skunks (*Spilogale putorius*), raccoons, California ground squirrels (*Citellus beecheyi*), long-tailed weasels (*Mustela frenata*), American crows, common ravens (*Corvus corax*), ring-billed gulls (*Larus delawarensis*), California gulls (*Larus californicus*), western gulls (*Larus occidentalis*), glaucous-winged gulls (*Larus glaucescens*), gull-billed tern (*Gelochelidon nilotica*), American kestrels (*Falco sparverius*), peregrine falcons (*Falco peregrinus*), northern harriers (*Circus cyaneus*), loggerhead shrikes, merlins (*Falco columbarius*), great horned owls (*Bubo virginianus*), burrowing owls (*Speotyto cunicularia*), great blue herons (*Ardea herodias*); and the following nonnative species: eastern red foxes (*Vulpes vulpes regalis*), Norway rats (*Rattus norvegicus*), Virginia opossums (*Didelphis marsupialis*), domestic and feral dogs (*Canis familiaris*), and cats (*Felis domesticus*). Loss or abandonment of eggs due to

predation by fire ants and Argentine ants (*Iridomyrmex humilis*) has also been observed (Fancher *et al.* 2002, Powell *et al.* 2002).

In Oregon, nest predation by corvids (common ravens and American crows) is the major cause of nest failures. Of 63 unexclosed nests in 2005, corvid predation accounted for 22 nest failures, by comparison with 14 failures due to mammalian or unknown predators and 10 due to abandonment (Lauten *et al.* 2006*a*). Exclosures were effective in protecting nests against this threat (0 of 83 exclosed nests failed due to nest predation).

American crows have been consistently documented as a major predator on western snowy plover nests along the California and Oregon coasts (Page 1990; Persons and Applegate 1997; T. Applegate, Bioresources, pers. comm. 1999; M. Stern, The Nature Conservancy, pers. comm. 1999). At Coal Oil Point, American crows were the most frequent predator on western snowy plover nests and experimentally placed quail eggs (Lafferty *et al.* 2006). Populations of American crows have increased in the San Francisco Bay and central California coast over the past several decades, and are positively associated with human population density (Leibezet and George 2002).

Common ravens are known predators of western snowy plover eggs (Wilson-Jacobs and Dorsey 1985, Point Reyes Bird Observatory unpublished data, George 1997, Stein 1993, Point Reyes Bird Observatory unpublished data, J. Albertson *in litt.* 1999, Point Reyes Bird Observatory unpubl. data, Stern *et al.* 1991). Ravens have consistently been the most significant nest predator at Point Reyes, accounting for 69 percent of all predation events over 5 years and destroying approximately 50 percent of nests (Hickey *et al.* 1995). Hatching success at Point Reyes National Seashore increased after exclosures were used to protect western snowy plover nests from ravens in 1996. Approximately 12 percent of nests in San Diego County were destroyed by ravens (Powell *et al.* 1996, Powell *et al.* 1997). Raven populations in coastal California have significantly increased in recent decades (Leibezet and George 2002), and as their range expands they are becoming increasingly significant as a nest predator on western snowy plovers; ravens were observed to destroy nests in Monterey Bay for the first time in 2002 and 2003 (G. Page *in litt.* 2004*b*). In northern California ravens are the single most limiting factor on western snowy

plover reproduction (Colwell *et al.* 2006). Ravens also prey on western snowy plover chicks, but not nearly to the extent that they do on eggs. However, at Point Reyes raven predation primarily affected chicks after exclosures were erected to protect snowy plover eggs (S. Allen *in litt.* 2004).

Gulls pose a special threat to breeding western snowy plovers because they not only depredate nests and chicks, but also usurp and trample western snowy plover nesting habitat and crush eggs (Persons and Applegate 1997, Point Reyes Bird Observatory unpublished data, Widrig 1980, J. Albertson *in litt.* 1999, Page *et al.* 1983).

The first time a gull-billed tern was found in San Diego County, California, was in 1985. Two years later they were nesting in south San Diego Bay (Unitt 2004). Since then, the nest colony has steadily increased with an estimated 52 pairs in 2006 (Patton 2006a). Gull-billed terns have become a concern to managers of beach-nesting birds in the region. Gull-billed terns were first documented taking California least terns (presumably chicks) in south San Diego Bay in 1992 (Caffrey 1993). Patton (2006a) summarizes recent incidents of gull-billed tern predation on both terns and western snowy plovers. He notes roughly 20 to 60 California least terns and 1 to 4 western snowy plover depredations by gull-billed terns and a greater number was suspected. Although the documented number of gull-billed tern depredations on western snow plovers is considerably lower than on California least terns, it is difficult to know the full extent of gull-billed tern impacts (Patton 2006b), especially for the plovers whose nests are more dispersed and less easily monitored.

Unlike management of other avian predators, management of gull-billed terns is problematic. The local subspecies of gull-billed tern, *G. n. vanrossemi*, is limited to western North America (Molina and Erwin 2006, but see Unitt 2004). The subspecies nests in scattered, localized colonies and "[i]n 2003 and 2005, the entire North American population of *vanrossemi* gull-billed terns ranged from about 533 to 810 pairs" (Molina and Erwin 2006). This means that this predator is considerably rarer than the listed bird species upon which it preys (California least terns and western snowy plovers), which poses a conundrum for managers of western snowy plovers and California least terns (Unitt 2004). Because of the gull-

billed tern's status, lethal predator control has not been used on this species since 1999 (Unitt 2004). Gull-billed terns will likely become a greater source of management concern as the local population of this species grows. Gull-billed terns have been observed at other locations of beach-nesting birds farther north from San Diego Bay, including Camp Pendleton, San Diego County (Foster 2005); Bolsa Chica, Orange County (Hamilton and Willick 1996), and Venice Beach, Los Angeles County (McCaskie and Garrett 2005).

Loggerhead shrikes are not known to take western snowy plover eggs, but do prey upon chicks and locally can have substantial effects on fledging success (Warriner *et al.* 1986, D. George *in litt.* 2001, Page *et al.* 1997, George 1997, Page 1988, Feeney and Maffei 1991).

Although not known to be predators of western snowy plover eggs, American kestrels are predators of chicks and possibly adults (D. George, pers. comm. 1998). Fledging success increased from 9 to 64 percent after a kestrel unexpectedly disappeared from a western snowy plover nest site in Moss Landing Wildlife Area (Page *et al.* 1998). In 1997, a merlin was suspected of taking 13 banded adults within the period of a few days at Salinas River National Wildlife Refuge. Also, western snowy plover chicks and adults are among the avian prey of the peregrine falcon (B. Walton, University of California Santa Cruz, pers. comm. 1998; D. George, pers. comm. 1998; Feeney and Maffei 1991). Northern harriers are effective predators of western snowy plover chicks and adults. In 1987, a harrier was observed hunting on the islands in the Salinas River where only approximately one third of the hatched chicks reached fledging age (Point Reyes Bird Observatory unpubl. data). At the Moss Landing Wildlife Area, fledging success dropped from 61 to 23 percent after a harrier began foraging there (Page *et al.* 1997). A northern harrier was seen capturing 2 to 4 western snowy plover chicks at Moss Landing salt ponds in 2000 (D. George *in litt.* 2001).

In recent decades, alien eastern red foxes have become a serious new predator of endangered and threatened animals in coastal habitats (Jurek 1992, Golightly *et al.* 1994, Lewis *et al.* 1993). Nonnative red foxes were imported into the southern Sacramento Valley, primarily for hunting and fur farming purposes, as early as the 1870s and experienced explosive spread in the 1970s and 1980s (Jurek 1992, Lewis

et al. 1993, 1995). The red fox now occurs throughout a significant portion of coastal California, including Marin, San Mateo, Santa Cruz, Monterey, San Luis Obispo, Santa Barbara, Ventura, Orange, and Los Angeles Counties (California Department of Fish and Game 1994). It also occurs at Monterey Bay (G. Page *in litt.* 1988) and San Francisco Bay (Harding *et al.* 1998), including the additional San Francisco Bay area counties of Napa, Solano, Contra Costa, Alameda, and Santa Clara (California Department of Fish and Game 1994). Red foxes also are present in some areas of coastal Oregon where western snowy plovers breed (D. George *in litt.* 2001, Lauten *et al.* 2006*b*).

Red foxes have been identified as a significant predator of western snowy plover eggs in the Monterey Bay area, where they are suspected of also preying on adults and chicks. On Monterey Bay beaches, red fox depredation of western snowy plover eggs resulted in a decline in clutch hatching rate of 30 percent from 1984 to 1990. After exclosures and mammalian predator control came into use to protect nests around Monterey Bay, annual clutch hatching rates have climbed from 43 to 68 percent (Neuman *et al.* 2004).

Predation of western snowy plover nests and chicks by red fox have been documented at Bandon Beach, New River and other portions of OR-15 on the Oregon coast. Biologists have documented red fox tracks around western snowy plover nest exclosures and have followed fox tracks back to dens located within western snowy plover nest areas. As part of the emergency response to the New Carissa oil spill in February 1999, a predator program was implemented. Animal and Plant Health Inspection Service (APHIS) Wildlife Services Division personnel removed 17 red fox from the New River area over a 3 month period (S. Richardson *in litt.* 2001). Ongoing predator management since 2002 has removed an average of 15 foxes per year from Bandon Beach/New River (Lauten *et al.* 2006*b*).

The U.S. Department of Agriculture, Wildlife Services Branch, has been involved in predator damage management for protection of threatened and endangered species for over 10 years in California. The management of nonnative red foxes has become a controversial issue in many areas of California, particularly in coastal habitats near urban areas (California Department of Fish and Game 1994). In November 1998, California voters approved Proposition 4, which banned the use of

leghold traps in California. In February 1999, the U.S. District Court issued a Preliminary Declaratory Relief Order, which allows the use of padded leghold traps on Federal and non-Federal lands for the purpose of protecting threatened or endangered species. Trapping of nonnative and native predators of western snowy plovers will therefore not be affected by Proposition 4 (J. Albertson *in litt.* 1999).

Coyotes are known predators of western snowy plover eggs in the Pismo Beach/Santa Maria River area of San Luis Obispo County (T. Applegate, pers. comm. 1996). They are the main nest predator of eggs on Vandenberg Air Force Base where they were the cause of 43 percent of all clutch losses attributed to predators from 1994 to 1997 (Persons and Applegate 1997). At Vandenberg Air Force Base, coyotes may be attracted to marine mammal carcasses on the beach early in the western snowy plover nesting season (Page and Persons 1995). Coyotes also have been identified as predators of western snowy plover nests at Mono Lake, California (Page *et al.* 1983).

Striped skunks have been recorded as predators of western snowy plover eggs (Hickey *et al.* 1995, George 1997, Page *et al.* 1997, Hutchinson *et al.* 1987, Stein 1993, Stern *et al.* 1991). Skunks were believed to be the main cause of nest loss on Morro Bay Spit in 1987, the only year that the reproductive success of western snowy plovers has been monitored at that location (Hutchinson *et al.* 1987). Persons and Ellison (2001) reported that the striped skunk was the predominant predator of nests at Morro spit, destroying 87 percent of depredated nests in 2000.

Domestic and feral cats are widespread predators. The threat of predation of western snowy plovers by cats increases when housing is constructed near western snowy plover breeding habitat. As natural-appearing beaches continue to be surrounded by urban areas, western snowy plovers will increasingly be subjected to this predator in the future. Predation by cats is difficult to measure because of the difficulty in finding evidence of bird remains, but they are known to take western snowy plover adults and eggs (B. Farner, pers. comm. *in* Powell and Collier 1994; Page 1988; D. George *in litt.* 2001).

Predation, while predominantly a natural phenomenon, is exacerbated through the introduction of nonnative predators and unintentional human encouragement of

larger populations of native predators. Elevated predation pressures result from landscape-level alterations in coastal dune habitats which, in turn, now support increased predator populations within the immediate vicinity of nesting habitat for western snowy plovers. Urbanization benefits red fox population growth by eliminating coyotes, which are the red fox's most common native predator and competitor; by providing ready sources of food, water and denning sites; and by aiding dispersion of foxes into new areas. Red foxes disperse readily in urban areas because there are no predators besides the domestic dog. Red foxes traverse most urban habitats, and readily cross busy highways and travel long distances underground through culverts (Lewis *et al.* 1993). Other predators, such as corvids, attracted by the presence of human activities (*e.g.*, improper disposal of trash), may frequent beaches in increasing numbers. Gulls have greatly expanded their range and numbers, especially along the United States portion of the Pacific coast, as a result of human-supplied food sources (trash, fish offal, and dumps). Thousands of California gulls now breed in the southern part of San Francisco Bay, where only a few were present in the early 1980s (J. Albertson *in litt.* 1999). This population growth is attributed largely to the increase in landfills along the Bay within the last 20 years. Also, crows and ravens forage at landfills. Buick and Paton (1989) found that losses of hooded plover (*Charadrius rubricollis*) nests with human footprints around them were higher than at those without footprints, suggesting "that scavenging predators may use human footprints as a visual cue in locating food." Beach litter and garbage also attract predators such as skunks and coyotes (*e.g.*, N. Read *in litt.* 1998). Unnatural habitat features such as landscaped vegetation (*e.g.*, palm trees), telephone poles, transmission towers, fences, buildings, and landfills near western snowy plover nesting areas attract predators and provide them with breeding areas (*e.g.*, J. Buffa *in litt.* 2004). These alterations all combine to make the coastal environment more conducive to various native and nonnative predators that adversely affect western snowy plovers.

Substantial evidence exists that human activities are affecting numbers and activity patterns of predators on western snowy plovers. For example, increased depredation of western snowy plover nests by ravens at the Oliver Brothers salt pond, California, may be an indirect adverse impact of nearby installation of light structures by the California Department of Transportation and high-tension power lines by the Pacific Gas and Electric Company, thereby creating corvid nesting sites

(G. Page, Point Reyes Bird Observatory, pers. comm. 1997). Raven nests have also been discovered by National Wildlife Refuge biologists in transmission towers near other snowy plover nesting areas managed by the Don Edwards San Francisco Bay National Wildlife Refuge in Warm Springs, Alviso, and Mountain View (J. Buffa *in litt.* 2004). On the Oregon coast, predation risk by mammals has increased as a result of the spread of European beachgrass, Scotch broom, and shore pine, which has transformed vast areas of open sand into dense grass-shrub habitat, providing excellent habitat for native and nonnative mammalian predators, such as skunks, raccoons, foxes, and feral cats (Stern *et al.* 1991). At Vandenberg Air Force Base, coyote predation can be exacerbated by human presence when trash or debris is left behind (N. Read *in litt.* 1998).

Signing and fencing of restricted areas on the beach may provide perches for avian predators of western snowy plover adults or chicks (Hallett *et al.* 1995). Although signs and fences are important conservation tools in many areas, land managers need to be aware that modifications to them may be necessary to deter predators in some circumstances.

4. The Inadequacy of Existing Regulatory Mechanisms

The western snowy plover is protected by the Federal Migratory Bird Treaty Act (16 U.S.C. 703 *et seq.*) and, in each state, by State law as a nongame species. The western snowy plover's breeding habitat, however, receives only limited protection from these laws (*e.g.*, the Migratory Bird Treaty Act prohibition against taking "nests"). Listing of the western snowy plover under State endangered species laws generally provides some protection against direct take of birds, and may require State agencies to consult on their actions, but may not adequately protect habitat. State regulations, policies, and goals include mandates both for protection of beach and dune habitat and for public recreational uses of coastal areas; consequently they may conflict with protection of western snowy plovers in some cases. Section 404 of the Clean Water Act (33 U.S.C. 1251 et seq.) and section 10 of the Rivers and Harbors Act (33 U.S.C. 403) are the primary Federal laws that could provide some protection of nesting and wintering habitat of the western snowy plover that is determined by the U.S. Army Corps of Engineers (Corps) to be wetlands or historic navigable waters of the United States. These laws, however, would apply to only a

small fraction of the nesting and wintering areas of the western snowy plover on the Pacific coast. Aside from the Migratory Bird Treaty Act, western snowy plovers have no protection status in Mexico.

To effectively recover the western snowy plover, it is necessary to develop participation plans among cooperating agencies, landowners, and conservation organizations to assure protection and appropriate management of breeding, wintering, and migration areas. Since listing of the western snowy plover in 1993, several local working groups have been developed and local governments and State and Federal agencies have cooperated extensively to implement a wide variety of western snowy plover conservation actions. These partners continue to work to implement appropriate management of coastal areas for recovery of the western snowy plover. These conservation efforts and the environmental policies of State and Federal agencies are described in greater detail in the Conservation Efforts section, below.

For additional discussion of regulatory mechanisms and management actions taken by California State Parks and other entities, see U.S. Fish and Wildlife Service (2006a).

5. Other Natural or Manmade Factors Affecting Their Continued Existence

a. Natural Events

Western snowy plover breeding and wintering habitat is subject to constant change from weather conditions. Stenzel *et al.* (1994) reported that the quality and extent of western snowy plover nesting habitat is variable in both the short- and long-term. Coastal beaches increase in width and elevation during the summer through sand deposition, making marginal beaches more suitable for nesting later in the season. Over the longer term, an increase or decrease in habitat quality may occur after several years of winter storms. Based on the amount of flooding, the availability of dry flats at the edges of coastal ponds, lagoons, and man-made salt evaporators also varies within and between seasons. Therefore, the number of western snowy plovers breeding in some areas may change annually or even over one breeding season in response to natural alterations in habitat availability (Stenzel *et al.* 1981).

Because most western snowy plover nesting areas occur on unstable sandy substrates, nest losses caused by weather-related natural phenomena commonly occur. High tides and strong winds cause many nest losses. Events such as extreme high tides (Wilson 1980, Stenzel *et al.* 1981), river flooding (Stenzel *et al.* 1981), and heavy rain (Wilson 1980, Warriner *et al.* 1986, Page 1988) have been reported to destroy or wash away nests. The annual percentage of total nest losses attributed to weather-related phenomenon has reached 15 to 38 percent at some locations (Wilson 1980, Warriner *et al.* 1986, Page 1988).

Stormy winters can adversely affect the western snowy plover. It is suspected that the severe storms occurring during the El Niño atmospheric and oceanic phenomenon of the winter of 1997/1998 caused a 10 to 30 percent decline in the 1998 western snowy plover breeding population, depending on the coastal region. In all monitored recovery units, the number of breeding birds in 1998 was lower than in the 1997 nesting season. Additionally, a very wet spring resulted in a later than normal breeding initiation and fewer nesting attempts.

The western snowy plover population naturally varies, both spatially and temporally, because of natural changes in weather and habitat conditions from year to year. However, as described above, human influences over the past century (*e.g.*, habitat destruction, invasion of introduced beachgrass, and elevated predation levels) have reduced the western snowy plover's ability to respond to these natural perturbations.

b. Disturbance of Breeding Plovers by Humans and Domestic Animals

The coastal zone of the United States, including both open coastal areas and inland portions of coastal watersheds, is home to over one-third of the U.S. human population, and that proportion is increasing (U.S. Fish and Wildlife Service 1995*a*). The southern California coastal area, which constitutes the central portion of the western snowy plover's coastal breeding range, attracts large crowds on a regular basis (Figure 6). The increasing level of human recreation was cited as a major threat to the breeding success of the Pacific coast population of the western snowy plover at the time of listing (U.S. Fish and Wildlife Service 1993*a*).

Figure 6. Recreationists at Salt Creek Beach, California (photo by Ruth Pratt, with permission).

i. Pedestrians

Pedestrians (*e.g.*, beach walkers and joggers) can cause both direct mortality and harassment of western snowy plovers. Pedestrians on beaches may crush eggs or chicks and chase western snowy plovers off their nests. Separation of western snowy plover adults from their nests and broods can cause mortality through exposure of vulnerable eggs or chicks to heat, cold, blowing sand, and/or predators. Pedestrians have been known to inadvertently step on eggs and chicks, deliberately take eggs from nests, and remove chicks from beaches, erroneously thinking they have been abandoned. People also may cause broods of western snowy plovers to run away from favored feeding areas. These effects are described in more detail below. Trash left on the beach by pedestrians also attracts predators. In addition to public pedestrians, military personnel using the beach for maneuvers, boat launches, and landings have the potential to similarly cause adverse impacts to western snowy plovers.

Beach-related recreational activities that are concentrated in one location (*e.g.*, sunbathing, picnicking, sandcastle building, birding, and photography) can negatively affect incubating adult western snowy plovers when these activities occur too close to their nests. Recreational activities that occur in the wet sand area (*e.g.*, sand sailing) can adversely affect western snowy plovers when they disturb plover adults or broods, which feed at the edge of the surf along the wrack line. Recreational activities that occur in or over deep water (such as the beach- and water-oriented activities of surfing, kayaking, wind surfing, jet skiing, and boating, and the coastal-related recreational activity of hang gliding) may not directly affect western snowy plovers; however, they can potentially be detrimental to western snowy plovers when recreationists use the beach to take a break from these activities, or as access, exit, or landing points.

Concentrations of people may deter western snowy plovers and other shorebirds from using otherwise suitable habitats. Anthony (1985) found that intensive human activity at Damon Point had a "bracketing effect" on the distribution of nesting western snowy plovers, confining their breeding activity to a section of the spit and precluding their regular use of otherwise suitable habitat. Fox (1990) also found that western snowy plovers avoided humans at Damon Point, and the presence of fishermen and beachcombers kept them hundreds of yards away from potential habitat. Because early-nesting western snowy plovers have narrower beaches from which to select nest locations, recreational use may be more concentrated in the limited habitat available. Also, repeated intrusions by people into western snowy plover nesting areas also may cause birds to move into marginal habitats where their chances of reproductive success are reduced. Studies of the Atlantic coast population of the piping plover (*Charadrius melodus*), an eastern species with habitat requirements very similar to the snowy plover, indicate that some piping plovers that nest early in the season are forced to move elsewhere when human use becomes too intense (Cairns and McLaren 1980). These authors concluded that piping plovers that nest early, before beaches become heavily used for recreation, "cannot predict and avoid reproductive failure in habitats that otherwise appear suitable to them." Burger (1993) observed that piping plovers, in response to human disturbance, spent more energy on vigilance and avoidance behavior at the expense of foraging activity, and sometimes abandoned preferred foraging habitat.

Page *et al.* (1977) observed western snowy plovers' response to human disturbance at two coastal beaches where normal beach use ranged from light to heavy. The study included 156 hours of observation at 15 western snowy plover nests. At Point Reyes, they found that pedestrians disrupt incubation of nests. When humans approached western snowy plovers, adults left their nests 78 percent of the time when people were within 50 meters (164 feet) and 34 percent of the time when people were over 100 meters (328 feet). They also found that western snowy plovers' reaction to disturbance by humans varied, ranging from one bird remaining off the nest for less than 1 minute when a person walked within 1 meter (3 feet) of the nest on a heavily-used beach to another western snowy plover leaving the nest when three people were 200 meters (656 feet) away on a less-used beach. They noted that "birds exposed to prolonged human activity near the nest seemed to become accustomed to it." It has been speculated that predators of western snowy plovers may benefit from a decline in wariness by western snowy plovers nesting on beaches that are subject to ongoing high levels of human disturbance (Persons and Applegate 1997).

Lafferty (2001) observed western snowy plovers' response to people, pet dogs, equestrians, crows and other birds. Observations were made at Devereux Slough in Santa Barbara County, Santa Rosa Island, San Nicolas Island, and Naval Base Ventura County (Point Mugu). This study found that western snowy plover are most frequently disturbed when approached closely (within 30 meters) by people and animals. The most intense disturbance (causing the western snowy plover to fly away) were in response to crows, followed by horses, dogs, humans, and other birds. Lafferty (2001) created a management model based on his findings and estimated flight response disturbances under different scenarios. The model predicted a reduced disturbance response for buffer zones of 20 to 30 meters.

Fahy and Woodhouse (1995) quantified the levels of recreational disturbance, their effect on western snowy plovers, and the effectiveness of the Linear Restriction Program at Ocean Beach, Vandenberg Air Force Base in 1995. Under this program signs directed visitors not to cross from the outer beach into the Linear Restriction area (inland of mean high tide mark, in dune habitat used by western snowy plovers). Seventy percent of all disturbances were in compliance with restriction warning signs. The disturbance types that were most and least frequently in

compliance with the boundary were joggers or walkers and stationary visitors, respectively. The closer the disturbance occurred to the plover, the more severe the plover response. All-terrain vehicles caused the most significant alert and flight behaviors by western snowy plovers, even though they were in compliance with the Linear Restriction. The disturbance types that caused incubating western snowy plovers to flush from their nests most frequently were joggers and walkers, followed by joggers or walkers with dogs off leash, and stationary visitors. The disturbance types that kept incubating western snowy plovers off their nests for the longest period of time were stationary visitors and surf fishermen, probably because of the duration of these stationary disturbances that occurred close to nests. Weekends accounted for 60 percent of all disturbances. The enforcement personnel appeared to have a limited presence; their presence was documented during only 14 percent of all identified disturbances.

Hoopes *et al.* (1992) quantified human use and disturbance to piping plovers in Massachusetts during the 1988 and 1989 nesting seasons. They found pedestrians caused piping plovers to flush or move at an average distance of 23 meters (75 feet). Pedestrians within 50 meters (164 feet) of the birds caused piping plovers to stop feeding 31 percent of the time.

Point Reyes Bird Observatory found that management actions that included exclusion zones around nesting areas, seasonal closure to dogs, and active weekend docent programs reduced mortality of chicks and eggs during the weekend such that the weekend and weekday mortality was the same (Peterlein and Roth 2003).

At the Pajaro River mouth in California, at least 14 percent of western snowy plover clutches were destroyed by being driven over, stepped on, or deliberately taken by people (Warriner *et al.* 1986). Since exclosures have been used to protect nests at the Pajaro River mouth and other locations at Monterey Bay, a few nests have still been deliberately destroyed by vandals in most years (Point Reyes Bird Observatory unpublished data). At South Beach, Oregon, the number of western snowy plovers declined from 25 in 1969 to 0 in 1981 when a new park was constructed next to the beach and the adjacent habitat became more accessible to vehicles and people (Hoffman 1972 *in* Oregon Department of Fish and Wildlife 1994).

At Vandenberg Air Force Base, western snowy plover monitoring during 1993 at South Beach (where recreational use was high) and North Beach (where recreational use was low) found the rate of nest loss caused by humans differed markedly: 24.3 percent of South Beach nests were lost compared to only 3.0 percent of North Beach nests (Persons 1994). Persons and Applegate (1997) reported that "rates of reproductive success, combined for 1994 through 1997, were substantially higher on North Beach than on South Beach." This difference occurred despite the fact that nesting habitat was posted as off-limits during the nesting season in 1994. However, at that time restrictions were new and not strictly enforced (R. Dyste *in litt*. 2004). Since 2000, public access has been restricted and fully enforced by Vandenberg Air Force Base personnel. Additionally, Santa Barbara County-supported volunteer docents were present at Surf Station (within Vandenberg Air Force Base) during the 2001-2003 plover breeding seasons when the beach was open for public access. In 2003, plover monitors did not document the loss of any nests within Surf Station Beach as a result of trampling by humans (R. Dyste *in litt*. 2004).

Loss of western snowy plover chicks also may occur because of human activities. The number of young produced per nesting attempt increased from 0.75 in disturbed habitat to 2.0 for nests free of disturbance at Willapa National Wildlife Refuge, Washington (Saul 1982). At Vandenberg Air Force Base, the 1997 fledging success of western snowy plovers was 33 to 34 percent on North Beach where recreational activity is restricted and only 12 percent on South Beach where recreational use is high (Persons and Applegate 1997). In 1999 and 2000, Ruhlen *et al*. (2003) found that increased human activities on Point Reyes beaches had a negative effect on western snowy plover chick survival. In both 1999 and 2000, western snowy plover chick loss was about three times greater on weekends and holidays than on weekdays. In most coastal areas, beach visitation in summer months is much higher on weekends and holidays than on weekdays.

Flemming *et al*. (1988) measured the effects of human disturbance on reproductive success and behavior of piping plovers in Nova Scotia. To assess human disturbance, they recorded positions of people, pedestrian tracks, and vehicle tracks, then defined classes based on visits per week. They found significantly fewer young survived in areas of high versus low disturbance; humans elicited a

significantly higher response level from adult piping plovers than did predators or nonpredatory species; chicks fed less and were brooded less when humans were within 160 meters (525 feet); and chick peck rate during feeding was lower when humans were present. They speculated that because chicks shifted from feeding and energy conservation activities to vigilance and cryptic predator avoidance behaviors, their energy reserves would be depleted, making them more susceptible to predators and inclement weather. They postulated that a decline in piping plover abundance in Nova Scotia could be caused by human disturbance altering chick behavior. Fewer chicks survived to 17 days in areas heavily disturbed by humans.

Schultz and Stock (1993) studied the effects of tourism on colonization, distribution, and hatching success of Kentish plovers (*Charadrius alexandrinus alexandrinus*), a Eurasian subspecies of the snowy plover, at the Wadden Sea in Germany. They measured disturbance intensity by counting and mapping tourists on 50 days from April to July, during times of peak human activity (1500 to 1600 hours) and in intervals of 30 minutes throughout other days. An index of person-hours per area per day was calculated. They found that Kentish plovers did not colonize heavily-disturbed areas and that resting and sunbathing people were apparently more disruptive than walking people because the latter generally followed the high-tide line. Clutch losses were lowest in areas with little disturbance and highest in areas with heavy disturbance. They indicated that hatching success in highly disturbed areas, even with optimal habitat, is as low as in poor habitat with a low level of disturbance.

ii. Dogs

Dogs on beaches can pose a serious threat to western snowy plovers during both the breeding and nonbreeding seasons. Unleashed pets, primarily dogs, sometimes chase western snowy plovers and destroy nests. Repeated disturbances by dogs can interrupt brooding, incubating, and foraging behavior of adult western snowy plovers and cause chicks to become separated from their parents. Pet owners frequently allow their dogs to run off-leash even on beaches where it is clearly signed that dogs are not permitted or are only permitted if on a leash. Enforcement of pet regulations on beaches by the managing agencies is often lax or nonexistent.

A number of examples of disruptive ways that dogs affect western snowy plovers have been noted at beaches in Monterey County (Marina State Beach), Santa Cruz County (Laguna, Scott Creek, and Seabright Beaches) and San Mateo County (Half Moon Bay and Pacifica Beaches) (D. George, pers. comm. 1997). Incubating birds have been flushed from nests by dogs, including nests located inside areas protected by symbolic fencing. Dogs also have displaced adults from nests with newly-hatched chicks. Roosting and feeding flocks, as well as individual birds, have been deliberately and persistently pursued by dogs. At Laguna Creek Beach, Zmudowski State Beach, and Salinas River State Beach, dogs partially or entirely destroyed western snowy plover nests which were in several cases, protected with symbolic fencing (D. George, pers. comm. 1997; Point Reyes Bird Observatory unpublished data; G. Page, pers. comm. 1998). Feral dogs are suspected to have disturbed western snowy plover nests and chicks on San Francisco Bay salt ponds (J. Albertson *in litt.* 1999).

Even when not deliberately chasing birds, dogs on a beach may disturb western snowy plovers and other shorebirds that are roosting or feeding. Page *et al.* (1977) found that westem snowy plovers flushed more frequently and remained off their nests longer when a person was accompanied by a dog than when alone. They collected data during 156 hours of observation at 15 nests at Point Reyes, California, and found the following distances at which western snowy plovers flushed from their nests as a result of disturbance by people with dogs. Within 50 meters (164 feet), people with dogs caused flushing 100 percent of the time. At a distance of over 100 meters (328 feet), people with dogs caused flushing 52 percent of the time (Page *et al*. 1977). Fahy and Woodhouse (1995) found that joggers or walkers with off-leash dogs caused a significantly greater number of avoidance responses from western snowy plovers than other types of disturbances at Ocean Beach, Vandenberg Air Force Base, California. Lafferty's (2001) management model predicted that intense disturbances could be dramatically reduced by removing dogs.

At wintering sites such as Ocean Beach in San Francisco, California, off-leash dogs have caused frequent disturbance and flushing of western snowy plovers and other shorebirds. Off-leash dogs chase wintering western snowy plovers at this beach and have been observed to regularly disturb and harass birds (P. Baye, U.S. Fish and

Wildlife Service, pers. comm. 1997). Observations by National Park Service volunteers suggest that unleashed pets represent the most significant recreational threat to wintering western snowy plovers and migratory shorebirds at Ocean Beach, because of the prolonged and repeated disturbance created when they chase birds (Hatch 1997). In 1995 and 1996, during 45 hour-long observations of wintering flocks of western snowy plovers at Ocean Beach, western snowy plovers responded by moving in 73 percent of 74 instances when dogs with or without people approached to within 15 meters (50 feet) (Golden Gate National Recreation Area unpublished data). When shorebirds are flushed, they must spend more energy on vigilance and avoidance behaviors at the expense of foraging and resting activity (Burger 1993, Hatch 1997). Disruption of foraging and roosting may result in decreased accumulation of energy reserves necessary for shorebirds to complete the migration cycle and successfully breed (Burger 1986, Pfister *et al.* 1992). Dog disturbance at wintering and staging sites, therefore, may adversely affect individual survivorship and fecundity, thereby affecting the species at the population level.

iii. Motorized Vehicles

Unrestricted use of motorized vehicles on beaches is a threat to western snowy plovers and their habitat. Motorized vehicles may affect remote stretches of beach where human disturbance would be slight if access were limited to pedestrians. The magnitude of this threat is variable, depending on level of use and type of terrain covered. Use of motor vehicles on coastal dunes may also be destructive to dune vegetation, especially sensitive native dune plants.

Driving vehicles in breeding habitat may cause destruction of eggs, chicks, and adults, abandonment of nests, and considerable stress and harassment to western snowy plover family groups (G. Page, pers. comm. 1997; J. Myers *in litt.* 1988; J. Price *in litt.* 1992; Stern *et al.* 1990; Casler *et al.* 1993; S. Richardson, pers. comm. 1998; Widrig 1980). In addition to recreational vehicles, vehicles used for military activities have also caused western snowy plover mortality (Powell *et al.* 1995, 1997; Persons 1994).

Driving motor vehicles at night seems to be particularly hazardous to western snowy plovers. Drivers of all-terrain vehicles at night have run over and killed

western snowy plover adults at Vandenberg Air Force Base, and State park ranger patrol vehicles have crushed western snowy plover chicks at Oceano Dunes State Vehicular Recreation Area during night patrols (R. Mesta *in litt.* 1998).

On the Eel River gravel bars, vehicle use (including motorcycles, ATVs, and full-size 4x4s) has resulted in the crushing of nests and disturbance to nesting plovers (Colwell *et al.* 2006).

Western snowy plover adults and chicks have been observed using tire tracks and human footprints for loafing at Camp Pendleton and Naval Amphibious Base Coronado (Powell and Collier 1994). This behavior increases their chances of being run over. Western snowy plover chicks also may have difficulty getting out of tire ruts, thereby increasing their likelihood of being run over. Their cryptic coloring and habit of crouching in depressions like tire tracks makes western snowy plover chicks especially vulnerable to vehicular traffic. In Massachusetts, between 1989 and 1997, a total of 25 piping plover chicks and 2 adults were found dead in off-road vehicle tire ruts on the upper beach between the mean high tide line and the foredune (U.S. District Court of Massachusetts 1998).

Hoopes *et al.* (1992) found off-road vehicles caused piping plovers to flush or move at an average distance of 40 meters (131 feet). Off-road vehicles within 50 meters (164 feet) of the birds caused piping plovers to stop feeding 77 percent of the time. While most responses by piping plovers to off-road vehicles resulted in movement by the birds, they observed three instances where the plovers "froze" in response to the off-road vehicles. Both types of responses have a negative impact on plovers through either disturbance, interruption of feeding behavior, or increasing the risk that piping plovers will be hit or crushed by vehicles.

At wintering sites, disturbance from motorized vehicles may harass western snowy plovers and disrupt their foraging and roosting activities, thereby decreasing energy reserves needed for migration and reproduction. When motorcycles, most of which were in the wet sand zone, were driven at high speed along Ocean Beach in San Francisco, Hatch (1997) observed that western snowy plovers and other shorebirds were continually disturbed and often took flight.

iv. Beach Cleaning

Removal of human-created trash on the beach is desirable to reduce predation threats by eliminating food for predators of western snowy plovers; however, the indiscriminate nature of mechanized beach-cleaning adversely affects western snowy plovers and their habitat. Mechanized beach cleaning can be dangerous to western snowy plovers by crushing their clutches and chicks or causing prolonged disturbance from the machine's noise. Also, this method of beach cleaning removes the birds' natural wrackline (area of beach containing seaweed and other natural wave-cast organic debris) feeding habitat, reducing the availability of food. Kelp and driftwood, with their associated invertebrates, are regularly removed and the upper layer of sand is disturbed. Beach grooming also alters beach topography, removes objects associated with western snowy plover nesting, and prevents the establishment of native beach vegetation (J. Watkins *in litt.* 1999). In all of Los Angeles County and parts of Ventura, Santa Barbara, and Orange Counties, California, entire beaches are raked on a daily to weekly basis. Large rakes, with tines 5 to 15 centimeters (2 to 6 inches) apart, are dragged behind motorized vehicles from the waterline to pavement or to the low retaining wall bordering the beaches (Stenzel *et al.* 1981). Even if human activity was low on these beaches, grooming activities completely preclude the possibility of successful western snowy plover nesting (Powell 1996).

v. Equestrian Traffic

Most equestrian use on beaches is directed to wet-sand areas. However, during high tide periods, horseback riders on the beach sometimes enter coastal dunes or upper beach areas (Figure 7), where they may crush clutches or disturb western snowy plovers (Point Reyes Bird Observatory unpublished data, Page 1988, Persons 1995, Craig *et al.* 1992, Woolington 1985).

Figure 7. Equestrians on beach (photo by U.S. Forest Service, with permission).

vi. Fishing

Impacts on western snowy plover nesting may be associated with surf fishing and shellfish harvesting in and near western snowy plover habitat. The improper disposal of offal (waste parts of fish), bait, and other litter attracts crows, ravens, and gulls, which are predators of western snowy plover eggs and chicks. Also, western snowy plovers may become entangled in discarded fishing lines (G. Page, pers. comm. 1998).

Surf fishing is a commercial enterprise in many coastal locations, including the ocean smelt fishery in northern California (C. Moulton *in litt.* 1997). Recreational surf fishing occurs throughout the California coast. In Humboldt County, California, Redwood National and State Parks have proposed allowing beach vehicle use, by annual permit, for commercial fishing and tribal fishing/gathering on Gold Bluffs Beach, Freshwater Spit, and Crescent Beach (J. Watkins *in litt.* 1999). In the State of Washington, the most popular season for surf fishing is April through July (Washington Department of Fish and Wildlife 1995). At present, demand for

surf perch fishing is relatively low in Oregon. However, the Oregon Department of Fish and Wildlife is promoting a surf perch fishery to lessen the demand for anadromous fishing. This fishery would increase vehicle driving to remote and relatively undisturbed sites used by western snowy plovers (K. Palermo *in litt.* 1998*a*).

Because the earliest western snowy plover clutches in Washington are laid between mid-April and mid-May, harvesting of razor clams during the mid-March to mid-May clamming season may have adverse impacts on prospecting or nesting western snowy plovers. Clammers near nesting areas may disturb adults and chicks; human activity in feeding areas may restrict western snowy plover foraging activity, and increased motorized traffic may increase the risk of nest and chick loss (Washington Department of Fish and Wildlife 1995). However, observations of western snowy plover and human activities during the spring 1995 razor clam season showed clamming had no visible impact on western snowy plovers where clamming intensity was low (Kloempken and Richardson 1995). Instances of trespassing into the western snowy plover protection area were noted; however, movement of the western snowy plover protection area boundary about 327 meters (1,073 feet) west of its previous location seemed to benefit the birds by providing more space between them and pedestrian and vehicular disturbances.

vii. Fireworks

Fireworks are highly disturbing to western snowy plovers. All western snowy plovers flushed from Coal Oil Point Reserve during a nearby July 4, 2005, fireworks display (C. Sandoval, University of California Santa Barbara, pers. comm. 2005). At Del Monte Beach, California, a western snowy plover chick hatched on July 4, 1996, within an area demarcated by symbolic fencing, and was abandoned by its parents after a fireworks display. Disturbance from the noise of the pyrotechnics is exacerbated by disturbance caused by large crowds attracted to fireworks events. California Department of Parks and Recreation staff estimated that 6,000 people visited Del Monte Beach on that day. Because of the extensive disturbance, the adult western snowy plovers left the nest site with two chicks, abandoned the third chick, and were not seen again (K. Neuman, California Department of Parks and Recreation, pers. comm. 1997). During July 4, 1992,

observations of piping plovers that nest on the Breezy Point Cooperative and adjacent beaches of Gateway National Recreation Area in Queens, New York, the birds were disturbed by fireworks displays (Howard *et al.* 1993). Management recommendations for this area included prohibition of fireworks in or near the fenced and posted nesting and brood-rearing areas.

viii. Kite Flying and Model Airplanes

Biologists believe plovers perceive kites as potential avian predators (Hoopes *et al.* 1992, Hatch 1997). The reaction of western snowy plovers to kites at Ocean Beach in San Francisco, California, "ranged from increased vigilance while roosting in close proximity to the kite flying, to walking or running approximately 10 to 25 meters (33 to 82 feet) away and resting again while remaining alert" (Hatch 1997). It is expected that stunt-kites would cause a greater response from western snowy plovers than traditional, more stationary kites. Stunt kites include soaring-type, two-string kites with noisy, fluttering tails, which often exhibit rapid, erratic movements.

Hoopes *et al.* (1992) found that piping plovers are intolerant of kites. Compared to other human disturbances (i.e., pedestrian, off-road vehicle, and dog/pet), kites caused piping plovers to flush or move at a greater distance from the disturbance, to move the longest distance away from the disturbance, and to move for the longest duration. Piping plovers responded to kites at an average distance of 85 meters (279 feet); moved an average distance of over 100 meters (328 feet); and the average duration of the response was 70 seconds.

It is expected that model airplanes may also have a detrimental impact to western snowy plovers because western snowy plovers may perceive them as potential predators (Hatch 1997).

ix. Aircraft Overflights

Low-flying aircraft (*e.g.*, within 152 meters (500 feet) of the ground) can cause disturbances to breeding and wintering western snowy plovers. Hatch (1997) found that all types of low-flying aircraft potentially may be perceived by western snowy

plovers as predators. She also found that the general response of roosting western snowy plovers to low-flying aircraft at Ocean Beach, San Francisco, California, was to increase vigilance and crouch in depressions on the beach, whereas foraging western snowy plovers frequently took flight. Plovers may, however, become acclimated to aircraft overflights in some instances, since at Naval Air Station North Island they chose to nest repeatedly within military airfield boundaries on runway ovals next to busy military runways (S. Vissman, U.S. Fish and Wildlife Service, pers. comm. 1997). Federal Aviation Regulations, Part 91, General Operating and Flight Rules, require that over open water, aircraft may not be operated closer than 152 meters (500 feet) to any person, vessel, vehicle, or structure. Emergency operations, including those by Coast Guard helicopters, are exempted from these rules. However, helicopters may be operated at less than 152 meters (500 feet) if the operation is conducted without hazard to people or property on the surface (U.S. Federal Aviation Administration 1997). Helicopters can cause excessive noise, which can also disturb western snowy plovers, even at an altitude of 152 meters (500 feet) (Howard *et al.* 1993; J. Watkins *in litt.* 1999; D. Stadtlander, pers. comm. 1999). At Marine Corps Base Camp Pendleton, California, where military training can require aircraft (especially helicopters) to fly at very low elevations, the Marine Corps minimizes impacts to western snowy plovers and California least terns by requiring aircraft to stay at least 91 meters (300 feet) above the ground over tern and plover nesting areas during the nesting season (U.S. Marine Corps 2006).

x. Special Events

Special events which attract large crowds, such as media events, sporting events, and beach clean-ups, have a potential for significant adverse impacts when held in or near western snowy plover habitat. An example is the National Marine Debris Monitoring Program, implemented by the U.S. Environmental Protection Agency in conjunction with the National Oceanic and Atmospheric Administration, National Park Service, and the U.S. Coast Guard. This year-round program uses volunteers (including high school students) to document and collect trash and marine debris on coastal transects within western snowy plover nesting and wintering habitat. Potential threats from crowds of people attracted to special events are similar to those previously identified for pedestrians, including direct mortality and harassment of western snowy plovers.

xi. Coastal Access

Expanding public access to the coast (*e.g.*, State Coastal Trails) for recreation (*e.g.*, walking, hiking, biking) may adversely affect western snowy plovers and their breeding or wintering habitat. Expanded coastal access brings significantly greater numbers of people to the beach and other coastal habitats, exacerbating potential conflicts between human recreational activities and western snowy plover habitat needs (see Pedestrian section). Expanded coastal access may exceed the threshold of beach visitors that public resource agencies (*e.g.*, State Parks and National Park Service) can effectively manage while also meeting their responsibilities to protect natural resources.

Bicycles are known to adversely affect western snowy plovers nesting on levees and roads near San Francisco Bay salt ponds within the Don Edwards San Francisco Bay National Wildlife Refuge. Many of these levees are closed to human access, but some bicyclists trespass onto closed levees. In 1998, one western snowy plover nest, located on the main access road to the Refuge, was run over by a bicycle as biologists were putting up a barrier to protect it (J. Albertson *in litt.* 1999).

xii. Livestock Grazing

Western snowy plover nests have been trampled by cattle, causing both direct mortality of eggs and flushing of adults from the nests (U.S. Fish and Wildlife Service *in litt.* 1995). Additionally, feral pigs (*Sus scrofa*) may trample western snowy plover habitat and disturb nesting western snowy plovers (R. Klinger, The Nature Conservancy, pers comm. 1998, D. George *in litt.* 2001). Cow and horse manure can introduce seeds of non-native plants into the dunes.

c. Oil Spills

The Pacific Coast population of the western snowy plover is vulnerable to oil spills. Western snowy plovers forage along the shoreline and in sea wrack (seaweed and other natural wave-cast organic debris) at the high-tide line and are thus at risk of direct exposure to oil during spills. The loss of thermal insulation is considered to be the primary cause of mortality in oiled birds (National Research Council 1985,

Leighton 1991). Oiled feathers lose their ability to keep body heat in and cold water out, causing reduced insulation, increased metabolic rate, and hypothermia. Ingestion of oil may lead to physiological changes in birds, including pathological effects on the alimentary tract, blood, adrenal glands, kidneys, liver, and other organs (Fry and Lowenstine 1985, Khan and Ryan 1991, Burger and Fry 1993). Exposure of adult birds to oil also may impair reproduction, including reductions in egg laying and hatchability (Ainley *et al.* 1981, Fry *et al.* 1986) and reductions in survival and growth of chicks (Trivelpiece *et al.* 1984). Oil transferred to eggs from plumage or feet of incubating birds can kill embryos (Albers 1977, Albers and Szaro 1978, King and Lefever 1979). Oiled shorebirds may spend more time preening and less time feeding than unoiled birds, such that their body condition and ability to migrate to breeding grounds and reproduce may be impaired (Evans and Keijl 1993, Burger 1997).

Oil spills may result in contamination or depletion of western snowy plover food sources. Elevated concentrations of total petroleum hydrocarbons have been found in the sand crab (*Emerita analoga*), a potential western snowy plover food item, following a southern California oil spill (J.E. Dugan, unpublished data). Oil or other chemicals washed onto mudflats or sand beaches may result in reduction in the availability of invertebrate prey (Kindinger 1981). Elimination of shorebird food resources on intertidal flats of the Saudi Arabian Gulf coast as a result of the large oil spills associated with the 1991 Gulf War led to drastic reductions in the number of shorebirds supported by this habitat (Evans *et al.* 1993). Disturbance and other adverse impacts to western snowy plovers also may occur during oil clean-up activities if response teams are not careful when driving heavy equipment and vehicles or traversing on foot through western snowy plover habitat.

During the 1990s, at least six oil spill incidents in California and one in Oregon resulted in adverse impacts to western snowy plovers. The U.S. Coast Guard and various other State and Federal agencies and the responsible parties responded to these spills. One of these incidents occurred between 1984 and 1998 at Unocal's Guadalupe Oil Field in San Luis Obispo, California contaminated western snowy plover habitat with toxic hydrocarbons. In 1993, oil spilled from a ruptured oil transfer line into McGrath Lake, Ventura County, California and then flowed into the Pacific Ocean. Western snowy plover habitat and prey were contaminated with

oil and wintering western snowy plovers were displaced during the cleanup activities (S. Henry *in litt.* 1998, McGrath Oil Spill Restoration Scoping Document 1995). In 1996, the SS Cape Mohican discharged fuel oil into the San Francisco Drydock Shipyard, California, where it spread throughout the central bay and into the Pacific Ocean, oiling western snowy plovers and their beach habitat (Cape Mohican Trustee Council 2002, Point Reyes Bird Observatory unpublished data). In 1997, a pipeline extending between an offshore oil platform (Platform Irene) and the mainland ruptured near Pedernales Point, Santa Barbara County, California, oiling western snowy plovers and wrack where western snowy plovers were seen feeding (Applegate 1998, Ford 1998, Lockyer *et al.* 2002). In 1997 and 1998, large numbers of tarballs became stranded on beaches at Point Reyes National Seashore and resulted in oiling of snowy plovers and their habitat. Subsequent tarball incidents in 2001 and 2002 resulted in identification of the source of the tarballs as the SS Jacob Luckenbach, an oil tanker that sank in 1953 (Carter and Golightly 2003, Point Reyes Bird Observatory unpublished data, Hughes 2003). In 1999, the dredge M/V Stuyvesant spilled fuel oil into the Pacific Ocean off Humboldt Bay, California (U.S. Coast Guard 2001), resulting in oiling of western snowy plovers and their habitat (LeValley *et al.* 2001).

In February 1999, the freighter New Carissa went aground near the North Jetty of Coos Bay, Oregon, breaking apart and spilling 25,000 to 70,000 or more gallons of oil into coastal water. (U.S. Bureau of Land Management 2001). The incident oiled approximately 52 snowy plovers, representing at least 60 percent of the Oregon wintering population of western snowy plover (Stern *et al.* 2000). In Washington, the 1988 Nestucca oil spill and the 1991 Tenyo Maru oil spill may also have affected western snowy plovers or their habitats, although impacts are not as well documented as in the above cases (Larsen and Richardson 1990).

In addition to catastrophic spills like those described above, chronic oil pollution may affect western snowy plovers. Surveys of beached birds have shown that small-volume, chronic oil pollution is an ongoing source of avian mortality in coastal regions (Burger and Fry 1993). Dead oiled birds and tarballs are found regularly on Pacific coast beaches in the absence of reported oil spills (Roletto *et al.* 2000). Potential sources of chronic oiling include natural seeps, bilge water pumping, sunken vessels, urban runoff, and small or unreported spills from vessels,

tankers, pipelines, and offshore oil platforms. Elevated concentrations of total petroleum hydrocarbons have been found in the sand crab *(Emerita analoga*), a potential western snowy plover food item, in the vicinity of natural oil seeps (Dugan *et al.* 1997).

Intensive oil spill cleanup operations, including use of vehicles to deploy beach booms, move personnel, and remove debris, cause disturbance to nesting and foraging activities of western snowy plovers. These temporary impacts are offset by restoration of habitat and cleaning affected birds.

d. Contaminants

The most likely route of exposure of western snowy plovers to contaminants other than spilled oil is through the diet. Western snowy plovers feed on aquatic and terrestrial insects, and the bioaccumulation of environmental contaminants on western snowy plover nesting and wintering grounds may adversely affect their health and reproduction. Organochlorines are known to have caused reduced avian egg production, aberrant incubation behavior, delayed ovulation, embryotoxicosis, and mortality of chicks and adults (Blus 1982). Selenium has caused decreased hatchability of avian eggs, developmental abnormalities, altered nesting behavior, and embryotoxicosis in birds in field and laboratory studies (Ohlendorf *et al.* 1986, Heintz *et al.* 1987). Mercury can cause decreased hatchability of avian eggs (Connors *et al.* 1975), boron has been shown to reduce hatchability of waterfowl eggs in laboratory experiments (Smith and Anders 1989), and arsenic may also adversely affect avian reproduction (Stanley *et al.* 1994).

Hothem and Powell (2000) analyzed 23 western snowy plover eggs collected from 5 sites (Camp Pendleton Marine Corps Base, Batiquitos Lagoon, Naval Amphibious Base Coronado, Sweetwater Marsh National Wildlife Refuge, and Tijuana Estuary) in southern California from 1994 to 1996 for metals and trace elements, and 20 eggs for organochlorine pesticides and metabolites. All eggs were either abandoned or failed to hatch. Organochlorines, including dieldrin, o,p'-DDD, o,p'-DDE, o,p'-DDT, p,p'-DDD, p,p'-DDE, p,p'-DDT, oxychlordane, and trans-nonachlor were found above the detection limits in western snowy plover eggs. Median DDE and PCB concentrations were less than those normally associated with eggshell

thinning. deformities, or other detrimental effects on birds. Twelve metals and trace elements (arsenic, boron, chromium, copper, iron, magnesium, manganese, mercury, nickel, selenium, strontium and zinc) were detected in at least 90 percent of the samples, but generally at background levels. Mean concentrations of all contaminants were below those that would adversely affect reproduction.

Concentrations of mercury in western snowy plover eggs that failed to hatch at Point Reyes National Seashore were five to ten times higher than the mercury concentrations in the five Southern California locations studied by Hothem and Powell (Schwarzbach *et al.* 2003). The mean mercury concentration of 1.07 micrograms/gram (1.07 parts per million), wet weight, in western snowy plover eggs from Point Reyes National Seashore is probably high enough to account for egg failure through direct toxic effects to western snowy plover embryos (Schwarzbach *et al.* 2003). Because only failed and abandoned eggs were taken rather than randomly collected eggs, the extent of mercury contamination of the entire breeding western snowy plover population at Point Reyes can not be reliably assessed from these data; however, the data from the 2000 field season would suggest that about one fifth of the nests appeared to be at risk from adverse effects of mercury (Schwarzbach *et al.* 2003).

e. Litter, Garbage, and Debris

Placement of litter, garbage, and debris in the coastal ecosystem can result in direct harm to western snowy plovers and degradation of their habitats. Litter and garbage feed predators and encourage their habitation at higher levels than would otherwise occur along the coast, making predators a greater threat to western snowy plovers. For example, as noted previously, the California gull (*Larus californicus*) has become far more prevalent in the South San Francisco Bay area. Currently, the estimated 25,000 California gulls in this area feed in landfills and forage in salt marshes using habitat that once supported the western snowy plover (J. Albertson, pers. comm. 2005).

Marine debris and contaminated materials on the beach also adversely affect western snowy plovers. Marine debris is attributed to both ocean and shoreline sources. Ocean sources of marine debris and contamination include fishing boats,

ships, and cruise lines. Cruise line debris may include small plastic shampoo, conditioner, hand lotion, and shoe polish containers, plastic cups, and balloons (Center for Marine Conservation 1995). Shoreline debris is usually from land sources. Western snowy plovers may become entangled in discarded fishing line, fishing nets, plastic rings that hold together six-packs of canned drinks, and other materials on the beach. Containers of contaminated materials (*e.g.*, motor oil, cleaning fluid, and syringes) can introduce toxic chemicals to the beach. The National Marine Debris Monitoring Program, headed by the U.S. Environmental Protection Agency, was established to clean and track sources of marine debris in coastal areas. This monitoring program, while beneficial to western snowy plovers in the long-term, could potentially adversely affect nesting western snowy plovers since the program is conducted year-round. Similarly, the annual spring SOLV beach cleanup held on the Oregon Coast in late March and the annual Coastal Cleanup Day held on the California coast in September are two organized beach events that are poorly timed with respect to prospecting and nesting western snowy plovers. These programs could greatly improve western snowy plover habitat if timed appropriately.

f. Water Quality and Urban Run-off

Many coastal beaches used as habitat by western snowy plovers contain channelized streams or outfalls receiving run-off from urban, industrial, and agricultural areas. Nonpoint sources of water pollution (including hydrocarbons, heavy metals, and household chemicals) could end up at coastal beaches used as western snowy plover foraging areas. In 1995, three dead male western snowy plovers (all banded and local breeders) were found in an area containing local outfalls, including an outfall connected to a sewage treatment plant at Monterey Bay. By the beginning of the next breeding season, it was discovered that another male western snowy plover from this area disappeared and possibly died. Factors unrelated to the outfall have not been ruled out in the disappearance of this bird. One of the birds was analyzed through necropsy and found to have an enlarged liver, but it could not be determined whether there was a relationship between the mortality and the outfall (Point Reyes Bird Observatory unpublished data).

g. Management for Other Special Status Species

In several instances fencing used to enclose California least tern colonies has caused mortality of western snowy plover chicks that have become entangled within the fence mesh (Powell and Collier 1995, Powell *et al.* 1995), or prevented western snowy plover chicks from following their parents to feeding areas by blocking their movement (Powell *et al.* 1996). These issues have largely been resolved by utilizing fencing with a mesh size of less than 0.64 centimeter (0.25 inch), tightening gaps in fencing seams, and installing "gates" in tern fencing (Foster 2005). Monitoring and minimization measures to avoid these impacts continue to be implemented in coordination with the appropriate Fish and Wildlife Offices. Increasing density and abundance of California least terns within colonies may also result in western snowy plovers being displaced a short distance, but the benefits of tern management for western snowy plovers appear to outweigh such conflicts.

At the Channel Islands and other lands managed by the National Park Service and the Department of the Navy, a decline of western snowy plovers may be caused by disturbance and habitat loss resulting from the large increase in numbers of marine mammals on beaches (U.S. Fish and Wildlife Service *in litt.* 1995, U.S. Department of the Navy *in litt.* 2001). Breeding pinnipeds, including northern elephant seals (*Mirounga angustirostris*), northern fur seals (*Callorhinus ursinus*) and California sea lions (*Zalophus californianus*) at San Miguel Island and San Nicolas Island, have occupied western snowy plover nesting habitat. Beach-cast dead whales have, on occasion, posed threats to nesting western snowy plovers. At Point Reyes beaches, large, whole carcasses have washed ashore and other agencies such as the National Marine Fisheries Service have sought to collect them for scientific purposes. They also attract people who are curious about whales. These activities could potentially cause direct mortality and disturbance to western snowy plovers. In addition, mammal carcasses attract scavengers such as gulls, ravens, crows, and coyotes that are potential predators to western snowy plovers.

E. IMPLICATIONS FOR THE COASTAL BEACH-DUNE ECOSYSTEM

The western snowy plover lives in an ecosystem that has been significantly degraded. Environmental stressors (*i.e.*, development, human recreation, degraded

water quality, etc.) have adversely affected the biological diversity of the coastal dune ecosystem. Many of the characteristics that attract people to coastal areas make these areas prime habitat for fish and wildlife resources. Although they comprise less than 10 percent of the Nation, coastal ecosystems are home to over one-third of the United States human population, nearly two-thirds of the Nation's fisheries, half of the migratory songbirds, and one-third of our wetlands and wintering waterfowl (U.S. Fish and Wildlife Service 1995*a*). The coasts also provide habitat for 45 percent of all threatened and endangered species, including three-fourths of the federally-listed birds and mammals (U.S. Fish and Wildlife Service 1995*a*). Proper stewardship of this unique ecosystem is needed to maintain its ecological integrity while meeting its human demands.

1. Description of Coastal Beach-Dune Ecosystem

The coastal beach-dune ecosystem may include several features such as beaches, foredunes, deflation plains, blow-outs, and reardunes. The beach includes the expanse of sandy substrate between the tide line and the foredune or, in the absence of a foredune, to the furthest inland reach of storm waves. Beach steepness, height, and width are affected by wave height, tidal range, sand grain size, and sand supply. The beach has high exposure to salt spray and sand blast and contains a shifting, sandy substrate with low water-holding capacity and low organic matter content. Dunes include sandy, open habitat, extending from the foredune to typically inland vegetation on stabilized substrate. Major differences occur between beach and dune in salt spray, soil salinity, and air and soil temperatures (Barbour and Major 1990).

Coastal dunes generally consist of three primary zones (Powell 1981). The foredunes are the line of dunes paralleling the beach behind the high tide line. Foredunes are characterized by unstabilized sand and a simple community of low-growing native dune plant species, such as American dunegrass (*Leymus mollis*). Foredunes also support a rich community of sand-burrowing insects (Powell 1981). Behind the foredunes is the deflation plain, which is at or near the water table and is characterized by a mixture of water tolerant plants and dune species. Deflation plains are also called dune hollows and can be invaded by hydrophilic (having a strong affinity for water) trees, shrubs, or herbs (*e.g.*, species of *Carex, Juncus, Salix, Scirpus*) (Barbour and Major 1990). The inner zone of coastal dunes consists

of stabilized dunes, which are dominated by woody perennial plants (Powell 1981). Beach flora can also colonize inland dune areas, where the sand is actively moving (Barbour and Major 1990).

Barren dunes, receiving sand from the beach and losing it to wind erosion, are mobile. Older, more inland dunes are stabilized by a nearly continuous plant cover; these dunes are referred to as stable dunes or fixed dunes. Localized openings in the plant cover, which permit wind erosion, are called blowouts, but they are not deep enough to allow invasion by mesophytes (plants growing in moderately moist environments). The innermost ridge of sand is generally high and is called a precipitation ridge; sand is blown over the ridge and down the slipface, continuing the process of dune advance (Barbour and Major 1990). The conditions necessary for dune growth at the coast are partly climatic, but more important is the occurrence of strong onshore winds, abundant sand supply, and vegetation that traps sand. Low, near-shore slopes with a large tidal range providing wide expanses of sand that dries at low tide are ideal for dune growth (Pethick 1984).

Very few coastal dunes are "natural," because they have been extensively altered over time by humans for agriculture, mineral extraction, military training, and recreation (Carter 1988). Before the introduction of European beachgrass, foredunes were low and rose gradually, and a large number of native species shared this habitat. They were composed of a series of dunes alternating with swales oriented perpendicular to the coast and aligned with prevailing onshore winds. Since the introduction of European beachgrass, most systems have been replaced by a steep foredune that gives way inland to a series of dunes and swales oriented parallel to the coast (Barbour and Major 1990).

Western snowy plovers use the beach and mobile dunes as nesting habitat. Other habitat features that occur within or adjacent to the coastal beach-dune ecosystem, and serve as important foraging habitat for the western snowy plover, include river, stream, and creek mouths, river bars, lagoons, and tidal and brackish-water wetlands.

2. Sensitive Species of the Coastal Beach-Dune Ecosystem

Along with the western snowy plover, many other sensitive species inhabit the coastal beach-dune ecosystem and adjacent habitats. Appendix E contains a list of, and brief species accounts for, sensitive species associated with this ecosystem and adjacent habitats. We recognize these fish and wildlife species as endangered, threatened, candidate species, or species of concern. This list includes a number of sensitive species recognized by the states of California, Oregon, and Washington. This appendix also describes several marine mammals associated with the coastal beach-dune ecosystem and protected under the Marine Mammal Protection Act of 1972 (16 U.S.C. 1361 *et. seq.*), as amended.

Some of these sensitive species have many threats in common with the western snowy plover. Habitat loss and degradation from shoreline development and beach stabilization, invasion of exotic species, and crushing by off-road vehicles are cited as major factors contributing to the status and listing of these species. European beachgrass is a current or potential threat to six federally-listed endangered plants that occur in coastal dunes of California: beach layia (*Layia carnosa*), Howell's spineflower (*Chorizanthe howellii*), Monterey spineflower (*Chorizanthe pungens* var. *pungens*), Menzies' wallflower (*Erysimum menziesii*), Monterey gilia *(Gilia tenuiflora* ssp. *arenaria*), and Tidestrom's lupine (*Lupinus tidestromii*) (Pickart 1997). European beachgrass is also a current and potential threat to native and sensitive plants in Washington and Oregon, including the pink sand-verbena (*Abronia umbellata* ssp. *breviflora*), which is classified as endangered in the State of Oregon. Equestrian use has also been identified as a threat to several endangered plant species, including the endangered Howell's spineflower, Menzies' wallflower, Monterey gilia, and the coastal dunes milk vetch (*Astragalus tener* var. *titi*). Off-road vehicles are cited as threats to several sensitive plant and animal species, including the endangered beach layia, Menzies' wallflower, Monterey gilia, Tidestrom's lupine, Hoffman's slender-flowered gilia (*Gilia tenuiflora* var. *hoffmanii*), and Smith's blue butterfly (*Euphilotes enoptes smithi*); the federally endangered La Graciosa thistle (*Cirsium longholepis*), and the following species considered to be of Federal concern: beach spectacle pod (*Dithyrea maritima*) and Morro blue butterfly (*Icaricia icarioides morroensis*).

The precarious status of these species is a symptom of a highly stressed ecosystem. Remedial efforts aimed at restoration of the natural processes that maintain this ecosystem, rather than single-species "fixes," are likely to have the greatest and most successful long-term benefits. Important components of ecologically-sound coastal beach-dune ecosystem management include (1) removal of exotic, invasive vegetation; (2) management of human recreation to prevent or minimize adverse impacts on dune formation, vegetation, invertebrate and vertebrate fauna; and (3) efforts to counter the effects of human-induced changes in the types, distribution, numbers, and activity patterns of predators. Implementation of more ecosystem-oriented approaches to western snowy plover protection would provide important benefits to other sensitive species within the coastal dune ecosystem and merits serious consideration.

Some western snowy plover recovery efforts implemented to date (*e.g.*, removal of European beachgrass) support the natural functions of the coastal dune ecosystem. Furthermore, many protection efforts for western snowy plovers should benefit other sensitive beach species, such as California least terns, and vice versa. Many of the same predators that take western snowy plover eggs also prey on California least tern eggs. The relatively low rate of predation of western snowy plover nests in San Diego County has been attributed to predator control programs to benefit California least terns and other species, funded primarily by the Department of Defense and National Wildlife Refuge System (Powell *et al.* 1995). These programs are implemented under contract with the U.S. Department of Agriculture, Wildlife Services branch. Control of ants at California least tern colonies probably also benefits western snowy plovers nesting nearby. Opportunities also may exist for reestablishment of special status plant species that occur in coastal dunes, including Menzies' wallflower, beach spectacle pod, Tidestrom's lupine, beach layia, and pink sand verbena.

Some conflicts have occurred in management of western snowy plovers and California least terns in southern California, including harm to western snowy plover chicks due to entanglement in the mesh of California least tern fencing as described above. These problems have now largely been minimized with the use of new methods and materials, however such management measures should continue

to be coordinated to meet the habitat needs of both western snowy plovers and California least terns.

Potential conflicts also exist between native dune restoration and western snowy plover habitat. Revegetation efforts could result in too much cover, thereby reducing the amount of suitable breeding habitat available for western snowy plovers.

Conflicting habitat requirements for western snowy plovers and pinnipeds have also occurred on lands where marine mammals haul out or breed on beaches that would otherwise be suitable for nesting western snowy plovers (U.S. Fish and Wildlife Service *in litt.* 1995, U.S. Department of the Navy *in litt.* 2001). Where this conflict continues to occur, coordination with land management agencies and NOAA's National Marine Fisheries (NMFS) may be helpful to identify methods for modifying or discouraging use by breeding pinnipeds during the western snowy plover nesting season.

Although some management measures may benefit a broad array of sensitive species within the coastal dune ecosystem (*i.e.*, control of *Ammophila*, access restrictions, and integrated predator management programs), some single-species protection measures for the western snowy plover, such as exclosures, are needed. Although exclosures can be risky to nesting western snowy plovers in some situations (see Lauten *et al.* 2006), they can be an effective way to protect nests against heavy recreational use and predation, especially where reductions in predator numbers would otherwise be temporary and difficult to achieve or would have adverse ecological effects.

F. CONSERVATION EFFORTS

Western snowy plover recovery efforts have accelerated since this population was federally listed as a threatened species in 1993. Current breeding and wintering site protection efforts are documented in Appendix C (Summary of Current and Additional Needed Management Activities). The most common management strategies include protection of nests with predator exclosures; signing and symbolic fencing of nesting areas; restrictions on motorized vehicles in the vicinity of western

snowy plover nests and broods; restrictions on dogs (even though enforcement of dogs on-leash has been problematic); and public information and outreach. These strategies are effective means of improving western snowy plover reproductive success.

1. Conservation Planning on Federal and State Lands

The direction of land management on Federal lands is often outlined in management plans or agency regulations that provide objectives and guidelines for western snowy plovers. These plans include the Naval Base Coronado Integrated Natural Resources Management Plan (U.S. Navy 2001), Camp Pendleton Integrated Natural Resources Management Plan (U.S. Marine Corps 2006), San Diego Bay National Wildlife Refuge Comprehensive Conservation Plan (U.S. Fish and Wildlife Service 2006*c*), Oregon Dunes National Recreation Area Management Plan (U.S. Forest Service 1994), the Coos Bay Shorelands Final Management Plan (U.S. Bureau of Land Management 1995*a*), the New River Area of Critical Concern Management Plan (U.S. Bureau of Land Management 1995*b*), the Draft Snowy Plover Management Plan for Ocean Beach, Golden Gate National Recreation Area (Hatch 1997), and the Western Snowy Plover Management Plan for the Point Reyes National Seashore (White and Allen 1999).

Wildlife protection, especially the preservation, restoration, and enhancement of threatened and endangered species and migratory birds, is the primary goal of national wildlife refuges, as stated in the National Wildlife Refuge System Administration Act of 1997 (16 U.S.C. 668dd *et. seq.*). Western snowy plover habitat on national wildlife refuges has been accorded intensive protection, including (1) integrated predator management and (2) closures during the nesting season where appropriate, to minimize adverse effects of disturbance. Consistent with requirements of the National Wildlife Refuge System Administration Act and the Refuge Recreation Act of 1962, as amended (16 U.S.C. 460k *et. seq.*) regarding compatibility of refuge activities, western snowy plover nesting areas within some national wildlife refuges are closed to public use during the breeding season. Western snowy plover use areas within some national wildlife refuges (such as Salinas River National Wildlife Refuge) are closed to public use year-round.

Additionally, the Department of Defense manages for western snowy plovers on military installations through actions associated with section 7 of the Endangered Species Act and through conservation planning efforts (*e.g.*, Programmatic Activities and Conservation Plans in Riparian and Estuarine/Beach Ecosystems on Marine Corps Base Camp Pendleton, 1995; see also Federal Regulatory Program, below). This includes avoidance and minimization measures, which have resulted in individual military installations placing limits on or otherwise restricting military activities and implementing management actions to specifically benefit western snowy plovers, such as monitoring, predator control, habitat improvement, and research. This management, in conjunction with other factors such as habitat availability and restricted public access, has allowed certain Department of Defense lands to significantly contribute to regional western snowy plover populations.

The *Washington State Recovery Plan for the Western Snowy Plover* recommends strategies to recover this species, including protection of the population, evaluation, and management of habitat, and initiation of research and education programs (Washington Department of Fish and Wildlife 1995).

The State of Oregon's *Conservation Program for the Coastal Population of the Western Snowy Plover*, required by the Oregon Endangered Species Act and adopted by the Oregon Fish and Wildlife Commission (Oregon Revised Statutes 496.171 through 496.192), requires a variety of actions to protect this subspecies. These actions include: (a) protecting all existing western snowy plover sites from negative impacts; (b) monitoring impacts and responding to damaging activities (*e.g.*, urban development and recreation disturbance) to minimize or eliminate their effects to western snowy plovers; (c) maintaining a long-term monitoring program to track numbers, distribution, and nesting success; (d) habitat management, such as local control of European beachgrass and maintaining predator protection measures to maximize breeding success for as long as deemed necessary; (e) conducting additional research to maintain and recover western snowy plovers; and (f) enhancing information availability, education, and awareness of western snowy plovers and their requirements for survival and recovery (Oregon Department of Fish and Wildlife 1994).

The California Public Resources Code (Section 5019.71) allows designation of natural preserves, the most protective designation given to a part of any California State Park system unit. The purpose of natural preserves is to preserve such features as rare or endangered plant and animal species and their supporting ecosystems, and representative examples of plant or animal communities existing in California prior to the impact of civilization. The Pajaro Rivermouth Natural Preserve, Wilder Creek Natural Preserve, and Salinas Rivermouth Natural Preserve were designated by the California State Park and Recreation Commission in recognition of the need to protect western snowy plovers. In addition, Section 5019.62 of the California Resources Code allows the designation of State seashores to preserve the outstanding values of the California coastline and provide for public enjoyment of those values. Within the state of California, the following California State seashores containing western snowy plover habitats have been established: Del Norte State Seashore; Clem Miller State Seashore; Sonoma Coast State Seashore; Año Nuevo State Seashore; Monterey Bay State Seashore; San Luis Obispo State Seashore; Point Mugu State Seashore; Capistrano Coast State Seashore; and San Diego Coast State Seashore. Under the California Public Resources Code, the California Department of Parks and Recreation has the authority to identify additional lands appropriate for inclusion in California State seashores and recommend land acquisition for these purposes.

Special management actions for western snowy plovers are conducted within the portions of California State Seashores that are owned by the California Department of Parks and Recreation. An example is the Monterey State Seashore, where the California Department of Parks and Recreation has conducted intensive management activities for western snowy plovers since 1991. Strategies include resource management, interpretation, law enforcement, and park operations. Resource management actions include monitoring, predator trapping, and use of exclosures, symbolic fences, and signage, and consideration of snowy plovers during planning recreational access and trails in San Francisco Bay. Interpretative efforts include informational signage at nesting areas, information brochures, small handout cards with photographs and information on western snowy plovers, several annual public outreach programs (*e.g.*, slide programs and field trips), and actions to engage community support for the western snowy plover guardian program (*i.e.*, recruitment, training, and scheduling for volunteer presence in sensitive habitat).

Enforcement actions include verbal warnings, written warnings, citations, and arrests as necessary. Key enforcement concerns include dogs off-leash and off-road vehicles, which are prohibited on all beaches. Operational management includes a permit process that screens special events to avoid the nesting season in sensitive areas, and regulation of recreational use of beaches to avoid sensitive areas (*i.e.*, kite flying, hang gliding, fishing, etc.). Other management actions on California Department of Parks and Recreation property within some other State seashores are shown in Appendix C.

2. Conservation Efforts on Federal and State Lands

a. Exclosures, Symbolic Fencing, and Signs

Since 1991, one of the primary techniques to protect nesting western snowy plovers has been the use of exclosures (Appendix F). Exclosures are small, circular, square, or triangular metal fences that can be quickly assembled and are designed to keep predators out of nests and/or prevent people from trampling nests (Figure 8). Exclosure designs are described in Appendix F; modifications to exclosure design in response to site specific predator conditions may be appropriate on a case by case basis but should be coordinated in advance with the Fish and Wildlife Service.

Nests protected from predators by exclosures have consistently had increased nest success (White and Hickey 1997, Stern *et al.* 1991, Craig *et al.* 1992, Mabee and Estelle 2000, U.S. Fish and Wildlife Service 2002, Lauten *et al.* 2006). At some locations in Oregon and California, exclosures are designed with tops consisting of parallel lengths of nylon seine lines spaced approximately 15 centimeters (6 inches) apart -or- mesh netting with a minimum spacing of approximately 10 centimeters (4 inches), designed to discourage entry by avian predators. At Eden Landing State Ecological Reserve in San Francisco Bay, nest predation decreased from 32 percent in 2000 to 3 percent in 2001, largely due to a switch from string tops to net tops on exclosures (Marriott 2001).

Figure 8. Erecting western snowy plover exclosure (photo by Sue Powell, with permission).

Although exclosures are contributing to improved productivity and population increases in some portions of the western snowy plover's Pacific coast range, problems have been noted in some localities. Potential risks associated with exclosures include vandalism, disturbance of the birds by curiosity seekers, and use of exclosures as predator perches. Over time, exclosures may provide a visual cue to predators, making it easier for them to target adults, chicks, and eggs, and requiring predator management. On several occasions depredations of adult western snowy plovers have been documented in or near exclosures, and efforts have been made to establish exclosures later in the season after the peak migration of raptors (Brennan and Fernandez 2004, Lauten *et al.* 2006). Also, predator exclosures may be impractical where western snowy plovers nest within California least tern colonies or other instances where such exclosures may conflict with the needs of other threatened or endangered species.

Symbolic fencing also is used to passively protect western snowy plover nests, eggs, and chicks during nesting season. This fencing consists of one or two strands of

light-weight cord or cable strung between posts to delineate areas where humans (*e.g.*, pedestrians and vehicles) should not enter (Figure 9). It is placed around areas where there are nests or unfledged chicks, and is intended to prevent accidental crushing of eggs, flushing of incubating adults, and, if large enough, to provide an area where chicks can rest and seek shelter when large numbers of people are on the beach. Directional signs (regarding closed areas, nesting sites, etc.) also are used within western snowy plover habitats and near protective fencing to alert the public and other beach users of the sensitivity of western snowy plover nesting and wintering areas. Installation of symbolic fencing at Coal Oil Point Reserve (CA-88) in conjunction with a docent program has allowed management of

Figure 9. Symbolic fencing on beach at Monterey Bay, California (photo by Ruth Pratt, with permission).

recreational use and resulted in successful re-establishment of a breeding population of western snowy plovers at the site (Lafferty *et al.* 2006).

Additionally, land managers may prevent or restrict access to areas used by nesting western snowy plovers. For example, military installations often curtail or redirect training activities near western snowy plover nesting areas and some State parklands

and recreation areas restrict public access in certain areas during the breeding season.

b. Law Enforcement

Management agencies recognize that law enforcement is needed for protection measures to be effective. Though a majority of beach visitors respect restrictions to protect western snowy plovers, there will always be a certain percentage who do not. Enforcement of western snowy plover area restrictions shows that managers are serious about compliance. In Oregon, biologists have established a working relationship with a variety of law enforcement agencies who have jurisdiction in western snowy plover habitat. Their goal is to increase awareness, gain advice, increase communication and coordination to alleviate jurisdictional conflicts, and train officers on how to minimize disturbance while patrolling western snowy plover habitat. Conflicting priorities and personnel turnover require perseverance to maintain effective working relationships across law enforcement jurisdictions.

c. Predator Control

Lethal and nonlethal means of predator control have been used with mixed success to protect western snowy plovers on Pacific beaches. Nonlethal methods include litter control at campgrounds (to reduce available food sources), exclosures and fencing, and trapping and relocation. Lethal methods include reducing local populations of avian predators by addling (*i.e.* killing the developing chick within the egg) of raptor and corvid eggs, trapping and euthanizing nonnative mammalian predators, and killing individual predators upon which nonlethal methods have proven ineffective.

On the Oregon Coast, snowy plover predator control has historically been in the form of nest exclosures and site specific lethal control. The use of nest exclosures, adaptively modified in response to predator behavior, has been very successful in increasing hatching success. However, because in some cases predation on adults has been linked to the presence of exclosures, their use is presently targeted to specific instances where it appears most beneficial, and the program is working toward elimination of exclosure use (Lauten *et al*. 2006a, 2006b).

In 2002, Federal and State agencies approved an integrated predator management program to improve western snowy plover nesting and fledging success in Oregon. The decision followed public review and comment on an analysis of the effects of the proposed predator control methods and alternatives to protect the western snowy plover in Oregon (U.S. Department of Agriculture 2002). To date lethal predator control has been implemented at selected plover breeding sites along the Oregon Coast at Coos Bay North Spit, Bandon Beach, New River, Siltcoos, Overlook, Tahkenitch, and Tenmile, resulting in an overall positive effect on western snowy plover productivity (Lauten *et al.* 2006*a*, 2006*b*).

Another form of predator control is fencing, which is used on the south spoils area of Coos Bay, North Spit, where the U.S. Bureau of Land Management, U.S. Army Corps of Engineers, and Oregon Department of Fish and Wildlife have fenced 8 hectares (20 acres) of western snowy plover nesting habitat. This wire mesh fence was installed to exclude mammalian predators, especially skunks, and to discourage human disturbance from off-highway vehicle use. The original fence, constructed in 1991, suffered from the effects of weathering and although it continued to deter vehicles, it was no longer an effective barrier to predators. In 1998, the U.S. Army Corps of Engineers and U.S. Bureau of Land Management jointly constructed a new fence and removed the old fence. The new fence matched the design of the 1991 fence (5-centimeter by 5-centimeter (2-inch by 2-inch) mesh fence material with an effective fence height of about 1.2 meters (4 feet) after burial of the bottom). However, the new fence has increased the protected area from 8 hectares (20 acres) to 28 hectares (71 acres), and includes both the south spoils area and the 1994 Habitat Restoration Area (E.Y. Zielinski and R.W. Williams *in litt.* 1999).

At the Don Edwards San Francisco Bay National Wildlife Refuge, fences are sometimes constructed across salt pond levees to block access by terrestrial predators (J. Albertson *in litt.* 1999). However, fences are not feasible in many areas, and do not restrict aerial predators.

Exclosures are much more effective when used in conjunction with an integrated predator management program that includes selective removal of non-native predators and other individual problem predators. Otherwise, exclosures may promote better hatching success, but not fledging success if predators such as red fox

(*Vulpes vulpes*) focus on adults protecting the nest or newly-hatched chicks that leave the exclosure to feed. These measures are also much more effective where combined with other access restrictions to increase survival of clutches and broods. Trapping the nonnative red fox has been credited with substantially increased western snowy plover abundance and productivity at Salinas River National Wildlife Refuge (E. Fernandez, U.S. Fish and Wildlife Service, pers. comm. 1998). At the Don Edwards San Francisco Bay National Wildlife Refuge, predation on western snowy plovers and California clapper rails by red foxes prompted the initiation of a predator management program targeting red foxes, feral cats, skunks, and raccoons, in conjunction with use of western snowy plover nest exclosures (J. Albertson *in litt.* 1999, Strong *et al.* 2004). This ongoing program has resulted in improved nest success. Use of exclosures has subsequently been discontinued due to the success of the trapping program and incidents of nest abandonment at exclosures. At Eden Landing Ecological Reserve selective removal of problem corvids and their nests has also been practiced by USDA Wildlife Services since 2004 (Tucci *et al.* 2006).

The U.S. Air Force has used electric fencing around the California least tern colony at Purisima Point, Vandenberg Air Force Base, California, where western snowy plovers also nest and winter. The electrified portion of this fence is approximately 273 meters (300 yards) long and 1.2 meters (4 feet) high. The electric fence contains six strands of electrified wire placed approximately 10.2 centimeters (4 inches) apart. This fence is generally effective at keeping out mammalian predators of California least terns. It has also incidentally protected a small population of western snowy plovers by deterring western snowy plover predators.

Proposals have been developed to test a conditioned taste aversion technique on predators of piping plovers (*i.e.*, red fox) by using quail eggs treated with the chemical emetine (McIvor 1991). The purpose of this technique is to condition foxes to avoid eating plover eggs, expecting that if foxes eat treated quail eggs prior to the nesting season and become sick, they might develop a conditioned aversion to eating plover eggs. This technique requires that the predator consumes the needed dose that will produce short-term illness but no mortality. Due to uncertainty in effectiveness, at this point in time we do not advocate this taste aversion technique. Proposals to test conditioned taste aversion techniques on predators of piping plovers on the east coast have not been implemented due to difficulties obtaining permission

to field test emetine (A. Hecht, U.S. Fish and Wildlife Service, pers. comm. 1996). Avery *et al.* (1995) found that deployment of quail eggs treated with the chemical methiocarb might be a useful means of reducing predation of California least terns by ravens and crows. However, subsequent tests of aversion methods have proven to be unsuccessful (E. Copper and B. Foster *in litt.* 2001).

With proper research, techniques that have been used to deter predators of other wildlife species may prove beneficial to western snowy plovers. Strategic placement of crow and gull carcasses around the perimeter of a California least tern colony has been used at Vandenberg Air Force Base (Persons and Applegate 1996), however, this method may not be effective for more loosely colonial species such as snowy plover (J. Buffa *in litt.* 2004). Moreover, the presence of gull carcasses could prove counterproductive by attracting mammalian predators (N. Read, U.S. Air Force, pers. comm. 1998).

In 1999 Vandenberg Air Force Base initiated studies of coyote ecology and movements, with the goal of developing non-lethal alternatives for reducing coyote predation on western snowy plover. Although results are preliminary, in 2001 beach access restrictions and regular pick-up of trash, in combination with availability of alternative prey such as rabbits, may have contributed to the lowest incidence of coyote predation ever recorded at Vandenberg Air Force Base, even though evidence of coyote presence continued to be observed on a daily basis.

For top-level predators such as coyotes, western snowy plover nests are not a primary food source. Vandenberg Air Force Base has avoided large-scale coyote removal to prevent exacerbated predation on listed species from mesopredators such as racoons, and to prevent expansion of non-native predators such as feral cats and red foxes into western snowy plover nesting areas (N. Read Francine *in litt.* 2001).

d. European Beachgrass Control

Experiments to find cost-effective methods to control or eradicate European beachgrass are ongoing. Control methods employed in various situations have included foredune grading and foredune breaching with front-end loaders and bulldozers, subsoiling with a winged subsoiler (essentially a heavy duty three-point

plow), discing with a standard farm tractor and disk, burning, saltwater irrigation, spraying of herbicide, and hand-pulling. Herbicide treatment is not always possible, however, when rare or federally-listed plants are present. In these cases hand-pulling or other mechanical removal may need to be employed. At Point Reyes National Seashore mechanical and hand-removal were used to remove non-native beach grass on 12 hectares (30 acres) with immediate beneficial response by nesting snowy plovers (Peterlein and Roth 2003). Some control methods are only suitable for the inland sites. Areas containing heavy growth of European beachgrass and woody vegetation are prescribed-burned prior to using heavy equipment. Areas are leveled to allow discing for maintenance. In some areas, oyster shell hash provided by a local oyster grower has been distributed after vegetation has been removed. Effectiveness of the various control methods varies, though some form of maintenance may always be required. Maintenance is critical and achieved through multiple treatments over a succession of years. Discing requires maintenance twice per year to keep beachgrass from reestablishing. Comparatively, yearly maintenance in portions of some restoration sites may not be needed after employing several years of bull-dozing, herbicides, or hand-pulling following initial mechanical removal.

Since 1994, multiple projects have been conducted in Oregon to control beachgrass on existing nest sites and to clear and maintain additional areas. These Habitat Restoration Areas (HRAs) are essential for the recovery of the western snowy plover. Three significant HRAs established on the Oregon Coast between 1994 and 2002 include the Dunes Overlook (Oregon Dunes National Recreation Area), Coos Bay North Spit, and New River. Other habitat restoration areas have recently been established or are planned at Baker Beach (140 acres), Tenmile Creek (200 acres) and Bandon Beach State Natural Area (30 acres). HRAs accounted for 34 percent of nests (Table 6) and 43 percent of fledglings (Table 7) found on the Oregon Coast between 1999 and 2004.

The Oregon Dunes National Recreation Area contains about 2,428 hectares (6,000 acres) of European beach grass and now has few remaining examples of intact native plant communities (Pickart 1997). Habitat restoration was initiated in the summer of 1998 and by 2002, the U.S. Forest Service had treated 24 hectares (60 acres) of the 208 hectares (516 acres) of habitat planned for restoration. Prior to 1999, no western

snowy plovers were found at the Overlook site, but after habitat was restored, western snowy plovers began nesting there successfully (Table 6, Table 7).

The U.S. Forest Service employs a combination of mechanical, manual, and herbicide treatments to control European beachgrass. Mechanical treatment consists of scalping off the top 1 meter (3 feet) of beachgrass and then burying it in an adjacent trench with a minimum covering of l meter (3 feet) of sand. Moderate to heavy resprouting occurs with this method, requiring manual or chemical follow-up treatment. Other mechanical treatments have consisted of placement of dredged material on the beachgrass and scalping the top half of foredunes to remove beachgrass and allow for inland sand movement and tidal action to maintain open dunes (K. Palermo *in litt.* 1998*b*).

Herbicide treatments have been conducted as a primary control method and as follow-up to mechanical control. In recent years, from 2 to 26 hectares (5 to 65 acres) of beachgrass were sprayed with an herbicide treatment of 8 percent Rodeo and nonionic surfactant (spray-to-wet) at three locations. Employees found that a follow-up application within 2 weeks of the first application was critical to obtain optimum coverage and initial die-off rates (90 percent). Additionally, herbicide treatments were most effective when conducted consecutively over 2 to 3 years depending on density. Beachgrass control at the Oregon Dunes is still considered experimental. Preliminary results suggest that maintenance will always be necessary (K. Palermo *in litt.* 1998*b*).

Table 6. Total number of nests at habitat restoration areas on the Oregon Coast 1994-2004 (J. Heaney, pers. comm. 2003; C. Burns, pers. comm.; M. VanderHeyden, pers. comm.; Castelein *et. al.* 2002; Lauten *et al.* 2006).

Site Name	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	**Total Nests**
Baker Beach									0	1	0	1
Dunes Overlook						2	8	15	8	9	14	56
Coos Bay North Spit	4	3	2	3	7	12	22	13	15	11	16	108
Bandon State NRA										4	17	21
New River						2	4	10	7	5	6	34

Table 7. Total number of fledged young at habitat restoration areas on the Oregon Coast 1994-2004. Includes fledglings from broods from undiscovered nests (J. Heaney, pers. comm. 2003; C. Burns, pers. comm; M. VanderHeyden pers. comm.; Castelein *et. al.* 2002; Lauten *et al.* 2006).

Site Name	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	**Total Nests**
Baker Beach									0	0	0	0
Dunes Overlook						3	5	2	2	3	6	21
Coos Bay North Spit	7	2	1	1	1	23	6	6	8	14	22	91
Bandon State NRA										4	15	19
New River						2	1	3	3	7	5	21

On Coos Bay North Spit, the Bureau of Land Management has cleared and maintained approximately 67 hectares (166 acres) of vegetation dominated by European beachgrass, shore pine, Sitka spruce, and Scotch broom. The objective is to remove predator cover, remove encroaching beachgrass, and expand the existing habitat. The goal is to create an area for western snowy plovers to nest that is large enough to lessen possible detection of nests and chicks by predators. Nest sites used by western snowy plovers on the North Spit include both beach habitat and inland areas of previous dredged material deposition. Many of the cleared areas were used almost immediately by nesting western snowy plovers or for brood rearing activities. Prior to 1994, western snowy plovers were not nesting in these areas, but after 1994, the Coos Bay North Spit became the most productive western snowy plover nesting sites on the Oregon Coast (Table 6, Table 7) (M. VanderHeyden, Bureau of Land Management, pers. comm.).

At the Coos Bay North Spit, an inmate crew from the Shutter Correctional Facility, hired by the U.S. Bureau of Land Management, hand pulled European beachgrass on approximately 6 hectares (15 acres) of the south spoil area. The 4-month project cost $11,500; most of these costs covered the crew supervisor's salary and transport vehicle charges. Another European beachgrass removal project around the south spoil areas of the Coos Bay North Spit, included burning European beachgrass, followed by scarification using a bulldozer in March 1994. By August, most of the area had resprouted (Oregon Department of Fish and Wildlife 1996). New beachgrass sprouts are relatively easy to remove. However, initial and maintenance work can be costly and labor intensive. At the Coos Bay North Spit, eradication of European beachgrass using 91.4 centimeters (36 inches) of sprayed seawater was attempted in 1996. The saltwater application was not effective because desiccated sand layers did not allow seawater penetration to the grass's root zone. Future experimentation using wetting agents to achieve water penetration on small-scale applications could demonstrate potential applicability of this technique (G. Dorsey, U.S. Army Corps of Engineers, pers. comm. 1997).

The New River Spit is another key nesting area for the western snowy plover that is managed by the Coos Bay U.S. Bureau of Land Management. Each year since 1998, the U.S. Bureau of Land Management has used heavy equipment (i.e., front-end loader, bulldozer) to remove European beachgrass from in and around a target

restoration site. Typically, the bulldozer is used to push the beachgrass into depressions and bury it under several feet of sand, or to push sand and beachgrass out into the surf zone. Just over two miles of foredune have been lowered and select areas along the foredune have been removed to allow ocean surf to overwash into interior portions of the spit. The overwashing aids in scouring vegetation and appears to self-maintain portions of the overwashes throughout the restoration area. By 2002, approximately 48 hectares (120 acres) of foredune and overwash were cleared of beachgrass (Jim Heaney, Bureau of Land Management, pers. comm. 2003).

Work at Lanphere-Christensen Dune Preserve in Humboldt County, California, showed that hand pulling can eliminate European beachgrass, but 3 years of multiple maintenance treatments were required (Pickart and Sawyer 1998). Use of heavy equipment (*e.g.*, "V" ripper) and herbicides may be more cost-effective; however, resprouting of the grass occurs, necessitating follow-up, manual pulling for long-term beachgrass removal (A. Pickart, The Nature Conservancy, pers. comm. 1997).

The effective strategy used by the California Department of Parks and Recreation to remove beachgrass at Marina Dunes and Salinas River State Beaches, Monterey Bay, included multiple herbicide applications of 10 percent Round-Up. Approximately 25 patches of beachgrass covering a total of approximately 0.5 hectare (1.3 acres) have been treated along a 6.4-kilometer (4-mile) section of beach. Each patch of beachgrass was sprayed every 3 months over a 3-year period. All treated sites were marked so that they could be easily located and monitored for regrowth and spread. Current plans include beachgrass removal on approximately 30 hectares (75 acres) at Zmudowski State Beach at the Pajaro River mouth (D. Dixon *in litt.* 1998).

Western snowy plover habitat restoration efforts at the Leadbetter Point Unit of the Willapa National Wildlife Refuge began in 2002 and continue. American beachgrass and some European beachgrass have been mechanically removed, clearing approximately 25 hectares (63 acres) as of 2006. In addition, cuts have been made through the foredune and oystershell placed to cover 11 hectares (28 acres) within the restored area (K. Brennan *in litt.* 2006).

Pickart (1997) suggested that chemical treatment of European beachgrass is likely to be the most cost-effective method used to date. Herbicides that have been used for

this purpose are glyphosates (trade names Rodeo and Round-Up). The most effective period for herbicide treatment of beachgrass is during its flowering stage (Wiedemann 1987); plants should be treated during periods of active growth (Pickart 1997). However, potential adverse biological impacts to other native plants and animals must be considered when using herbicides, and selective spraying may be difficult in some areas. Chemical treatment in active western snowy plover nesting areas may need to be limited to the period outside the breeding season in certain areas to avoid disturbing nesting western snowy plovers.

Additional management options for beach and dune erosion control are needed. Beachgrass continues to be used because it has been tried successfully in the past, nursery stock is available, and field planting technology is well known. However, negative aspects of its monoculture are recognized. Proper planting and management of a mixture of native vegetation, together with the provision of walkways for pedestrian traffic and the elimination of horse traffic, cattle grazing, and off-road vehicles, may result in stabilization as effective as beachgrass, yet there has been minimal experimentation with this technique (Barbour and Major 1990).

e. Off-Road Vehicle Restrictions and Management

Management strategies to reduce off-road and other vehicle impacts have been implemented at some western snowy plover breeding areas. At Pismo/Oceano Dunes State Vehicular Recreation Area, California, management strategies include fenced-off nesting areas; placement of exclosures around nests; restrictions on vehicle speed and access areas; and requirements that car campers remove all trash. At Pismo/Oceano Dunes State Vehicle Recreation Area, the California Department of Parks and Recreation, Off-Road Vehicle Division, has developed an interim management plan, which is adapted annually in coordination with us to address what effects current management measures have on hatching rates and fledging success, as well as recruitment into the western snowy plover population (California Department of Parks and Recreation 2005). The Off-Road Vehicle Division of the California Department of Parks and Recreation is now funding the development of a habitat conservation plan (in anticipation of applying for a section 10(a)(1)(B) permit under the Endangered Species Act) for the Pismo/Oceano Dunes State Vehicular Recreation

Area and other State parks within the San Luis Obispo Coast District of the California Department of Parks and Recreation.

The conservation issues for western snowy plovers and California least terns at the Pismo/Oceano Dunes State Vehicular Recreation Area are directing the development of the habitat conservation plan, but other species also will be covered. This plan will evaluate the effects that recreation and park management activities are having on the covered species.

On Camp Pendleton, the Marine Corps conducts its vehicle operations in and near nesting areas in ways that minimize impacts to western snowy plovers. Under the Marine Corps' Base Regulations all training activities, including vehicle training, are prohibited within 300 meters of fenced nesting areas during the breeding season (1 March to 15 September). Further, amphibious vehicles are directed to transit adjacent to nesting areas with tracks in the ocean whenever possible (U.S. Marine Corps 2006).

On the Don Edwards San Francisco Bay National Wildlife Refuge, part of the main access road (Marshlands Road) is closed to motorized vehicles from April 1 to August 31, to protect western snowy plovers nesting near the roadway. Highway traffic cones and ribbons are installed to discourage vehicle access to nesting areas on roads and levees (J. Albertson *in litt.* 1999).

In 1995, after the Oregon Dunes National Recreation Area completed its management plan, the U.S. Forest Service petitioned the Oregon Parks and Recreation Department to close several kilometers of beach that had been open to vehicles. Resulting closures reduced conflicts between off-highway vehicles and nonmotorized recreationists, western snowy plovers, and other wildlife (E.Y. Zielinski and R.W. Williams *in litt.* 1999).

Leadbetter State Park (immediately to the south of Willapa National Wildlife Refuge) is closed to beach driving from April 15 to the day after Labor Day. The entire beach along Willapa National Wildlife Refuge is closed to driving year round, except during razor clam openers (K. Brennan *in litt.* 2006). Diligent surveillance and enforcement by applicable agencies is extremely important due to the potential for violations.

f. Population Monitoring

Western snowy plover researchers in Washington, Oregon and California conduct intensive population monitoring programs. Tasks include some or all of the following: (1) conducting winter and breeding season window surveys; (2) banding adults and chicks; (3) determining nest success; (4) determining fledging success, (5) monitoring and documenting brood movements; and (6) collecting general observational data on predators.

The Point Reyes Bird Observatory has been monitoring the distribution and breeding success of western snowy plovers since 1977. Monitoring at Vandenberg Air Force Base has been conducted by Point Reyes Bird Observatory and SRS Technologies. Additionally, Santa Barbara County-supported volunteer docents stationed at Surf Station, within Vandenberg Air Force Base, keep tallies of numbers of visitors, violations prevented, and predators seen (R. Dyste *in litt.* 2004). The U.S. Geological Survey Biological Resources Division monitored western snowy plovers in San Diego County from 1994 to 1998. Teams led by Elizabeth Copper, Robert Patton, Shauna Wolf, and Brian Foster have monitored western snowy plovers in San Diego County since 1999 for military installations. The Oregon Natural Heritage Program and The Nature Conservancy have conducted western snowy plover monitoring since 1990 in Oregon. The Point Reyes Bird Observatory, Oregon Natural Heritage Program, and U.S. Geological Survey, Biological Resources Division, also band western snowy plovers at some locations (Figure 10). The California Department of Parks and Recreation conducts annual monitoring throughout the state and at the Pismo/Oceano Dunes State Vehicular Recreation Area (J. Didion *in litt.* 1999). Mad River Biologists and Humboldt State University are currently conducting intensive population monitoring in northern California. Department of Defense installations continue to maintain long-term programs for monitoring and management of western snowy plover populations and predators in San Diego and Ventura Counties, including programs at Camp Pendleton, Naval Amphibious Base Coronado, Naval Radio Receiving Facility Imperial Beach, North Island, and San Clemente Island.

Figure 10. Banding a western snowy plover chick (photo by Bonnie Peterson with permission)

g. Salt Pond Management

Intensive management at the Moss Landing Wildlife Area has made a major contribution to western snowy plover breeding success in the Monterey Bay area. Management by Point Reyes Bird Observatory staff, in coordination with the California Department of Fish and Game, has been ongoing since 1995. Management activities include draw-down of water levels in part of the salt ponds at the beginning of the nesting season to provide dry sites for nests, and flooding of remnant wet areas twice per month through the nesting season to maintain foraging habitat for adults and their young. Predator control is conducted by the U.S. Department of Agriculture, Wildlife Services Branch.

The Don Edwards San Francisco Bay National Wildlife Refuge manages a former salt pond called the "Crescent Pond" (within location CA-36, mapped in Appendix L) for western snowy plovers by reducing the water levels prior to the breeding season. In the early 1990s, this pond was mostly unvegetated salt flat, but since then native pickleweed (*Salicornia virginica*) has slowly increased on the site, making the areas

less valuable for western snowy plover nesting habitat. The Refuge has begun to conduct winter flooding in the Crescent Pond to reduce vegetative cover and improve western snowy plover nesting habitat.

The 2003 acquisition of Cargill's West Bay, Alviso, and Baumberg Salt Ponds in the South Bay by California Department of Fish and Game and Don Edwards San Francisco Bay National Wildlife Refuge will greatly further the goal of achieving 810 hectares (2,000 acres) of ponds managed for western snowy plover habitat (see Recovery Action 2.6). The Refuge's long-term management plans for these areas will include management that is compatible with western snowy plover and will coordinate with the recovery goals of this Recovery Plan (J. Albertson, pers. comm. 2005). Many of the salt ponds are currently used for breeding and wintering by western snowy plovers. San Francisco Bay Bird Observatory is assisting the Refuge with salt marsh management and western snowy plover monitoring.

h. Habitat Acquisition

Acquisition and management of key sites is an important conservation effort. In October 1998, The Nature Conservancy transferred the approximately 193-hectare (483-acre) Lanphere-Christensen Dunes Preserve (part of Mad River Mouth and Beach, California, CA-7) to us for conservation purposes. The area will be managed by the Humboldt Bay National Wildlife Refuge for natural resources, including the western snowy plover. In October 1998, the Port of San Diego announced an agreement enabling approximately 560 hectares (1,400 acres) of Western Salt Company land (CA-131) to be managed by the San Diego National Wildlife Refuge. The salt ponds are a western snowy plover nesting and wintering area. As noted above, Cargill's transfer of the West Bay, Alviso, and Baumberg salt ponds, including 6,110 hectares (15,100 acres), to California Department of Fish and Game and Don Edwards San Francisco Bay National Wildlife Refuge was completed in 2003; portions of this area will be managed as western snowy plover habitat.

i. Use of Volunteers

Volunteers contribute to the conservation of western snowy plovers and their habitat at many beach locations, including Morro Bay and Oceano Dunes State Vehicular

Recreation Area, Point Reyes National Seashore, and Golden Gate National Recreation Area. Volunteers and docents assist public land managers in many ways (Appendix K), including informing park visitors about threats to the western snowy plover, reducing human and pet disturbances, and assisting with direct habitat enhancement (*e.g.*, manual removal of European beachgrass; Figure 11). In 1998, the Western Snowy Plover Guardian Program was developed to assist the conservation and recovery of western snowy plovers in Monterey Bay. This program is mainly a volunteer effort by local citizens who assist in protecting western snowy plovers through monitoring, reporting, and educational activities (D. Dixon *in litt.* 1998).

Figure 11. High school students removing European beachgrass (photo by Kerrie Palermo, with permission).

j. Public Outreach and Education

Public land managers and private conservation organizations have produced public educational materials, including brochures, posters, flyers, and informational/interpretative signs regarding western snowy plovers (Appendix K). Environmental education/interpretation is recognized by land management agencies as an important tool that supports their mission of resource stewardship. Increased

understanding and appreciation of natural resources (specifically threatened and endangered species) often results in increased public support. This support is not easily measured and when the audience is children, results may not be seen until they reach adulthood. However, those agencies conducting western snowy plover education to date have found a positive response by individuals. In Oregon, on-site monitors of the U.S. Forest Service (Oregon Dunes National Recreation Area) and U.S. Bureau of Land Management report a willingness of the majority of contacted individuals to comply with restrictions after better understanding the reasons for them.

The La Purisima Audubon Society, Santa Barbara County, produced an educational video about the western snowy plover and the California least tern in 1999. It was distributed to public schools and museums within Santa Barbara County in 2000.

k. Section 6 Cooperative Agreements

Section 6 of the Endangered Species Act allows us to enter into cooperative agreements with states that establish and maintain active programs for the conservation of listed species. Through funding under section 6, those states assist the recovery of endangered and threatened species and monitor their status. Between 2000 and 2006, traditional section 6 funds have been used for creation of a docent program at Silver Strand State Beach in California ($8,300); development of a water management plan at Moss Landing Wildlife Area, California ($4,886); surveillance and protection of snowy plover nests on California beaches ($92,000); and surveys, nest monitoring, protecting nests with exclosures, collecting data on human uses of beaches, and encouraging beach uses compatible with snowy plovers in Oregon ($64,386) and Washington ($48,677). HCP Planning grants were used for development of a habitat conservation plan to address management of beach use by the Oregon Parks and Recreation Department ($103,950) and development of an Environmental Impact Statement for this Habitat Conservation Plan ($200,000). A Recovery Land Acquisition grant ($307,000) supported purchase of a conservation easement on 89 hectares (220 acres) of western snowy plover habitat along 3.7 kilometers (2.3 miles) of the Elk River Spit.

3. Conservation Efforts on Private Lands

Private landowners interested in conservation efforts for western snowy plovers and coastal dune habitats have made important contributions to recovery efforts for coastal dune species. At Ormond Beach, California, Southern California Edison has enhanced approximately 60 hectares (150 acres) of degraded wetlands and coastal dune habitat for several special status species, including the western snowy plover and California least tern (D. Pearson, Southern California Edison, pers. comm. 1996).

4. Federal Regulatory Program

a. Critical Habitat

On March 2, 1995, we published a proposed rule to designate critical habitat for western snowy plover at 28 areas along the coast of California, Oregon, and Washington (U.S. Fish and Wildlife Service 1995*b*). At that time, critical habitat was proposed to fulfill an outstanding requirement under section 4 of the Endangered Species Act to highlight important habitat areas on which activities that require Federal actions need to be evaluated under section 7 of the Endangered Species Act. A funding moratorium by the U.S. Department of the Interior for listing actions was in place during the period April 1995 to April 1996. We subsequently acknowledged a serious backlog of listing actions and the need to prioritize them (U.S. Fish and Wildlife Service 1996*b*). Hence, we developed guidance for assigning relative priorities to listing actions conducted under section 4 of the Endangered Species Act during fiscal years 1998 and 1999 (U.S. Fish and Wildlife Service 1998). Designation of critical habitat was placed in the lowest priority (Tier 3). Under this guidance, we placed higher priority on listing imperiled species that currently have limited or no protection under the Endangered Species Act than on devoting limited resources to the process of designating critical habitat for currently-listed species. In addition, we found that because the protection afforded by critical habitat designation applies only to Federal actions, such designation provides little or no additional protection beyond the "jeopardy" prohibition of section 7 of the Endangered Species Act, which also applies only to Federal actions (U.S. Fish and Wildlife Service 1998).

In December 1995, legal challenges by the Environmental Defense Center, Santa Barbara, California, against the U.S. Department of the Interior to finalize designation of critical habitat for the western snowy plover were overruled by the California District Court (U.S. District Court, Central District of California 1995). At that time, the Court's order was based on its decision that lack of funding prevented the Secretary of the Interior from taking final action on proposals for designating critical habitat. However, on November 10, 1998, the U.S. District Court for the Central District of California ruled that the Secretary of the Interior must publish a final designation of critical habitat for the western snowy plover before December 1, 1999 (U.S. District Court, Central District of California 1998).

A final rule designating critical habitat was published on December 7, 1999 (U.S. Fish and Wildlife Service 1999). In May of 2002 the Coos County Board of County Commissioners, Friends of Oceano Dunes, and Concerned Citizens for western Lane County filed a complaint asking for invalidation of the rule. The United States moved for voluntary remand to reconsider the economic analysis and for partial vacatur of the existing designation. On July 19, 2003, the District Court for the District of Oregon granted the United States' motion, ordering the Service on remand to consider the economic impact analysis and ensure that the new rule is based on the best scientific evidence available. This Order was converted to Judgment on July 2, 2003. Based on the potential for harm to the population, at the Service's request the court left most of the established units in place during the redesignation process, but vacated two units in southern California and two units in Washington.

On December 17, 2004, we published a new proposal to designate critical habitat for the Pacific coast distinct population segment of the western snowy plover (U.S. Fish and Wildlife Service 2004*b*). The final rule to designate critical habitat was published on September 29, 2005 (U.S. Fish and Wildlife Service 2005). This rule designated critical habitat in 32 units, compared to 28 units in the 1999 critical habitat final rule, but covers only 4,921 hectares (12,145 acres) compared to 7,881 hectares (19,474 acres) in the 1999 rule. Of the 32 units, 23 are in California, 5 are in Oregon, and 3 are in Washington. Of the total acreage, 1,002 hectares (2,478.5 acres), or 20 percent, are on Federal lands; 2620.5 hectares (6,474 acres), or 53 percent, are on land owned by States or local agencies; and 1294.5 hectares (3,191 acres), or 26 percent, are privately-owned.

It is important to understand what critical habitat means and how it differs from this recovery plan. Section 3 of the Endangered Species Act defines critical habitat to mean: (i) the specific areas within the geographical area occupied by the species at the time it is listed on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed, upon determination that such areas are essential for the conservation of the species. The term "conservation" is defined in section 3 as "the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary." Therefore, critical habitat is to include biologically suitable areas necessary to recovery of the species.

Section 7 of the Endangered Species Act requires Federal agencies to consult with us to evaluate the effects that any activities they fund, authorize, or carry out may have on designated critical habitat. Agencies are required to ensure that such activities are not likely to adversely modify (*e.g.*, damage or destroy) critical habitat. Because the issuance of permits under section 10(a)(1)(B) of the Endangered Species Act constitutes a Federal action or connection and is subject to an internal section 7 consultation, habitat conservation plans developed for actions on private lands must also analyze the potential for adverse modification of critical habitat. Accordingly, where Federal activities may affect western snowy plover critical habitat, we will consult with Federal agencies under section 7 to ensure that these actions do not adversely modify critical habitat.

Critical habitat designation does not create a wilderness area, preserve, or wildlife refuge, nor does it close an area to human access or use. It applies only to activities sponsored at least in part by Federal agencies. Such federally-permitted land uses as grazing and recreation may take place if they do not adversely modify critical habitat. Designation of critical habitat does not constitute a land management plan, nor does it signal any intent of the government to acquire or control the land. Therefore, if there is no Federal involvement (*e.g.*, Federal permit, funding, or license), activities of a private landowner, such as farming, grazing, or constructing a home, generally are not affected by a critical habitat designation, even if the landowner's property is within

the geographical boundaries of critical habitat (U.S. Fish and Wildlife Service 1993*c*). Without a Federal connection to a proposed action, designation of critical habitat does not require that landowners of State or other non-Federal lands do anything more than they would otherwise do to avoid take of listed species under provisions of section 9 of the Endangered Species Act.

By comparison, a recovery plan delineates site-specific management actions that we believe are required to recover and/or protect listed species, establishes objective, measurable criteria for downlisting or delisting the species, and estimates time and cost required to carry out these actions. A recovery plan is not a regulatory document and does not obligate cooperating or other parties to undertake specific tasks or expend funds.

Critical habitat designation is not necessarily intended to encompass a species' entire current range. Recovery plans, however, address all areas determined to be important for recovery of listed species and identify needed management measures to achieve recovery. Because critical habitat designations may exclude areas based on factors such as economic cost, approved or pending management plans, or encouragement of cooperative conservation partnerships with landowners, the areas identified in recovery plans as important for recovery of the species may not be identical to designated critical habitat. The recovery units described in this recovery plan include but are not restricted to the 32 areas designated as critical habitat: Damon Point, Midway Beach, Leadbetter Point, Bayocean Spit, Baker/Sutton Beaches, Siltcoos to Tenmile, Coos Bay North Spit, and Bandon to Floras Creek in Recovery Unit 1; Lake Earl, Big Lagoon, McKinleyville area, Eel River area, MacKerricher Beach, and Manchester Beach in Recovery Unit 2; Point Reyes Beach, Limantour Spit, Half Moon Bay, Santa Cruz Coast, Monterey Bay Beaches, and Point Sur Beach in Recovery Unit 4; San Simeon Beach, Estero Bay, Devereaux Beach, Oxnard Lowlands in Recovery Unit 5; and Zuma Beach, Santa Monica Bay, Bolsa Chica area, Santa Ana River Mouth, San Onofre Beach, Batiquitos Lagoon, Los Penasquitos, and South San Diego in Recovery Unit 6. Implementation of the recovery actions in this recovery plan (*e.g.*, monitoring, habitat improvement, nest protection, recreation management) may not be limited to designated critical habitat areas.

b. Section 9 Take Prohibitions

Section 9 of the Endangered Species Act of 1973, as amended, prohibits any person subject to the jurisdiction of the United States from taking (i.e., harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting) listed wildlife species. It is also unlawful to attempt such acts, solicit another to commit such acts, or cause such acts to be committed. Regulations implementing the Endangered Species Act (50 CFR 17.3) further define "harm" to include significant habitat modification or degradation that results in the killing or injury of wildlife by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering. "Harass" means an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns, which include, but are not limited to, breeding, feeding, or sheltering.

As an example under the authority of section 9 of the Endangered Species Act, on May 15, 1998, we received preliminary injunctive relief against the Town of Plymouth, Massachusetts, because their beach management failed to prevent take (killing) of a piping plover chick by an off-road vehicle (U.S. District Court for Massachusetts 1998). The judge's order prohibited off-road vehicle traffic through the piping plover's nesting season unless the town implemented specific management measures to preclude take, including twice-daily monitoring of nests and a 400-meter (1,148-foot) buffer of protected habitat for newly-hatched chicks.

The proposed special rule under section 4(d) of the Endangered Species Act (U.S. Fish and Wildlife Service 2006b) would exempt most recreational and commercial activities within a county from section 9 prohibitions on take of western snowy plovers, if documentation of conservation actions was provided and populations within the county met targets based on the Management Goal Breeding Numbers in Appendix B of the recovery plan. Research and monitoring actions would continue to require recovery permits under section 10(a)(1)(A) of the Endangered Species Act.

c. Section 10 Permits

Section 10 of the Endangered Species Act and related regulations provide for permits that may be granted to authorize activities otherwise prohibited under section 9, for scientific purposes or to enhance the propagation or survival of a listed species (i.e., section 10(a)(1)(A) permits). These permits have been granted to certain biologists of conservation organizations (*e.g.*, Point Reyes Bird Observatory and Oregon Natural Heritage Program) and Federal and State agencies to conduct western snowy plover population monitoring and banding studies and construct predator exclosures. It is also legal for employees or designated agents of certain Federal or State agencies to take listed species without a permit if the action is necessary to aid sick, injured, or orphaned animals or to salvage or dispose of a dead specimen.

Section 10(a)(1)(B) of the Endangered Species Act also allows permits to be issued for take of endangered and threatened species that is "incidental to, and not the purpose of, carrying out an otherwise lawful activity" if we determine that certain conditions have been met. An applicant for an incidental take permit must prepare a habitat conservation plan that specifies the impacts of the take, the steps the applicant will take to minimize and mitigate the impacts, funding that will be available to implement these steps, alternative actions to the take that the applicant considered, and the reasons why such alternatives are not being utilized. Conditions that we must meet include a determination: (1) whether the taking will be incidental, (2) whether the applicant will minimize and mitigate the impacts of such taking to the maximum extent possible, (3) that adequate funding for the recovery will be provided, (4) that the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild, and (5) of any other measures that we may require as being necessary or appropriate for the recovery plan. Section 10(a)(1)(B) of the Endangered Species Act provides for permits that have the potential to contribute to conservation of listed species. Such permits are intended to reduce conflicts between the conservation of listed species and economic activities, and to develop partnerships between the public and private sectors.

d. Section 7 Requirements and Consultations

Section 7(a)(1) of the Endangered Species Act requires all Federal agencies to "utilize their authorities in furtherance of the purposes of [the] Act by carrying out programs for the conservation of endangered species and threatened species". Hence, Federal agencies have a greater obligation than do other parties, and are required to be pro-active in the conservation of listed species regardless of their requirements under section 7(a)(2) of the Act. Section 7(a)(2) of the Endangered Species Act requires Federal agencies to consult with us prior to authorizing, funding, or carrying out activities that may affect listed species. Section 7 obligations have caused Federal land management agencies to implement western snowy plover protection measures that go beyond those required to avoid take; for example, eradicating European beachgrass and conducting research on threats to western snowy plovers. Other examples of Federal activities that may affect western snowy plovers along the Pacific coast, thereby triggering a section 7 consultation, include permits for sand management activities or major restoration projects that affect coastal processes or that are targeted to protect other species on Federal lands such as dune plants (National Park Service, U.S. Department of the Interior); disposal of dredged materials (U.S. Army Corps of Engineers); military training (U.S. Department of Defense); and funding to public agencies for projects to repair beach facilities, such as public access paths (Federal Emergency Management Agency).

e. Other Federal Regulations, Executive Orders, and Agreements

Section 404 of the Clean Water Act, as amended, and section 10 of the Rivers and Harbors Act of 1899 are the primary Federal laws that could provide some protection of nesting and wintering habitat of the western snowy plover that is determined by the U.S. Army Corps of Engineers (Corps) to be wetlands or historic navigable waters of the United States. Excavation or placement of any fill material (including sand) below the high tide line, as defined under 33 CFR, Section 328.3(d), Definition of Waters of the United States, also requires a permit from the U.S. Army Corps of Engineers.

Executive Order 11644, Use of Off-Road Vehicles on Public Lands, and Executive Order 11989, Off-Road Vehicles on Public Lands, pertain to lands under custody of

the Secretaries of Agriculture, Defense, and Interior (except for Native American Tribal lands). Executive Order 11644 requires administrative designation of areas and trails where off-road vehicles may be permitted. Executive Order 11989 states that "... the respective agency head shall, whenever he determines that the use of off-road vehicles will cause or is causing considerable adverse effects on the soil, vegetation, wildlife, wildlife habitat ... immediately close such areas or trails to the type of off-road vehicles causing such effects, until such time as he determines that such effects have been eliminated and that measures have been implemented to prevent future recurrence". Compliance with this executive order would promote prohibitions or restrictions on off-road vehicles so that they are not allowed to adversely affect sensitive habitats used by western snowy plovers.

Executive Order 11988, Floodplain Management, and Executive Order 11990, Protection of Wetlands, provide protective policies that apply to western snowy plover habitats. Executive Order 11988 mandates that all Federal agencies avoid direct or indirect support of floodplain development wherever there is a practicable alternative. Executive Order 11990 mandates that all Federal agencies shall "provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands..." Compliance with Executive Order 11988 would promote protection of beach and dune habitats through restrictions on development within floodplains. Application of Executive Order 11990 would promote protection of wetland habitats used by western snowy plovers.

Executive Order 13112, Invasive Species, directs Federal agencies to prevent the introduction of invasive species; control their populations in a cost-effective and environmentally sound manner; monitor invasive species; restore native species and habitat conditions in ecosystems that have been invaded; conduct research and develop technologies to prevent their introduction; and promote public education on invasive species and the means to address them. This executive order also requires that a Federal agency "not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species..." Compliance with this executive order would enhance western snowy plover habitats through (1) avoidance of use, approval, or funding the planting of invasive species

like European beachgrass; and (2) active programs to remove this invasive species and restore coastal dune habitats with native plant species.

The Fish and Wildlife Coordination Act (16 U.S.C. 661-667e), as amended, requires that whenever a proposed public or private water development project is subject to Federal permit, funding, or license, the conservation of fish and wildlife resources shall be given equal consideration. This Act also requires that project proponents shall consult with us and the State agency responsible for fish and wildlife resources. Compliance with the Fish and Wildlife Coordination Act highlights the importance of considering and providing for the habitat needs of fish and wildlife resources when reviewing projects that would adversely affect these resources.

The National Environmental Policy Act of 1969, (42 U.S.C. 4321-4347), as amended, requires that each Federal agency prepare an environmental impact statement on the potential environmental consequences of major actions under their jurisdiction. Environmental impact statements must include the impacts on ecological systems, any direct or indirect consequences that may result from the action, less environmentally damaging alternatives, cumulative long-term effects of the proposed action, and any irreversible or irretrievable commitment of resources that might result from the action. Compliance with the National Environmental Policy Act highlights the need to disclose, minimize, and mitigate impacts to biological resources, including western snowy plovers.

The Coastal Zone Management Act of 1972 (16 U.S.C. 1451-1464), as amended, established a program for states to voluntarily develop comprehensive programs to protect and manage coastal resources. To receive Federal approval and funding under this Act, states must demonstrate that they have programs and enforceable policies that are sufficiently comprehensive and specific to regulate land uses, water uses, and coastal development, and must have authorities to implement enforceable policies. Local coastal plans, local comprehensive plans, and implementing measures by coastal planning jurisdictions pursuant to the Coastal Zone Management Act should be developed, updated, and implemented with protective measures for western snowy plovers.

Western snowy plovers are protected under the Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712), as amended. Under the Migratory Bird Treaty Act, prohibited acts include pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting any migratory bird, nest, or eggs without a permit from the U.S. Fish and Wildlife Service.

5. State Regulatory Protection, Policies, and Agreements

In Washington, Oregon, and California, each state holds title to, and has regulatory jurisdiction over, the coastal intertidal zone. In Washington, the area between mean high tide to extreme low tide is the seashore conservation area under the authority of the Washington State Parks and Recreation Commission. In California, the California State Lands Commission has regulatory authority to the mean high tide line along the California coast.

In Oregon, the Oregon Parks and Recreation Department administers the State beach for the ocean shore recreation area, which is defined as the area between the line of extreme low water and the statutory vegetation line, which is a line surveyed to the approximate line of vegetation that existed in 1969 (Oregon Revised Statutes 390.770). The Oregon Division of State Lands also has jurisdiction over waters of the state along the Pacific coast to the line of highest tide or the line of established vegetation, whichever is higher. Therefore, the Oregon Parks and Recreation Department has direct jurisdiction, authority, and responsibility for management of western snowy plover habitats in the State of Oregon, which owns not only to the mean high tide line, which is western snowy plover foraging habitat, but also into the vegetation line, which is essentially the dry sand area used by western snowy plovers for nesting.

State coastal planning and regulatory agencies, such as the California Coastal Commission, require preparation of local coastal zone management plans by local coastal municipalities. These local coastal zone management plans must comply with the Coastal Zone Management Act of 1972 regarding protection of coastal resources, including natural resources. Under the California Coastal Management Program, coastal resources are managed and cumulative impacts addressed through: (1) coastal permits and appeals; (2) planning and implementation of local coastal programs; and

(3) Federal consistency review. However, effective management of cumulative impacts is difficult under the existing management framework because multiple jurisdictions have varying policies and standards in different geographic areas (California Coastal Commission 1995). Through the Coastal Commission's regional cumulative assessment program, cumulative impacts to coastal resources can be addressed through the periodic review of local coastal programs. In California, most local coastal programs and general plans were completed prior to 1993 (when we listed the western snowy plover as a threatened species); therefore, many do not reflect protective measures specifically for the western snowy plover.

The Oregon Department of Land Conservation and Development is the designated coastal zone management agency for the State of Oregon. The State of Oregon's land use planning system has several elements that are related to conservation of western snowy plovers and their habitats. In Oregon, local jurisdictions (cities and counties), service districts, and State agencies are required to develop Local Comprehensive Plans and Implementing Measures, such as zoning and land division ordinances, to effect these plans. Each plan must satisfy a set of 19 goals established through Oregon land use law and policy. Plans must be reviewed by the Land Conservation and Development Commission for consistency with these goals before they can be put into effect. Several of the planning goals have application to, or should be considered during, planning for western snowy plover conservation and recovery. These goals include: Goal 5 - Open Spaces, Scenic and Historic Areas, and Natural Resources; Goal 7 - Areas Subject to Natural Disasters and Hazards; Goal 8 - Recreational Needs; Goal 16 - Estuarine Resources; Goal 17 - Coastal Shorelands; and Goal 18 - Beaches and Dunes.

Taken in aggregate, the elements of these goals that can contribute to western snowy plover recovery include:

- several requirements for protection of wildlife habitat;
- requiring protection of estuarine ecosystems including habitats, diversity, and other natural values;
- establishing that uses of beaches and dunes shall be based on factors including the need to protect areas of critical environmental concern and significant wildlife habitat;

- requiring that coastal plans provide for uses of beaches and dunes that are consistent with their ecological values and natural limitations;
- requiring an evaluation of the beneficial effects to natural resources from allowing continuation of natural events that are hazardous to human developments (such as erosion and ocean flooding);
- establishing a preference for nonstructural solutions to erosion and flooding of coastal shorelands over structural approaches (such as seawalls and rip-rap);
- requiring that development of destination resorts be compatible with adjacent land uses and maintain important natural features such as threatened and endangered species habitats;
- encouraging coordination among State, Federal, and local governmental agencies while developing recreation plans, and discouraging development of recreation plans that exceed the carrying capacity of the landscape;
- encouraging planning for Open Space, Scenic and Historic Areas, and Natural Resources (Goal 5), Recreational Needs (Goal 8), and Coastal Shorelands (Goal 17) in close coordination; and
- allowing dune stabilization programs only when in conformance with the overall comprehensive plan and after assessment of the potential impacts.

Some aspects of these planning goals could be interpreted to be contrary to western snowy plover conservation and recovery when viewed in isolation. However, when viewed in the context of the entire goal or all the planning goals, these elements should be compatible with western snowy plover conservation and carefully-planned habitat restoration activities. Two such elements are the directive to increase recreational access to coastal shorelands and the restrictions placed on dune grading and removal of vegetation. Goal 17 - Coastal Shorelands directs local governments and the Oregon Parks and Recreation Department to develop a program to increase public access. In many areas, recreational use of western snowy plover habitat during the nesting season is detrimental to or incompatible with western snowy plover conservation. However, this goal also recognizes that many shorelands have unique or exceptional natural area values, includes the objective of reducing adverse impacts to fish and wildlife habitat associated with use of coastal shorelands, clearly establishes that significant wildlife habitat shall be protected, establishes that uses of such habitat areas shall be consistent with protection of natural values, and directs recreation plans to provide for "appropriate" public access and recreational use. Goal

18 - Beaches and Dunes directs local governments and State and Federal agencies to regulate actions in beach and dune areas to minimize any resulting erosion and only allows foredune breaching to replenish interdune areas or in the case of an emergency. Western snowy plover habitat restoration efforts in areas that have been overtaken by European beachgrass (*Ammophila arenaria*) may involve foredune breaching, vegetation removal, dune grading, and other actions that will remove the European beachgrass and restore the natural beach and dune processes of sand movement, including erosion and deposition. However, this goal also recognizes the need to protect areas of critical environmental concern, areas of biological importance, and areas with significant habitat value, specifically identifies removal of "desirable" vegetation as an action requiring minimization of erosion, and requires that any foredune breaching be consistent with sound principles of conservation.

The Washington State Parks and Recreation Commission administers the Seashore Conservation Act of 1988 in accordance with the Revised Code of Washington and the Washington Administrative Code. The Seashore Conservation Area (Revised Code of Washington 43.51) emphasizes the importance of beaches to the public for recreational activities. In designating beach areas to be reserved for pedestrian use, it considers natural resources, including protection of shorebird and marine mammal habitats, preservation of native beach vegetation, and protection of sand dune topography. Chapter 352-37 (Ocean Beaches) of the Washington Administrative Code requires local governments within the Seashore Conservation Area to prepare recreation management plans that designate at least 40 percent of the ocean beach for use by pedestrians and nonmotorized vehicles from April 15 to the day after Labor Day. These regulations also identify restrictions on certain uses within ocean beaches, including motor vehicles, equestrian traffic, speed limits, aircraft, wind/sand sailers, parasails, hovercraft, group recreation events, and beach parking and camping. In 1989, an interagency agreement was signed by the Washington Department of Natural Resources, Washington State Parks and Recreation Commission, Washington Department of Wildlife, and City of Ocean Shores regarding management of mixed uses at Damon Point. The intent of the agreement was to protect western snowy plovers while allowing recreation.

State regulations, policies, and goals for the States of California, Oregon, and Washington provide many protective measures for western snowy plovers. However,

because they frequently emphasize public uses of beach habitat, there is potential for conflicts between human uses of the coastal zone and needed management measures for recovery of the western snowy plover.

The California Department of Parks and Recreation has written management guidelines for the western snowy plover which are meant to be used in conjunction with the recovery plan. Management actions will be implemented from the guidelines and may result in changes in how coastal units are operated. Increased emphasis will be required for monitoring, nest area protection, prohibition of certain activities in important nesting areas, and public education.

6. Consultations, Habitat Conservation Plans, and Other Regulatory Actions

Through consultations with Federal agencies under section 7 of the Endangered Species Act and through the development of habitat conservation plans with non-Federal agencies developed under section 10 of the Endangered Species Act, we provide nondiscretionary terms and conditions that minimize (sections 7 and 10) and mitigate (section 10) the impacts of covered activities on listed species and their habitat. Several major consultations and habitat conservation planning efforts to benefit the western snowy plover have been completed or are currently under way.

In 1995 our Sacramento Fish and Wildlife Office completed formal consultation with the National Park Service, Golden Gate National Recreation Area, on the effects of their management of Ocean Beach, San Francisco on the western snowy plover. Ocean Beach experiences tremendous visitor use year-round because of its proximity to San Francisco, yet it supports high numbers of nonbreeding western snowy plovers, which may be present from May through July. The consultation covered actions and policies the National Park Service had taken that resulted in unnecessary harassment of nonbreeding western snowy plovers. Most significant of these measures was their policy not to enforce regulations requiring pets to be leashed and under control by their owners on all National Park Service lands. Data collected by the National Park Service clearly identified that unleashed dogs were the most significant disturbance factor of the many sources of disturbance to western snowy plovers on Ocean Beach. As a result of the consultation, the National Park Service began to enforce their “leash law” along 3.2 kilometers (2 miles) of beach utilized by western snowy plovers. The

National Park Service implemented this policy despite vocal and persistent opposition by the San Francisco Society for the Prevention of Cruelty to Animals and other local advocacy groups, including the "Rovers for Plovers", which organized themselves to challenge the National Park Service's leash law. These groups were successful in advocating their position in numerous television news stories and articles in local newspapers. At the height of this discourse, the local public radio station held a round-table discussion between the National Park Service, U.S. Fish and Wildlife Service, and Society for the Prevention of Cruelty to Animals, and solicited audience members to call in and identify their viewpoint. The overwhelming majority of callers supported leash law restrictions that would minimize harassment of western snowy plovers.

Our Arcata Fish and Wildlife Office has formally consulted with the U.S. Army Corps of Engineers regarding gravel extraction on the Eel River, California. Gravel mining operations are subject to permits from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act. The western snowy plover breeds on the Eel River gravel bars. Impacts to the western snowy plover and its designated critical habitat associated with gravel mining operations have been assessed based on nesting surveys and changes to habitat resulting from gravel extraction. The Arcata Fish and Wildlife Office has also worked with Humboldt County, the California Department of Fish and Game, and the California Department of Parks and Recreation to implement additional protections for nesting western snowy plovers at MacKerricher, Manchester, Little River, Humboldt Lagoons, and Prairie Creek State Parks; Clam Beach County Park, and the Eel River Wildlife Area. These measures include installation of nest exclosures, signing, and development of educational material for kiosks. Technical assistance has also been provided to Prairie Creek State Park and MacKerricher State Park on exotic vegetation management programs (J. Watkins *in litt.* 1999, pers. comm. 2001). A section 7 consultation with the Bureau of Land Management on finalization of a management plan for Humboldt Bay South Spit is expected to be initiated soon (J. Watkins, pers. comm. 2006).

Our Ventura Fish and Wildlife Office is attempting to initiate a regional approach to habitat conservation planning for western snowy plovers and other listed species along Monterey Bay in Monterey County, California. Currently, there are several proposed development projects within the city of Sand City and a "city wide" habitat

conservation plan has been prepared for these projects. The City of Sand City has yet to present a complete draft of their habitat conservation plan to the Ventura Fish and Wildlife Office for review. Formerly, the City of Marina was also proposing several coastal developments that were expected to have adverse effects on western snowy plovers, but these projects are no longer planned due to changes in land ownership and other factors. The City of Marina has halted the drafting of a habitat conservation plan for lands within their jurisdiction. We have expressed concerns about projects being presented in a piecemeal fashion, which does not allow an adequate assessment of their cumulative effects, and have recommended a regional approach through preparation of a regional habitat conservation plan. This plan would provide greater conservation benefits to the western snowy plover. In addition to the adverse effects of development on western snowy plovers and their habitat, recreation on the extensive public lands along Monterey Bay is also adversely affecting western snowy plovers. Therefore, public land managers, including our Refuges Division, the California Department of Parks and Recreation, the California Department of Fish and Game, and the Monterey Peninsula Regional Park District, need to be involved in planning efforts along Monterey Bay.

Through the consultation process, our Ventura Fish and Wildlife Office determined that a draft biological opinion on Vandenberg Air Force Base's initial proposed beach management plan for the western snowy plover, concluding that the plan would "likely jeopardize the continued existence of the western snowy plover and adversely modify its critical habitat." Our draft biological opinion of January 2001 pointed out that the Air Force's beach plan would have allowed twice as much nesting habitat to be open to public recreation as was allowed during the 2000 breeding season, and it would have reduced the time the Air Force spends patrolling the beaches by about 80 percent. Based on this feedback, the Air Force subsequently reinitiated consultation on a modified version of the beach management plan, including commitments to signage, information kiosk, and enforcement patrols. The Ventura Fish and Wildlife Office issued a non-jeopardy biological opinion on the modified action in March 2001. Beach opening and full implementation of conservation measures was implemented on May 25, 2001, with hours and days of open beach limited due to limited availability of enforcement personnel. For the next three breeding seasons (2002, 2003, 2004), the Service issued biological opinions on annual beach management plans proposed by the Air Force. In 2004, we had a series of meetings

with the Air Force to discuss their beach management strategy and its effects on the western snowy plover. Through a cooperative effort, the Service and the Air Force came to agreement on a 5-year beach management plan that includes many of the same protective measures that had been in place the last several years, yet allows the Air Force to provide recreational access seven days a week. On March 1, 2005, the Ventura Fish and Wildlife Office issued a new non-jeopardy biological opinion on the Air Force's proposed 5-year beach management plan (2005-2009).

Our Ventura Fish and Wildlife Office is also involved with the development of a habitat conservation plan being funded by the Off-Road Vehicle Division of the California Department of Parks and Recreation for the Pismo/Oceano Dunes State Vehicular Recreation Area and other State parks within the San Luis Obispo District of the California Department of Parks and Recreation. The Ventura Fish and Wildlife Office is also involved in the development of a HCP for the Rancho Guadalupe County Park, Santa Barbara, California. These habitat conservation plans will evaluate and mitigate for effects that recreation and park management activities are having on the covered species, including the western snowy plover.

Recent consultations handled by our Newport Field Office include those in response to the New Carissa Oil Spill, a consultation on BLM management actions at the New River Area of Critical Environmental Concern (ACEC), and a consultation on the Integrated Predator Damage Management Program 2002 to 2007. The Oregon Parks and Recreation Department is currently developing a Habitat Conservation Plan that proposes restrictions on some Oregon beaches to help the plover population recover.

The New Carissa oil spill was a long and complicated incident involving a variety of Federal, State, local and private participants. On February 4, 1999, the *New Carissa,*carrying 359,000 gallons of bunker oil and 37,400 gallons of diesel, grounded on the north spit of Coos Bay and began leaking oil shortly thereafter. Subsequently, oil and oiled wildlife were observed on the beach. Attempts were made to burn off the oil. The vessel broke into two pieces during the second attempt. There were three formal consultations associated with the *New Carissa* between 1999 and 2000. The first consultation addressed the effects of issuing permits for salvage of the *New Carissa* stern section, the second the effects of restoring recreational access to the Coos Bay north spit, and the third the response efforts led by the Coast Guard. In all

three consultations, it was concluded that the proposed actions would not jeopardize the western snowy plover if protective measures required to limit take were implemented.

A consultation on the New River ACEC was completed in 2005. The purpose of the biological opinion was to address a variety of issues: recreation management at Floras Lake where measures were not adequately protecting nesting plovers; the periodic construction of a breach on the New River spit to improve fish and wildlife habitat and alleviate flooding; increased habitat restoration; and the development of a primitive beach camping area.

A consultation on Oregon's Integrated Predator Damage Management Program was completed in 2001. The objective of this program is to assist in recovery of the western snowy plover in Oregon by improving western snowy plover nesting and fledging success, through 1) expanding assessment efforts to all western snowy plover breeding and nesting locations to determine predator species responsible for nest, chick and adult predation; and 2) reducing the local predator populations where feasible and where the predator species or individual is known. The consultation calls for a variety of lethal and non-lethal methods to be used by APHIS-WS personnel to control the predator population.

The Oregon Parks and Recreation Department has been working with various cooperating agencies to develop a Habitat Conservation Plan for Oregon beaches. The Oregon Parks and Recreation Department is responsible for various management activities for most of Oregon's coast, including recreation management, general beach management, and the management of natural resources. In addition, the Oregon Parks and Recreation Department is responsible for issuing various permits along the Oregon coast. Some of these activities may result in "take" of or harm to the snowy plover. A draft version of the Habitat Conservation Plan was distributed to the public in January 2004. The Oregon Parks and Recreation Department conducted public meetings in seven coastal communities to solicit public comment. The area covered under the HCP includes the portions of the ocean shore along the Oregon coast that extend between the mouth of the Columbia River South Jetty on the north and the California/Oregon border on the south (approximately 230 miles of beach). In addition, specific portions of six key state parks, state natural areas, and state

recreation areas are included in the covered lands to be managed for snowy plover recovery. Implementation of the plan will begin after approval and completion of the Habitat Conservation Plan and its associated documents.

In southern California, we, through our Carlsbad Fish and Wildlife Office, have worked with local jurisdictions to develop regional habitat conservation plans under section 10 of the Endangered Species Act. The Multiple Species Conservation Program addresses southwestern San Diego County, including, for example, western snowy plover breeding habitat in south San Diego Bay through the City of San Diego. The Multiple Habitat Conservation Program addresses northwestern San Diego County. This plan provides for the conservation of western snowy plover breeding habitat and will potentially result in more management in association with a proposed preserve.

Also in San Diego County, we have been working with the Navy and the Marine Corps to avoid and minimize impacts to western snowy plovers. For example, with the assistance of our programmatic biological opinion in 1995, the Marine Corps has addressed training-related impacts on western snowy plovers and other species on approximately 17 miles of coastline on Camp Pendleton. We have likewise worked with the Navy at Naval Base Coronado to develop a program to conserve western snowy plover nesting and breeding habitat and allow necessary military training. As a result of successful management on these San Diego County military installations, they support a majority of the western snowy plover population in Recovery Unit 6 (*e.g.*, roughly 65 percent in 2006 from window survey data) while the military installations accomplish their respective training missions.

In the past, several instances were documented of western snowy plover nests being trampled by cattle belonging to the Vail and Vickers Company on Santa Rosa Island within the Channel Islands National Park, owned and managed by the National Park Service. In 1996, a lawsuit to remove cattle from Santa Rosa Island was initiated by the Environmental Defense Center, Santa Barbara, on behalf of the National Park Conservation Association. It was initiated under the authority of the Clean Water Act and the Endangered Species Act, based on concerns about management of livestock by the National Park Service and associated impacts to water quality and sensitive

plant and animal species. As a result of a lawsuit settlement, all cattle were removed from Santa Rosa Island in early 1998.

7. Regulatory Protection and Policies of Local Governments

Local governments regulate municipal land uses through development of local land use plans, general plans, comprehensive plans, and zoning policies. On April 21, 1998, we requested that county and coastal city planners within the states of Washington, Oregon, and California complete land-use management surveys regarding the western snowy plover. We sent surveys to 91 State, county, or coastal city planners and received responses from 37 percent of the recipients. Approximately 50 percent of the respondents were aware that western snowy plover habitats occur within their jurisdictions. However, only about one-third knew whether sandy beach and other habitats within their jurisdictions provided breeding and/or wintering habitat for western snowy plovers. Many general plans, coastal zone programs, and comprehensive plans prepared by local governments contain land use designations that are protective of western snowy plover habitats (*e.g.*, parkland, open space, and conservation designations for sandy beach). However, allowable uses in or adjacent to these zones, such as development (*e.g.*, seawalls, recreational facilities, single-family homes), recreation and public access, could cause direct or indirect threats to breeding or wintering western snowy plovers.

Whereas 43 percent of the respondents include regulatory policies that protect western snowy plover habitat (*e.g.*, sandy beach) in their general plans, local coastal programs or comprehensive plans, only 8 percent have developed regulatory policies specifically to protect the western snowy plover. These respondents included the City of Half Moon Bay, California, and Coos and Curry Counties, Oregon. Only 23 percent of the respondents specifically explain the threatened status of the western snowy plover, identify western snowy plover breeding/wintering locations, or specify shorebird nesting/roosting habitats as environmentally sensitive habitat areas in their jurisdictions. About 50 percent of the respondents indicated they either (1) have approved development within or adjacent to sandy beach or other habitats used by the western snowy plover, or (2) did not know whether such development had been approved by their agency. About half of these same respondents could provide some information on the number of permits authorized, area or linear distance affected,

percentage of development types (*e.g.*, housing, recreational) permitted, and permit conditions.

Based on these responses, it seems that specific locations of, and protective measures for, western snowy plover breeding and/or wintering locations are not included in most of the existing general plans, comprehensive plans, local coastal programs, or their implementing ordinances. Also, to better assess cumulative impacts, these responses indicate a need for a better tracking method regarding development projects approved within and adjacent to western snowy plover habitat.

8. Interagency Coordination

Each of the six recovery units for the western snowy plover is represented by a working group which meets at least once a year to coordinate western snowy plover recovery efforts. The working groups have provided a forum for the participation of affected Federal and State agencies and others in discussion, implementation, and adjustment of recovery efforts. Items addressed include research and monitoring needs, predator control, recreation management, habitat restoration, public outreach and law enforcement. In addition, a joint meeting of all six working groups is held annually. This group, consisting of beach managers, researchers, and outreach staff, meet to discuss range-wide issues (within the United States), to coordinate recovery actions, to learn from the experience of others, and to share information and research. Attendees have included local, State, and Federal agency staff, non-governmental organizations, consulting firms, private citizens, and volunteers.

The recovery unit working groups vary somewhat in organizational structure depending on major local issues, patterns of land ownership within the area, and specific agencies responsible for management. For example, the Oregon/Washington working group is composed of several subcommittees, including Outreach, Media, Predator Control, Research, Law Enforcement, and Recovery Plan Implementation. They facilitate funding partnerships for monitoring and management programs, thus promoting the best use and leveraging of limited funds. They also act as the main forum for discussing and tracking the status and trends of the snowy plover population. The subcommittees have worked on or supported a variety of cooperative projects, such as monitoring of yearly reproductive success, predator control, and

outreach materials. Products developed by the Outreach subcommittee include an outreach plan for Oregon/Washington and "Share the Beach" bookmarks, table tents, dog leashes, brochures, interpretive signs, and coloring books. The Media subcommittee is producing a media outreach CD for distribution to various media outlets and inter-agency press releases. The Predator Control subcommittee approved a predator management plan for Oregon, which first went into effect in 2002. The purpose of the Research subcommittee is to identify research and monitoring priorities, establish criteria for setting priorities, review proposed projects, and address funding mechanisms. The Law Enforcement subcommittee focuses on improving compliance with rules and regulations in plover nesting areas and the Recovery Plan Implementation subcommittee is working on guidance that would assist in "stepping down" the recovery plan for Oregon and eventually Washington.

In 1998, an interagency effort in Oregon produced a slide show and portable display to educate beach visitors about western snowy plover conservation. Outdoor education specialists and/or western snowy plover biologists from the U.S. Bureau of Land Management, U.S. Forest Service, Oregon Department of Fish and Wildlife, Oregon Parks and Recreation Department, and U.S. Fish and Wildlife Service participated in this effort. The show provides basic information about the western snowy plover, the reasons for its decline, and actions needed for its recovery, emphasizing the contribution that beach visitors can make.

II. RECOVERY

A. RECOVERY STRATEGY

The recovery strategy for the Pacific coast population of the western snowy plover (western snowy plover) includes three major components: 1) increase population numbers distributed across the range of the Pacific coast population of the western snowy plover; 2) ameliorate or eliminate threats by conducting intensive ongoing management for the species and its habitat, and developing mechanisms to ensure management in perpetuity; and 3) monitor western snowy plover populations and threats to determine success of recovery actions and to refine management actions. Developing and implementing intensive adaptive management actions, ensuring that management will continue in perpetuity, and monitoring to refine management actions, are all necessary to achieve the targeted population increases across the range. These three major components of the recovery strategy each include many actions and multiple partners that are described in further detail below.

1. Recovery Strategy Components

The following recovery strategy components will guide future recovery efforts for the U.S. Pacific coast population of the western snowy plover.

a. Population increases should be distributed across the western snowy plover's Pacific coast range.

A key component of recovering western snowy plovers is to ensure that population increases are distributed throughout the species' Pacific coast range. In order to achieve this, management goals (Appendix B) and needed management actions (Appendix C) have been determined for 155 sites distributed along the coasts of southern Washington, Oregon, and California. Additionally, the population's range has been divided into six recovery units (see discussion below) with population goals established for each recovery unit. The six recovery units correspond to regions of the U.S. Pacific coast and to the six subpopulations used in the Population Viability Analysis for the Pacific coast Snowy Plovers (Appendix D). In the population viability analysis, the Pacific coast population of the western snowy plover is treated

as a metapopulation, defined as a set of subpopulations among which there is limited dispersal.

The population viability analysis assumes dispersal among subpopulations is limited; however, even limited dispersal among subpopulations is important to species survival and recovery. Dispersal of the population across its breeding range helps to counterbalance catastrophes, such as extreme climatic events, oil spills, or disease that might depress regional survival and/or productivity. Maintaining robust, well-distributed subpopulations should reduce variance in survival and productivity of the Pacific coast population of the western snowy plover as a whole, facilitate interchange of genetic material between subpopulations, and promote recolonization of any sites that experience declines or local extirpations due to low productivity and/or temporary habitat loss.

This recovery plan and the population viability analysis (Appendix D) consider the U.S. Pacific coast population of the western snowy plover to be a single management entity, and population goals and objectives are based on that premise. No portion of the Pacific coast population of the western snowy plover appears to function as a distinct population segment. The Recovery Team therefore recommends that no State, geographic region, or subpopulation of the Pacific coast population of the western snowy plover be considered for delisting separately from the others.

b. Remove or reduce threats by conducting intensive ongoing management for the species and its habitat, and develop mechanisms to ensure management in perpetuity to prevent a reversal of population increases following delisting under the Endangered Species Act.

Management consists of multiple components, including identifying actions to ameliorate or eliminate threats, developing mechanisms to ensure management in perpetuity, continuing outreach and education to provide information to the public, partners, and stakeholders on recovery needs and opportunities, and developing of partnerships among Federal, State, and local agencies and groups to develop and implement effective management. Management actions for the western snowy plover are described in the recovery action outline and in Appendix C. These management actions are necessary to eliminate or ameliorate threats to the western snowy plover,

including loss, degradation, and alteration of habitat; disease, predation; and other manmade factors including disturbance of breeding and wintering birds, contaminants, and oil spills.

In addition to specific management recommendations to ameliorate or eliminate threats, the recovery action outline and recovery strategy for the western snowy plover include several recovery actions to develop mechanisms to ensure that management actions continue in perpetuity to ensure that threats remain neutralized. These include establishing working groups and developing participation plans for each recovery unit; ensuring sufficient U.S. Fish and Wildlife Service staff to coordinate recovery of the Pacific coast population of the western snowy plover; developing and implementing management plans for publicly owned lands; assisting local governments and private land owners in developing habitat conservation plans, developing land use protection measures, and developing landowner agreements; and acquiring habitat where necessary. A key component of these efforts includes education and outreach to inform partners and the public about recovery needs and opportunities for the western snowy plover. Actions for outreach are included in the recovery action outline, and the Information and Education Plan (Appendix K) provides greater detail on implementing these outreach and education actions.

Participation of many different groups will be essential to achieve both short-term and long-term management for the western snowy plover and its habitat. The roles of various groups, potential conservation tools and funding available, and the Recovery Team's vision for participation and coordination of partners are further described below.

c. Annual monitoring of western snowy plover subpopulations and reproductive success, and monitoring of threats and effects of management actions in reducing threats, is essential for adaptive management and to determine the success of recovery efforts.

The recovery action outline describes monitoring for breeding, wintering, and migration areas both to determine whether population numbers and survival of western snowy plovers is increasing and whether threats continue to limit population increases. Additional research actions are also recommended to study certain threats

and develop management techniques and monitoring methods. Results from research and monitoring efforts will be used to develop, refine, and improve management of western snowy plovers and their habitat. Monitoring of demographic characteristics will be necessary to demonstrate that population goals in the recovery criteria are being achieved. Monitoring of threats and effects of management actions in reducing those threats also is essential in demonstrating progress toward recovery and ultimately will assist in threats analyses necessary to make a delisting determination.

2. Roles of Federal, State, Local, and Private Sectors

a. Role of Federal Lands

Federal lands administered by the U.S. Fish and Wildlife Service, National Park Service, U.S. Forest Service, U.S. Bureau of Land Management, the National Marine Sanctuary Program, U.S. Marine Corps, and the U.S. Departments of the Army (including Corps of Engineers), Navy, and Air Force are extremely important to the conservation of the western snowy plover. In California, breeding occurs on National Wildlife Refuge lands, Department of Defense lands, Bureau of Land Management lands, and National Park Service lands. In Oregon, the major Federal landowners are the U.S. Forest Service and Bureau of Land Management, although the State also has jurisdiction over much of the Federally owned area (from mean high tide to the vegetation line) through a recreational easement (E.Y. Zielinski and R.W. Williams *in litt.* 1999). In Washington, the breeding area at Leadbetter Point is within a National Wildlife Refuge.

Under section 7(a)(1) of the Endangered Species Act, Federal agencies are required to actively promote the conservation of listed species. The western snowy plover cannot be recovered simply through general habitat protection or complying with required section 7(a)(2) consultations. The western snowy plover must be actively monitored and managed for the purpose of recovery or its population size will decline. Federal agencies alone cannot assure recovery of the western snowy plover, but should have a leading role in monitoring and management efforts to assure survival and recovery of this species. Some Federal lands contain large areas of contiguous habitat, including adjacent inland areas that are easier to manage for conservation of natural resources than fragmented, linear strips of land that may be owned by states, counties, cities,

and private landowners. Protection of western snowy plovers and their habitat on Federal lands is important not only because of the direct benefits to plovers that use these areas, but also because plover protection programs on Federal lands frequently utilize state-of-the art management measures and therefore serve as examples to non-Federal landowners. The Federal Government also should take the lead in addressing the sensitive issue of predator control.

b. Role of State Lands

State lands administered by the California Department of Parks and Recreation, California Department of Fish and Game, Oregon Department of Fish and Wildlife, Oregon Parks and Recreation Department, Washington Department of Fish and Wildlife, Washington State Parks and Recreation Commission, and Washington Department of Natural Resources play an important role in conservation of western snowy plovers and their habitats. Intensive management for western snowy plovers occurs at a number of State-owned plover habitat areas. The western snowy plover cannot be preserved simply through general habitat protection. Western snowy plovers must be actively monitored and managed to achieve recovery goals on State lands or their population size will decline.

c. Roles of State and Local Governments

State and local government agencies, including state planning agencies and city and county planning and community resources departments, have the primary responsibility for overseeing land uses within their jurisdictions. Therefore, their involvement in future recovery planning and implementing processes is critical. All Appendix B locations should be identified as environmentally sensitive habitat areas requiring protective measures for the western snowy plover in state and local planning documents and zoning designations. Local coastal programs should be amended to include these areas. To facilitate this effort, Federal and State agencies managing western snowy plover habitat should provide technical assistance and information to local governments (see Actions 3.1.6, 3.1.7 and 5.2). We can provide detailed maps of current western snowy plover breeding and/or wintering locations; these maps will be updated periodically as needed.

d. Role of Municipal Lands

Regional, county, and city lands, including regional and municipal park districts, also serve a role in conserving breeding and wintering habitats for western snowy plovers. Because these areas frequently receive heavy pedestrian and recreational use, local jurisdictions with active public outreach programs can reach a large segment of the coastal community regarding the plover's status and habitat needs.

e. Role of Private Lands

Conservation efforts on private lands are needed for the survival and recovery of many listed and other sensitive species. Private landowners can also make important contributions to western snowy plover conservation through facilitating or allowing the monitoring of western snowy plover populations on their land and implementing protective measures.

3. Conservation Tools and Strategies

There are numerous conservation tools and strategies available to Federal, State, municipal, and private landowners interested in western snowy plover protection and recovery. Appendix H includes a summary of conservation tools and strategies that may be adopted by landowners, nonprofit organizations, and regulatory agencies to protect western snowy plover habitat.

4. Funding Sources

Appendix I includes a summary of some potential sources of funds for implementation of recovery actions for the western snowy plover. This list is not intended to be exhaustive, however, and other funding opportunities may also be available.

An essential mechanism for recovery of the western snowy plover is the development and implementation of participation plans for each of the six recovery units (see Action 3.1.2). A key element of these participation plans is the long-term commitment by participating agencies to seek annual, ongoing funding for western

snowy plover management and monitoring activities so that funding within agency budgets can be secured.

In many areas a significant portion of western snowy plover conservation resources are expended in efforts to minimize the adverse impacts of recreation. Often, the primary objective of signs, ropes, on-site interpretation, and enforcement is to manage the behavior of beach-goers such that impacts to western snowy plovers are reduced as much as possible. In areas that have suffered extensive habitat loss or degradation, such recreation management activities are an extremely high priority in order to protect the western snowy plovers using the limited habitat that remains. For some beach managers, much of the funding and staff time expended on recreation management in and near western snowy plover habitat comes from resources targeted for threatened and endangered species recovery. In absence of the need to coordinate and pay for recreation management activities, more of these limited conservation dollars and staff resources could be directed toward western snowy plover management actions such as biological monitoring, habitat restoration, and predation control.

This situation is unique in the experience of many resource biologists. More typically, avoidance, minimization, and mitigation measures are integral components of projects or programs that entail adverse impacts to sensitive resources, and the costs of these activities are regarded as part of the overall cost of the project or program. Applying this traditional construct to recreation projects and programs could significantly promote western snowy plover recovery in several ways. First, it would require impacts to western snowy plovers to be considered up front when planning beach access or other recreation projects. Second, it would encourage impact avoidance and minimization since such measures are often less expensive than mitigation. Third, it would promote involvement of recreation professionals in designing and implementing recreation management measures. And fourth, it would eliminate or reduce the diversion of biological resource management funds toward recreation management activities, thus enabling more of those dollars to be spent on western snowy plover recovery actions.

5. Coordination, Participation, and Working Groups

We strongly believe that a collaborative stewardship approach to the proactive management of listed species involving government agencies (Federal, State, and local) and the private sector is critical to achieving the ultimate goal of recovery of listed species under the Endangered Species Act. An essential mechanism to achieve recovery of the western snowy plover is the formation and maintenance of working groups for each of the six recovery units (Appendix A), (see Action 3.1.1). Representation from the full range of Federal, State, local, and private landowners and other parties who have a stake in western snowy plover conservation within each of these six recovery units is needed to advance the recovery actions recommended in this recovery plan. Working group membership should include land managers, environmental groups, user groups, and groups involved in conservation projects (including local chapters such as the National Audubon Society, Sierra Club, Native Plant Society, Americorps, California Conservation Corps, Boy Scouts, Surfrider Foundation, and other recreational use groups). These groups can provide large networks of volunteers who can be mobilized to assist public resource agencies in the implementation of management measures for protection and recovery of the western snowy plover.

Working groups for each of the six recovery units currently exist and convene annually for regional and rangewide meetings. Through evaluation, communication, and coordination, members of each of the six working groups should manage the western snowy plover population and monitor progress towards recovery. They should produce annual reports on population monitoring and the effectiveness of management activities for the working group and our Arcata Fish and Wildlife Office. Each of the six working groups should prepare a participation plan, thereby formalizing recovery implementation efforts and the intentions of responsible agencies to seek ongoing, annual funding for recovery implementation. The Recovery Coordinator should coordinate and communicate with each recovery unit to support recovery efforts and assure implementation of the recovery plan (see Actions 3.1 through 3.4, 6, and 7). The Recovery Coordinator also should coordinate with other western snowy plover survey efforts and assessments throughout the west and throughout North America. Coordination with these other efforts may provide valuable information on the status and distribution of the western snowy plover, as

well as valuable information on management actions that may benefit the Pacific coast population of the western snowy plover. A coordinated international conservation program with Mexico also should be established to protect western snowy plover populations and their habitat in that country (see Action 8).

B. RECOVERY UNITS

The Pacific coast population of the western snowy plover has been divided into six recovery units (Appendix A, Figures A-1 through A-7). Establishing recovery units with specific recovery goals for each recovery unit will assist in meeting the objective of ensuring that population increases are distributed throughout the western snowy plover's Pacific coast range. A recovery unit is a special unit of a listed species that is geographically or otherwise identifiable and is necessary to the survival and recovery of the entire listed entity. Recovery units are individually necessary to conserve genetic robustness, demographic robustness, important life history stages, or other features for long-term sustainability of the entire listed species. However, recovery units are not listed as separate entities and cannot be delisted individually. Each recovery unit must be recovered before the species can be delisted.

The resilience to extinction of a widespread species can be negated if the species is subjected to a new stress over a large area (Raup 1991:122, 182). For the western snowy plover the primary stresses that led to the listing of the species were the loss of habitat due to encroachment of European beachgrass and urban development. As a consequence of such widespread habitat loss and the subsequent reduction in the range and vigor of the species, the western snowy plover is now more vulnerable to environmental fluctuations and catastrophes that the species would otherwise be able to tolerate. Chance events such as oil and contaminant spills, windstorms, and continued habitat loss from European beachgrass expansion, described earlier in this plan, could now cause or facilitate the extirpation of the entire listed species or one or more of the breeding populations.

The recovery unit approach in this recovery plan addresses this risk to the long-term survival and recovery of the western snowy plover by employing two widely recognized and scientifically accepted goals for promoting viable populations of listed species: (1) creation or maintenance of multiple populations so that a single or series

of catastrophic events cannot destroy the whole listed species; and (2) increasing the size of each population in the respective recovery unit to a level where the threats of genetic, demographic, and normal environmental uncertainties are diminished (Mangel and Tier 1994; National Research Council 1995:91; Tear *et al.* 1993; Meffe and Carroll 1994:192).

In general, the larger the number of populations and the larger the size of each population, the lower the probability of extinction (Raup 1991:182; Meffe and Carroll 1994:190). This basic principle of redundancy applies to the western snowy plover. By maintaining viable populations at the breeding locations within multiple recovery units, the threats represented by a fluctuating environment are alleviated and the species has a greater likelihood of achieving long-term survival and recovery. Conversely, loss of one or more important breeding locations within a recovery unit could result in an appreciable increase in the risk that the entire listed species may not survive and recover. Because western snowy plovers tend to exhibit site fidelity, migration to new nesting sites could increase stress to breeding birds and reduce nesting success.

Therefore, when evaluating the potential impact of land management actions that may affect the western snowy plover, we will consider whether a significant loss of western snowy plover breeding or wintering habitat in one recovery unit --without adequate compensation alleviating the impacts of that loss-- would adversely affect the viability of the population in that recovery unit as well as the long-term viability of populations in other recovery units.

Several aspects of the biology and life history of the western snowy plover indicate that designation of recovery units is necessary to ensure the long term health and sustainability of the western snowy plover. A portion of the Pacific coast population of western snowy plovers do not migrate up or down the coast and are year round residents. Additionally, the majority of western snowy plovers that do migrate are site-faithful, returning to the same breeding areas in subsequent breeding seasons (Warriner *et al.* 1986, Stenzel *et al.* 1994). Western snowy plovers occasionally nest in exactly the same location as the previous year (Warriner *et al.* 1986). These two features indicate that the Pacific coast population of western snowy plover likely exhibits subpopulation and metapopulation structure (see also Appendix D).

Designation of separate recovery units across the range will ensure that metapopulation dynamics can be maintained for the species.

The area covered by the six recovery units encompasses all the known breeding and wintering sites for the Pacific coast population of the western snowy plover. In addition to exhibiting site fidelity to breeding locations, western snowy plovers also exhibit fidelity to wintering locations. In contrast to many migratory birds, winter migration of the Pacific coast population of western snowy plovers is not uni-directional. Western snowy plovers may move both north and south along the coast from breeding locations. Nesting birds from Oregon have wintered as far south as Monterey Bay, California, while birds from Monterey Bay in central California have wintered north to Bandon, Oregon and south to Laguna Ojo de Liebre in Baja California, Mexico (Page *et al*. 1995*a*). Nesting birds from San Diego County in southern California have wintered north to Vandenberg Air Force Base in Santa Barbara County and south to Baja California (Powell *et al*. 1995, 1996, 1997). Designation of separate recovery units, each essential to the recovery of the western snowy plover, will ensure that wintering and migratory habitat is distributed across the western snowy plover's Pacific coast range and is protected and managed to maximize western snowy plover population survival.

The six recovery units for the Pacific coast population of the western snowy plover are: (1)Washington and Oregon; (2) Del Norte to Mendocino Counties, California; (3) San Francisco Bay, California; (4) Sonoma to Monterey Counties, California; (5) San Luis Obispo to Ventura Counties, California; and (6) Los Angeles to San Diego Counties, California. These recovery units were designated partly based on gaps in distribution of western snowy plover breeding and wintering locations, and on gaps in available habitat along the coast. For example, a significant portion of the coast of Sonoma County and southern Mendocino County is rocky and composed of steep bluffs lacking beach, dune, or estuary habitat suitable for the western snowy plover. This area constitutes a gap in the distribution of breeding and wintering locations between recovery units 2 and 4. This situation is repeated along the coast of Monterey County, where a gap in western snowy plover locations and suitable habitat occurs between recovery units 4 and 5. Smaller gaps also occur between recovery units 1 and 2, and between recovery units 5 and 6. Recovery unit 3 is unique and has

been designated as a separate recovery unit because much of the habitat in the San Francisco Bay area consists of salt ponds and salt pond levees.

The six recovery units designated for the western snowy plover also vary significantly in numbers of breeding western snowy plovers. Recovery unit 5 supports the greatest number of western snowy plovers, approximately half of the U.S. population, and has the greatest amount of available suitable habitat. Recovery units 4 and 6 support, or have the potential to support, a lesser number of western snowy plovers, collectively about a third of the population. The population in Recovery Unit 3 is relatively lower but has potential to increase with intensive management of salt pond habitat. Recovery units 1 and 2 also support relatively low numbers of western snowy plovers, probably due to suitable habitat being lesser in extent and more widely separated, but represent about half of the geographic range of the Pacific coast population of western snowy plovers within the United States and provide essential wintering, migratory, and breeding habitats.

Collectively, recovery of western snowy plovers within each of the six recovery units is necessary to maintain metapopulation dynamics, ensure protection and appropriate management of wintering and migratory habitat, and ensure the long term health and sustainability of the Pacific Coast population of western snowy plovers across its current range.

C. RECOVERY GOALS AND OBJECTIVES

The goal of this recovery plan is to ensure the long-term viability of the Pacific coast western snowy plover population so that this population can be removed from the Federal list of endangered and threatened species. The specific objectives to achieve this goal are the major components of the recovery strategy described above:

1) Increase population numbers distributed across the range of the Pacific coast population of the western snowy plover;

2) Conduct intensive ongoing management for the species and its habitat and develop mechanisms to ensure management in perpetuity; and

3) Monitor western snowy plover populations and threats to determine success of recovery actions and refine management actions.

D. RECOVERY CRITERIA

Recovery criteria for the Pacific coast population of the western snowy plover include numeric subpopulation targets, reproductive productivity targets, and establishment of management actions. Under each of these three major recovery criteria are additional subcriteria that must be achieved in order to progress toward the major criteria or that must be achieved in order to determine whether the major criteria are being met. Subcriteria include completing development and implementation of population, demographic and threat monitoring programs, incorporating specific management actions into participation and management plans, and completing research actions necessary to refine management actions.

Recovery criteria in this recovery plan are necessarily preliminary and will need periodic reassessment because additional data upon which to base decisions about western snowy plover recovery are needed (*i.e.*, effective predator management techniques, effective restoration techniques, improved monitoring techniques, additional demographic information for some subpopulations). Research actions, monitoring programs, and periodic recovery implementation review are included as recovery actions in order to obtain this information. The completion of many of these actions have been incorporated into recovery criteria in order to ensure that new information is incorporated into recovery implementation decisions.

The recovery criteria recommend that the Pacific Coast population of the western snowy plover be maintained at 3,000 breeding birds. This population increase to 3,000 breeding individuals could occur within 25 years with intensive management of breeding and wintering sites (see Appendix D. Population Viability Analysis for Pacific Coast Snowy Plovers). This population level must be maintained for at least ten years. In addition, average annual productivity of at least one (1.0) fledged chick per male in each recovery unit must be maintained in the last 5 years prior to delisting. Forty years may be required to achieve these demographic components of the recovery criteria, assuming that mechanisms to assure long-term protection and

management of breeding, wintering, and migration areas necessary to maintain the subpopulation sizes and average productivity have been developed and are in place.

The Pacific coast population of the western snowy plover will be considered for delisting when the following criteria have been met:

Criterion 1. Monitoring shows that an average of 3,000 breeding adults distributed among 6 recovery units as specified below have been maintained for a minimum of 10 years:

Recovery Unit	*Subpopulation Size*
1. Washington and Oregon	250 breeding adults
2. Del Norte to Mendocino Counties, California	150 breeding adults
3. San Francisco Bay, California	500 breeding adults
4. Sonoma to Monterey Counties, California	400 breeding adults
5. San Luis Obispo to Ventura Counties, California	1,200 breeding adults
6. Los Angeles to San Diego Counties, California	500 breeding adults

Subpopulation sizes represent the best professional judgment of the Western Snowy Plover Recovery Team's technical subteam. Numbers are based on a site-by-site evaluation of historical records, recent surveys, and future potential (assuming dedicated, proactive management at breeding and wintering locations). Collectively, these numbers represent an approximately 70 percent increase in the Pacific coast population size from the time of listing. On a cumulative range-wide basis the recovery criteria are approximately 83 percent of the total of the "Management Goal Breeding Numbers" identified in Appendices B and C, which represent site-specific target populations under an intensive management scheme. The recovery criteria for population size and distribution for the Pacific coast population of the western snowy plover represent only a portion of its historical abundance and distribution.

To reach these subpopulation sizes will require proactive management to attain a level of productivity that will allow the population to grow. The population viability analysis (Appendix D) suggests that reproductive success between 1.2 to 1.3 fledglings per male per year, with adult survival of 76 percent and juvenile survival of 50 percent, provides a 57 to 82 percent probability of reaching a population of 3,000 western snowy plovers within 25 years. Enhancing productivity is critical to population growth. Once the population size criterion is met, a lower rate of productivity can sustain the population.

1a. A program is developed and implemented to monitor the western snowy plover breeding population and wintering locations (see Actions 1.1 and 1.2) to determine whether recovery unit subpopulation criteria are being achieved.

The monitoring program must include monitoring of population size and distribution, survival, and productivity. Monitoring population size and distribution are necessary as a means of measuring whether the recovery criterion is being met. Monitoring demographic characteristics such as survival and productivity also will be necessary to determine population trends and progress toward achieving the recovery criterion. The monitoring program should also assess whether management goals for breeding and wintering sites listed in Appendix B are being achieved. Collectively, the breeding management goal numbers are about 20 percent higher than the recovery criteria subpopulation sizes. Monitoring of individual sites will assist in determining the effectiveness of management actions and whether any refinements are necessary. Monitoring of wintering sites will assist in indicating whether survival of western snowy plovers is sufficient to make progress toward meeting breeding population size criteria.

When the species has recovered sufficiently to be delisted, the ongoing program of monitoring actions should be integrated into a post-delisting monitoring plan to cover a minimum of 5 years after delisting and ensure ongoing recovery and effectiveness of management actions. This monitoring plan should be developed and ready for implementation before delisting.

1b. A program is developed and implemented to monitor the site-specific threats identified in Appendix C (Action 1.3) and monitoring results are used to refine site-specific management actions identified in Appendix C.

In conjunction with monitoring of breeding subpopulation sizes and distribution and demographic characteristics, threats at each breeding and wintering site must be monitored in order to determine whether management actions are effective in increasing western snowy plover survival and reproduction. If threats continue limiting population increases, or additional threats are identified, management actions recommended in Appendix C may require modification.

1c. Management activities identified in Appendix C that are necessary to ameliorate threats and achieve increases in reproductive success, survival, and overall population size are incorporated into participation and management plans developed and implemented under Criterion 3.

Appendix C provides location-specific summaries of current management activities at western snowy plover breeding and wintering sites based on: 1) responses by public land managers and private conservation organizations to a survey prepared by the Recovery Team on western snowy plover management and beach use; and 2) supplemental information from the Recovery Team and from our field office staff. Appendix C also identifies additional management activities needed at each site to ameliorate threats and achieve management goals. These management recommendations are intended to provide preliminary guidance but additional management needs likely will be identified through monitoring, research, and site-specific experience.

1d. Research actions (Action 4) are completed and incorporated into management and participation plans and into monitoring plans.

Several research needs identified under Action 4 are necessary to refine and improve management activities for the western snowy plover and also to improve monitoring of western snowy plover population sizes, demographics, and threats. Improving and refining management actions will increase the effectiveness of management actions in increasing population numbers, survivorship, and productivity. Improved monitoring

techniques are needed to ensure that monitoring efforts are adequate to detemine whether recovery actions are successful and recovery criteria are being met.

Criterion 2. A yearly average productivity of at least one fledged chick per male has been maintained in each recovery unit in the last 5 years prior to delisting.

From currently available data, it is estimated that males must average one fledged young annually for population equilibrium (see Appendix D). Higher rates of productivity will be necessary to reach the target population size of 3,000 breeding adults. After this population size is achieved and maintained for a minimum of 10 years, a lower rate of productivity of one fledged chick per male will be necessary to maintain the population size at an average of 3,000 breeding adults. Monitoring programs developed and implemented under criteria 1a and 1b should continue throughout this period. We also assume that management designed to ameliorate threats (criteria 1c and 3) will continue through this period and after delisting.

Criterion 3. Mechanisms have been developed and are in place to assure long-term protection and management of breeding, wintering, and migration areas listed in Appendix B to maintain the subpopulation sizes and average productivity specified in Criteria 1 and 2.

Development of mechanisms to ensure long-term management and protection of western snowy plovers and their habitat are listed under Action 3, which outlines the recovery actions recommended to meet these recovery criteria. The recovery action outline section describes each action in detail. The recovery action outline lists all subactions necessary to fulfill the main recovery action. It also represents a prioritization of measures to be implemented. Completion of these actions will ensure that threats to western snowy plovers and their habitat are ameliorated and that management will continue after delisting to prevent a reversal of population increases.

3a. Working groups for each of the six recovery units are established.

Action 3.1 recommends the establishment of working groups for each recovery unit. Working groups should be diverse and include representatives from Federal, State, local, and private sectors. At present working groups are in existence for all recovery

units, and should continue to be maintained and meet regularly. The roles of the working groups are to coordinate and facilitate recovery efforts within each recovery unit, assess population trends, and carry out outreach activities.

3b. A participation plan for each recovery unit working group has been developed and implemented.

Each working group is tasked with developing a participation plan that delineates and prioritizes recovery activities within each recovery unit and for each location identified in Appendix B. These plans should identify the roles and responsibilities of each member of the working group and their commitments to carry out identified recovery actions.

3c. Management plans for all Federal and State lands identified in Appendix C have been developed and implemented.

Appendix C identifies the landowners of western snowy plover wintering and breeding sites. Many of the sites are owned or managed by Federal or State agencies. Development and implementation of management plans that incorporate the management goals and recommendations in Appendix C for all these sites are necessary to ensure that population goals are reached, threats ameliorated, and long-term protection and management of western snowy plovers and their habitat are in place.

3d. Mechanisms to protect and manage western snowy plover breeding and wintering sites identified in Appendices B and C are in place for all areas owned or managed by local governments or private landowners.

Appendix C also identifies many western snowy plover breeding and wintering locations that are owned or managed by local governments, private conservation organizations, or private landowners. These lands also require protection and management to ensure that population goals are reached, threats ameliorated, and long-term protection and management of western snowy plovers and their habitat are in place. Because of the diverse ownership and management of these lands, many different mechanisms may be used to ensure protection and management of these

locations. These mechanisms are further described in the recovery action outline and Appendices H and I.

3e. Public information and education programs are developed and implemented.

Outreach is a major component of developing and putting in place mechanisms to assure long-term protection and management of breeding, wintering, and migration areas listed in Appendix B. Outreach efforts will be needed to solicit participation of the many Federal, State, local, and private groups in recovery efforts and notify groups and individuals of recovery opportunities and incentives for the western snowy plover. Outreach efforts also must be used as a component of management of western snowy plovers and their habitats. These efforts will include informing the public and gaining their support for measures intended to protect western snowy plovers.

E. RELATIONSHIP OF RECOVERY ACTIONS AND CRITERIA TO THREATS

The goal of this recovery plan is to ensure the long-term viability of the Pacific coast population of western snowy plovers so that they can be removed from the Federal list of endangered and threatened species. The delisting process requires demonstrating that threats to the western snowy plover have been reduced or eliminated such that the species survival in the wild is assured. Table 8 lists the threats to the western snowy plover that have been identified during and since the listing process and indicates the actions and recovery criteria in the recovery plan that address each threat.

The western snowy plover faces multiple threats throughout its Pacific coast range. Major threats to the western snowy plover include habitat destruction and modification and lack of habitat protection mechanisms (listing factors A and D), disease or predation (listing factor C), and manmade factors that primarily result in disturbance or mortality of breeding birds (listing factor E). Effects of research on western snowy plovers (listing factor B) is also a threat but is comparatively minor and easily addressed through permitting processes. Many of the threats to western snowy plovers are interrelated or have complex interactions with each other. For example, coastal development that destroys or modifies habitat (listing factor A) also

results in increased disturbance from recreational activities (listing factor E) and in increased predator populations (listing factor C). Recovery actions and criteria therefore may address multiple threats.

The majority of threats to the western snowy plover, other than habitat destruction or modification, affect the western snowy plover's productivity (breeding success) and survival within otherwise suitable habitat. Criteria 1 and 2 are directed at determining whether the effects of threats on productivity and survival have been removed and expected population and productivity increases are being achieved. Threats addressed by these recovery criteria primarily fall under listing factors B, C, and E. Reduction and elimination of these threats, and the expected increases in productivity and survival, rely primarily on developing intensive management and monitoring programs for the western snowy plover. Criterion 3 is directed at achieving the management and habitat protections necessary to reduce and eliminate threats that fall primarily under listing factors A and D, but also address threats under listing factors B, C, and E that can be eliminated or ameliorated by ensuring long-term management.

Table 8. Threats to the Pacific coast population of the western snowy plover and steps within the recovery plan to reduce or eliminate threats.

Factor*	Threat	Action	Criterion
A	**The present of threatened destruction, modification, or curtailment of its habitat or range.**		
A*	Encroachment of introduced beachgrass and nonnative vegetation.	1.1-1.3, 2.2.1, 3.1-3.10, 4.1.1, 5.1-5.7	1b-d, 2, 3a-e
A*	Shoreline stabilization	1.1-1.3, 2.1, 3.1-3.10, 5.1-5.7	1b, 1c, 3a-e
A*	Urban development and construction	1.1-1.3, 2.1, 3.1-3.10, 5.1-5.7	1b, 1c, 3a-e
A	Dredging disturbance and tailings deposit	1.1-1.3, 2.1, 3.1-3.10, 5.1-5.7	1b, 1c, 3a-e
A*	Sand mining	1.1-1.3, 2.1, 2.2.2, 3.1-3.10, 5.1-5.7	3a-e
A	Beach nourishment with inappropriate design and/or sand type	1.1-1.3, 2.2.3, 3.1-3.10, 5.1-5.7	3a-e
A	Driftwood removal	1.1-1.3, 2.3.4, 3.1-3.10, 5.1-5.7	1b, 1c, 2 3a-e
A	Beach fires and camping	1.1-1.3, 2.3.3, 3.1-3.10, 5.1-5.7	1b, 1c, 2 3a-e

Factor*	Threat	Action	Criterion
A	Water course diversion, impoundment, or stabilization	1.1-1.3, 3.1-3.10, 5.1-5.7	1b, 1c, 3a-e
A	Habitat conversion for other species	1.1-1.3, 3.1-3.10, 5.1-5.7	1d, 3a-e
A	Operation of salt ponds	1.1-1.3, 3.1-3.10, 5.1-5.7	1b, 1c, 3a-e
B	**Overutilization for commercial, recreational, scientific or educational purposes.**		
B*	Egg collecting	1.1-1.3, 2.3.8	none, 1c
B	Studying and monitoring plovers	1.4, 1.5, 3.1-3.2, 4.3	1a-d 2
B	Banding	4.6	1a-d
C	**Disease or predation.**		
C*	Introduced nonnative predators	1.1-1.3, 2.4, 4.2, 3.1-3.10, 5.1-5.7	1b, 1c, 2 3a-e
C	Increased populations of native predators due to human influences	1.1-1.3, 2.4, 4.2,3.1-3.10, 5.1-5.7	1b, 1c, 1d, 2, 3a-e
C*	Predator attractants	1.1-1.3, 2.4, 4.2, 3.1-3.10, 5.1-5.7	1b, 1c, 1d, 2, 3a-e
C	Predation by domestic and feral cats	1.1-1.3, 2.4, 4.2, 3.1-3.10, 5.1-5.7	1a-d, 2, 3a-e
D	**The inadequacy of existing regulatory mechanisms.**		

Factor*	Threat	Action	Criterion
D*	Limited habitat protection under the Migratory Bird Treaty Act and State laws	2.3.8, 3.1-3.10, 5.1-5.7	3a-e
D	Conflicting beach management methods and mandates	1.1-1.3, 2.3.8, 3.1-3.10, 5.1-5.7	1b, 1c, 3a-e
D*	Sections 404 of Clean Water Act and 10 of Rivers and Harbors Act apply to limited amount of habitat	2.3.8, 3.1-3.10, 5.1-5.7	1b-d 3a-e
D*	Lack of protection in Baja California, Mexico	8	
E	**Other natural or manmade factors affecting its continued existence.**		
E*	Loss of nests and habitat due to natural events	1.1-1.3, 1.6, 2.1, 2.2, 2.3.8, 3.1-3.10, 4.4, 4.5, 4.10	1b, 1c, 3a-e
E*	Disturbance by pedestrians	1.1-1.3, 2.3.1, 2.3.8, 3.1-3.10, 4.9, 5.1-5.7	1b, 1c, 2, 3a-e
E*	Disturbance by dogs	1.1-1.3, 2.3.1, 2.3.2, 2.3.8, 3.1-3.10, 4.9, 5.1-5.7	1b, 1c, 2, 3a-e
E*	Disturbance by motorized vehicles	1.1-1.3, 2.3.5, 2.3.8, 3.1-3.10, 4.9, 5.1-5.7	1b, 1c, 2, 3a-e

Factor*	Threat	Action	Criterion
E*	Disturbance by beach cleaning	1.1-1.3, 2.3.5, 2.4.1, 3.1-3.10, 4.9, 5.1-5.7	1b, 1c, 2, 3a-e
E*	Disturbance from equestrian traffic	1.1-1.3, 2.3.6, 2.3.8, 3.1-3.10, 4.9, 5.1-5.7	1b, 1c, 2, 3a-e
E	Disturbance from fishing activities	1.1-1.3, 2.3.3, 2.3.8, 3.1-3.10, 4.9, 5.1-5.7	1b, 1c, 2 3a-e
E	Disturbance by fireworks	1.1-1.3, 2.3.3, 2.3.8, 3.1-3.10, 4.9, 5.1-5.7	1b, 1c, 2, 3a-e
E	Disturbance by kites and model airplanes	1.1-1.3, 2.3.3, 2.3.8, 3.1-3.10, 4.9, 5.1-5.7	1b, 1c, 2, 3a-e
E*	Military exercises and aircraft overflights	1.1-1.3, 2.3.8, 2.3.9, 3.1-3.10, 5.1-5.7	1b, 1c, 2 3a-e
E	Large crowds associated with special events	1.1-1.3, 2.3.3, 2.3.8, 3.1-3.10, 4.9, 5.1-5.7	1b, 1c, 2 3a-e
E	Increased coastal access to beaches	1.1-1.3, 2.3.1.2, 2.3.8, 3.1-3.10, 4.9, 5.1-5.7	1b, 1c, 2 3a-e
E	Livestock grazing	1.1-1.3, 2.3.7, 2.3.8, 3.1-3.10, 5.1-5.7	1b, 1c, 3a-e

Factor*	Threat	Action	Criterion
E	Oil spills and disturbance from oil spill clean-ups	1.1-1.3, 2.5, 4.7, 5.6	1b-d 3a-e 1b, 1c, 2 3a-e
E	Environmental contaminants	1.1-1.3, 4.8, 5.6	1b-d, 3a-e
E	Litter, garbage, & debris	1.1-1.3, 2.3.8, 2.4.1, 3.1-3.10, 4.9, 5.1-5.7	1b, 1c, 2 3a-e
E	Urban runoff and impaired water quality	1.1-1.3, 2.1, 2.3.8, 3.1-3.10, 5.1-5.7	3a-e
E	Management for other special status species	1.1-1.3, 1.7, 2.6, 2.7, 2.3.3, 3.1-3.10, 4.2.2, 5.1-5.7	3a-e

* Indicates threats originally identified during the listing process.

III. NARRATIVE OUTLINE OF RECOVERY ACTIONS

1 **Monitor breeding and wintering population and habitats of the Pacific coast population of the western snowy plover to determine effects of recovery actions to maximize survival and productivity.** To assure the long-term viability of western snowy plover populations, their populations and breeding and wintering habitat should be monitored and managed in a systematic, ongoing fashion. Systematic, ongoing monitoring of breeding birds and wintering birds should be undertaken at the recovery-unit level to measure progress towards recovery and identify management and protection efforts that are needed. In addition to the known breeding sites, all known wintering locations (Appendix B) are considered currently important to western snowy plover conservation. These sites include both wintering locations that currently support breeding birds and locations that may potentially support nesting birds in the future. These locations also may support migrating western snowy plovers. There is a need for better information about wintering and migration sites, including spatial and temporal use patterns, feeding areas, habitat trends, and threats. Appendix C, Table C-1 identifies 147 locations where monitoring western snowy plover populations is occurring or recommended to achieve management goals.

1.1. **Annually monitor western snowy plover abundance, population size, and distribution at breeding and wintering locations in each recovery unit using window surveys.** Comprehensive range-wide window surveys of breeding locations and wintering locations (Appendix B) should be conducted annually to determine population trends and fluctuations, and to determine whether management goal breeding numbers (Appendix B) are being achieved. The window survey described in Appendix J (Monitoring Guidelines) should be employed as the primary index of population size to minimize the probability of double-counting birds nesting at multiple locations during the same season. Window surveys are conducted over a relatively short time period to minimize double-counting of birds that change location during the season, but may not fully account for all breeding or wintering birds. Window survey methodology should be improved and correction factors estimated (Action 4.3.1) to improve the

accuracy and utility of population indices. This correction may require some banding at sites where there are currently no marked birds on which to base correction factors.

1.2 Develop and implement a program to monitor western snowy plover productivity and annual survival in each recovery unit. Development and implementation of a program to monitor western snowy plover productivity and survival, in addition to comprehensive population size and distribution monitoring, is necessary to measure progress toward achieving recovery criteria and to assess the effectiveness of management in removing threats that affect nesting success and survival. Results from this monitoring program also may be used to update the population viability analysis and assess progress toward recovery goals (Actions 4.11 and 6). Monitoring productivity and survival likely will be much more intensive than monitoring population sizes and distribution (Action 1.1), and cannot be implemented at all breeding sites because of insufficient color band combinations to monitor the entire Pacific coast population. Plans for monitoring these demographic characteristics instead should utilize methods to sample demographic characteristics across the breeding range and in each recovery unit. Actions 4.3.2 and 4.3.3 recommend developing methodologies to estimate productivity and survival. The monitoring program should incorporate these methods and should specify the number of sites sampled in each recovery unit, how sites will be selected, and indicate control sites from intensively monitored breeding locations (*i.e.*, the coast of Oregon, extreme northern California, and the shoreline of Monterey Bay).

1.3 Develop and implement a program to monitor at all breeding and wintering sites the habitat conditions, disturbances, predation, and other threats limiting abundance of breeding and wintering birds, clutch hatching success, chick fledging success, and survival. Monitoring of threats to the western snowy plover is necessary to determine effectiveness of recovery actions in ameliorating or eliminating threats, assess progress toward recovery, and refine site-specific managements as necessary. A standardized threats monitoring program

should be developed and applied to all breeding and wintering sites in conjunction with monitoring developed and implemented under actions 1.1 and 1.2. At a minimum, monitoring should include determining substrate characteristics and vegetation composition (level of nonnative species), frequency and levels of disturbance (*e.g.*, recreational activities, pets, vehicles, horses), and presence and abundance of predators. Appendix J (Monitoring Guidelines) provides general guidance on monitoring but may require revision as research actions under action 4 are completed. Opportunities to incorporate monitoring into Federal activities subject to section 7 of the Endangered Species Act, such as dredging and discharges regulated by the U.S. Army Corps of Engineers, should be utilized when possible.

1.4 Develop and implement training and certification programs for western snowy plover survey coordinators and observers, consistent with recommendations in Appendix J (Monitoring Guidelines). Classroom and field training are required for observers who survey for western snowy plovers, and before we can issue a section 10(a)(1)(A) permit. Instruction programs and materials should be developed for comparable training to occur throughout the western snowy plover range to improve consistency of data collection. Classroom topics should include, but not be limited to: (1) biology, ecology, and behavior of breeding western snowy plovers; (2) identification of adult plovers, their young, and their eggs; (3) threats to plovers and their habitats; (4) survey objectives, protocols, and techniques; (5) regulations governing the salvage of carcasses or eggs; (6) special conditions of existing recovery permits; (7) field identification of potential western snowy plover predators; (8) biology and behavior of predator and scavenger species; and (9) other activities (*e.g.*, banding). Field training should include, as appropriate: (1) locating, identifying, and monitoring nests; (2) handling eggs and capturing and handling adults or chicks; (3) specifics on the target activity for which a recovery permit is to be issued, or under which an observer will work; (4) practical field exercises; and (5) field review of appropriate classroom topics.

1.5 Develop a submittal system for monitoring data to ensure consistent reporting among recovery units and sites, and annually review and revise the system as necessary. Initially, range-wide survey data will be limited to results from 2 annual window surveys. As population and demographic monitoring methods are developed and implemented (Actions 1.1, 1.2, 4.3.1, 4.3.2, and 4.3.3), a more sophisticated reporting and compiling system will be necessary. Our lead office should coordinate with researchers involved with monitoring to ensure that data collection, submittal, and entry systems remain current, include correction factors that account for lack of detections during surveys, and are consistent among recovery units and sites. An annual range-wide report should be developed and distributed to all interested parties. Additionally, consistent reporting of sightings of banded western snowy plovers is needed. Sightings of banded birds provide information on the wintering sites of breeding birds, use of multiple sites by breeding and wintering plovers, and survival and dispersal of adults and juveniles. In accordance with procedures of the U.S. Geological Survey, Bird Banding Laboratory, the Point Reyes Bird Observatory should continue to act as the color band coordinator for the Pacific coast population to avoid use of duplicate color banding schemes among researchers.

1.6 Assess and evaluate new breeding, wintering, and migration areas as they are discovered to determine threats and management needs and update lists of areas identified in Appendices B and C as data become available. As new western snowy plover breeding and wintering areas are discovered, data should be collected to assess site boundaries, habitat characteristics, population levels, and any significant threats. The current list of important breeding and wintering locations (Appendix B) should be expanded or refined as appropriate, and any new areas incorporated into management and monitoring plans. Areas determined to be important for migration through action 4.4.4 also should be evaluated and added to the list of areas requiring protection, management, and monitoring. Management goals and needed management to ameliorate or eliminate threats should be developed for all new breeding, wintering, and migration

areas and should be included in periodic revisions of Appendices B and C of this recovery plan.

1.7 Annually coordinate monitoring of western snowy plovers and California least terns to minimize effects of disturbance to both species. Coordination with least tern monitors and managers is needed in all areas where western snowy plovers share breeding sites with California least terns. Coordination should take place at biannual pre-and post-season California least tern monitoring meetings. Protocols for monitoring California least terns should be revised as necessary so that western snowy plovers are not detrimentally affected. Human activities within some least tern colonies in southern California include monitoring by one to four people several days per week; maintenance of tern fences; predator management; site preparation; and banding/observation efforts. Human activities associated with tern monitoring must be recognized as additional disturbance to western snowy plovers. Section 10(a)(1)(A) permits, issued under the authority of the Endangered Species Act for western snowy plovers and least terns, should include both species where applicable. Monitoring efforts for both species should be kept separate because of differences in monitoring techniques and species' behaviors. Monitors of least terns and western snowy plovers should be aware of species' differences in nest spacing, brood-rearing, foraging behavior, time of breeding, vulnerability to disturbance, and monitoring and banding techniques.

Western snowy plovers generally begin nesting at least 1 month before the arrival of breeding least terns; thus, tern management often begins well after western snowy plovers have initiated nests. Site preparation (vegetation removal and fence construction) should be coordinated to minimize disturbance to nesting western snowy plovers, and if possible to enhance breeding success for both species (as well as considering other sensitive species, including plants, that may be present). Predator management also should be coordinated to benefit both species.

1.8 Develop post-delisting monitoring plan. Prior to delisting a five-year monitoring plan should be developed. Methodology and scope of post-delisting monitoring should be appropriately integrated with existing monitoring efforts for continuity and comparability. Monitoring and research results should be used to guide the long-term conservation of the species.

2 Manage breeding and wintering habitat of the Pacific coast population of the western snowy plover to ameliorate or eliminate threats and maximize survival and productivity. The Pacific coast population of the western snowy plover is sensitive to changes in productivity and in adult and juvenile survival rates (see Appendix D). Furthermore, recovery of this species is contingent on intensive management of breeding habitat and availability of wintering habitat for more than the current number of western snowy plovers (see recovery criteria). Appendix C provides a summary of site-specific management needs at 155 breeding and wintering locations (actions 2 and 3). Management efforts may be time-consuming, costly, and sometimes require intensive management. Western snowy plover breeding habitat is extremely dynamic and factors affecting breeding success, such as types and numbers of predators, can change quickly; therefore, managers should be prepared to modify protection as needed. Action 6 recommends annual review of progress toward recovery and revision of site-specific management actions based on monitoring and research results and site-specific experience. Management and protection of western snowy plovers on Federal and State lands are especially important. In addition, protection on Federal and State lands furnishes leadership by example to local land managers. Land managers should recognize that components of breeding habitat include: areas where plovers prospect for nesting sites, make scrapes, lay eggs, feed, rest, and rear broods. Breeding habitat also includes travel corridors between nesting, resting, brood-rearing, and foraging areas. Wintering and migration habitats should also be monitored and managed to maximize survival and recruitment of western snowy plovers into the breeding population.

2.1 Maintain natural coastal processes that perpetuate high quality breeding and wintering habitat by incorporating the following recommendations into development of participation plans, management planning, and habitat protection (action 3) for the sites identified in Appendix C and any additional sites identified through surveys and monitoring. The dynamic nature of beach strand habitats as storm-maintained ecosystems should be recognized and allowed to function. Natural process that contribute to maintaining wide, flat, sparsely-vegetated beach strands preferred by western snowy plovers include: inlet formation, migration, and closure; erosion and deposition of sand dunes; and overwash and blowouts of beach and dune habitat. Coastal development, beach stabilization, construction of rock jetties and seawalls, sand removal and dredging, water diversion and impoundment, and planting of nonnative vegetation interfere with these processes and result in loss and degradation of habitat.

Maintenance of natural coastal processes can be accomplished through establishment of management plans, conservation easements, fee title acquisition, zoning, and other means. Coastal development, beach stabilization, resource extraction, and water diversion and/or impoundment projects should be carefully assessed for impacts to wintering western snowy plovers. Recommendations from U.S. Fish and Wildlife Service offices (under the Endangered Species Act and Clean Water Act) and/or State agencies should focus on avoiding or minimizing adverse impacts to wintering habitat. Where adverse effects cannot be avoided, agencies should document impacts so that cumulative effects on this species' habitat can be assessed and compensated. When beach development cannot be avoided, the following protections should be implemented: (1) construction should take place outside the nesting season, (2) developers and others should be advised during planning stages that stabilization of shorelines will result in additional habitat degradation and that these impacts may affect evaluation and issuance of permits under the jurisdiction of the U.S. Army Corps of Engineers or State coastal management agencies, and of measures to minimize the impacts, (3) property owners (*e.g.*, hotel or resort owners) should tailor recreational

activity on the beach and dunes to prevent disturbance or destruction of nesting western snowy plovers, their eggs, and chicks, (4) lights for parking areas and other facilities should not shine on western snowy plover habitat, (5) sources of noise that would disturb western snowy plovers should be avoided, and (6) the establishment of predator perches and nesting sites should be avoided when designing facilities. Appendix C, Table C-1 identifies 86 locations which currently have development restrictions in place and 16 locations where development should be restricted or avoided to achieve management goals.

2.1.1 Develop a prioritized list of western snowy plover wintering and breeding sites where natural coastal processes need protection, or where impaired natural coastal processes should be enhanced or restored. Recovery Unit working groups should evaluate the sites within their recovery unit and determine where natural processes are likely to be disrupted or are in need of being enhanced or restored, or are of particular importance to maintaining high quality western snowy plover habitat. Sites should be prioritized based on their importance to western snowy plover breeding and the degree of threat to the western snowy plover and its habitat should natural processes be disrupted.

2.1.2 Identify mechanisms necessary to protect, enhance, or restore natural coastal processes for the sites identified in action 2.1.1 and implement through incorporating into actions 3.1 -3.10. Mechanisms to protect, enhance, or restore natural processes may include development of management plans that prohibit or restrict activities that disrupt natural process (*i.e.* dredging or sand removal, recreational activities that contribute to excessive erosion or compaction), acquisition of habitat, landowner agreements, local land use protection measures, or enhancement activities. Identification of these sites and mechanisms should be used to guide implementation of long-term management and protection under action 3.

2.2 Create and enhance existing and potential breeding and wintering habitat. Past and ongoing impacts to western snowy plover breeding habitat from development, artificial beach stabilization, and other projects have resulted in loss and degradation of western snowy plover habitat. Habitat enhancement and creation are needed at multiple sites to offset these losses. Where impacts cannot be avoided, projects should remediate and compensate habitat loss and degradation by maintaining natural long-shore sand budgets and minimizing interference with natural patterns of sand accretion and depletion. When these types of projects are planned, complex natural sand movement patterns should be taken into account. Beach management policies should recognize that many current erosion and sedimentation problems are the result of past property and/or inlet "protection" efforts. Habitat restoration projects in historic or potential breeding sites, where feasible, is encouraged. Creation of habitat should be emphasized in areas not subject to recreational impacts.

2.2.1 Remove nonnative and other invasive vegetation from existing and potential habitat and replace with native dune vegetation. Land managers should implement remedial efforts to remove or reduce vegetation that is encroaching on western snowy plover breeding habitat or obstructing movement of chicks from nesting to feeding areas. Particular attention should be given to the eradication of introduced beachgrass (*Ammophila* spp.) within coastal dunes.

2.2.1.1 Develop and implement prioritized removal and control strategies for introduced beachgrass and other nonnative vegetation for each recovery unit. These strategies should include early intervention to prevent expansion into breeding areas where introduced beachgrass and other nonnative vegetation have not yet spread or are in early stages of spreading. Attention also should be given to the removal of giant reed, Scotch broom, gorse, iceplant, and shore pine. Remove/manage vegetation on salt ponds, including levees.

Schedule/coordinate removal efforts to avoid disturbing nesting western snowy plovers. Appendix C, Table C-1 identifies 86 locations where removal of nonnative and other vegetation is either currently occurring or needs to be initiated to achieve management goals.

2.2.1.2 Replace exotic dune plants with native dune vegetation where it is likely to improve habitat for western snowy plovers. Land managers should make special efforts to reestablish native dune plants in western snowy plover nesting habitat, while concentrating on removal of nonnative vegetation. Native dune vegetation includes American dunegrass (*Leymus mollis*), beach morning glory (*Calystegia soldanella*), pink sand-verbena (*Abronia umbellata*), yellow sand verbena (*Abronia latifolia*), beach bursage (*Ambrosia chamissonis*), grey beach pea (*Lathyrus littoralis*), whiteleaf saltbush (*Atriplex leucophylla*), and California saltbush (*Atriplex californica*). These efforts should be targeted for coastal dune sites that currently support nonnative vegetation species such as introduced beachgrass (*Ammophila* spp), and should be combined with removal of this invasive plant. Seeds of local native dune plants collected within approximately 32 kilometers (20 miles) of the site to be planted should be used as replacement plant stock. Revegetation efforts should be monitored to ensure that the amount of vegetative cover is compatible with suitable breeding habitat for plovers.

2.2.2 Deposit dredged material to enhance or create nesting habitat. Near-shore (littoral drift) and on-shore disposal of dredged material seems to be beneficial for perpetuating high quality western snowy plover nesting habitat in some instances and should be encouraged where appropriate. However, monitoring of habitat characteristics before, during, and after projects is needed, particularly in cases of

large operations occurring on sites where western snowy plovers nest or are deemed likely to nest following the disposal operation. On-shore disposal of dredged material should be scheduled outside the nesting season and, where possible, during seasons when birds are not present. In addition, dredged material must be clean sand or gravel of appropriate grain size and must be graded to a natural slope.

2.2.2.1 Evaluate western snowy plover breeding and wintering sites listed in Appendix C and potential breeding sites to determine whether dredged materials may be used to enhance or create nesting habitat. Recovery Unit working groups should identify sites where dredged material may be used to enhance or create nesting habitat. Evaluation of sites should include impacts (short- and long-term) to existing western snowy plover habitat, likelihood of use by western snowy plovers, whether appropriate sources of clean dredged material exist, and opportunities to utilize material from dredging projects.

2.2.2.2 Develop and implement plans, including pre- and post-project monitoring, to use dredged material to enhance or create nesting habitat at the sites identified in action 2.2.2.1. Plans to implement use of dredged material to enhance or create nesting habitat should be developed for sites identified in action 2.2.2.1. Plans should include measures to minimize impacts to western snowy plovers and existing habitat and should include pre- and post-project monitoring to determine effectiveness of the project in enhancing or creating nesting habitat.

2.2.3. Implement beach nourishment activities if action 4.1.2 indicates beach nourishment activities are effective in enhancing western snowy plover habitat. Beach nourishment activities have the potential to enhance western snowy plover habitat, but should be carefully evaluated to weigh the probable adverse and beneficial effects on plovers and on other sensitive coastal dune species.

2.2.3.1 Evaluate and identify sites where beach nourishment activities may be effective in creating and enhancing western snowy plover habitat. Potential sites include those sites where natural coastal processes have been disrupted (*i.e*. by coastal development, beach stabilization, construction of rock jetties and seawalls, etc.). Evaluation of sites should consider potential for adverse effects to existing western snowy plover habitat, whether appropriate sand sources are available, and whether long-term benefits are likely to occur.

2.2.3.2 Develop and implement beach nourishment plans, including pre- and post-project monitoring for the sites identified in action 2.2.3.1. Plans to implement beach nourishment activities to enhance or create nesting habitat should be developed for sites identified in action 2.2.3.1. Plans should include measures to minimize impacts to western snowy plovers and existing habitat and should include pre- and post-project monitoring to determine effectiveness of the project in enhancing or creating nesting habitat.

2.2.4 Create, manage, and enhance coastal ponds and playas for breeding habitat. Coastal ponds and playas, including salt ponds, should be enhanced and created to improve breeding habitat. Significant opportunities for management of nesting plovers currently exist within San Francisco Bay salt ponds, Moss Landing

Wildlife Area, Bolsa Chica wetlands, and south San Diego Bay salt ponds. However, salt ponds should only be created or enhanced at existing salt pond habitat; they should not be used for mitigation or compensation of coastal beach-dune or other western snowy plover habitats. Creation of habitat should be emphasized in areas that would preclude or reduce recreational impacts. Appendix C, Table C-1 identifies 15 locations where habitat enhancement is either currently in place or needs to be initiated to achieve management goals. Additional sites also may provide opportunities to enhance western snowy plover breeding habitat.

2.3 Prevent disturbance of breeding and wintering western snowy plovers by people and domestic animals. Disturbance by humans and domestic animals causes significant adverse impacts to breeding and wintering western snowy plovers. Because human disturbance is a primary factor affecting western snowy plover reproductive success, land managers should give the highest priority to implementation of management techniques to prevent disturbance of breeding birds. Western snowy plover breeding and wintering sites are highly variable in their amount of recreational activity. Land managers should conduct site-specific evaluations to determine whether recreational activities, domestic animals, and off-road vehicles pose a threat to plovers and implement appropriate measures. As information is gathered, it should be incorporated into conservation efforts. Management plans (Actions 3.3.1, 3.3.2, and 3.4) should include appropriate human/domestic animal access restrictions to prevent disturbance of western snowy plovers. Management techniques described below can reduce impacts of beach recreation on western snowy plovers, but they must be implemented annually as long as the demand for beach recreation continues.

2.3.1 Prevent pedestrian disturbance. Management measures to protect western snowy plovers should be determined on a site-by-site basis; factors to consider include the configuration of habitat as well as types and amounts of on-going pedestrian activity. On national wildlife refuges and State natural preserves within the

California State Parks system, where protection of wildlife is the paramount purpose of Federal and State ownership, western snowy plover habitat should be closed during the breeding season. Other areas also should be closed when necessary to adequately protect breeding western snowy plovers.

2.3.1.1 Restrict access to areas used by breeding western snowy plovers, as appropriate. Unless a beach is closed to public entry, or use is minimal, posting and/or fencing of nesting areas is recommended to discourage pedestrian use of the area and allow for plover courtship and prenest site selection, to prevent obliteration of scrapes, crushing of eggs or chicks, and repeated flushing of incubating adults. Any access restrictions should be accompanied by outreach programs to inform the public of any restrictions and provide educational material on the western snowy plover (see action 5).

2.3.1.1.1 Seasonally close areas used by breeding western snowy plovers. Dates of seasonal closures/restrictions should be based on the best data available, and be coordinated by geographic region for consistency in communicating with the public. Closures may be determined on a year-to-year basis and other options such as fencing may be considered first. To provide broods with access to foraging areas, closures should cover the area down to and including the water line, where practical. Areas where territorial plovers are observed also should be closed to prevent disruption of territorial displays and courtship. Because nests can be difficult to locate, especially during egg-laying, closure of these areas will also prevent accidental

crushing of undetected nests. Appendix C, Table C-1 identifies 81 locations where public access is either currently restricted or it is recommended it be restricted to achieve management goals.

2.3.1.1.2 Fence areas used by breeding western snowy plovers. Fencing to keep people and beach activities out of nesting/brood rearing areas should not hinder chick movements, unless fencing is specifically meant to keep chicks from being harmed. Areas with a pattern of nesting activity in previous year(s) or where territorial plovers are observed should be fenced before plovers begin nest-site selection. Because nests can be difficult to locate, especially during egg-laying, closure of these areas will also prevent accidental crushing of undetected nests. Symbolic fences (one or two strands of 1/4 inch plastic-coated steel cable strung between posts) with signs identifying restricted areas substantially improve compliance of beach-goers and decrease people's confusion about where entry is prohibited. On portions of beaches that receive heavy human use during the breeding season, fencing of prime brood-rearing areas to exclude or reduce numbers of pedestrians also should be implemented to contribute to the survival and well-being of unfledged chicks. Appendix C, Table C-1 identifies 64 locations where nesting areas are fenced or where fencing is recommended to achieve management goals.

2.3.1.1.3 Post signs in areas used by breeding western snowy plovers. Areas with a pattern of nesting activity in previous year(s) should be posted before plovers begin nest-site selection. On portions of beaches that receive heavy human use during the breeding season, posting of prime brood-rearing areas to exclude or reduce numbers of pedestrians also should be implemented to contribute to the survival and well-being of unfledged chicks. Appendix C, Table C-1 identifies 65 locations where exclusionary signs are in place or recommended to achieve management goals.

2.3.1.2 Locate new access points and trails well away from western snowy plover nesting and wintering habitat, and modify existing access and trials as necessary. Recreational users such as campers, clammers, anglers, equestrians, collectors, *etc.*, should be encouraged to consistently use designated access points and avoid restricted areas. Roads, trails, designated routes, and facilities should be located as far away from western snowy plover habitat as possible. Recreationists using boats should be restricted or prohibited from areas being used by the western snowy plover. Appendix C, Table C-1 identifies 67 locations where boat use is currently and/or is recommended to be prohibited or restricted, and 81 locations where access is currently and/or is recommended to be prohibited or restricted to achieve management goals.

2.3.1.2.1 Evaluate existing and planned access at all breeding and wintering locations and determine whether access may adversely affect western snowy plovers and their habitat. Review of access points should include evaluating level of and timing of use by recreational users and level of effects on the western snowy plover.

2.3.1.2.2 For sites where access is determined in action 2.3.1.2.1 to adversely affect western snowy plovers, develop and implement plans to minimize effects. Actions that could minimize effects of access include seasonal restrictions, signs, fencing, or relocation or modification of access points or trails.

2.3.2 Implement and enforce pet restrictions. It is preferable that land managers prohibit pets on beaches and other habitats where western snowy plovers are present or traditionally nest or winter because any noncompliance with leash laws can cause serious adverse impacts to western snowy plovers. If pets are not prohibited, they should be leashed and under manual control of their owners at all times. Pets should be prohibited on beaches and other western snowy plover habitats if, based on observations and experience, pet owners fail to keep pets leashed and under full control.

Land managers should document the type and frequency of infractions of rules and regulations requiring pets on leash. This information, including the number of verbal warnings, written warnings, and notices to appear (citations), should be documented so that comparisons can be made between locations. This documentation could help ensure that adequate effort is being

made to enforce pet regulations. Appendix C, Table C-1 identifies 120 locations where pets are currently prohibited or restricted and where they are recommended to be prohibited or restricted to achieve management goals.

2.3.3 Annually review existing recreational activities at breeding and wintering sites listed in Appendix C and develop and implement plans to prevent disturbance from disruptive recreational activities where western snowy plovers are present. Some recreational activities may disrupt western snowy plover breeding and foraging, attract predators, destroy nests, or degrade habitat. Management of a variety of recreational activities is needed to minimize these effects. Special events, including sporting events, media events, fireworks displays, and beach clean-ups, attract large crowds and require special attention. Special events planned in western snowy plover nesting areas should not be held during the plover nesting season. Early planning and coordination with local resource agencies should be emphasized. Fireworks should be prohibited on beaches where plovers nest. When fireworks displays are situated to avoid disturbance to western snowy plovers, careful planning also should be conducted to assure that spectators will not walk through and throw objects into plover nesting and brood-rearing areas. Sufficient personnel also must be on-site during these events to enforce plover protection measures and prevent use of illegal fireworks in the vicinity of the birds.

Flying of kites and model airplanes should be managed to avoid adverse impacts in areas where nesting plovers are present. Sports such as ball- and frisbee-throwing should be managed within hitting and throwing distance of western snowy plover nesting areas because of tendencies for stray balls and frisbees to land in closed areas where they can smash nests and where efforts to remove them can disturb territorial or incubating birds. Camping and beach fires should be prohibited in western snowy plover

nesting areas during the nesting season. Appendix C, Table C-1 identifies 11 locations where kites are and/or should be prohibited and/or restricted to achieve management goals, but additional recreational activities also should be reviewed for potential adverse effects to western snowy plovers.

2.3.4 Inform beach users of restrictions on driftwood removal through posting of signs. Driftwood removal should not be allowed unless needed to create sufficient open habitat to induce nesting activities. In such cases, driftwood removal should occur outside of the breeding season. Appendix C, Table C-1 identifies 26 locations where driftwood collection restrictions currently occur and/or are recommended for restriction to achieve management goals. Driftwood removal should also be minimized through enforcement as identified in Action 2.3.8.

2.3.5 Prevent disturbance, mortality, and habitat degradation by prohibiting or restricting off-road vehicles, including beach-raking machines. Recreational off-road vehicles should be prohibited or restricted at western snowy plover breeding areas, as appropriate. Violations associated with unauthorized entry of recreational off-road vehicles into closed or fenced nesting areas should be strictly enforced. During the nonbreeding season, enforcement of violations regarding recreational off-road vehicle use should continue where western snowy plover use of beaches occurs year-round. Because of potential habitat degradation caused by mechanized beach cleaning, alternatives to this type of beach cleaning are recommended, including manual beach cleaning by agency staff and volunteers knowledgeable about the need to maintain coastal dune habitat characteristics and to protect western snowy plovers. Appendix C, Table C-1 identifies 101 locations where off-highway vehicles are currently and/or recommended for prohibition or restriction to achieve management goals.

Essential vehicles within western snowy plover nesting areas should: (1) travel on sections of beaches where unfledged chicks are present only if absolutely necessary; (2) when possible, travel through chick habitats only during daylight hours; (3) travel at less than 8 kilometers (5 miles) per hour; (4) use a guide familiar with western snowy plovers; (5) use open four-wheel motorized off-highway vehicles or nonmotorized all-terrain bicycles to improve visibility; (6) avoid driving on the wrack (marine vegetation) line and during high-tide periods; (7) travel below the high tide mark and as close to the water line as is feasible and safe; and (8) avoid previous tracks on the return trip.

2.3.6 Implement restrictions on horseback riding in nesting areas through annual coordination with commercial and private equestrian operations and groups. Strategies to reduce adverse impacts to nests from commercial and private equestrian use of western snowy plover habitat should include: (1) use of designated trail systems or, when absent, use of the wet sand area in areas not closed to the water line; (2) advance coordination with local resource agencies regarding locations of nests and broods; (3) compliance with closed or restricted areas; and (4) informing riders of the need for restrictions to protect habitats used by western snowy plovers and other sensitive coastal dune species. Avoid high-tide periods. Violations regarding unauthorized entry into closed or restricted breeding areas by equestrians should be strictly enforced. Appendix C, Table C-1 identifies 72 locations where restriction or prohibition of horses currently exists or is recommended to achieve management goals.

2.3.7 Implement and enforce restrictions on livestock in nesting areas through annual coordination with land managers, landowners, and grazing lessees. Strategies to reduce adverse impacts to nests from livestock grazing in western snowy plover habitat should include: (1) advance coordination with local resource agencies regarding locations of nests and broods; (2)

compliance with closed or restricted areas; and (3) informing landowners of the need for restrictions to protect habitats used by western snowy plovers and other sensitive coastal dune species. Violations regarding unauthorized entry into closed or restricted breeding areas by livestock should be strictly enforced. Appendix C, Table C-1 identifies 18 locations where restriction or prohibition of livestock currently exists or is recommended to achieve management goals.

2.3.8 Enforce regulations in areas used by breeding western snowy plovers. Land managers should monitor violations and enforce regulations within all closed and restricted areas, with particular attention to areas where nests or broods are present.

2.3.8.1 Determine enforcement needs for western snowy plover breeding and wintering sites and provide sufficient wardens, agents, or officers to enforce protective measures in breeding and wintering habitat. Wardens are especially needed on heavily-used beaches during the peak recreational season, which coincides with the western snowy plover breeding season in many locations. Federal, State, and local authorities should provide a coordinated law enforcement effort to eliminate activities that may adversely impact western snowy plovers, such as illegally-parked vehicles, trespassing off-road vehicles, pedestrians, pets in restricted areas, illegal or unauthorized activities (*e.g.*, fireworks, beach fires, driftwood removal), pets off leash, and littering. Patrols and enforcement are needed to ensure compliance and to make sure restrictive measures are successful. Specific actions to be implemented include patrols in protected areas (see action 2.3.8.2) and car patrols to prevent illegal driving and parking. Appendix C, Table C-1 identifies 105 locations where

enforcement of regulations currently occurs or is recommended to occur to achieve management goals.

2.3.8.2 Develop and implement annual training programs for enforcement personnel and others who work in western snowy plover breeding habitat to improve enforcement of regulations and minimize effects of enforcement actions on western snowy plovers and their habitat. Federal, State, and local enforcement personnel and others who work in western snowy plover habitat should be trained to be familiar with the Endangered Species Act and other wildlife conservation statutes, and with the measures recommended in this recovery plan. Training, especially specific training for professional law enforcement agents regarding investigation of potential wildlife and Endangered Species Act violations, should be coordinated with local U.S. Fish and Wildlife Service Law Enforcement offices. It is essential that wardens, whether professional or volunteers, (1) be thoroughly trained in procedures for conducting patrols in a manner that minimizes risk to plovers; (2) have at least basic knowledge of western snowy plovers for public education purposes; and (3) be trained to handle potentially confrontational situations. *In cases involving take of listed species, it is essential that investigations be conducted only by trained, certified, and professional law enforcement agents.* Our local Law Enforcement office should be informed *immediately* whenever evidence of suspected take of western snowy plovers is encountered.

Enforcement personnel should be instructed in measures that can minimize effects of enforcement actions on western snowy plovers. Where the extent of habitat to be protected is large, making foot patrols infeasible, horses,

four-wheel all-terrain vehicles/off-road vehicles, or nonmotorized all-terrain bicycles, are preferred over trucks, automobiles, *etc*., because they afford improved visibility for operators. Except during emergencies, vehicle speed should not exceed 8 kilometers (5 miles) per hour and horses should be ridden at a walk only. In addition to providing maximum visibility for operators, horse and foot patrols by uniformed personnel have the added advantage of providing informational/educational interactions with beach visitors to promote compliance with plover protection measures.

Enforcement and emergency response personnel (such as search and rescue, and fire) should be well aware of potential western snowy plover locations. These locations should be named as avoidance areas as a part of their plans and training exercises. Enforcement patrols should use the same access trails as beach visitors; if additional access points are needed, they should be the minimum necessary and as far away from nesting plovers as possible.

2.3.9 Develop and implement a program to annually coordinate with local airports, aircraft operations, and agency aircraft facilities to facilitate compliance with aviation regulations regarding minimum altitude requirements. Each recovery unit working group should develop a list of local airports, aircraft operations, and agency aircraft facilities within each recovery unit. Working groups, land managers, and the U.S. Fish and Wildlife Service should annually inform them of western snowy plover breeding areas that should be avoided by aircraft operations or where minimum altitude requirements should be enforced to minimize disturbance of western snowy plovers. Aircraft operations within western snowy plover habitat should require a minimum altitude of 152 meters (500 feet) for aircraft and a possibly higher altitude for

helicopters. Aircraft operations that have already established guidelines allowing aircraft to fly under the 152-meter (500-foot) threshold should raise the limits to this minimum threshold or higher as needed. Exceptions such as use for low-altitude military training should be addressed in coordination with the appropriate Fish and Wildlife Office through section 7 consultation.

Ultralight aircraft are a new potential source for negative effects to the snowy plover. Ultralight aircraft landed on nesting plover beaches at Point Reyes National Seashore in 2003. These aircraft are sometimes associated with an airport but often are kept on ranches or other private lands (S. Allen *in litt.* 2004).

In addition, land managers should report suspected violations of aviation regulations in western snowy plover nesting areas during the breeding season. Suspected violations and the aircraft's registration number should be reported to law enforcement officers and, if appropriate, the Federal Aviation Administration. If not in violation of aviation regulations (*e.g.*, helicopters), a description of the helicopter should be reported to law enforcement officers so they can notify the operator of the presence of, and potential for take of, western snowy plovers in nesting areas.

2.4 Prevent excessive predation for western snowy plovers. Land managers should employ an integrated approach to predator management that considers a full range of management techniques. Managers may need to reevaluate and clarify their policies on the management of predator populations and/or habitat where predation might be limiting local western snowy plover populations. In particular, policies that prohibit management of native predator populations, even when human-abetted factors have caused substantial increases in their abundance, may be counter-productive to the overall goal of protecting "natural" ecosystems.

In addition to predator management activities by on-site biologists, assistance from the U.S. Department of Agriculture (Wildlife Services

Branch) biologists, State wildlife agency furbearer biologists, biologists specializing in avian predators, and professional trappers should be sought and used as needed and appropriate. Federal, State, and local agencies and the general public should be aware of the adverse consequences to listed species if needed predator control measures are prohibited or restricted. Appendix C, Table C-1 identifies 61 locations where predator control currently occurs or is recommended to achieve management goals. Below are specific means of predator control.

2.4.1 Manage litter and garbage and its removal to minimize attracting predators on western snowy plover habitat. Litter and garbage in western snowy plover habitat may increase predation of western snowy plovers by providing food that attracts predators and encourages increased predator populations. Appropriate management of litter and garbage, particularly in areas that receive heavy recreational use, is needed to prevent or minimize excessive predation.

2.4.1.1 Implement and enforce anti-littering regulations. Litter should not be allowed in western snowy plover breeding areas to avoid attracting predators. Littering ordinances should be enforced year-round.

2.4.1.2 Evaluate the effects of current litter and garbage management on predation of western snowy plover at breeding and wintering sites. All sites in Appendix C should be evaluated to determine whether garbage and litter affect predation on western snowy plovers by attracting predators.

2.4.1.3 Develop and implement garbage and litter management plans for all sites identified in action 2.4.1.2 where litter and garbage contribute to predation on western snowy plovers. Plans for managing litter and garbage should be incorporated into

long-term protection and management efforts developed and implemented under action 3. Beachgoers should be discouraged from leaving or burying trash or food scraps on the beach. Trash cans should not be located on the beach unless there is no other recourse to prevent littering. Emptying cans in the evening instead of leaving them overnight is preferable. Fish-cleaning stations should be located well away from plover breeding areas. Land managers should supply covered or scavenger-proof trash receptacles at access points and away from western snowy plover habitat, and receptacles should be routinely emptied. Until predator-proof trash containers can be installed, existing trash cans should be emptied frequently to reduce attractiveness and availability of their contents to scavenging predators. Land managers should also provide toilets at access points and away from western snowy plover habitat to discourage people from using the dunes.

Although removal of trash from the beach reduces predation threats, beach-raking should be avoided year-round to protect breeding and wintering western snowy plovers (see action 2.3.5). Beach-raking of western snowy plover habitat also should be avoided because it removes plover food sources. Trash should be selectively removed from the beach manually, but natural materials, including shells, kelp, and driftwood, should be left intact (see action 2.3.4).

2.4.2 Annually identify predator perches and unnatural habitats attractive to predators and remove where feasible. Planners should not allow unnatural habitats or other predator attractants to be placed near western snowy plover nesting locations. Where feasible, land managers should remove from western snowy plover breeding locations any exotic vegetation, perches, and other

features that attract avian and mammalian predators. Where signs and fences are necessary as part of management to protect plover breeding areas, attempts should be made to design them in a way that will deter their use by predators (*e.g.*, install spikes on fence posts).

2.4.3 Erect predator exclosures to reduce western snowy plover egg predation and improve productivity (number of fledglings per male) where appropriate. Guidelines for the use of predator exclosures to protect nesting western snowy plovers are contained in Appendix F. Exclosures are a valuable tool for countering human-abetted predation threats to western snowy plover eggs, but they are not appropriate for use in all situations, nor do they provide any protection for mobile plover chicks, which generally leave the exclosure within one day of hatching and move extensively along the beach to feed. Exclosures should be used in conjunction with an integrated predator management program. Also, exclosures must be carefully constructed, monitored, and evaluated by qualified persons. In some areas, avian predators have learned over time to associate exclosures with a source of prey (J. Buffa *in litt.* 2004). String (twine) or a more substantial plastic stealth material may be needed on top of exclosures to deter avian predators. Appendix C, Table C-1 identifies 53 locations where exclosures are currently used or recommended for use to achieve management goals.

The use of exclosures (small circular, square, or triangular metal fences that can be quickly assembled) to deter predator and human intrusion is recommended as one of the most effective management tools to protect nests (see Appendix F for exclosure protocols). However, it should be recognized that while exclosures provide nest protection, they do not ensure survival of chicks to fledging age and may contribute to predation on adults, so their use should be evaluated carefully and may not substitute for other measures

that reduce human disturbance (2.3) or control predation (2.4.1, 2.4.2, 2.4.3, 2.4.5).

2.4.4 Evaluate the need for and feasibility of predator removal and implement removal where warranted. Where predators have been identified through monitoring to adversely affect western snowy plover breeding success and/or survival and cannot be adequately controlled through use of exclosures, land managers should evaluate the need for and feasibility of predator removal. Removal of predators should be pursued where it is feasible, warranted, humanely conducted, and useful. Situations that may especially warrant predator removal include those where nonnative predators such as red fox (*Vulpes vulpes regalis*), feral cats, and Norway rats (*Rattus norvegicus*) are present, where predators have been introduced to islands, where predator range extensions have been human-abetted, or where high rates of western snowy plover adult, chick, or egg predation (which cannot be countered with predator exclosures or other aversion methods) are occurring. Nonnative predators should be lethally controlled in plover nesting habitat. Native predators should be removed or controlled by nonlethal means whenever possible. Gulls also should be discouraged from establishing and expanding nesting colonies at western snowy plover nesting areas, and land managers should determine whether existing gull colonies warrant removal. If removal is not warranted, exclosures around plover nests should be used to prevent large flocks of roosting gulls from trampling plover nests.

Federal and State permits must be obtained to legally capture, kill, or hold and release birds protected under the Migratory Bird Treaty Act and State laws. Also, individuals responsible for capturing such birds and the holding facility must have the proper Federal and State permits, and Federal land managers must document that such activities are in compliance with the National Environmental Policy Act. Biological considerations for determining whether

removal of avian predators is appropriate include the time of year (to assess whether the predator is caring for young or is a fledgling itself), whether the predatory bird is a resident or migrating through western snowy plover nesting habitat, and whether the predatory bird is a sensitive species or listed under the Endangered Species Act. Because of the potential for swift and significant losses of plovers by avian predators, land managers should plan in advance to complete the necessary procedures and secure needed permits to effectively deal with cases of high negative impact on western snowy plovers. If feasible, removal of native predators should focus on problem individuals rather than populations. Possible control methods include egg addling, nest removal, translocation of problem individuals, and holding in captivity with later release after plover breeding season. State permits must also be obtained as appropriate for the capture and removal of problem mammals (*e.g.*, raccoons, skunks, and opossums). In 2001, the California Coastal Commission determined that predator management in western snowy plover habitat on Vandenberg Air Force Base was also subject to Coastal Consistency review under the Coastal Zone Management Act.

2.4.5 Remove bird and mammal carcasses in western snowy plover nesting areas. Where practical and not disturbing to western snowy plovers, dead birds and mammals that wash up on the beach in close proximity to plover nests should be removed to reduce the attraction of predators to plover nests. Removal of carcasses of marine mammals and species listed under the Endangered Species Act should be coordinated with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service.

2.5 Protect western snowy plovers and their breeding and wintering habitat from oil or chemical spills. Land managers should develop oil/chemical spill emergency response plans that provide for protection of known western snowy plover breeding areas. The U.S. Coast Guard should update their emergency response measures to include protective

measures for the western snowy plover. In the event of a spill in the vicinity of a western snowy plover nesting or feeding area, efforts should be made to prevent oil/chemicals from reaching these beaches. Clean-up operations should be prompt, but agencies should exercise special care during remediation efforts and coordinate closely with us to prevent accidental destruction of nests and/or excessive disturbance of breeding adults, nests, or chicks. Response plans should include applicable recommendations contained in this recovery plan (*e.g.*, Action 2.3.5 regarding essential vehicles).

Efforts must be made to minimize the likelihood of oil or chemical spills in plover wintering areas. Land managers should develop oil/chemical spill emergency response plans that provide for protection of known plover wintering areas. The U.S. Coast Guard should update their emergency response measures to include protective measures for the western snowy plover. Shorebird or coastal ecosystem protection plans developed by State or local agencies to address oil/chemical spills should also include protection measures for western snowy plovers. In the event of a spill in a known western snowy plover wintering area, efforts should be made to prevent oil/chemicals from impacting plovers and unavoidable impacts should be documented. Restoration efforts should begin expeditiously, but agencies should exercise special care and coordinate closely with us to prevent excessive disturbance to wintering western snowy plovers. Further, habitat restoration efforts must be conducted in compliance with the National Environmental Policy Act and the Coastal Zone Management Act.

If western snowy plovers or their habitat sustain injury due to oil/chemical spills, the responsible parties should restore the areas to their original condition or the Federal Government (U.S. Coast Guard) should lead the clean-up effort; appropriate claims should also be filed under the Natural Resource Damage Assessment regulations to recover damages and undertake relevant restoration work. Assessment of natural resource damages is facilitated by availability of baseline data on pre-spill conditions. Therefore, whenever possible, agencies that own or manage

western snowy plover habitat should collect baseline data on behavior, reproduction, distribution, abundance, and habitat use. The baseline information on plover distribution and habitat use should also be supplied to the Area Committees that develop and update regional spill contingency plans so that this information can be incorporated into pre-spill planning efforts for protection of sensitive environments and species. Oil spill emergency response personnel should be well aware of potential plover locations. These locations should be named as avoidance areas as a part of their training exercises. Appendix C, Table C-1 identifies 4 locations where contaminant removal is occurring or is recommended to achieve management goals.

2.5.1 U.S. Fish and Wildlife Service biologists should participate in Area Committees responsible for maintaining the Area Contingency Plans for the Pacific Coast to facilitate the updating of spill response plans to include protection of western snowy plovers. Active participation in the Area Committees would require funding for staff participation from the six U.S. Fish and Wildlife Service offices responsible for the coastlines of California, Oregon and Washington.

2.5.2 Assign monitors to beaches that are inhabited by western snowy plovers to protect western snowy plovers from injury during spill responses. Monitors would be responsible for identifying areas of beach that are in use by plovers and directing response personnel and vehicles around these sensitive areas. Potential monitors should be identified in advance, and, where necessary, retained under contract so they can begin work immediately in the event of a spill. Spill response may require approximately two weeks of cleanup work that should be monitored, with potentially five incidents of this magnitude per year.

2.6 Reduce adverse impacts of recovery efforts for other sensitive species, including those within the San Francisco Bay Recovery Unit, by compensating for the loss of western snowy plover breeding and wintering habitat. Management and recovery actions for other sensitive species carried out in western snowy plover habitat should be evaluated for adverse effects to western snowy plover habitat. All efforts should be made to conserve western snowy plover habitat and minimize adverse effects. Where this is not possible, any loss of western snowy plover habitat values should be compensated. Within coastal beach-dune habitats in Washington, Oregon, and California, compensation efforts should emphasize the removal of beachgrass (*Ammophila* spp.) for lost western snowy plover breeding habitat resulting from management for other sensitive species.

To compensate for the loss of existing western snowy plover breeding habitat values in San Francisco Bay from planned conversion to tidal marsh, appropriate salt ponds should be designated for protection and enhancement as western snowy plover breeding habitat. Currently, most western snowy plover breeding habitat occurs on levee roads, margins of active salt ponds, and pond bottoms of inactive salt ponds. Roads and levees provide lower quality habitat because of disturbance and ease of predator access. Any losses of western snowy plover breeding habitat should be replaced with habitat that provides similar or higher values (*i.e.*, salt ponds or salt pans) in concert with recovery actions implemented from the Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (U.S. Fish and Wildlife Service in prep.). Habitat enhancement for western snowy plovers should be phased in with scheduled tidal marsh restoration for other listed species. During this interim period, land managers should make all efforts to achieve the recovery criteria of 500 breeding adults within the San Francisco Bay Recovery Unit by intensively managing existing western snowy plover breeding habitat.

Any replacement of western snowy plover breeding habitat in San Francisco Bay should concentrate on areas where the necessary components of western snowy plover breeding habitat can be created.

These areas include locations where unvegetated salt pans, salt ponds, islets and levees, and tidal mudflats/sandflats can be created or enhanced. Also, attempts should be made to avoid areas that are adjacent to landfills or other high concentrations of potential predators. Unless it is shown to be infeasible, creation and enhancement of western snowy plover breeding habitat should be emphasized in areas that currently support high numbers of breeding plovers and/or are not conducive to salt marsh restoration. The area to be managed for western snowy plovers should be sufficient to support a population of 500 breeding birds, estimated at 809 hectares (2,000 acres) of managed salt ponds. Most of these managed salt ponds should be located in South San Francisco Bay, which supports most of the existing western snowy plover population; however, some should also be located in the North Bay. Created or enhanced salt ponds should be intensively managed, similar to the Moss Landing Wildlife Area salt ponds. Management measures practiced at these salt ponds include maintenance of water control structures to maintain desired water levels, removal of excessive vegetation, and predator control.

2.7 Discourage pinnipeds from usurping western snowy plover nesting areas. Land managers should monitor pinniped colonies adjacent to western snowy plover breeding habitat and seek to keep breeding pinnipeds from occupying western snowy plover nesting areas during the breeding season where possible. Where conflicts occur, breeding pinnipeds should be discouraged from hauling out at western snowy plover breeding areas or be relocated, if feasible. Implementation of this action should be coordinated with the National Marine Fisheries Service to ensure compliance with the Endangered Species Act of 1973 and the Marine Mammal Protection Act of 1972 (16 U.S.C. 1361 *et seq.*).

2.7.1 In coordination with National Marine Fisheries Service, investigate feasibility and methods for discouraging pinniped use of western snowy plover nesting areas. Marine mammal populations have increased in many western snowy plover nesting areas. However, methods, effectiveness, and impacts of discouraging pinniped use of beaches are unknown and should be

investigated. Methods considered should be evaluated for their effects on western snowy plovers and their habitat as well as effectiveness in discouraging pinniped use. Workshops, such as those conducted by NMFS, for developing methods to reduce conflicts between pinnipeds and other species and human users should be held.

2.7.2 Identify areas where pinniped use is negatively affecting western snowy plover nesting and implement any appropriate methods identified in action 2.7.1. If effective methods are determined through action 2.7.1, sites where pinniped use negatively affects western snowy plover nesting should be identified and methods to discourage pinniped use implemented. Implementation of any methods to discourage pinniped use should be closely coordinated with the National Marine Fisheries Service to ensure compliance with the Endangered Species Act of 1973 and the Marine Mammal Protection Act of 1972 (16 U.S.C. 1361 *et seq.*).

3 Develop mechanisms for long-term management and protection of western snowy plovers and their breeding and wintering habitat. Long-term management and protection will be needed on Federal and non-Federal lands to meet recovery criteria for each recovery unit and to meet management goals for individual breeding and wintering locations. Development of long-term protection mechanisms should include opportunities for participation of various stakeholders in development of management options.

3.1 Establish and maintain western snowy plover working groups for each of the six recovery units to facilitate regional cooperative networks and programs. Development of regional cooperative networks and programs, coordinating local public and private land use planning with State and Federal land use planning, recovery planning, and biodiversity conservation is needed (Figure 12). To facilitate and develop regional cooperative programs, working groups have been established for each of the six recovery units and should be maintained. U.S. Fish and Wildlife

Service field offices should facilitate exchange of information among working groups. The working groups should be composed of representatives from the Federal, State, local, and private sectors; and meet regularly to assess western snowy plover population trends and coordinate plover recovery efforts. Each of the six working groups should use this recovery plan as a guide, but members will prioritize in cooperation with our Arcata Fish and Wildlife Office what management measures need to be implemented in their recovery unit because they have on-the-ground, day-to-day, experience about what is currently being done in these areas. Working groups should assist with updating information contained in Appendices B and C, tracking whether management goals are being met, and recommending changes in management goals and site-specific management actions, if necessary. Public outreach also should be a major focus of the working groups. An interchange of ideas between all six working groups should also occur on an on-going basis.

3.2 Develop and implement regional participation plans for each of the six recovery units that outline strategies to implement recovery actions. The 1994 Interagency Cooperative Policy on Recovery Plan Participation and Implementation Under the Endangered Species Act (U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration 1994) provides for a participation plan process, which involves all appropriate agencies and affected interests in a mutually-developed strategy to implement recovery actions. Participation plans for implementing recovery actions for the western snowy plover that include all partners should be developed by each of the six recovery unit working groups. In addition to outlining a strategy to implement recovery actions, the participation plan should include strategies for evaluation of progress and needs for plan revision. Participation plans may also achieve the policy's goal of providing for timely recovery of species while minimizing social and economic impacts. Plans should identify and prioritize specific recovery activities for each location identified in Appendices B and C,while considering the needs of the entire Pacific coast population. They

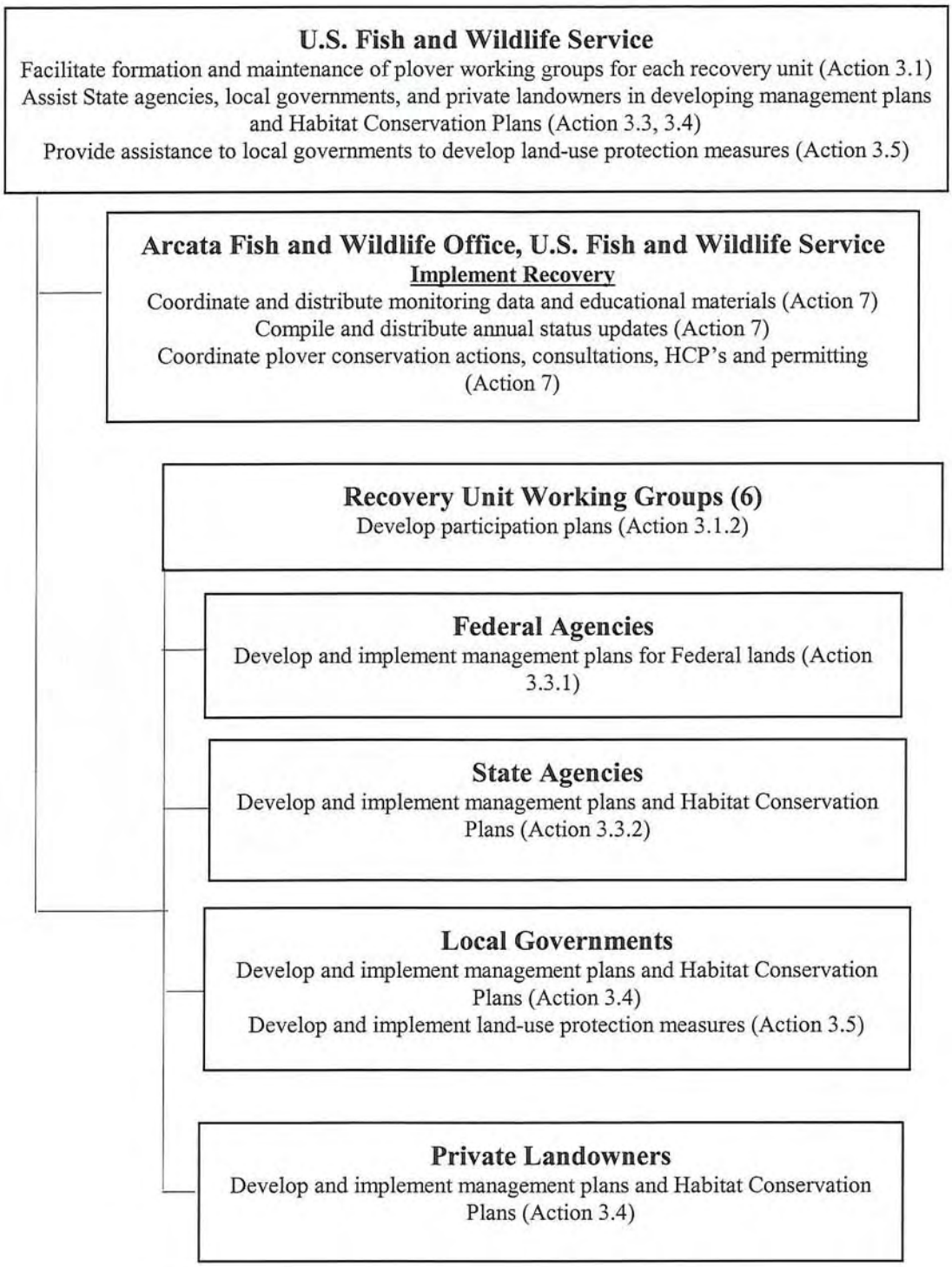

Figure 12. Chart of recovery planning and implementation efforts.

should include, but not be limited to: (1) endorsements by responsible agencies of their intent to seek economic resources for ongoing recovery actions; (2) outreach efforts to enhance the public's understanding of the western snowy plover's habitat needs (including an information and education strategy specific to area demographics and recreational activities); (3) economic incentives for conservation of western snowy plovers on private lands; and (4) all actions necessary to maintain western snowy plover productivity after delisting. Participation plans may also identify ways in which recovery actions for western snowy plovers will be covered as part of coastal ecosystem plans or other conservation measures.

3.3 Develop and implement management plans for all Federal and State lands to provide intensive management and protection of western snowy plovers and their habitat. Federal and State land managers should develop and implement management plans for all breeding and wintering locations (listed in Appendix B) that occur on Federal or State lands. Intensive management programs for western snowy plovers at national wildlife refuges should be implemented and annually evaluated to ensure they provide sufficient plover protection. Intensive management programs also should be implemented and periodically evaluated on lands administered by the National Park Service, U.S. Forest Service, U.S. Bureau of Land Management, U.S. Army Corps of Engineers, and Federal military bases, State wildlife areas, State ecological reserves, and State park lands (including State natural preserves and State seashores).

3.3.1 Develop and implement management plans for Federal lands. Federal agencies should develop or update, as appropriate, site-specific management plans that address threats to western snowy plovers, and adopt management measures for habitat protection and enhancement on Federal lands. Management plans should be implemented on an ongoing basis. Federal agencies also should review their proposed actions under the requirements of sections 7 and 10 of the Endangered Species Act prior to implementing the management plans because they may require authorization under section 7(a)(2) or 10(a)(1)(A).

3.3.2 Develop and implement management plans and habitat conservation plans on State wildlife areas, State ecological reserves, and State beaches. State agencies that manage State beaches, wildlife areas, or ecological reserves should develop and implement site-specific management plans and habitat conservation plans to minimize and mitigate impacts to western snowy plovers, and management measures for habitat protection and enhancement on State lands. State agencies should coordinate the development of habitat conservation plans with us and apply for section 10(a)(1)(B) permits under the Endangered Species Act if their management actions and allowed uses are resulting in incidental take of western snowy plovers.

3.4 Develop and implement habitat conservation plans or other management plans for western snowy plover breeding and wintering sites owned or managed by local governments and private landowners. We should provide assistance in the development of habitat conservation plans or other management plans to: (1) county and city governments that manage western snowy plover habitats; (2) private resource managers; and (3) owners of large amounts of private natural land. Habitat conservation plans are only required if an incidental take permit under section 10(a)(1)(B) of the Endangered Species Act is desired or required.

3.5 Provide technical assistance to local governments in developing and implementing local land use protection measures through periodic workshops. Federal and State agencies should assist local governments with jurisdiction over western snowy plover habitats in developing western snowy plover protection policies as part of new or revised local general plans, zoning policies, implementing measures, land use plans, comprehensive plans, and local coastal programs. For areas where beach closures are necessary, appropriate ordinances, administrative rules, and regulations should be developed by State and local governments to enable law enforcement officers to conduct necessary enforcement actions.

Technical assistance such as maps of western snowy plover habitats, identification of local threats, and recommended site-specific protective measures should be provided to coastal planners. At least two workshops within each recovery unit that provide local governments with basic information on the western snowy plover, its habitats, threats, and recommended protective measures should be conducted during the first 10 years of recovery plan implementation. Additional technical assistance likely will be required but should be provided on an as needed basis as new or revised general plans, policies, ordinances, and other land use protection measures are developed.

3.6 Develop and implement cooperative programs and partnerships with the California State Coastal Commission, the Oregon Department of Land Conservation and Development, the Washington State Parks and Recreation Commission, the Oregon Parks and Recreation Department, the California Department of Parks and Recreation, and the Oregon Department of Fish and Wildlife to ensure that they use their authorities to the fullest extent possible to promote the recovery of the western snowy plover. Federal and State agencies should assist the California State Coastal Commission, Oregon Department of Land Conservation and Development, Washington State Parks and Recreation Commission, Oregon Parks and Recreation Department, California Department of Parks and Recreation, and Oregon Department of Fish and Wildlife in reviewing, updating, and amending local coastal programs and policies for consistency with the western snowy plover recovery plan. This review should include protection of western snowy plover habitats, cumulative impacts to western snowy plovers, and policies or restrictive measures recommended in this recovery plan.

3.7 Obtain long-term agreements with private landowners. Agreements between Federal and State agencies and private landowners interested in western snowy plover conservation should be developed and implemented. Landowners should be informed of the significance of plover populations on their lands and be provided with information about available conservation mechanisms, such as agreements and incentive

programs. For private lands with potential occurrences of western snowy plovers, permission should be sought from landowners to conduct on-site surveys. If surveys identify plover populations, landowners should be informed of their significance and offered incentives to continue current land uses that support species habitat. Appendix C, Table C-1 identifies 69 locations where landowner cooperation/cooperative agreements are occurring or are recommended to achieve management goals.

3.8 Identify and protect western snowy plover habitat available for acquisition. Federal, State, and private conservation organizations should protect western snowy plover habitat as it becomes available, through fee title or conservation easement, *etc*. We and other organizations should identify sites that may become available for acquisition, and we should continue to evaluate excess Federal lands for western snowy plover habitat and apply to acquire them as they become available. Each recovery unit working group should develop a list of priority properties for acquisition, and Federal, State, and nongovernmental organizations should work with land conservancy groups to implement land trades and acquisitions. Management plans for the western snowy plover should be developed during the land acquisition process.

3.9 Ensure that section 10(a)(1)(B) permits contribute to Pacific coast western snowy plover conservation. Recommendations contained in this recovery plan should guide the preparation of habitat conservation plans under section 10(a)(1)(B) of the Endangered Species Act for western snowy plovers on the Pacific coast by providing information to: (1) guide potential applicants in developing plans that minimize and mitigate the impacts of take and (2) assist us in evaluating the impacts of any proposed conservation plans on the recovery of the Pacific coast western snowy plover population. The section 10(a)(1)(B) permit process may be a valuable mechanism for developing the long-term protection agreements called for in Actions 3.3.2 and 3.4, especially where significant population growth has already occurred and productivity exceeds l.0 fledged chick per male.

3.10 Ensure that consultations conducted pursuant to section 7 of the Endangered Species Act contribute to Pacific coast western snowy plover conservation. The recovery plan should also guide the evaluation of impacts to western snowy plovers pursuant to section 7(a)(2) of the Endangered Species Act. In evaluating these impacts, we and other Federal agencies should consider each of the breeding and wintering locations listed in Appendix B as important for recovery, and should also refer to the management goal breeding numbers for applicable locations and determine how the proposed project will affect those goals. Coordination with military bases which have western snowy plover populations is important to ensure that military activities do not affect the western snowy plovers or their habitat. Appendix C, Table C-1 identifies 54 locations where military uses are either restricted or recommended for restriction to achieve management goals.

4 Undertake scientific investigations that facilitate recovery efforts. Major gaps remain in our understanding of useful protection measures and conservation efforts for the western snowy plover. These include effective methods for habitat restoration, predator control, and monitoring population numbers and demographic characteristics.

4.1 Investigate effective methods for habitat restoration.

4.1.1 Evaluate the effectiveness of past and ongoing methods for habitat restoration by removal of introduced beachgrass and identify and carry out additional investigations necessary. Land managers, in coordination with recovery unit working groups, should summarize methods used to date for removal of introduced beachgrass and review their effectiveness. They also should pursue any additional field studies necessary to determine the most effective and cost-efficient methods for habitat restoration through removal of introduced beachgrass. Controlled studies with improved monitoring would provide needed direction for management decisions.

4.1.2 Evaluate the impacts and potential benefits of past and ongoing beach nourishment activities and identify and carry out any additional studies necessary to determine effects of beach nourishment activities on western snowy plover habitat. Beach nourishment activities should be carefully evaluated to weigh the probable adverse and beneficial effects on plovers and on other sensitive coastal dune species. Pre- and post-deposition beach profiles and faunal studies (including invertebrates) should be conducted to determine effects on habitat suitability for western snowy plovers. Consideration should be given to whether the projected long-term benefits are likely to occur.

4.2 Develop and test new predator management techniques to protect western snowy plover nests and chicks. Because many of the techniques currently used to reduce predation have disadvantages or limitations in effectiveness, new predator management techniques should be investigated. Assistance from the U.S. Department of Agriculture, Wildlife Services Branch, from State wildlife agency furbearer biologists, and other predatory bird and mammal specialists should be sought on these matters.

4.2.1 Develop higher-efficiency nest exclosures. Because exclosures must be deployed quickly, and currently-designed exclosures are heavy and labor- and time-intensive to erect, new exclosure designs should be tested. Prototypes should include lightweight materials that are easier to transport and a design that is easy to assemble and install.

4.2.2 Develop California least tern exclosures that prevent harm to western snowy plovers. Resource managers should continue to investigate modified designs for California least tern enclosures to further minimize western snowy plover mortality.

4.2.3 Identify, prioritize, and carry out needed investigations on control of native and nonnative predators. Aspects of the

ecology of problematic avian predators (*e.g.*, ravens and shrikes) and native mammals (*e.g.*, coyotes and gray foxes) that could be used to gain an understanding of how to control their impact on western snowy plover nesting areas during the plover breeding season should be investigated. Information also is needed on the applicability and usefulness of other control methods, including aversive techniques for conditioning predators to avoid foraging in western snowy plover nesting areas or preying on western snowy plover eggs, chicks, or adults. Investigation is also needed to develop methods to discourage gull colonies. Aversive techniques may include taste aversions, displaying predator carcasses, or installing electric fences. Effective modifications of signs and fencing to prevent their use as predator perches also requires investigation. While in many cases there appear to be practical obstacles to development of effective aversion techniques that can be efficiently applied in the field, the goal of reducing predation with minimum disruption to native predator populations that are important to overall ecosystem balance is desirable and any methods that appear potentially practical and useful should be evaluated for success and cost-effectiveness. Initial study trials might be done at sites or seasons where western snowy plovers are not present in order to minimize unplanned adverse impacts. Recovery unit working groups should identify and prioritize studies needed and inform us of their recommendations.

4.2.4 Identify, prioritize, and carry out needed investigations on predator management at the landscape level. Resource managers should investigate landscape-level management of predators that inhabit western snowy plover nesting areas. This management could include removal of predator nest sites and other predator attractants or habitat on lands surrounding western snowy plover breeding areas. Recovery unit working groups should identify and prioritize studies needed and inform us of their recommendations.

4.2.5 Investigate techniques for identifying predators responsible for individual nest predation events. Techniques should be developed to identify predators responsible for nest predation events so that appropriate management measures can be applied. Such techniques could include installation of a remote video camera to monitor western snowy plover nests and exclosures and identify problematical predators.

4.3 Improve methods of monitoring population size and reproductive success of western snowy plovers. Methods used to monitor western snowy plover populations have differed over time and from site to site. To measure progress toward recovery reliably, standard monitoring guidelines have been developed (Appendix J). Logistical and financial constraints likely will preclude complete coverage of all areas, so sampling methods should be developed.

4.3.1 Improve methods of monitoring western snowy plover population size. Not all western snowy plovers at a given location are detected during a single survey, such as the annual breeding-season window survey. Consequently, correction factors are necessary to extrapolate population size from window surveys. Correction factors are determined on a site-specific basis. Intensive monitoring and/or color banding make it possible to know the number of western snowy plovers present at a site. When a window survey is completed, the ratio of the total number of western snowy plovers to the number of western snowy plovers counted provides a correction factor that may be used for future window surveys of the site and for other sites with window surveys but without intensive monitoring. Site-specific correction factors should be obtained for all major nesting locations. When correction factors have been determined for many sites, patterns may emerge that allow correction factors to be applied more broadly.

4.3.2 Develop sampling methods for annually estimating reproductive success within each recovery unit. While it is extremely valuable to monitor clutch hatching success and chick fledging success at each site as a measure of habitat quality, it is critical to determine the number of young fledged per male for each recovery unit to measure the potential for population stability and growth. Measuring the number of young fledged per male requires intensive monitoring, and at sites with large numbers of birds, some method of identifying individual males. Extensive color banding of adults and their young, enabling determination of young fledged per male, has been undertaken in large portions of coastal Oregon, the shoreline of Monterey Bay, and coastal San Diego County for the past several years. These efforts should continue. Since there are insufficient color band combinations to monitor all individuals in every recovery unit, sampling procedures should be developed to color band adequate samples of males, and if necessary their chicks, in the other recovery units to obtain estimates of the number of young fledged per male. Color banding for measuring reproductive success should be integrated with banding for estimating population size.

4.3.3 Develop methods to monitor western snowy plover survival rates within each recovery unit. Extensive color banding of adult plovers and their young in coastal Oregon, the shoreline of Monterey Bay, and coastal San Diego County has enabled survival rates of adults and young to be calculated for several years (see Population Status and Trends and Survival sections). These efforts should continue. Information on survival rates of birds from other recovery units can be derived from birds banded for monitoring reproductive success or estimating population size.

4.4 Conduct studies on western snowy plover habitat use and availability.

4.4.1 Identify western snowy plover brood habitat and map brood home ranges. Brood movements should be mapped and distances

quantified to identify how large an area must be protected for broods. Determine home ranges of western snowy plovers through radio telemetry studies. Traditionally used brood habitat should be identified and protected through actions 2 and 3.

4.4.2 Identify components of high-quality western snowy plover brood rearing habitat. The elements of high-quality brood habitat should be determined to facilitate creation and enhancement of suitable characteristics at other breeding locations.

4.4.3 Quantify wintering habitat needs of western snowy plovers along the Pacific coast. The amount of habitat needed to support wintering western snowy plovers along the Pacific coast should be determined. This effort should include estimating the numbers of western snowy plovers that can be supported at wintering locations listed in Appendix B and identifying important site characteristics. This action will require consideration of wintering habitat quality along the Pacific coast of the United States and Mexico, and quantifying the combined interior and coastal populations.

4.4.4 Identify any important migration stop-over areas used by migrating but not by breeding or wintering western snowy plovers. Additional information on western snowy plover migration patterns is needed because migration involves expenditure of energy that may affect survival or productivity. Although monitoring and protection of breeding and wintering locations are currently higher priorities than protection of migration sites, further investigations of, and protective measures for, migration sites should be undertaken when feasible. Threats and management needs of identified migration stop-over habitat should be evaluated and included in management monitoring, and protection tasks (see action 1.6).

4.5 Develop and implement a research program to determine causes of adult western snowy plover mortality, including investigation of possible causes, magnitude, and frequency of catastrophic mortality. Determine causes of mortality and the stage in the annual cycle (*e.g.*, post-breeding, migration, winter, pre-breeding, breeding) at which mortality occurs for each sex and age class. This assessment can be done through intensive, bi-weekly monitoring to determine relative health and potential for disease. Monitoring could include fat content and weight related to the season.

4.6 Improve techniques for banding western snowy plovers. Improve the technique for banding birds to reduce injuries. Because western snowy plover injuries are usually associated with Federal metal bands but not with plastic bands, removal of U.S. Fish and Wildlife Service lettering from the inside of the metal band should be investigated. Eliminating use of the U.S. Fish and Wildlife Service metal band also should be considered. Experimentation with new techniques must be conducted cautiously and may need to include pre-testing on nonlisted surrogate species.

4.6.1 Compile information regarding number and types of banding injuries to western snowy plovers to determine extent and causes of banding injuries. Several banding injuries to western snowy plovers have been reported. However, there is currently no consistent reporting of injuries to determine the extent or types of injuries. Working groups should compile information on banding injuries to use in determining the type and extent of the problem and in developing a course of action. Information collected should include number of injuries, type of injury (abrasion, foot loss, broken leg, *etc.*), probable cause of injuries (foreign object lodged between band and leg, wearing of band, *etc.*), effect of injuries on behavior (breeding, foraging, predator avoidance), type of bands (plastic or metal) associated with injuries, whether metal bands had writing on the inside or other rough areas likely to cause abrasion or lodging of foreign object.

4.6.2 Review compiled information and determine and implement a appropriate course of action to minimize banding injuries. The information complied in step 4.6.1 should be reviewed to determine the appropriate course of action to minimize banding injuries. Review may reveal that banding injuries are rare or have little impact on breeding success or survival, in which case no changes to banding procedures may be necessary. However, extensive numbers of injuries or impacts on breeding success and survival may require actions such as changing the location of metal bands from the tarsus to tibiotarsus, discontinuing use of metal bands, or using different band types. All decisions regarding changes to banding procedures should consider effects of such changes to the type, quantity, and quality of data that may be gathered from banding efforts, and whether such changes will affect the ability to determine population trends, monitor success of management actions, or otherwise affect recovery efforts. For example, discontinuing use of metal bands may affect the ability to gather information on survival, longevity, and dispersal useful in analyzing population viability.

4.7 Identify effects of oil spills on western snowy plovers. Research should be conducted on the direct and indirect effects of oil spills on western snowy plovers, including, but not limited to: (1) how oil spills affect the plover's prey base; (2) chronic effects of oiling; (3) transmission of oil on partially-oiled birds from the breast to the egg; (4) at what stage oiled plovers need to be captured or re-captured; (5) preferable methods to remove oil from soiled birds; and (6) impacts to plovers during oil clean-up and remediation activities.

4.8 Monitor levels of environmental contaminants in western snowy plovers. When abandoned eggs and/or dead chicks that are not needed for law enforcement investigations become available, they should be collected for potential contaminants assessment. Egg removal and salvage of dead chicks should only be done by individuals possessing proper Federal and State authorizations. Chemical analysis of salvaged specimens should be

coordinated through our Division of Environmental Contaminants. All salvaged eggs should be analyzed for organochlorine pesticides, total polychlorinated biphenyls (PCB's), selenium, mercury, and boron.

All sampling should be opportunistic, based on availability of eggs that are known to be abandoned. Eggs should never be removed from the beach as long as there is any realistic chance that they might hatch. In the case of unhatched eggs from a partially hatched clutch, eggs should not be collected until at least 36 hours after the known hatch date of the other eggs. Full clutches should not be collected unless it is known that 35 or more days have elapsed since the last egg was laid. When this opportunistic sampling of failed eggs indicates potential problems with contaminants, follow up studies should be carried out (see action 4.9).

4.9 Design and conduct contaminants studies if monitoring of contaminants in action 4.8 indicates potential contaminants effects. When opportunistic sampling of failed eggs (action 4.8) indicates potential problems with contaminants, additional studies should be carried out to evaluate the extent of contamination in western snowy plover diets, its effects on nest success and egg hatchability, and its effects on various life stages of snowy plovers (eggs vs. adults). Thresholds when management action is required should be identified. When the target threshold is exceeded research should be conducted to identify the source.

4.10 Identify, prioritize, and carry out needed investigations of the effects of human recreation on western snowy plovers. Many studies on the effects of recreational activities on western snowy plovers have already been conducted. To avoid duplicating previous or ongoing efforts, recovery unit working groups should evaluate and prioritize additional study needs to determine the effects of human recreation on western snowy plover. Western snowy plover should be monitored for effects from recreational activities such as off-road vehicle riding, horseback riding, walking, jogging, fishing, aircraft, ultralight aircraft, and kite-flying.

4.11 Revise the population viability analysis (Appendix D), if needed, when sufficient additional information on demographic characteristics (survival rates, reproductive success) is available from each recovery unit and information is obtained on the probability and magnitude of catastrophic mortality events. As new information on population numbers, survival rates, and reproductive success are acquired from monitoring (actions 1.1 and 1.2), monitoring techniques are improved (action 4.3), and mortality sources and rates of mortality are determined (action 4.5), the population viability analysis should be reviewed and revised if additional information differs significantly from that used to construct the original analysis.

5 Undertake public information and education programs. Expanded efforts are needed to increase public awareness of the needs of western snowy plovers, other rare beach species, and the beach and dune ecosystem. Public outreach efforts should be a major focus of each of the working groups for the six recovery units. Appendix C, Table C-1 identifies 84 locations where public information and education is either currently occurring or is recommended to achieve management goals.

5.1 Develop and implement public information and education programs. Millions of beach recreationists come in contact with western snowy plover nesting and wintering areas each year. Disregard to signs, symbolic fencing, and leash laws by beach users can directly affect the productivity and health of western snowy plovers on those beaches. Public information and education efforts play a key role in obtaining compliance of beach recreationists with plover protection measures that, in turn, affect the birds' recovery. Central messages to the beach-going public include: (1) respect areas fenced or posted for protection of plovers and other rare beach species; (2) do not approach or linger near western snowy plovers or their nests; (3) if pets are permitted on beaches used by plovers, keep the pets leashed; (4) don't leave or bury trash or food scraps on beaches, as garbage attracts predators that may prey upon plover eggs or chicks; and (5) do not build wood structures that can be used as predator perches.

Because of the importance of information and education for the western snowy plover recovery effort, as part of this recovery plan, we developed an Information and Education Plan for the Western Snowy Plover, Pacific coast population (Appendix K).

5.2 Inform Federal, State, and local resource/regulatory agencies and local planning departments of threats to breeding and wintering western snowy plovers and their habitats. Periodic meetings and/or workshops should be held to inform Federal, State, and local resource management and regulatory agencies, and city and county planning departments about threats, research, and management needs for plovers. A network of public agency staff from each of the six recovery unit working groups should develop a coordinated approach to present this information to these agencies periodically, or as needed.

5.3 Develop and maintain updated information and education materials on western snowy plovers. Members of the six recovery unit working groups should develop new western snowy plover information and education materials for target audiences to stimulate public interest and awareness. In addition, all materials should be kept reasonably current regarding the status of the species and protection efforts. These materials should also explain the need for conservation of the beach and dune ecosystem and the plight of other rare beach-dwelling species. Videos detailing needed western snowy plover recovery actions by location and recovery unit should be developed, and might be efficiently produced in conjunction with updated public service advertisements.

5.4 Alert landowners and beach-goers about access restrictions within western snowy plover habitats. Land managers should begin providing informational and educational outreach at least 2 weeks prior to the onset of the nesting season to provide beach-goers and interested landowners with advance notice of impending restrictions on publicly-owned western snowy plover breeding habitats. This outreach is particularly important for the first year of restrictions. If necessary,

follow-up publicity that includes information on citations issued to violators should be implemented to help reinforce the message.

5.5 Provide trained personnel to facilitate protective measures, provide public education, and respond to emergency situations. Biologists, docents, volunteers, and other personnel should be trained to patrol western snowy plover nesting areas to monitor birds, distribute educational materials, respond to emergency situations, and ensure that beach-goers stay out of fenced areas and adhere to other plover protection measures. Biologists engaged in monitoring, management, or research activities should also advance the public's understanding of plover management needs.

5.6 Develop protocols for handling sick, displaced, injured, oiled, and dead birds or salvaged eggs. Land managers within each recovery unit should develop protocols for all trained personnel identifying who should be contacted when injured, dead, oiled, or displaced birds are found, and who is permitted to handle these birds. Federal and State salvage permits are necessary for the disposal of dead birds and the transportation of injured birds. Federal and State endangered species permits are necessary for wildlife rehabilitators to accept and care for injured and sick birds. Coordination with biologists that are monitoring and banding western snowy plovers is essential for capture and release of injured/rehabilitated birds. Live chicks that are found should not be moved or taken for rehabilitation as these chicks are often not abandoned, even though plover adults may not be obvious at the time the chicks are seen. Protocols should also be developed on how to collect and preserve salvaged eggs used for contaminants analysis.

5.7 Establish a distribution system and repository for information and education materials. Land managers must distribute information and education materials to target audiences. To reach the large population of potential beach-goers within a few hours' drive of many major metropolitan areas, broad-scale information and education mechanisms should be implemented, including distribution by mass media such as

newspapers, radio and television announcements, and internet web sites. Land managers should also focus their information and education efforts on user groups at beach parking lot entry stations and kiosks, visitor centers, marinas, beach-front housing developments, equestrian and angler access points, and locations providing off-road vehicle permits. Public outreach efforts should be directed to groups within the geographical location of the managed beaches (*e.g.*, to private and commercial equestrian users) and to groups outside of the area who use the beaches on a regular or seasonal basis (*e.g.*, to off-road vehicle associations from out-of-state or inland locations). Land managers, with the help of docents and volunteers, should coordinate with local school teachers to develop and present environmental education lesson plans and participatory activities for elementary and middle school groups.

We will act as a central repository for current and new information and education materials received; upon request, we will make these materials available to recovery unit working groups and the general public. We will also maintain information on western snowy plovers at our website (http://www.fws.gov/arcata). Major distributional efforts should also continue by Federal, State, and local agencies, and private conservation organizations.

5.8 Establish a reporting and distribution system for annual monitoring data and management techniques. Our Arcata Fish and Wildlife Office should coordinate and produce an annual report of submitted breeding and wintering monitoring data and distribute it to recovery unit working groups. This report should describe results of monitoring throughout the western snowy plover population's range. A distribution system should also be established for sharing information on predator management techniques, nest protection, etc. among working groups.

6 Review progress towards recovery and revise recovery efforts as appropriate. Communication, evaluation, and coordination play a major role in western snowy plover recovery efforts. Land managers within each of the six recovery unit working groups should review the effectiveness of their

management activities in coordination with other members of their working group, and revise management measures as appropriate. They should also provide results of annual population monitoring and the effectiveness of management activities to their working group and to our Arcata Fish and Wildlife Office.

6.1 Develop and implement a tracking process for the completion of recovery actions and the achievement of delisting criteria. A tracking process should be developed to track the completion of recovery actions and progress toward delisting. Utilizing information from specific actions, the recovery criteria such as the implementation of management activities can be tracked. Information from the tracking process can be used in outreach and in helping identify when the western snowy plover can be delisted.

6.2 Review progress toward recovery annually within each recovery unit working group and revise site-specific recovery efforts as appropriate to meet recovery goals. Communication, evaluation, and coordination play a major role in western snowy plover recovery efforts. Land managers within each of the six recovery unit working groups should review the effectiveness of their management activities in coordination with other members of their working group, and revise management measures as appropriate. They should also provide results of annual population monitoring and the effectiveness of management activities to their working group and to our Arcata Fish and Wildlife Office.

Additionally, the working groups in conjunction with land managers should review success in meeting management goal breeding numbers recommended in Appendix B, and develop recommendations for any necessary revisions to those numbers based on site-specific conditions. Ongoing and needed management activities recommended in Appendix C also should be evaluated and revised according to site specific conditions. Revisions to management goals and management activities should be provided to our Arcata Fish and Wildlife Office.

6.3 Assess the applicability, value, and success of this recovery plan to the recovery of the western snowy plover every 5 years until the recovery criteria are achieved. Rather than revising the entire recovery plan, it is proposed that minor revisions, clarifications, and prioritization changes be made through an addendum, to be produced and distributed every 5 years. This addendum would address data gaps identified in this version of the recovery plan including recommended management prescriptions, specific habitat management recommendations, management goal breeding numbers, directed surveys; and necessary changes discussed in previous recovery actions. It would provide a summary of the recovery actions implemented to date, and it would be a forum to solicit comments from the Recovery Team, stakeholders, and others interested parties on any proposed major changes. Major changes, elimination, or addition of recovery actions may initiate a revision.

6.4 Prepare a delisting package for the Pacific coast population of the western snowy plover. If actions 6.1 through 6.3 indicate recovery criteria have been met, actions to ameliorate or eliminate threats have been implemented and determined to be effective, and analyses of threats demonstrate that threats identified during and since the listing process have been ameliorated or eliminated, prepare a delisting package.

6.5 Prepare and implement a post-delisting monitoring plan. If delisting is warranted, prepare a post-delisting monitoring plan. Section 4 of the Endangered Species Act requires, in cooperation with the States, monitoring for a minimum of five years all species that have been recovered (*i.e.*, delisted).

7 Dedicate sufficient U.S. Fish and Wildlife Service staff for coordination of western snowy plover recovery implementation. Our Arcata Fish and Wildlife Office holds lead responsibility for coordinating implementation of western snowy plover recovery. We should assure that the Arcata Fish and Wildlife Office has sufficient staff to handle the primary responsibility of implementing the western snowy plover recovery plan. Duties should include

coordination and distribution of monitoring information and educational materials; transmission of copies of annual population monitoring results to our field offices that are responsible for western snowy plover issues; compilation and distribution of annual population status updates to all working groups; coordination with our other field offices in CNO and Region 1 regarding western snowy plover conservation actions, consultations, habitat conservation plans, and permits; facilitating coordination among the working groups created for the six recovery units; and fund raising to support recovery implementation actions.

8 Establish an international conservation program with the government of Mexico to protect western snowy plovers and their breeding and wintering locations in Mexico. Meeting the recovery goals outlined in this recovery plan is dependent only on actions recommended for implementation along the Pacific coast of the United States. However, other actions are identified for Mexico to complement conservation efforts in the United States. Efforts should be made to establish an international conservation program between the U.S. Fish and Wildlife Service and Mexico's National Institute of Ecology, Ministry of Environment, Natural Resources and Fisheries. Programs to facilitate implementation of this conservation program should include Partners in Flight, North American Waterfowl Management Plan, and the Borderlands Initiative.

8.1 Develop a joint effort between the United States and Mexico to protect western snowy plover populations and their habitat. Joint efforts should be implemented to determine important habitat in Mexico and protect these breeding and wintering locations from human disturbance.

8.2 Encourage research and monitoring of breeding and wintering western snowy plovers in Baja California, Mexico, by universities and authorities of Mexico. Joint efforts should be made to develop and implement a long-term monitoring program for western snowy plover populations of Mexico. They should include developing methods for consistent monitoring, coordination of banding and color-marking with

banders from the United States, assessment of the population status of breeding and wintering birds, and assessment of environmental impacts that may adversely affect plover populations.

8.3 Encourage development and implementation of public information and conservation education in Mexico for western snowy plovers. Public information and educational efforts should be coordinated and implemented by the United States and Mexico. They should include development of bilingual pamphlets for distribution to anglers, tourists, and local communities, and construction and placement of bilingual signs alerting them of the presence of nesting western snowy plovers.

9 Coordinate with other survey, assessment, and recovery efforts for the western snowy plover throughout North America. Western snowy plovers range through much of North America, and many individuals of the Pacific Coast population of western snowy plovers may overwinter in areas that overlap with other populations. Participation and coordination with other groups working on survey, assessment, and recovery efforts may yield valuable information on the distribution, status, and management needs for the Pacific Coast population of the western snowy plover. This coordination effort should be included in establishment of an international conservation program with Mexico.

IV. IMPLEMENTATION SCHEDULE

The following Implementation Schedule outlines actions needed, responsible parties, and estimated costs to recover the United States portion of the Pacific coast population of the western snowy plover. Considering the recovery criteria, results of the population viability analysis (Appendix D), and fulfillment of the recommendations contained in the recovery plan, recovery of the western snowy plover could occur in approximately 40 years. This time estimate assumes dedicated, proactive efforts toward improvements in western snowy plover management in the near-term, and subsequent management at a maintenance level commensurate with fulfillment of the recovery criteria.

The total cost of implementing actions outlined in this recovery plan over 40 years is $149,946,000. However, this figure represents only a portion of the overall costs because the cost of many actions cannot be estimated at this time. For example, costs associated with intensive protection and management on Federal and State lands (Action 3.3) should be determined by members of each of the six recovery unit working groups because they are most familiar with their site-specific needs and constraints. Costs of many actions were estimated based on current management recommendations provided in Appendix C. However, coastal ecosystems are dynamic and necessary management actions may vary with time, as site conditions change. Improvements over time in methods for predator control, control of nonnative vegetation, and monitoring are also expected and may affect actual costs.

It should be recognized that expenditure of funds for recovery of the western snowy plover will provide far-reaching benefits beyond those gained for a single species. Allocation of these funds will also benefit many other sensitive fish and wildlife species, the coastal beach-dune ecosystem, public appreciation for natural habitats, and aesthetics. These estimated costs do not reflect a cost/benefit analysis that incorporates other values or economic effects with implementation of the recommendations contained in this recovery plan.

We believe that protection and management costs could be substantially reduced by selecting protection strategies that are more restrictive of other beach uses.

While we believe that it is neither feasible nor desirable to completely eliminate beach recreation in most western snowy plover habitat, we also recognize that management strategies that protect western snowy plovers on beaches where public use is also maintained require a continuing commitment of person-power, and are inherently expensive.

The Implementation Schedule lists and ranks actions that should be undertaken within the next 5 years. This schedule will be reviewed routinely until the recovery objective is met, and priorities and actions will be subject to revision.

Key to Acronyms used in the Implementation Schedule

Definition of action priorities:

Priority 1 - An action that must be taken to prevent extinction or prevent the species from declining irreversibly in the foreseeable future.

Priority 2 - An action that must be taken to prevent a significant decline in species population or habitat quality, or some other significant negative impact short of extinction.

Priority 3 - All other actions necessary to provide for full recovery of the species.

Definition of action durations and costs:

Annual - An action that will be implemented each year.

Continual - An action that will be implemented on a routine basis once begun.

Ongoing - An action that is currently being implemented and will continue until action is no longer necessary.

As needed - An action that will be implemented on an "as needed" basis.

Unknown - Either action duration or associated costs are not known at this time.

To Be Determined (TBD) - Costs to be determined at a later date.

Responsible parties*:

ARMY	U.S. Army
BLM	U.S. Bureau of Land Management
CCC	California State Coastal Commission
CDFG	California Department of Fish and Game
CDPR	California Department of Parks and Recreation
CE	U.S. Army Corps of Engineers
CI	Cities
CO	Counties
CON	California Coastal Conservancy
EBRPD	East Bay Regional Park District
ES	U.S. Fish and Wildlife Service, Division of Ecological Services (includes Endangered Species and Contaminants)
FAA	U.S. Department of Transportation, Federal Aviation Administration
HARD	Hayward Area Recreation and Park District
IA	U.S. Fish and Wildlife Service, Office of International Affairs
LE	U.S. Fish and Wildlife Service, Division of Law Enforcement
LMAO	Land Management Agencies and Organizations and other Cooperators. (This category includes Federal and local land management agencies listed above, private organizations and individuals that own and manage snowy plover breeding and wintering habitat, and private conservation groups that provide on-site protection of lands owned by others.)
MPOSD	Mid-Peninsula Open Space District
MPRPD	Monterey Peninsula Regional Park District
NASA	National Aeronautics and Space Administration-Ames Research Center
NAVY	U.S. Navy
NMFS	National Marine Fisheries Service
NPS	National Park Service
ODFW	Oregon Department of Fish and Wildlife
ODLCD	Oregon Department of Land Conservation and Development
OPRD	Oregon Parks and Recreation Department

P	Private landowners (except HARD, MPOSD, and TNC)
PA	U.S. Fish and Wildlife Service, Public Affairs
PGH	Port of Grays Harbor
PO	Port of Oakland
PRBO	Point Reyes Bird Observatory Conservation Science
PSL	Port of San Luis Harbor District
RSCH	Research institutions and agencies
RW	U.S. Fish and Wildlife Service, Division of Refuges and Wildlife (includes Realty)
SDRPJPA	San Dieguito River Park Joint Powers Authority
TNC	The Nature Conservancy
TPL	Trust for Public Land
USAF	U.S. Air Force
USCG	U.S. Coast Guard
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
BBL	U.S. Geological Survey, Bird Banding Laboratory
BRD	U.S. Geological Survey, Biological Resources Division
USMC	U.S. Marine Corps
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WS	U.S. Department of Agriculture, Wildlife Services Branch
WSPRC	Washington State Parks and Recreation Commission

* All responsible parties listed for actions in Implementation Schedule are considered lead agencies for those actions.

IMPLEMENTATION SCHEDULE

Western Snowy Plover Pacific Coast Population Recovery Plan

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
1	Annually monitor abundance, population size and distribution at breeding and wintering locations.	1.1	annual	LMAO, CO, CI, RSCH	2,194	54.9	54.9	54.9	54.9	54.9	Assumes 157 window survey days, with 2 biologists per location at. Action needed to determine fulfillment of recovery criteria.
1	Develop and implement a program to monitor productivity and annual survival.	1.2	annual	LMAO, CO, CI. RSCH	TBD						Action needed to determine fulfillment of recovery criteria. Depends partly on completion of 4.3.2 and 4.3.3.
1	Develop and implement a program to monitor habitat condition and threats at all breeding and wintering sites.	1.3	annual	LMAO, RSCH	1,125	60	27	27	27	27	Assumes initial cost for development of standardized monitoring program and subsequent monitoring for 155 sites.
3	Develop and implement training and certification programs for western snowy plover survey coordinators and observers.	1.4	continual	ES, LMAO, RSCH	363.5	32	8.5	8.5	8.5	8.5	Assumes initial cost to develop program and subsequent implementation.

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
3	Improve submittal system for monitoring data to ensure consistent reporting.	1.5	continual	ES, LMAO, BBL, PRBO	346	32	8	8	8	8	Assumes initial cost to develop submittal and reporting system and subsequent annual review.
3	Assess and evaluate new breeding wintering and migration areas for threats and management needs and update lists as data become available.	1.6	continual	ES, LMAO, PRBO	TBD						Depends on results of annual surveys and monitoring.
3	Coordinate monitoring of snowy plovers and California least terns to minimize disturbances.	1.7	annual	ES, RW, NAVY, USMC, USAF, CDFG, CDPR, WS, BRD	1,020	25.5	25.5	25.5	25.5	25.5	Coordinate at biannual pre- and post-season California least tern monitoring meeting. Assumes 2 meetings at 2 days per meeting with 9 agency staff attending.
3	Develop a post-delisting monitoring plan.	1.8	TBD	ES, LMAO, CO, CI, RSCH	TBD						

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
1	Develop a prioritized list of wintering and breeding sites where natural coastal processes need protection and/or enhancement.	2.1.1	2 yrs	ES, LMAO, CO, CI, RSCH	59.65	59.65					Assumes time to evaluate sites and development of the prioritized list.
1	Identify and implement mechanisms to protect, enhance or restore natural coastal processes.	2.1.2	continual	ES, LMAO, CO, CI, RSCH	TBD						Incorporate into ongoing management in action 3. Costs will depend on mechanisms identified and carried out.
1	Develop and implement prioritized removal and control for introduced beachgrass and other non-native vegetation.	2.2.1.1	continual	CE, LMAO, CO, CI	TBD						App C identifies 86 sites. Costs range for mechanical, manual and/or chemical control: $1,000 to $87,000/hectare ($400 to $35,000 per acre).
2	Replace exotic dune plants with native dune vegetation where it is likely to improve habitat.	2.2.1.2	continual	CE, LMAO, CO, CI	TBD						Estimated cost of planting native vegetation: $30,000 per hectare ($12,000 per acre). Number of sites to be determined.

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
3	Evaluate breeding and wintering sites to determine whether dredged materials may be used to enhance or create nesting habitat.	2.2.2.1	2 yrs	CE, ES, LMAO, CO, CI	110	55	55				Assumes cost to evaluate each site.
3	Develop and implement plans to use dredged materials may be used to enhance or create nesting habitat.	2.2.2.2	ongoing	CE, ES, LMAO, CO, CI	TBD						Costs will depend on completion of acts on 2.2.2.1.
3	Identify sites where beach nourishment may be effective in creating and enhancing habitat.	2.2.3.1	2yrs	CE, ES, LMAO, CO, CI	110	55	55				Assumes cost to evaluate each site.
3	Develop and implement beach nourishment plans for site identified in action 2.2.3.1.	2.2.3.2	ongoing	CE, ES, LMAO, CO, CI	TBD						Cost dependent on number of sites identified in 2.2.3.1 and outcome of 4.1.1.

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
1	Create, manage, and enhance coastal ponds and playas for breeding habitat.	2.2.4	ongoing	ES, RW, CE, CDFG, NASA, HARD, LMAO	TBD						App C identifies 15 sites. Costs dependent on type and area of restoration.
1	Seasonally close areas used by breeding snowy plovers.	2.3.1.1.1	annual	LMAO, CO, CON, CI	559.2	13.98	13.98	13.98	13.98	13.98	App C identifies 81 sites. Assumes cost to close these sites.
1	Fence areas used by breeding snowy plovers	2.3.1.1.2	annual	LMAO, CO, CON, CI	14,840	371	371	371	371	371	App C identifies 64 sites. Cost assumes 1 kilometer fencing required per site at a cost of $5,900 per kilometer.
1	Post signs in areas used by breeding snowy plovers	2.3.1.1.3	annual	LMAO, CO, CON, CI	202	5	5	5	5	5	App C identifies 65 sites. Cost dependent on number of signs needed at each site, but assumes cost for installation and a minimum of 4 signs at $20 per sign.
1	Evaluate effects of existing and planned access at all breeding and wintering locations and any new locations identified.	2.3.1.2.1	1 year	LMAO, CO, CI	455	455					Appendix C identifies 81 sites. Assumes cost to conduct use survey for the identified sites.
1	Develop and implement plans to minimize adverse access effects.	2.3.1.2.2	continual	LMAO, CO, CI	TBD						Costs depend on outcome of 2.3.1.2.1.

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
3	Implement and enforce pet restrictions.	2.3.2	continual	LMAO, CO, CI	39,406	985	985	985	985	985	Appendix C identifies 120 sites Assumes staff time to implement and enforce restrictions at the identified sites.
1	Annually review recreational activities and develop and implement plans to prevent disturbance from disruptive recreational activities at breeding and wintering sites	2.3.3	annual	LMAO, CO, CI	21,948	549	549	549	549	549	Assumes staff cost to develop and implement plans at each site annually.
3	Prevent driftwood removal through posting of signs	2.3.4	continual	LMAO, CO, CI	1,805	50	45	45	45	45	Appendix C identifies 26 sites. Cost dependent on number of signs needed at each site, but assumes cost for installation and a minimum of 4 signs at $20 per sign.
1	Prevent disturbance, mortality, and habitat degradation by prohibiting or restricting off-road vehicles and beach-raking machines.	2.3.5	continual	LMAO, CO, CI	18,760	469	469	469	469	469	Appendix C identifies 101 sites. Assumes staff time for monitoring on weekends.
3	Implement restrictions on horseback riding through annual coordination.	2.3.6	annual	LMAO, CO, CI	1,033.7	25.8	25.8	25.8	25.8	25.8	Appendix C identifies 72 sites. Assumes staff time to implement restrictions.

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
3	Implement and enforce restrictions on livestock through annual coordination.	2.3.7	annual	LMAO, CO, CI	255	6.3	6.3	6.3	6.3	6.3	Appendix C identifies 18 sites. Assumes staff time to implement restrictions.
1	Determine enforcement needs and provide sufficient wardens, agents or officers to enforce protective measures in breeding and wintering habitat.	2.3.8.1	continual	LE, LMAO, CO, CI	TBD						Cost will depend on identified enforcement needs.
3	Develop and implement training programs for enforcement personnel to improve enforcement of regulations and minimize effects of enforcement.	2.3.8.2	continual	LE, LMAO, CO, CI	320	8	8	8	8	8	Annual training cost estimate $8,000 per year.
2	Develop and implement a program to annually coordinate with local airports, aircraft operations regarding minimum altitude requirementss.	2.3.9	annual	LMAO, CO, CI, FAA, LE	339.8	8.5	8.5	8.5	8.5	8.5	Assumes staff costs per recovery unit to compile list and notify aircraft operations and facilities.
3	Implement and enforce anti-littering regulations.	2.4.1.1	annual	LMAO, CO, CI	TBD						Incorporate into ongoing management and Action 3.

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
3	Evaluate the effects of current litter and garbage management on predation at breeding and wintering sites.	2.4.1.2	2 yrs	LMAO, CO, CI	110	55	55				Assumes evaluation time per site.
3	Develop and implement garbage and litter management plans where litter and garbage contribute to predation.	2.4.1.3	continual	LMAO, CO, CI	TBD						Costs will depend on 2.4.1.2 and plans developed.
3	Annually identify and remove predator perches and unnatural habitats attractive to predators.	2.4.2	continual	LMAO, CO, CI	375.2	9.4	9.4	9.4	9.4	9.4	Assumes staff time to complete action each year.
1	Erect predator exclosures to reduce egg predation and improve productivity.	2.4.3	annual	LMAO, CO, CI	18,266	456	456	456	456	456	App C identifies 53 sites. Assumes cost per unit installation.
1	Evaluate the need for predator removal and implement where warranted and feasible.	2.4.4	as needed	LMAO, CO, CI, WS, CDFG	TBD						App C identifies 61 sites for additional predator control. Costs dependent on assessment of needs and feasability.
3	Remove bird and mammal carcasses in nesting areas.	2.4.5	as needed	LMAO, CO, CI	TBD						

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
1	U.S. Fish and Wildlife Service biologists should participate in Area Committees responsible for maintaining the Area Contingency Plans for the Pacific Coast to facilitate the updating of spill response plans to include protection of western snowy plovers.	2.5.1	annual	ES	5,154	128.9	128.9	128.9	128.9	128.9	Assumes staff time from the six ES office responsible for coastlines of CA, OR, and WA.
1	Assign monitors to beaches that are inhabited by western snowy plovers to protect western snowy plovers from injury during spill responses.	2.5.2	as needed	ES, USCG, LMAO, CO, CI	1,984	49.6	49.6	49.6	49.6	49.6	Assumes cost of two weeks of monitoring for five incidents per year.
2	Compensate the loss of plover breeding and wintering habitat associated with recovery efforts for other sensitive species.	2.6	ongoing	ES, RW, CE, LMAO	TBD						Costs dependent on effectiveness of minimizing habitat loss.
3	Investigate feasibility and methods for discouraging pinniped use of nesting areas.	2.7.1	5 yrs	ES, NMFS, NAVY, LMAO	320	64	64	64	64	64	Assumes staff time to investigate.

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
3	Identify areas where pinniped use is negatively affecting nesting and implement any appropriate methods.	2.7.2	TBD	ES, NMFS, NAVY, LMAO	TBD						Costs dependent on number of sites identified and methods determined in 2.7.1.
1	Establish and maintain snowy plover working groups for each of the six recovery units.	3.1	continual	ES, LMAO, CO, C I, P	3,650	96	96	91	91	91	Essential mechanism to advance plover recovery. Includes biannual meeting costs and staff costs to establish new working groups.
2	Develop and implement regional participation plans for each of the six recovery units.	3.2	1 yr for develop-ment, continual thereafter	ES, LMAO	193		193				Assumes staff cost to develop and implement participation plans.
3	Develop and implement management plans for Federal lands.	3.3.1	ongoing	RW, ARMY, BLM, CE, NASA, NAVY, NPS, USAF, USMC, USFS	TBD						Implementation cost dependent on content of plans developed.

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
3	Develop and implement management plans and Habitat Conservation Plans on State wildlife areas, State ecological reserves, and State beaches.	3.3.2	5 years	CDFG, CDPR, ODFW, OPRD, WDFW, WDNR, WSPRC	966	193	193	193	193	193	Assumes cost for each recovery unit to assist in development. Implementation cost to be determined.
3	Develop and implement Habitat Conservation Plans or other management plans for sites owned by local governments or private landowners.	3.4	5 years	ES, LMAO, CO, CI, P, EBRPD, HARD, MPOSD, MPRPD, PGH, PO, SL, TNC, SDRPJPA	966	193	193	193	193	193	Assumes cost for each recovery unit to assist in development. Implementation cost to be determined.
2	Provide technical assistance to local governments in developing and implementing local land use protection measures through periodic workshops.	3.5	10 years	ES, CCC, CDFG, CDPR, CON, ODFW, ODLCD, OPRD, WDNR, WDFW, WSPRC, CO, CI	TBD						Estimated at 2 workshops per recovery unit at a cost of $ (Patty Carol in RO)

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
3	Develop and implement cooperative programs and partnerships with the California State Coastal Commission, the Oregon Department of Land Conservation and Development, the Washington State Parks and Recreation Commission, the Oregon Parks and Recreation Department, the California Department of Parks and Recreation, and the Oregon Department of Fish and Wildlife.	3.6	continual	ES, CCC, ODLCD, ODFW, OPRD, CDPR, WSPRC	TBD						Costs may vary from year to year based on identified program needs.
3	Obtain long-term agreements with private landowners.	3.7	12 years	ES, CDFG, P CDPR, ODFW, WDFW, WSPRC, LMAO	2,319	193	193	193	193	193	Assumes staff time to facilitate 6 agreements per year per recovery unit. Appendix C identifies 72 sites.
3	Identify and protect habitat available for acquisition.	3.8	ongoing	CON, ES, RW, LMAO	TBD						

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
3	Ensure that any section 10(a)(1)(B) and section 7(a)(2) permits contribute to Pacific coast western snowy plover conservation.	3.9	ongoing	ES, Federal agencies	1,288	32`32	32	32	32	32	Assumes staff time for annual evaluation.
3	Ensure that section 7 consultations contribute to Pacific coast western snowy plover conservation.	3.10	ongoing	ES, Federal agencies	1,288	32`32	32	32	32	32	Assumes staff time for annual evaluation.
2	Evaluate effectiveness of habitat restoration by removal of introduced beachgrass and identify additional studies necessary.	4.1.1	continual	CON, ES, LMAO, RSCH	TBD						Depends on the number and location of sites as well as the temporal duration of the restoration project.
3	Evaluate the impacts and potential benefits of past and ongoing beach nourishment activities and identify and carry out any additional studies necessary.	4.1.2	ongoing	ES, LMAO, RSCH, CE, CI, CO	TBD						
2	Develop higher-efficiency nest enclosures.	4.2.1	ongoing	ES, LMAO, RSCH	20	10	5	3	2	0	Compare new exclosures with current ones to determine effects on snowy plovers.

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
2	Develop California least tern enclosures that prevent harm to snowy plovers.	4.2.2	as needed	ES, USMC, CDFG, CDPR, LMAO, RSCH	TBD						Costs specific to sites with California least tern enclosures. Estimated cost for materials (fencing/posts): $7 per linear foot ($23 per meter).
3	Identify, prioritize and carry out investigations on control of predators.	4.2.3	as needed	ES, RW, LMAO, WS, CDFG, RSCH, CO, CI, P	TBD						Cost dependent on number and types of studies identified.
3	Investigate predator management at the landscape level.	4.2.4	as needed	ES, RW, LMAO, WS, RSCH, CO, CI, P	TBD						Costs dependent on number and types of studies identified.
3	Investigate techniques for identifying nest predators.	4.2.5	continual	LMAO, RSCH	TBD						
2	Improve methods of monitoring population size.	4.3.1	ongoing	ES, LMAO, RSCH	TBD						Dependent on costs of intensive monitoring of some sites.
2	Develop sampling methods for annually estimating reproductive success.	4.3.2	2 years	ES, RSCH	64	64					Assumes time to compile and review data and develop methodology.
3	Develop methods to monitor plover survival rates.	4.3.3	ongoing	ES, LMAO, RSCH	TBD						

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
3	Identify brood habitat and map brood home ranges.	4.4.1	ongoing continual	ES, LMAO, RSCH, CO, CI, P	TBD						Costs dependent on study design. May include radio telemetry.
3	Identify components of high-quality brood rearing habitat	4.4.2	1 year	ES, LMAO, RSCH, CO, CI, P	131	131					Assumes study at 6 geographically representative sites for duration of breeding season.
3	Quantify wintering habitat needs along the Pacific coast.	4.4.3	5 years	ES, RSCH, BRD, PRBO	75	75					Assumes study at 6 geographically representative sites during winter months.
3	Identify important migration stop-over habitat.	4.4.4	ongoing	ES, LMAO	TBD						
3	Develop and implement a research program to determine causes of adult mortality.	4.5	ongoing	LMAO, RSCH	TBD						Costs dependent on study design.
3	Compile information regarding number and types of banding injuries to plovers.	4.6.1	1 year	ES, RSCH, PRBO, BRD, BBL	32	32					Assumes staff time to develop, distribute and compile information requests.
3	Review compiled information (see 4.6.1) and determine and implement an appropriate course of action.	4.6.2	1 year	ES, RSCH, PRBO, BRD, BBL	32						Assumes staff time to review compiled information, distribution and coordination with other responsible parties.

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
3	Identify effects of oil spills on snowy plovers.	4.7	as needed	ES, RSCH, BRD, LMAO	TBD						Typical range of cost for study is estimated between $25,000 - $100,000.
3	Monitor levels of environmental contaminants in snowy plovers.	4.8	as needed	ES, RSCH, BRD, LMAO	TBD						Depends on number and type of samples. Cost estimate $700 per sample, but may vary depending on type of contaminant.
3	Design and conduct contaminants studies if monitoring of contaminants in action 4.8 indicates potential contaminants effects.	4.9	as needed	LMAO, ES, RSCH, BRD	TBD						Depends on number of sites and samples analyzed. Cost estimates for studies range from $25,000 to $50,000 per site.
3	Identify, prioritize and carry out studies on the effects of human recreation on western snowy plovers.	4.10	ongoing	LMAO, ES, RSCH, PRBO, BRD	TBD						Costs dependent on research needs identified.
3	Revise the population viability analysis when sufficient additional information is available	4.11	1 year	ES, RSCH, PRBO, BRD	25						Assumes cost to conduct modeling.
2	Develop and implement public information and education programs.	5.1	ongoing	ES, PA, LMAO	TBD	TBD	TBD	TBD	TBD	TBD	Depends on individual recovery unit strategies. See Appendix K (Information & Education Plan) for estimates of component expenses.

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
3	Inform Federal, State and local planning agencies and local planning departments of threats to breeding and wintering snowy plovers and their habitats.	5.2	continual	ES, LMAO, CCC, CDFG, CDPR, ODFW, ODLCD, OPRD, WDFW, WDNR, WSPRC, CO/CI	TBD						
3	Develop and maintain updated information and education materials on snowy plovers.	5.3	ongoing	ES, PA, LMAO, CO, CI	TBD						Incorporate into ongoing management and Action 3.1 through 3.10. See Appendix K
3	Alert landowners and beach-goers about access restrictions within snowy plover habitats.	5.4	ongoing	ES, PA, LMAO, CO, CI	TBD						Incorporate into ongoing management and Action 3.1 through 3.10. See Appendix K
3	Provide trained personnel to facilitate protective measures, provide public education, and respond to emergency situations.	5.5	continual	LMAO, CO, CI	TBD						Need to secure funds for volunteer coordinator and staff to train volunteers. Incorporate into Action 3.1 through 3.10. See Appendix K.
3	Develop protocols for handling sick, displaced, injured, oiled, and dead birds or salvaged eggs.	5.6	1 with periodic review	LMAO, CO, CI	32.2	32.2					Assumes staff time to develop protocol.

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
3	Establish a distribution system and repository for information and education materials.	5.7	continual	ES, LMAO, CO, CI	TBD						Incorporate into ongoing management and Action 3.1 through 3.10 and 7. See Appendix K.
3	Establish a reporting and distribution system for annual monitoring data.	5.8	annual	ES	644	16	16	16	16	16	Assumes time spent collecting and compiling data.
2	Develop and implement a tracking process for the completion of recovery actions and the achievement of delisting criteria.	6.1	continual	ES, RW, ARMY, BLM, CE, NASA, NAVY, NPS, USAF, USFS, USMC, CDFG, CDPR, ODFW, OPRD, WDFW, WDNR, WSPRC, LMAO	688	64	16	16	16	16	Assumes staff time to develop and implement tracking process.
3	Review progress toward recovery annually.	6.2	annual	ES, LMAO	566	14	14	14	14	14	Assumes staff time to compile and review data.
3	Assess the applicability, value and success of this plan to the recovery of the western snowy plover every 5 years.	6.3	every 5 years		258					32.2	Assumes staff time to review every 5 years.
3	Prepare a delisting package for the Pacific coast population of the western snowy plover.	6.4	6 months	ES	64	64					Assumes staff time to prepare delisting package.

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
3	Prepare and implement a post-delisting monitoring plan.	6.5	6 months	ES	64	64					Assumes staff time to prepare and implement post-delisting monitoring plan.
1	Dedicate sufficient U.S. Fish and Wildlife Service staff for coordination of western snowy plover recovery implementation.	7	continual	ES	5,152	128.8	128.8	128.8	128.8	128.8	Assumes staff time to coordinate recovery implementation
3	Develop a joint United States and Mexico effort to protect snowy plover populations and their habitat.	8.1	continual	ES, IA	TBD						
3	Encourage research and monitoring of breeding and wintering snowy plovers in Baja California, Mexico by universities and authorities of Mexico.	8.2	continual	ES, IA, RSCH, BRD	TBD						
3	Encourage development and implementation of public information and conservation education in Mexico.	8.3	continual	ES, IA, PA	TBD						

Priority No.	Action Description	Action Number	Action Duration	Responsible Parties	Total Costs	Cost Estimate (in $1,000 units) FY1	FY2	FY3	FY4	FY5	Comments/Notes
3	Coordinate with other survey, assessment, and recovery efforts for the western snowy plover throughout North America.	9	continual	ES, IA, RSCH, BRD	TBD						

Total Cost of Recovery through 2046: $149,946,000 plus additional costs that cannot be estimated at this time.

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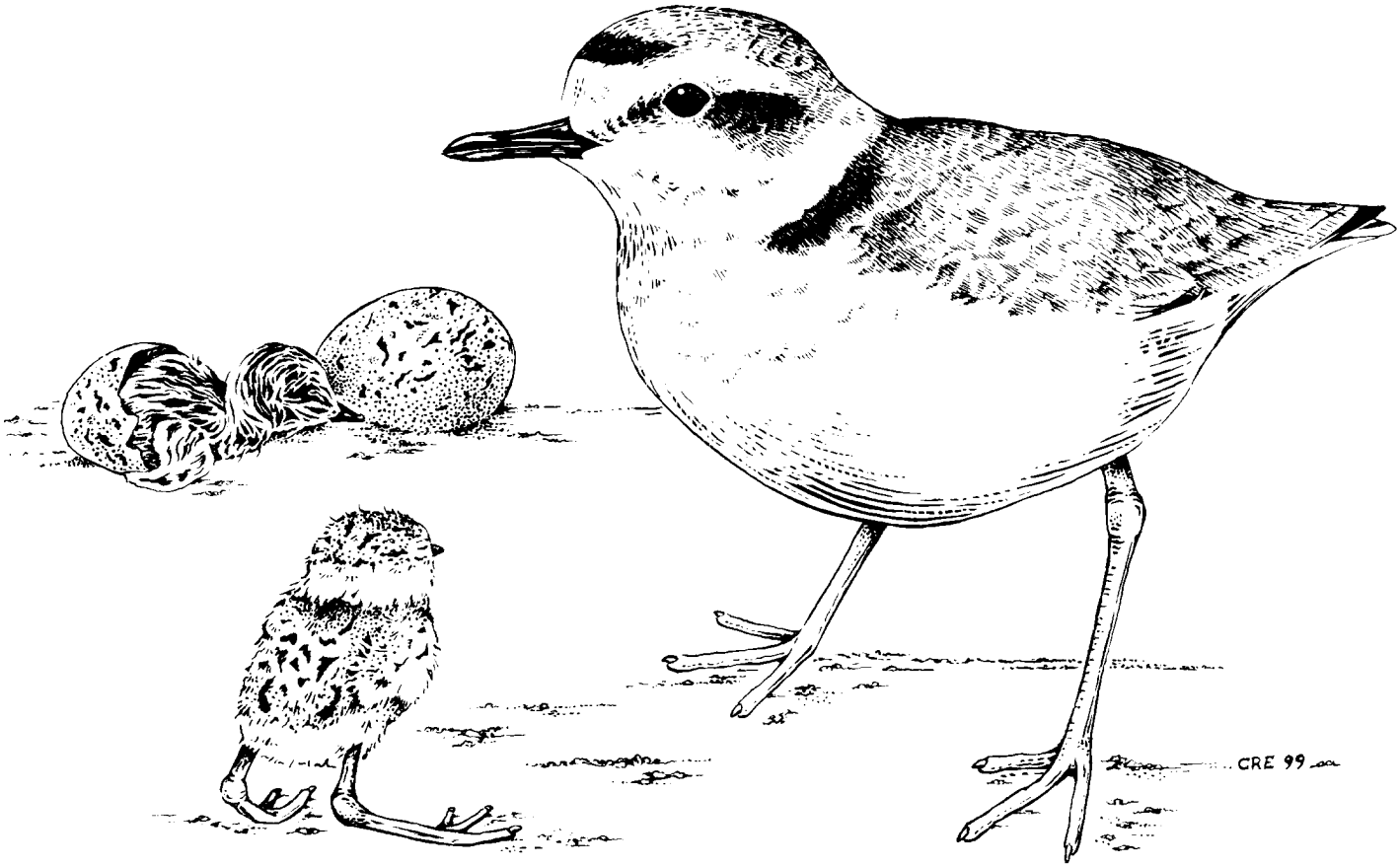
Western Snowy Plover
(Charadrius alexandrinus nivosus)
Pacific Coast Population Recovery Plan



Volume 2 (Appendices)

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Santa Cruz, California

Recovery Plan for the

Pacific Coast Population of the

Western Snowy Plover

(*Charadrius alexandrinus nivosus*)

Volume 2: Appendices

California/Nevada Operations Office
U.S. Fish and Wildlife Service
Sacramento, California

APPENDIX A

LOCATIONS OF CURRENT OR HISTORICAL SNOWY PLOVER BREEDING AND WINTERING AREAS

The following maps (Figures A-1 through A-7) show the general locations of current or historical western snowy plover breeding or wintering areas on the U.S. Pacific coast within each recovery unit. The breeding and wintering locations and recovery units include only the coastal beaches, estuaries, gravel bars and salt ponds that provide western snowy plover habitat; inland areas of counties are illustrated on Figures A-1 through A-7 solely for reference. Location numbers on the maps are referenced to the numbers in parentheses shown after the location names found in the left-hand column of Table B-1 (Appendix B) and Table C-1 (Appendix C). Detailed maps of each of these locations are given in Appendix L.

Figure A-1. Recovery Units 1 to 6, Washington, Oregon, and California.

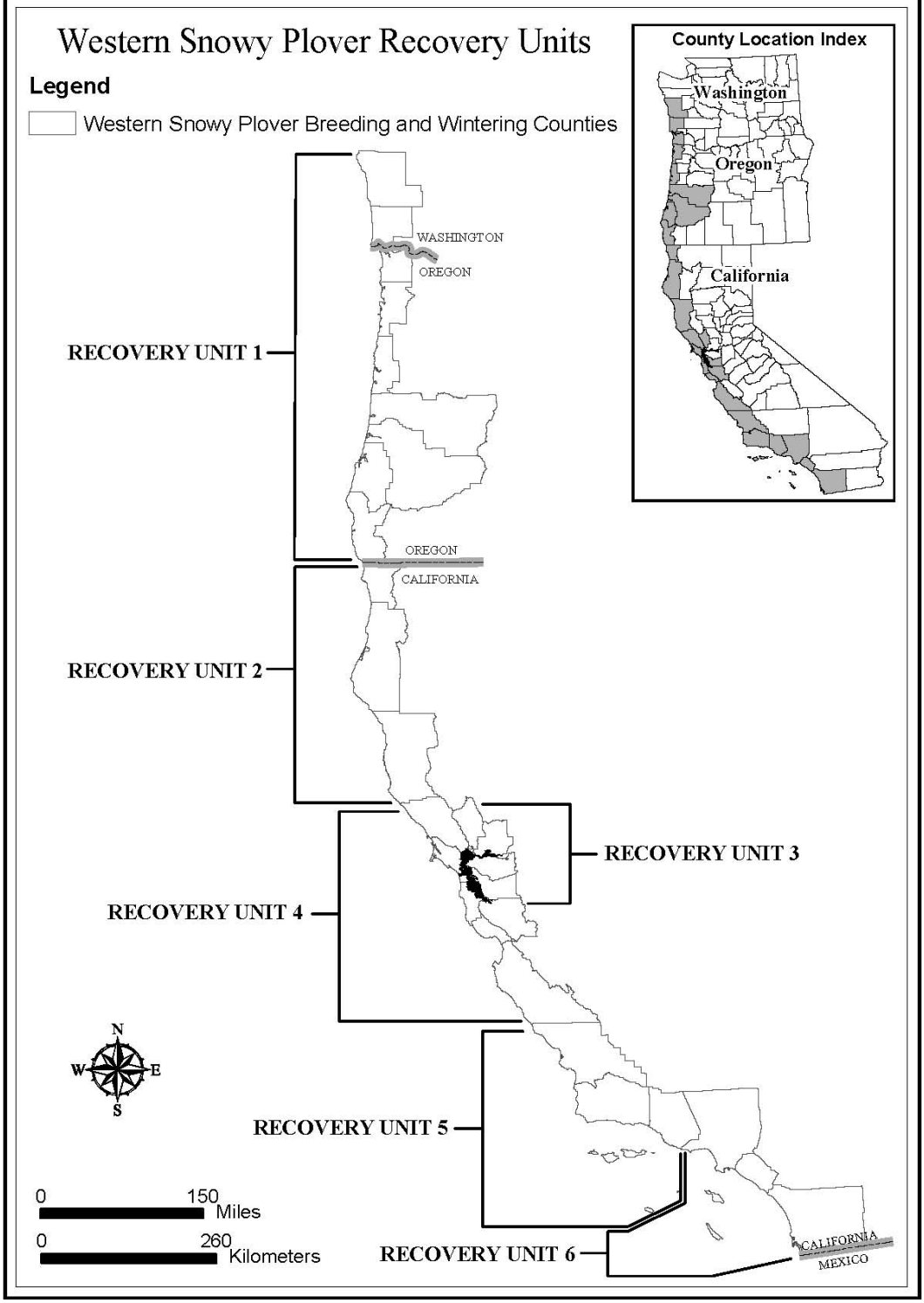


Figure A-2. Recovery Unit 1, Washington and Oregon.

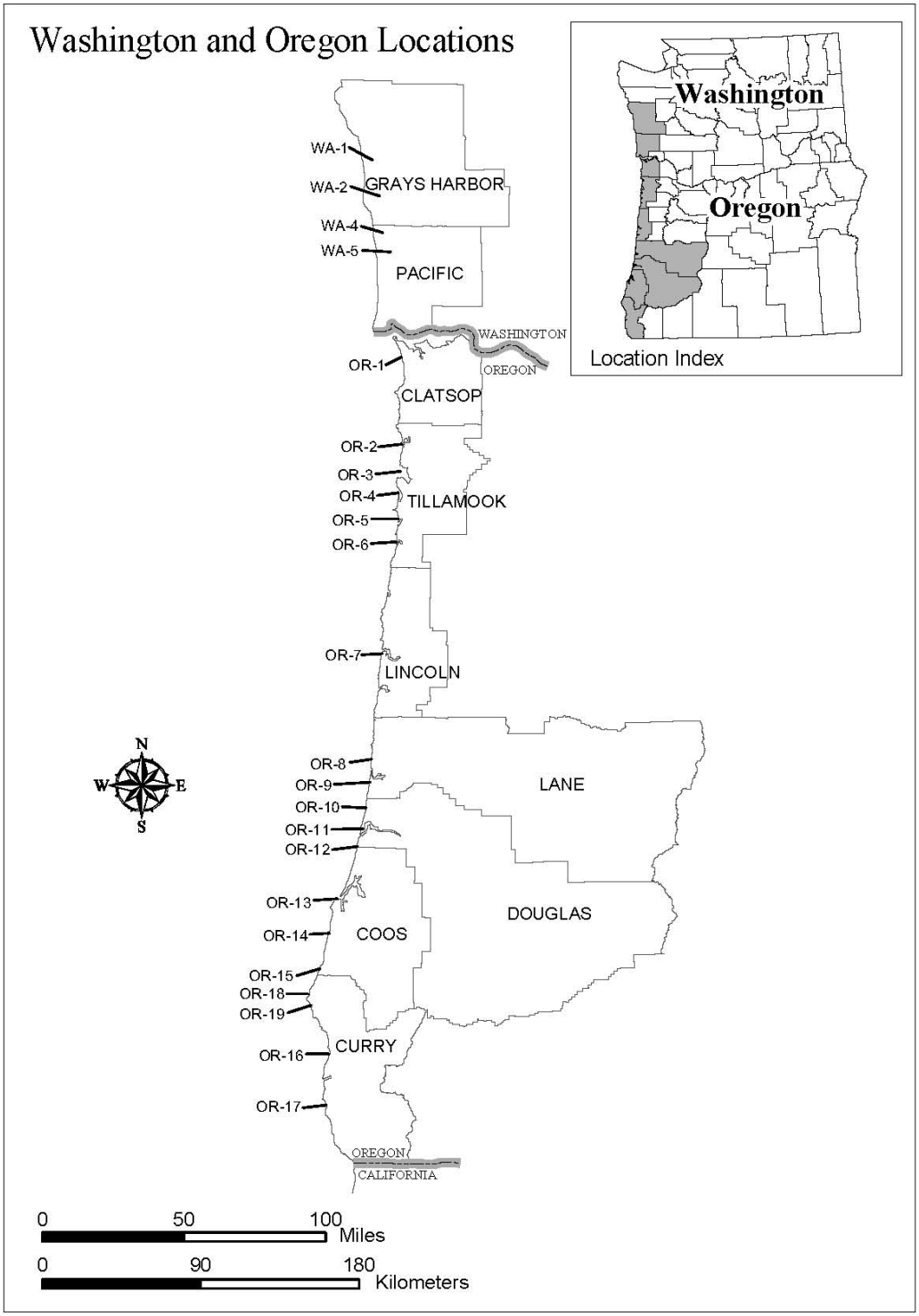


Figure A-3. Recovery Unit 2, Del Norte to Mendocino Counties, California.

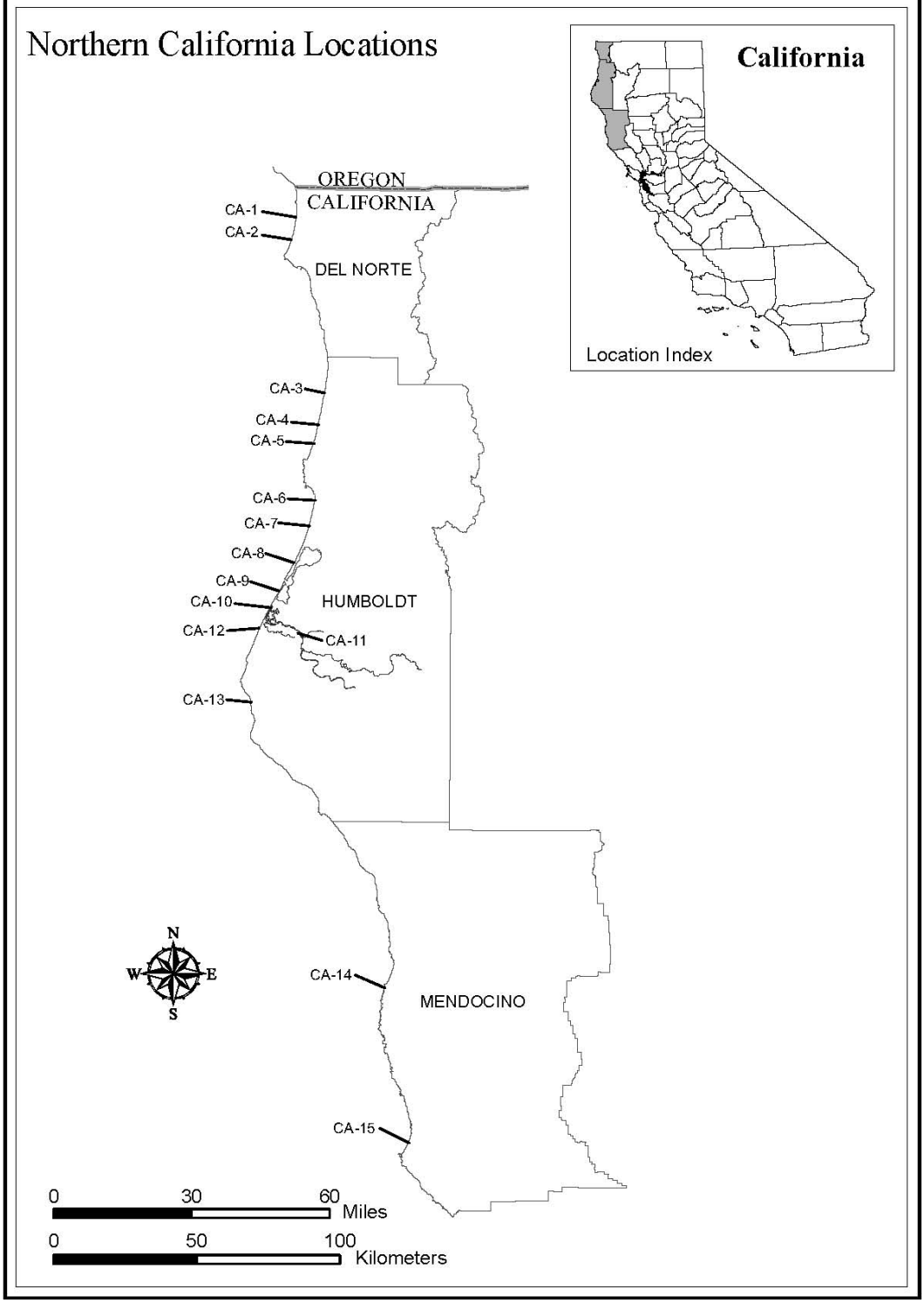


Figure A-4. Recovery Unit 4, Sonoma to Monterey Counties, California.

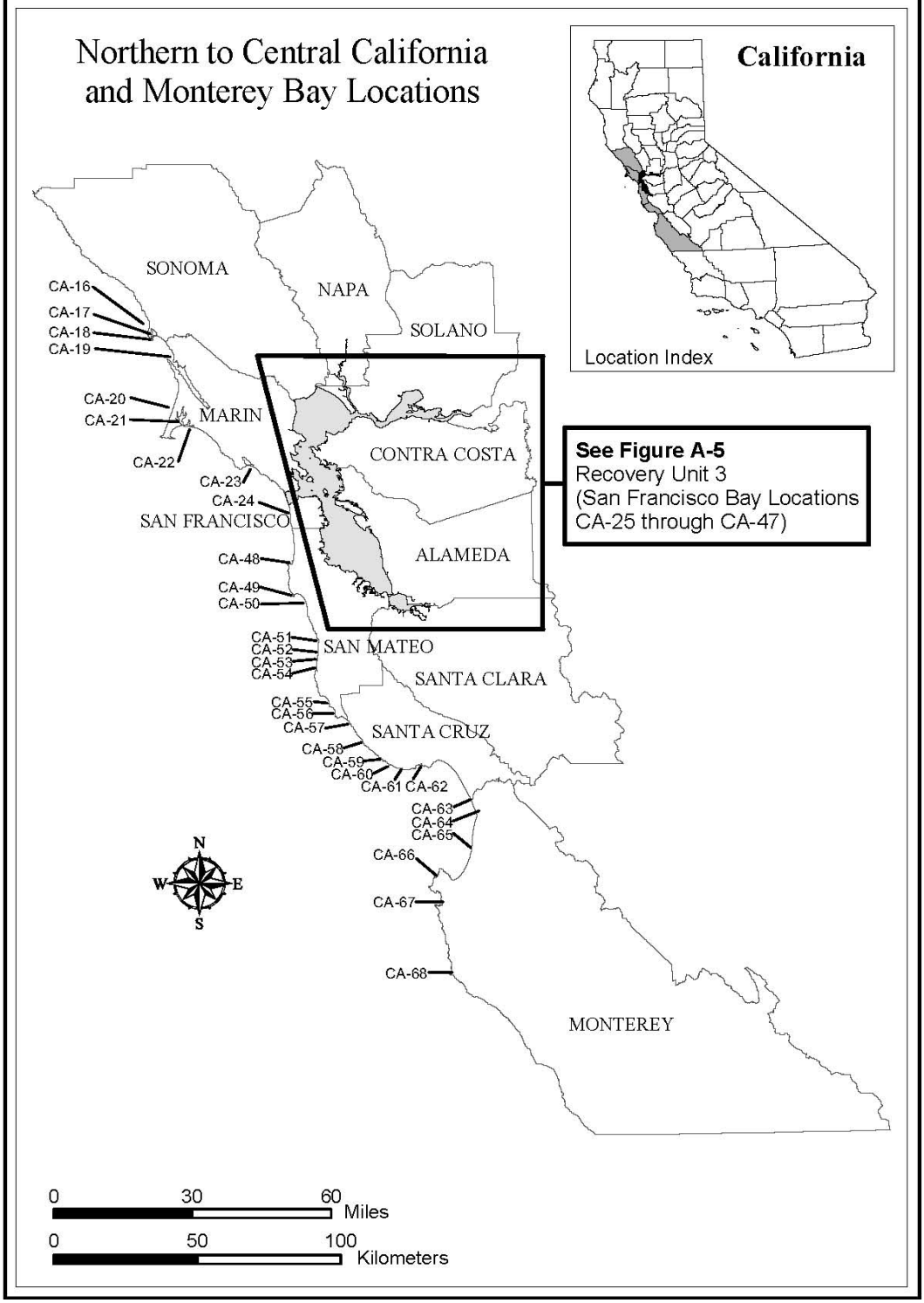


Figure A-5. Recovery Unit 3, San Francisco Bay, California.

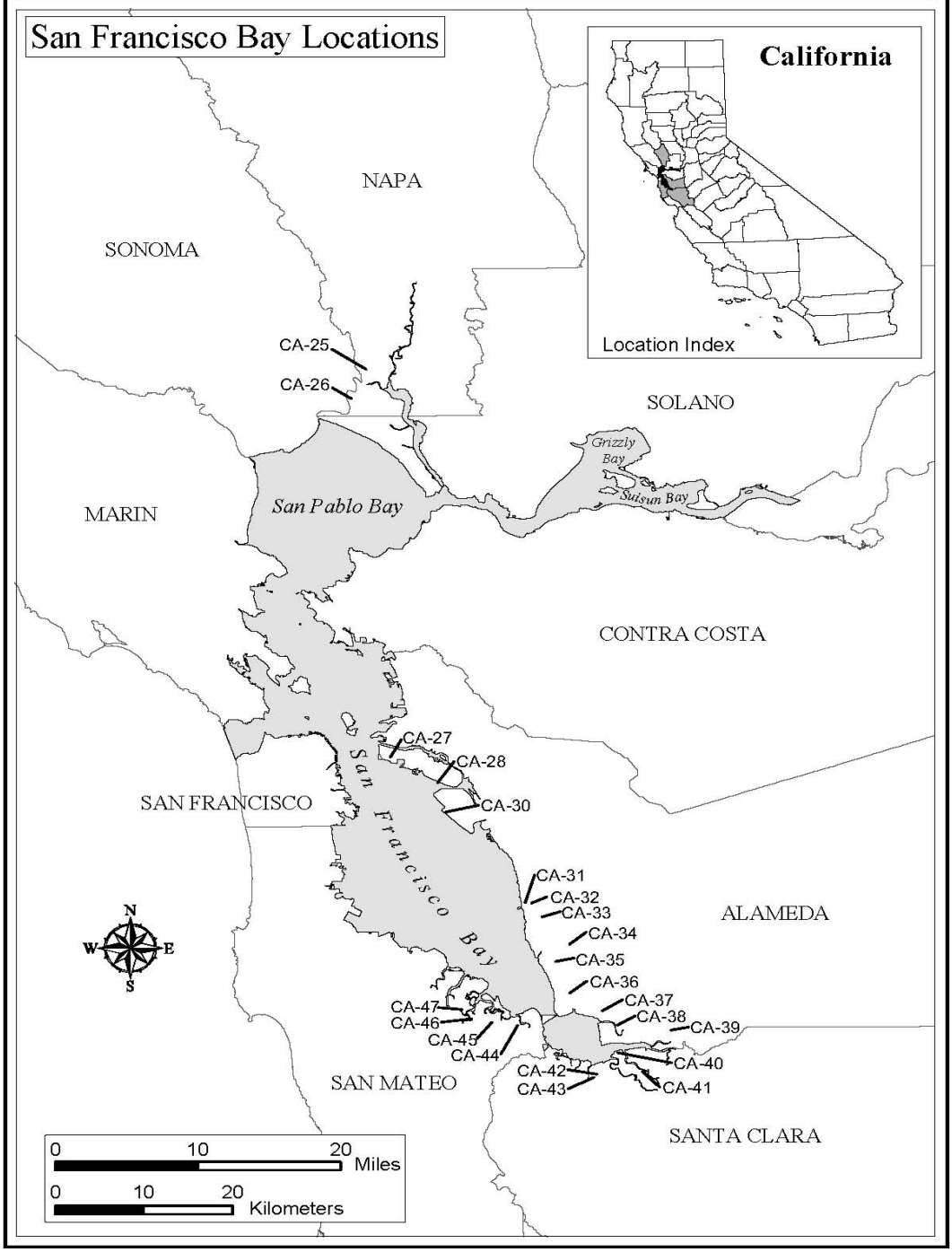


Figure A-6. Recovery Unit 5, San Luis Obispo to Ventura Counties, California.

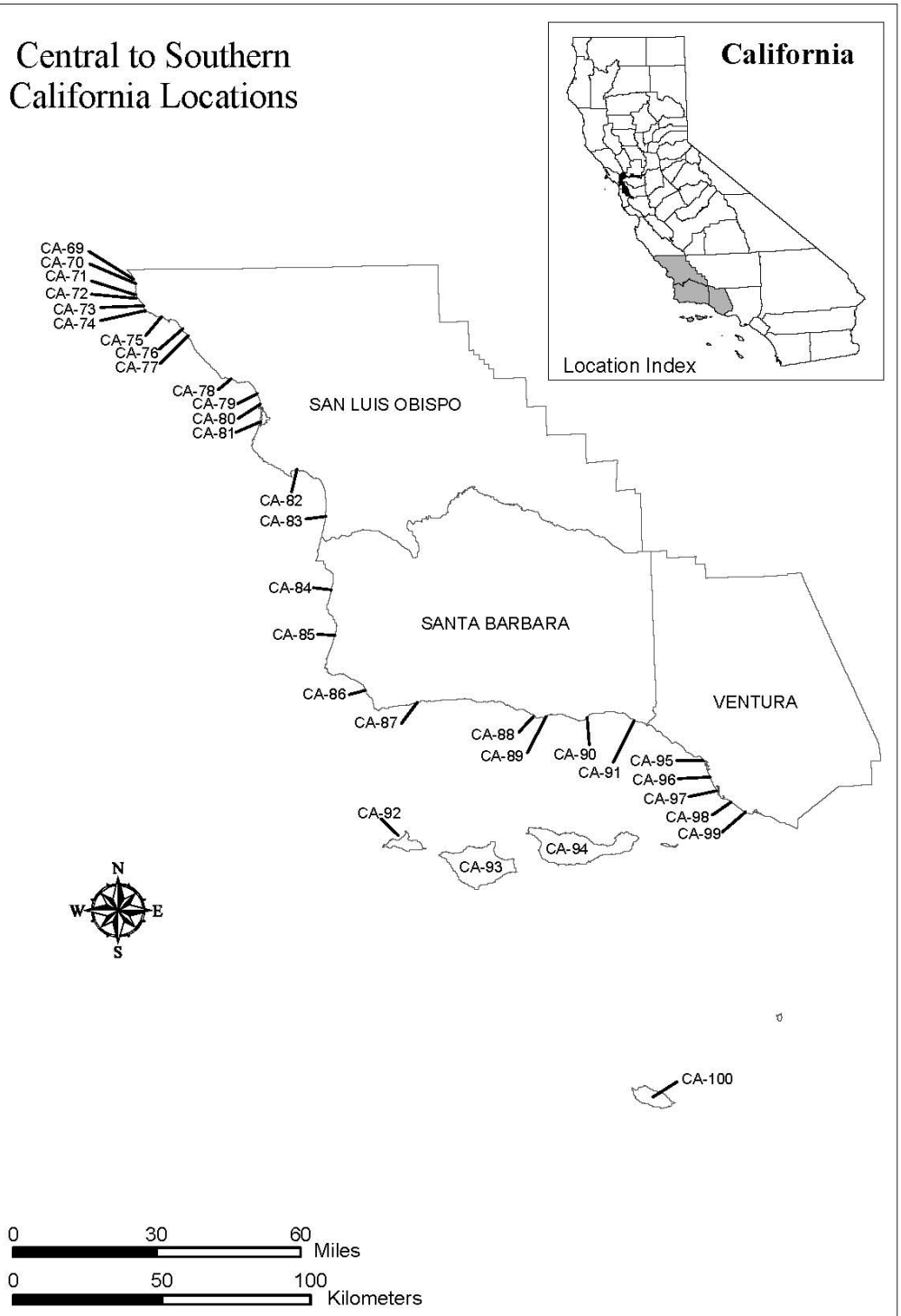
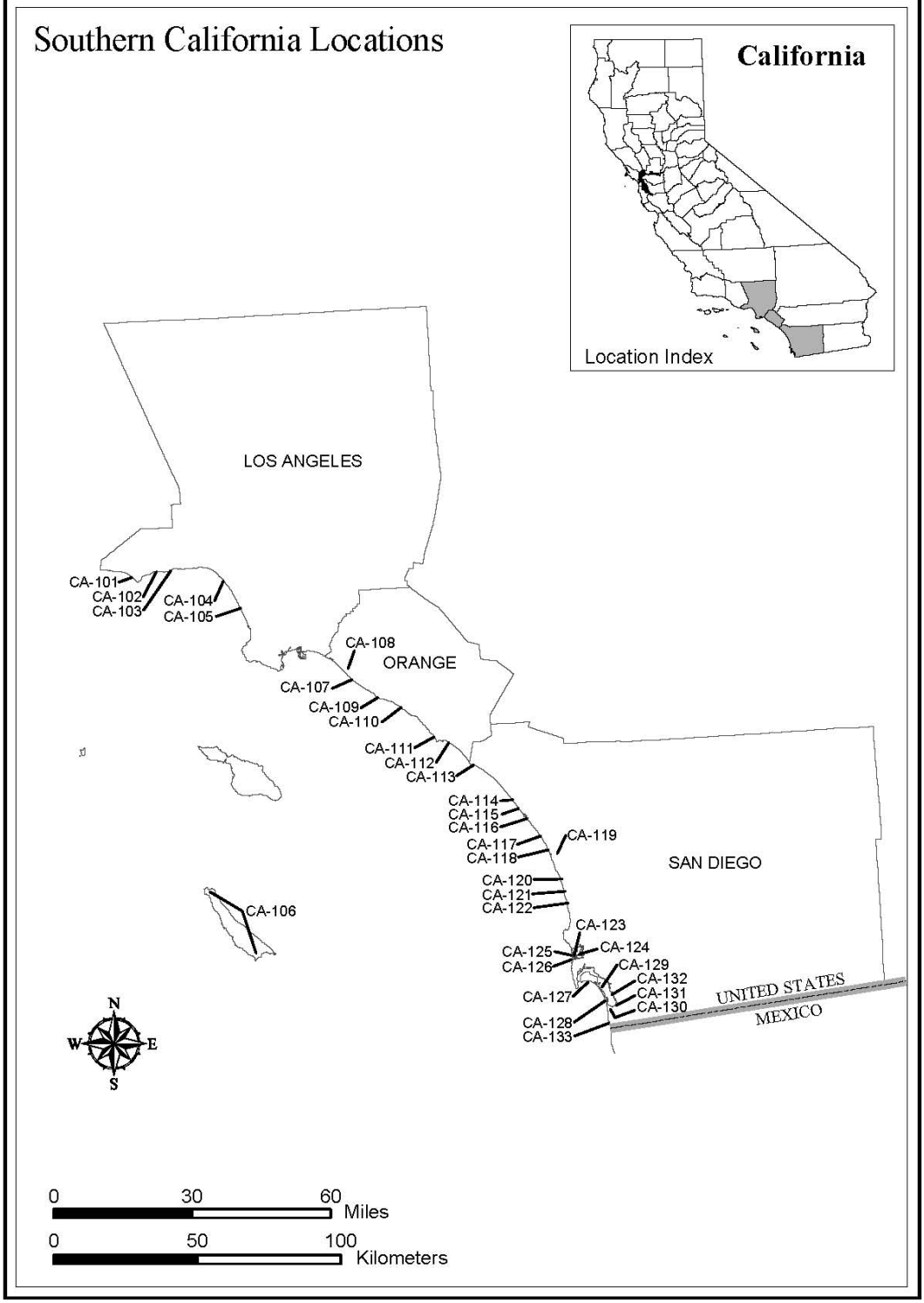


Figure A-7. Recovery Unit 6, Los Angeles to San Diego Counties, California.



APPENDIX B

INFORMATION ON SNOWY PLOVER BREEDING AND WINTERING LOCATIONS

This appendix provides information on numbers of breeding and wintering snowy plovers at specific locations along the U.S. Pacific coast (Table B-1). These locations are important for the recovery of the Pacific coast population of the western snowy plover. It is possible that locations not currently identified in Table B-1 may in the future contribute to meeting population targets within recovery units. Locations are mapped in Appendix A (Figures A-1 through A-7) and in greater detail in Appendix L.

WASHINGTON

Data on numbers of snowy plovers nesting at primary areas (WA-2 and WA-5) in Washington are from years in which at least 20 surveys were completed at a given location. At Leadbetter Point/Gunpowder Sands (WA-5), these years include 1986 and 1994 to 2005. At Damon Point/Oyhut Wildlife Area (WA-2), these years include 1985, 1986, and 1992 to 2005. Data on nesting at Midway Beach (WA-4) are from window surveys in 1994 and 1995 and intensive monitoring since 1998. Breeding numbers were estimated by: (1) determining for each year which was greater, (a) the highest single-survey adult tally for May and June, or (b) the highest single-survey tally of males plus the highest single-survey tally of females for May and June; and then (2) reporting the lowest and highest estimates among all years.

Data on numbers of snowy plovers wintering in Washington are from November through February, 1977 to 2005. Sources include: (1) coordinated coastwide surveys between 1995 and 2005; (2) Christmas Bird Count data; (3) shorebird surveys completed by Buchanan (1992); and (4) incidental observations as summarized by the Washington Department of Fish and Wildlife (1995).

OREGON

Information on numbers of nesting snowy plovers at specific locations along the Oregon coast are derived from breeding season surveys conducted annually since 1978. The Oregon Department of Fish and Wildlife coordinated the breeding window survey each year from 1979 to 2001. Since 2002 the U.S. Fish and Wildlife Service has coordinated the survey effort. Partners include the Oregon Natural Heritage Information Center. Surveys typically occurred in late May/early June, and consisted of single-day counts of adult plovers at each site with all sites inventoried in a 1- to 2-day period. Winter numbers were from surveys conducted annually since 1983 by the Oregon Department of Fish

and Wildlife and various partners. Surveys typically occurred in January or February, and consisted of single-day counts of adult snowy plovers at each site with all sites inventoried in a 1- to 2-day period.

CALIFORNIA

Numerical information on nesting snowy plovers before 2000 at specific locations along the California coast is derived from:

1. four coast-wide May/June surveys coordinated by the Point Reyes Bird Observatory during 1977/80, 1989, 1991 and 1995;

2. a supplemental Point Reyes Bird Observatory survey of Del Norte and Humboldt Counties in May 1996;

3. intensive monitoring of breeding plovers by Point Reyes Bird Observatory in Marin and Sonoma Counties from 1986 to 1989 and from 1995 to 1997, and in Santa Cruz and Monterey Counties from 1994 to 1997;

4. U. S. Air Force surveys of nesting snowy plovers at Vandenberg Air Force Base (CA- 84) and the Santa Ynez River mouth (CA-85) by Phil Persons from 1994 to 1997;

5. U. S. National Park Service summer surveys on San Miguel Island (CA-92) from 1987 to 1997 and Santa Rosa Island (CA-93) from 1989 to 1997;

6. U. S. Navy summer surveys of San Nicolas Island (CA-100) from 1989 to 1997;

7. an estimate of the number of snowy plovers on Santa Cruz Island (CA-94) from surveys conducted 1994 to 1996 by The Nature Conservancy (R. Klinger pers. comm. 1997);

8. intensive monitoring of nesting snowy plovers in San Diego County by Abby Powell, U.S. Geological Survey, Biological Resources Division, and her colleagues from 1994 to 1998;

9. an estimate of the number of snowy plovers nesting at Salt Pond 7A levee (CA-25) in 1992 and at Little Island (CA-26) during 1989 to 1991 and 1993 (R. Leong pers. comm. 1997);

10. an estimate of the number of nesting snowy plovers at the Oakland Airport (CA-30) in 1996 and at Bay Farm Island from 1993 to 1995 (L. Feeney pers. comm. 1997);

11. an estimate of the number of snowy plovers nesting at Alameda Naval Air Station (CA-27) from 1982 to 1983 (L. Collins pers. comm. 1998); and

12. anecdotal information on a few sites provided by additional observers.

In the following table, data on breeding numbers before 2000 are derived from the four Point Reyes Bird Observatory coast wide-surveys, the supplemental Point Reyes Bird Observatory 1996 survey of Humboldt and Del Norte Counties, and the National Park Service and Navy surveys of the three Channel Islands, pooled and presented without parentheses as minimum and maximum numbers. Information for the Eel River Mouth to Van Duzan River (CA-11, not covered on the Point Reyes Bird Observatory surveys) is an estimate of the number of adults breeding there during summer 1997 (R. LeValley pers. comm. 1998). Numbers in parentheses for sites CA-16 and CA-20 to CA-23 represent maximum numbers of adults estimated to have nested there from 1980 to 1997. Numbers in parentheses for sites CA-63 to CA-65 indicate the range in numbers believed to have nested from 1994 to 1997. Also in parentheses are the number of adults estimated to have nested at site CA-68 in 1997. For sites CA-84 and CA-85, Point Reyes Bird Observatory data for surveys prior to 1994 are supplemented in parentheses by the range of annual maxima on May/June surveys conducted by Phil Persons between 1994 to 1997. For Orange and San Diego Counties, numbers derived from studies by Abby Powell and her colleagues between 1994 to 1997 are enclosed with parentheses and marked with an asterisk.

Numerical information on wintering snowy plovers along the California coast was collected primarily by volunteers of Point Reyes Bird Observatory. To represent the number of wintering birds at California locations before 2000, we used their maximum annual counts between 1 November and 28 February for the winters 1985/86 through 1996/97. For locations with data from at least 6 of the 12 winters, the range from the second lowest to the second highest yearly count is presented in the table. For locations with 5 or fewer years of data (designated sparse), the lowest and the highest yearly counts are given and supplemented, in parentheses, with the range of maximum counts for winters 1979/80 to 1984-85 as summarized in Page *et al.* (1986). The range of winter numbers for the Jetty Road to Aptos (CA-63) and Monterey to Moss Landing (CA-65) sites in Monterey Bay were estimated from maximum annual November to February winter counts from 1985/86 to 1996/97 at the following locations: Sunset State Beach (1-116), Pajaro River Mouth (71-85), Moss Landing State Beach (42-153), Salinas River State Beach near Potrero Road (1-98), north spit of the Salinas River (7-100), Salinas River National Wildlife Refuge (7-80) and Del Monte (54-87). For most Orange and San Diego County locations, information collected by Abby Powell and her colleagues during the

winters of 1994/95 to 1997/98 are enclosed in parentheses and designated by an asterisk. The range of winter numbers for Naval Air Station North Island was based on an estimate of wintering snowy plovers from surveys conducted from 1994 to 1997 by the U.S. Navy. The range of winter numbers for San Miguel Island was based on incidental observations by National Park Service and National Marine Fisheries Service personnel during the winters of 1993/94 to 1997/98. The range of winter numbers for Santa Rosa Island was based on maximum annual winter counts conducted November 20 through December 5, from 1993 to 1997. The range of winter numbers for Santa Cruz Island was based on an estimate of wintering snowy plovers from surveys conducted during 1994 to 1996 by The Nature Conservancy. The estimate of wintering snowy plovers at the Eel River North Spit and Beach (CA-10) reflects the highest-count data (January 1995) from Mark Fisher, California Department of Fish and Game (M. Fisher *in litt.* 1995).

For both wintering and breeding numbers since 2000, the range from minimum to maximum counts between 2000 and 2005 is reported. Surveys in California were coordinated by Point Reyes Bird Observatory in 2000 and in 2002 through 2005.

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Leora Feeney for data from Oakland Airport and Bay Farm Island.
Robin Leong for data from Salt Pond 7A levee and Little Island.

Laura Collins for data from Alameda Naval Air Station.
Mark Fisher for data from Eel River, North Spit and Beach.
Ron LeValley for data from Eel River Mouth to Van Duzan River.
U.S. Navy (Elizabeth Copper) for data from Naval Air Station North Island.
Zlatunich (2006) for data from Crissy Field in San Francisco.

MANAGEMENT POTENTIAL

Table B-1 also provides guidance on management potential for breeding locations. The Management Potential Breeding Numbers represent population targets of breeding adults that we believe can be achieved under an intensive management scheme. These numbers were derived independently of the recovery criteria, and therefore, do not exactly match the recovery criteria. Collectively, the Management Potential Breeding Numbers are about 20 percent higher than the recovery criteria subpopulation sizes. The numbers are based on the best professional judgment of the technical subteam of the snowy plover recovery team and are indications to land managers of the potential productivity of various areas for plovers.

Management Potential Breeding Numbers were developed for the draft recovery plan by the technical subteam of the snowy plover recovery team, estimating the population levels attainable under intensive management based on survey data at breeding locations and expert opinion regarding the feasibility of management options and the extent and quality of habitat. In this final recovery plan, we (U.S. Fish and Wildlife Service, in coordination with species experts and land managers) have modified the Management Potential Breeding Numbers from the draft recovery plan for certain locations to reflect updated information about habitat quality, population status, and management strategies. As informal targets for management at specific breeding locations, these numbers are intended to be flexible, considering variation in habitat conditions and management opportunities from year to year and from location to location. In the recently proposed special rule under section 4(d) of the Endangered Species Act (U.S. Fish and Wildlife Service 2006b) the Management Potential Breeding Numbers from the draft recovery plan were proposed as targets that, when achieved at the county level and accompanied by documentation of conservation measures implemented, would trigger exemption from most take prohibitions within the county. This special rule has not yet been finalized.

Management Potential Breeding Numbers for individual sites within the San Francisco Bay recovery unit (Sites CA-25 through CA-47) cannot be determined at this time because management potential for the snowy plover must be considered in concert with habitat restoration needs for other listed species. Under the Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (U.S. Fish

and Wildlife Service in prep.), some existing salt ponds in San Francisco Bay will be converted to tidal marsh habitat, while others will be intensively managed as snowy plover habitat. The overall management goal for San Francisco Bay locations is 500 breeding snowy plovers, estimated to be achievable with 809 hectares (2,000 acres) of managed salt ponds (see Action 2.6).

Locations which show a “0" under Management Potential Breeding Numbers currently support primarily wintering and/or migrating snowy plovers. Actions 1 and 2 in the Narrative Outline of Recovery Actions provide guidance on monitoring and managing wintering and migration habitats.

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Table B-1. Numbers of Snowy Plovers Breeding and Wintering at U.S. Pacific Coast Locations and Management Potential at These Locations

WASHINGTON	Adult Breeding Numbers (Range of annual max counts)		Management Potential (Breeding Birds)	WINTERING NUMBERS (Range of annual max counts)		Hectares (Acres)	Kilometers (Miles) of Coastline
	Before 2000	2000 – 2005		Before 2000	2000 – 2005		
Grays Harbor County							
Copalis Spit (WA-1)	0	0	6†	0	0	191 (473)	2.6 (1.6)
Damon Point/Oyhut Wildlife Area (WA-2)	3-10	4-10	12†	0	0	488 (1207)	8.2 (5.1)
Pacific County							
Westport Spit (WA-3) dropped - lack of habitat			0†				
Midway Beach (WA-4)	0-33	14-33	30†	0-8	15-32	362 (895)	2.6 (1.6)
Leadbetter Point/Gunpowder Sands (WA-5)	13-45	24-38	30	0-28	8-26	514 (1,270)	12.5 (7.8)
Graveyard Spit (discovered in 2006, not mapped)		6					

OREGON	Adult Breeding Numbers (Range of annual max counts)		Management Potential (Breeding Birds)	WINTERING NUMBERS (Range of annual max counts)		Hectares (Acres)	Kilometers (Miles) of Coastline
	Before 2000	2000 – 2005		Before 2000	2000 – 2005		
Clatsop County							
Columbia River to Necanicum River (OR-1)	0	0-2	4	0	0	958 (2,367)	21.6 (13.4)
Tillamook County							
Nehalem Spit (OR-2)	0	0	4	0	0	235 (581)	6.9 (4.3)
Bayocean Spit (OR-3)	0-10	0	16	0-5	0-1	286 (707)	8.4 (5.2)
Netarts Spit (OR-4)	0	0	4	0	0	107 (265)	5.2 (3.2)
Sand Lake Spits (OR-5)	0	0	4	0	0	163 (402)	10.6 (6.6)
Nestucca Spit (OR-6)	0	0	4	0	0	161 (397)	5.8 (3.6)
Lincoln County							
South Beach, Newport (OR-7)	0	NS	4	0	0	18 (45)	3.1 (1.9)
Lane County							
Heceta Head to Siuslaw River (OR-8)	0-5	1-11	12	0-14	9-25	197 (486)	9.7 (6.0)
Siuslaw River to Siltcoos River (OR-9)	0-5	5-7 (all Siltcoos Spit)	2	1-23	20-39	267 (660)	16.6 (10.3)

OREGON	Adult Breeding Numbers (Range of annual max counts)		Management Potential (Breeding Birds)	WINTERING NUMBERS (Range of annual max counts)		Hectares (Acres)	Kilometers (Miles) of Coastline
	Before 2000	2000 – 2005		Before 2000	2000 – 2005		
Lane/Douglas Counties							
Siltcoos River to Threemile Creek (OR-10)	0-9	15-21	20	0-10	0-1	405 (1,000)	15.2 (9.4)
Douglas County							
Threemile Creek to Umpqua River (OR-11)	0-2	0	4	0-1	0	1,159 (2,863)	17.1 (10.6)
Douglas/Coos Counties							
Umpqua River to Horsfall Beach (OR-12)	3-10	6-12 (all Tenmile spit)	20	0-22	0-15	355 (878)	26.3 (16.3)
Coos County							
Horsfall Beach to Coos Bay, (OR-13 - A thru C)	2-36	13-21	54	0-19	0-9	480 (1,186)	16.8 (10.4)
Whiskey Creek to Coquille River (OR-14)	0-2	0	0	0-2	0	159 (394)	10.3 (6.4)
Coos/Curry Counties							
Bandon State Park to Floras Lake (OR-15)	7-46	11-24	54	0-26	0-26	700 (1,730)	20.6 (12.8)
Curry County							
Sixes River Mouth (OR-16)	0	0	4	0	NS?	44 (108)	1.5 (0.9)
Elk River Mouth (OR-17)	0	0	4	0	0	90 (222)	3.7 (2.3)
Euchre Creek (OR-18)	0	0	4	0	0	51 (125)	3.7 (2.3)
Pistol River (OR-19)	0	0	4	0	0	76 (188)	4.7 (2.9)

CALIFORNIA	Adult Breeding Numbers		Management Potential (Breeding birds)	Wintering Numbers		Hectares (Acres)	Kilometers (Miles) of Coastline
	Before 2000	2000 – 2005		Before 2000	2000 – 2005		
Del Norte County							
Smith River Mouth (CA-1)	0-6	0	8	Unk	0-1	291 (718)	9.4 (5.8)
Lake Earl (CA-2)	0-8	0	10	sparse 0 (0-3)	0	412 (1,018)	10.0 (6.2)
Humboldt County							
Gold Bluffs Beach (CA-3)	0	0-1	0	sparse 0 (0-9)	0-3	75 (186)	14.2 (8.8)
Stone Lagoon (CA-4)	0	NS	0	sparse 1-7 (7-14)	0	41 (100)	2.6 (1.6)
Big Lagoon (CA-5)	0-13	0-3	16	sparse 0	0-6	129 (320)	6.1 (3.8)
Clam Beach/Little River (CA-6)	2-7	3-10	6	11-32	20-45	149 (369)	4.2 (2.6)
Mad River Mouth and Beach (CA-7) (Strawberry Creek through Lanphere Dunes)	0-17	3-12	12	0-7	0	477 (1,179)	14.4 (8.9)
Humboldt Bay, North Spit (CA-8)	1-11	0	8	sparse 0-10 (0-3)	0	392 (969)	12.9 (8.0)
Humboldt Bay, South Spit (CA-9)	0-7	0-4	30	7-22	0-8	183 (453)	7.9 (4.9)
Eel River, North Spit and Beach (CA-10)	0-11	0-11	20	0-78	0	177 (438)	10.8 (6.7)
Eel River Mouth to Van Duzen River (CA-11)	(26)	5-26	40	0	0	2,088 (5,162)	20.5 (12.7) (river)
Eel River, South Spit and Beach (CA-12)	0-9	0-2	20	3-79	1-75	250 (619)	9.4 (5.8)
McNutt Gulch (CA-13)	0	NS	10	sparse 10	0	156 (385)	10.0 (6.2)
Mendocino County							
MacKerricher Beach, (CA-14 – A & B)	0-15	0-7	20	23-37	37-50	517 (1,277)	8.2 (5.1)
Manchester Beach (CA-15)	0	0-2	0	1-4	4-14	262 (648)	8.4 (5.2)
Sonoma County							
Salmon Creek (CA-16)	0-19 (18)	0-5	10	1-43	0-18	58 (144)	3.9 (2.4)
Bodega Harbor (CA-17)	0	NS	0	16-48	NS	111 (273)	2.1 (1.3)
Doran Spit (CA-18)	0	0	0	23-59	0	25 (63)	2.7 (1.7)
Marin County							
Dillon Beach (CA-19)	0	0	0	31-72	96-123	35 (88)	2.3 (1.4)
Point Reyes Beach (CA-20)	6-29 (50)	17-26	50	46-71	18-98	422 (1,044)	18.1 (11.2)
Drakes Spit (CA-21)	0-7 (4)	0	4	53-87	0	16 (39)	1.1 (0.7)

CALIFORNIA	Adult Breeding Numbers		Management Potential (Breeding birds)	Wintering Numbers		Hectares (Acres)	Kilometers (Miles) of Coastline
	Before 2000	2000 – 2005		Before 2000	2000 – 2005		
Limantour Spit (CA-22)	0-8 (9)	0-4	10	35-70	0-95	188 (464)	8.5 (5.3)
Bolinas Spit/Stinson Beach (CA-23)	0-6 (6)	0	0	6-22	0-11	34 (83)	3.1 (1.9)
San Francisco County							
Ocean Beach (CA-24)	0	0-1	0	30-50	0-30	60 (147)	5.2 (3.2)
Crissy Field (discovered 2005, not mapped)					2-6		c. 0.9 (0.6)
Napa County							
Salt Pond 7A Levee (CA-25)	0-4	0♣	Unknown (see Task 2.6)	Unknown	NS♣	19 (47)	0.0 (0.0)
Little Island (CA-26)	2-12	NS♣	Unknown (see Task 2.6)	Unknown	NS♣	15 (37)	0.0 (0.0)
Alameda County							
Alameda Naval Air Station (CA-27)	0-2 (irreg.)	NS♣	Unknown (see Task 2.6)	Unknown	NS♣	3 (7)	0.0 (0.0)
Alameda South Shore (CA-28)	Unknown	NS♣	Unknown (see Task 2.6)	Formerly 50+	NS♣	26 (64)	3.4 (2.1)
CA-29 has been dropped due to lack of suitable habitat							
Oakland Airport, (CA-30 - 1 & 2)	12-16	NS♣	Unknown (see Task 2.6)	Unknown	NS♣	24 (58)	0.0 (0.0)
Oliver Salt Ponds, North of Hwy. 92 (CA-31)	34-41	0♣	Unknown (see Task 2.6)	sparse 50-100	0♣	54 (134)	0.0 (0.0)
Oliver Salt Ponds, South of Hwy. 92 (CA-32)	2	NS♣	Unknown (see Task 2.6)	Unknown	NS♣	14 (35)	0.0 (0.0)
Baumberg Salt Ponds (CA-33)	34-157	91♣	Unknown (see Task 2.6)	sparse 60-320	16♣	621 (1,534)	0.0 (0.0)
Turk Island Salt Ponds (CA-34)	2-31	NS♣	Unknown (see Task 2.6)	Unknown	NS♣	39 (97)	0.0 (0.0)
Coyote Hills Salt Ponds (CA-35)	17-70	0♣	Unknown (see Task 2.6)	Unknown	0♣	38 (94)	0.0 (0.0)
Dumbarton Salt Ponds (CA-36)	9-37	0♣	Unknown (see Task 2.6)	Unknown	26♣	246 (609)	0.0 (0.0)
Plummer Creek Salt Pond (CA-37)	0-40	NS♣	Unknown (see Task 2.6)	Unknown	NS♣	122 (301)	0.0 (0.0)

CALIFORNIA	Adult Breeding Numbers		Management Potential (Breeding birds)	Wintering Numbers		Hectares (Acres)	Kilometers (Miles) of Coastline
	Before 2000	2000 – 2005		Before 2000	2000 – 2005		
Mowry Salt Ponds (CA-38)	4-10	NS♣	Unknown (see Task 2.6)	Unknown	NS♣	11 (28)	0.0 (0.0)
Warm Springs Salt Pond (CA-39)	1-7	23♣	Unknown (see Task 2.6)	Unknown	28♣	120 (298)	0.0 (0.0)
Santa Clara County							
Knapp Salt Pond (CA-40)	0-10	NS♣	Unknown (see Task 2.6)	Unknown	NS♣	22 (56)	0.0 (0.0)
Alviso Salt Ponds (CA-41)	5-17	7♣	Unknown (see Task 2.6)	Unknown	0♣	79 (194)	0.0 (0.0)
Moffett Field (CA-42)	0-2	NS♣	Unknown (see Task 2.6)	Unknown	NS♣	22 (54)	0.0 (0.0)
Crittenden Marsh (CA-43)	0-6	NS♣	Unknown (see Task 2.6)	Unknown	NS♣	32 (78)	0.0 (0.0)
San Mateo County							
Ravenswood Salt Pond Levee (CA-44)	1-6	3♣	Unknown (see Task 2.6)	Unknown	1♣	182 (449)	0.0 (0.0)
Redwood City Salt Pond (CA-45)	4-9	NS♣	Unknown (see Task 2.6)	Unknown	NS♣	12 (29)	0.0 (0.0)
Redwood Creek (CA-46)	0-3	NS♣	Unknown (see Task 2.6)	Unknown	NS♣	6 (15)	0.0 (0.0)
Middle Bair Island (CA-47)	3	NS♣	Unknown (see Task 2.6)	Unknown	NS♣	78 (194)	0.0 (0.0)
Pacifica Beach (CA-48)	0	0 in 2005♣ NS other yrs	0	7-19	10-33	12 (29)	1.1 (0.7)
Pillar Point (CA-49)	0	0 in 2005♣ NS other yrs	0	3-35	0	2 (4)	0.3 (0.2)
Half Moon Bay Beaches (CA-50)	0-7	1-17	10	24-45	0-65	63 (156)	2.3 (1.4)
Tunitas Beach (CA-51)	Unknown	0-2	4	Unknown	0-34	10 (24)	0.8 (0.5)
San Gregorio Beach (CA-52)	0	0 in 2005♣ NS other yrs	0	0-5	0-75	7 (18)	0.5 (0.3)
Pomponio Beach (CA-53)	0	0 in 2005♣ NS other yrs	0	sparse 1-2 (2-40)	0	7 (17)	0.6 (0.4)
Pescadero Beach (CA-54)	0-4	0	6	8-35	0	34 (84)	1.1 (0.7)

CALIFORNIA	Adult Breeding Numbers		Management Potential (Breeding birds)	Wintering Numbers		Hectares (Acres)	Kilometers (Miles) of Coastline
	Before 2000	2000 – 2005		Before 2000	2000 – 2005		
Gazos Creek (CA-55)	0-2 (irreg.)	0-2	4	5-33	0-31	26 (65)	1.8 (1.1)
Año Nuevo, (CA-56 - 1 through 3)	0-9 (irreg.)	0	10	0-8	0-2	23 (57)	2.1 (1.3)
Santa Cruz County							
Waddell Creek (CA-57)	0-11	0	10	32-50	0	8 (19)	1.1 (0.7)
Scott Creek Beach (CA-58)	0-8	1-12	8	16-114	62-106	12 (30)	1.1 (0.7)
Laguna Creek Beach (CA-59)	0-5	0-2	8	11-47	0-59	4 (10)	0.5 (0.3)
Baldwin Creek Beach (CA-60) ("Four Mile Beach")	0	0-1	0	sparse 0-8	NS	8 (19)	0.3 (0.2)
Wilder Ranch Beach (CA-61)	8-16	0-5	16	33-52	1-26	10 (25)	0.5 (0.3)
Seabright Beach (CA-62) (in Twin Lakes State Beach)	0	0	0	20-53	0-58	12 (29)	0.8 (0.5)
Santa Cruz/Monterey Counties							
Jetty Road to Aptos (CA-63) (Manresa State Beach thru Moss Landing State Beach)	8-38 (13-37)	Total: 17-93	Total: 54	Est. 150-250	Total: 3-117	250 (617)	13.7 (8.5)
Manresa and Sunset State Beaches		0-17	18		0-65		
Pajaro River mouth (End of Sunset State Beach to Pajaro River)		5-48	26		1-8		
Moss Landing State Beach (Zmudowski State Beach through Moss Landing State Beach)		12-45	10		0-44 (all but 1 on Moss L)		
Monterey County							
Elkhorn Slough Mudflat/Salt Pond (CA-64) (a.k.a. Moss Landing Wildlife Area)	6-47 (70)	30-75	80	25-95	0-29 (recently “no habitat”)	118 (291)	0.0 (0.0)

CALIFORNIA	Adult Breeding Numbers		Management Potential (Breeding birds)	Wintering Numbers		Hectares (Acres)	Kilometers (Miles) of Coastline
	Before 2000	2000 – 2005		Before 2000	2000 – 2005		
Moss Landing to Monterey (CA-65) (Moss Landing through Monterey State Beach)	61-104 (90-125)		Total: 162	estimate 120-190		644 (1,590)	24.2 (15.0)
Salinas River State Beach Molera/Potrero (Salinas State Beach from the mouth of Elkhorn Slough to northern boundary of Monterey Dunes Colony)		8-59	10		0-363		
Monterey Dunes (beach in front of Monterey Dunes property)		(incl. above)	12		(incl. above)		
North Salinas (beach from south boundary of Monterey Dunes property to north boundary of Salinas River National Wildlife Refuge; mouth of Salinas River		10-27	20		(incl. above)		
Salinas River National Wildlife Refuge		17-49	40		0-15		
Martin property beach		(incl. below?)	12		0-48		
Lone Star beach and interior areas		(incl. below?)	32		(incl. above)		
Marina & Indian Head State Beaches (includes Reservation Road to Stilwell Hall on Fort Ord)		13-52	16		0-91		
Sand City/Del Monte (southern boundary of Fort Ord to City of Monterey) (Sand City through Monterey State Beach)		0	20		0-31		
Asilomar Beach, (CA-66 - 1 & 2)	0	NS	0	0-37	0	18 (45)	1.5 (0.9)
Carmel River Mouth (CA-67)	0	NS	0	9-31	0	24 (58)	1.1 (0.7)
Point Sur (CA-68)	3-4 (20)	5-8	20	4-65	0-7	49 (120)	1.5 (0.9)
San Luis Obispo County							
San Carpoforo Creek (CA-69)	0-9	0-1	10	18-36	26-46	23 (56)	1.0 (0.6)
Arroyo Hondo Creek (CA-70)	0	NS	0	sparse 0-42	NS	9 (22)	1.0 (0.6)
Pt. Sierra Nevada (CA-71)	0	NS	0	0-10	NS	9 (21)	0.5 (0.3)
Arroyo de la Cruz (CA-72)	0	NS	0	0-15	NS	7 (17)	0.5 (0.3)
Sidney's Lagoon (CA-73)	0	3	0	sparse (0-20)	NS	3 (7)	0.3 (0.2)
Piedras Blancas, (CA-74 - 1 & 2)	0	NS	0	2-8	NS	14 (34)	1.1 (0.7)
Arroyo Laguna Creek (CA-75)	0-6	0-2	6	28-91	0	3 (6)	0.3 (0.2)
Pico Creek (CA-76)	0	NS	0	sparse (0-8)	NS	8 (19)	0.8 (0.5)

CALIFORNIA	Adult Breeding Numbers		Management Potential (Breeding birds)	Wintering Numbers		Hectares (Acres)	Kilometers (Miles) of Coastline
	Before 2000	2000 – 2005		Before 2000	2000 – 2005		
San Simeon Beach (CA-77)	0	1-6	0	17-52	54-143	15 (38)	1.5 (0.9)
Villa Creek (CA-78)	Unknown	21-38	25†	sparse (0-16)	32-45	10 (24)	0.5 (0.3)
Toro Creek (CA-79)	0-16	0-13	16	23-98	0-121	14 (35)	0.8 (0.5)
Atascadero Beach (CA-80)	0-38	5-23	40	67-152	44-249	106 (261)	3.5 (2.2)
Morro Bay Beach (CA-81)	34-94	87-205	110	53-148	3-103	343 (846)	11.1 (6.9)
Avila Beach (CA-82)	0	NS	0	sparse 12 (0-6)	NS	13 (33)	1.1 (0.7)
San Luis Obispo/Santa Barbara Counties							
Pismo Beach/Nipomo Dunes (CA-83)	123-246	81-200	350	173-314 sparse	154-381	882 (2,179)	19.2 (11.9)
Santa Barbara County							
Vandenberg Air Force Base (CA-84) (a.k.a. Minuteman Beach)	90-145 (131-160)	57-105	250	177-265	46-82	450 (1,113)	12.7 (7.9)
Santa Ynez River Mouth/Ocean Beach (CA-85) (a.k.a. Vandenberg Air Force Base)	10-97 (75-118)	49-315	150	79-233	113-224	202 (498)	7.4 (4.6)
Jalama Beach (CA-86)	0-1	0	0	11-87	0	20 (49)	1.9 (1.2)
Hollister Ranch (CA-87)	8	NS	10	Unknown	NS	146 (361)	12.3 (7.6)
Devereaux/Sands/Ellwood (CA-88) (a.k.a. Coal Oil Point)	0-2 (irreg.)	8-30	25†	81-147	120-400	24 (60)	3.1 (1.9)
Goleta Beach (CA-89)	0	0 in 2005♣ NS other yrs	0	sparse 0-6 (6-72)	0	44 (109)	3.7 (2.3)
Point Castillo/Santa Barbara Harbor (CA-90)	0	1	0	19-52	0	38 (94)	4.8 (3.0)
Carpinteria Beach (CA-91)	0	NS	0	0-24	0-2	5 (13)	0.8 (0.5)
San Miguel Island, (CA-92 - 1 through 8)	(5-68)	0	30	(15-200)	2	245 (606)	15.8 (9.8)
Santa Rosa Island, (CA-93 - 1 through 11)	(71-121)	10-37	130	250-320	NS	671 (1,658)	21.3 (13.2)
Santa Cruz Island, (CA-94 - 1 & 2)	24-36	3	20	24-36	34	36 (89)	3.5 (2.2)
Ventura County							
San Buenaventura Beach (CA-95)	0	0-22	0	26-47	35-72	37 (91)	3.9 (2.4)
Santa Clara River Mouth/Mandalay State Beach (CA-96)	9-70	6-22	60	28-33	44-81	190 (470)	7.9 (4.9)
Hollywood Beach (CA-97)	0-5 (irreg.)	0-6	4	sparse 6-23	18-20	31 (76)	1.9 (1.2)

CALIFORNIA	Adult Breeding Numbers		Management Potential (Breeding birds)	Wintering Numbers		Hectares (Acres)	Kilometers (Miles) of Coastline
	Before 2000	2000 – 2005		Before 2000	2000 – 2005		
Ormond Beach (CA-98)	20-34	10-35	50	sparse 0-123 (38-44)	36-117	106 (263)	4.7 (2.9)
Mugu Lagoon Beach (CA-99)	40-82	51-85	110	sparse 12-62 (100-127)	31-67	259 (640)	10.5 (6.5)
San Nicolas Island, (CA-100 - 1 through 15)	(78-116)	62-90	150	185	134-243	166 (410)	12.9 (8.0)
Los Angeles County							
Zuma Beach (CA-101)	0	NS	0	41-82	106-133	66 (164)	4.5 (2.8)
Corral Beach (CA-102)	0	NS	0	sparse 1-7 (8)	0	9 (21)	1.1 (0.7)
Malibu Lagoon/Beach (CA-103)	0	NS	0	27-60	0-33	21 (52)	0.8 (0.5)
Santa Monica Beach (CA-104) (Includes most of N Venice Beach)	0	NS	0	sparse 0-18 (0-4)	14-40 (all in N Santa Monica State Beach)	200 (494)	9.4 (5.8)
Dockweiler to Hermosa Beach (CA-105) (Playa del Rey thru Hermosa Beach)	0	NS	0	9-34	53-75 (0 in El Segundo & Manhattan)	230 (567)	13.2 (8.2)
San Clemente Island, (CA-106 – 1 through 5)	0-2* (irreg.)	0	0	(20-50)*	12-25	29 (71)	2.9 (1.8)
Orange County							
Huntington Beach (CA-107) (Bolsa Chica State Beach through Huntington State Beach)	0-2 (irreg.)	NS	0	5-33 (20-50)*	11-52	226 (558)	13.9 (8.6)
Bolsa Chica Wetlands (CA-108)	8-21 (10-30)*	27-66	70†	1-44 (40-60)*	0-9	504 (1,246)	0.0 (0.0)
Newport Beach (CA-109) (Newport Beach through Balboa Beach)	0	0	0	sparse 0-6 (0-4)	0-12	204 (505)	8.4 (5.2)
Crystal Cove (CA-110) (Corona Del Mar State Beach to Abalone Point)	(0)*	NS	0	11-21 (10-30)*	0-24 (0 in Corona del Mar)	45 (112)	5.0 (3.1)
Salt Creek Beach (CA-111) (Dana Strand/Salt Creek)	0	NS	0	23-29	23-38	23 (56)	2.6 (1.6)
Doheny Beach (CA-112)	(0)*	NS	0	0-23 (10-30)*	0	45 (111)	4.0 (2.5)
Orange/San Diego Counties							
San Onofre Beach (CA-113) (predominantly within San Diego County)	(0-2)* (irreg.)	NS	15	2-16 (10-30)*	14-60	54 (133)	4.4 (2.7)

CALIFORNIA	Adult Breeding Numbers		Management Potential (Breeding birds)	Wintering Numbers		Hectares (Acres)	Kilometers (Miles) of Coastline
	Before 2000	2000 – 2005		Before 2000	2000 – 2005		
San Diego County							
Aliso/French Creek Mouth (CA-114) (Surveys now combine 114 & 115 as "Camp Pendleton")	(3-6)*	13-67	40	(10-30)*	42-115 (Camp Pendleton)	51 (126)	2.3 (1.4)
Santa Margarita River Estuary (CA-115)	33-74 (35-75)*	41-66	160	25-64 (30-60)*		220 (543)	4.7 (2.9)
San Luis Rey River Mouth (CA-116)	0	NS	0	sparse 0-15 (0-14)	0	14 (34)	1.0 (0.6)
Agua Hedionda Lagoon/Beach (CA-117)	0-54 (0)*	0	10	0-20 (0-20)*	0	180 (444)	2.3 (1.4)
South Carlsbad Beach (CA-118)	(0)*	NS	0	0-30*	22-82	57 (142)	4.7 (2.9)
Batiquitos Lagoon (CA-119)	6-13 (6-30)*	5-26	70	(10-30)*	0-51	271 (670)	0.0 (0.0)
San Elijo Lagoon/Beach (CA-120) (San Elijo Lagoon, Cardiff State Beach)	0-23 (0)*	0-3	20†	3-28 (0-10)*	0-31	218 (540)	1.9 (1.2)
San Dieguito Lagoon/Beach (CA-121)	0-6 (0)*	0	20†	6-52 (0-10)*	0	144 (356)	2.1 (1.3)
Los Penasquitos Lagoon/Beach (CA-122)	0-1 (0)*	0	10	0-34 (10-30)*	4-39	53 (131)	1.6 (1.0)
Mission Bay, Bonita Cove (CA-123)	(0-2)* (irreg.)	NS	0	50-80 (0-80)*	0-62 (only Mariner's Pt surveyed)	36 (88)	3.2 (2.0)
Mission Bay, Fiesta Island (CA-124)	(0)*	NS	10†	(0-20)*	0	15 (37)	1.5 (0.9)
South Mission Beach (CA-125)	(0)*	0-1	0	(0-70)*	0-106	25 (62)	1.8 (1.1)
Ocean Beach/San Diego FCC (CA-126) (River Mouth)	(0)*	NS	0	2-57 (10-70)*	0-81 (river channel)	43 (105)	2.1 (1.3)
NAS North Island (CA-127) (NAS North Island through Coronado Beach)	(2-4)*	4-18	20	(2-60)	30-65 (all but 1 on NAS)	147 (362)	5.8 (3.6)
NAB Coronado/Silver Strand State Beach/Naval Radio Receiving Facility (CA-128)	(17-45)*	26-58	65	(10-100)*	89-117	189 (468)	10.0 (6.2)
NAB Delta Beach Bay (CA-129)	(2-8)*	0-10	10	(0-30)*	14	42 (105)	1.8 (1.1)
South San Diego Bay Marine Biological Study Area (CA-130)	(0)*	NS	0	(0-80)*	2	13 (31)	0.0 (0.0)
Western Salt Company/South San Diego Bay Unit SDBNWR (CA-131)	9-31 (1-5)*	0-4	30†	(0-10)*	0-4	734 (1,814)	4.0 (2.5)
Sweetwater National Wildlife Refuge (CA-132)	(7-1l)*	0-2	25†	(0-150)*	0-36	123 (305)	2.4 (1.5)
Tijuana River Beach (CA-133)	4-37 (4-20)*	6-16	40	0-91 (10-40)*	29-93 (0 on Border Field State Park)	98 (243)	3.7 (2.3)

NS Not Surveyed.

?? No survey data available, or data not comparable.

† Management Potential modified from draft recovery plan:

Copalis Spit (WA-1): Potential decreased from 10 to 6. Erosion caused by the northward shift of Connor Creek has reduced amount of available habitat.

Damon Point (WA-2): Potential decreased from 20 to 12. Few secure nesting areas are available due to high public use over most of unit.

Westport (WA-3): Potential decreased from 8 to 0. The beach has eroded and is now too narrow to support nesting; little opportunity for beachgrass removal due to private ownership of upland dune areas.

Midway Beach (WA-4): Potential increased from 10 to 30, as accretion of sand on the beach since 1998 has greatly increased available habitat and population has increased.

Villa Creek (CA-78): Potential increased from 0 to 25, as new survey data since publication of draft recovery plan have consistently confirmed presence of a breeding population and potential appears achievable.

Devereaux Beach (CA-88): Potential increased from 4 to 25, as management for western snowy plovers at Coal Oil Point was initiated in 2001 and has been successful in increasing nesting success and population size. New survey data since publication of draft recovery plan have consistently confirmed presence of a breeding population. Potential of 25 is consistent with size of new breeding population and appears achievable.

Bolsa Chica Wetlands (CA-108): Potential increased from 50 to 70. Since the draft recovery plan, this site has undergone an extensive restoration program increasing the amount of available western snowy plover nesting habitat.

San Elijo Lagoon/Beach (CA-120): Potential increased from 10 to 20. Since the draft recovery plan, current and planned restoration and enhancement actions are anticipated to improve western snowy plover nesting habitat.

San Dieguito Lagoon/Beach (CA-121): Potential increased from 10 to 20. This site is now undergoing an extensive restoration program, which is anticipated to increase the amount of available western snowy plover nesting habitat.

Mission Bay, Fiesta Island (CA-124): Potential increased from 0 to 10. The potential presented in the original draft recovery plan were inconsistent between Appendix B, which listed 0, and Appendix C, which listed 10. This change corrects that error.

Western Salt Company (CA-131): Potential increased from 10 to 30. Since the draft recovery plan, the site is now under management as the South San Diego Bay Unit of the San Diego Bay National Wildlife Refuge. It is operating under a final Comprehensive Conservation Plan (August 2006) that intends to expand nesting and improve chick foraging opportunities to provide a significant benefit to western snowy plovers over past conditions.

Sweetwater National Wildlife Refuge (CA-132): Potential increased from 20 to 25. Since the draft recovery plan, the Sweetwater Marsh Unit of the San Diego Bay National Wildlife Refuge is operating under a final Comprehensive Conservation Plan (August 2006) that intends to increase management for western snowy plovers and provide "moderate benefit" to the species over past conditions.

* From surveys by Abby Powell and colleagues, from 1994 through 1997.

♣ Counts from 2005 summer window surveys or 2004/5 winter window surveys, given based on Point Reyes Bird Observatory's summary table “Comparison of the 2004-05 winter and 2005 summer Snowy Plover surveys of the California coast”. Localities marked as NS were not included in summary table. During 2000 and 2002-2004 in San Francisco Bay, comparable summer window surveys were done (see Table 4 in main text) as well as more intensive population monitoring in main South Bay population centers (Strong and Dakin 2004, Strong *et al.* 2004), but window survey summary tables did not break out totals among specific localities.

1 Acreages calculated for San Francisco Bay salt ponds and salt pond levees (Locations CA-25, CA-26, and CA-31 through CA-47) were based on acreage of salt pond (using planimeter) and average levee crown width of 3.7 meters (12 feet).

2 Although Avila Beach is proposed for excavation of underlying oil contamination and beach restoration, it is anticipated that restoration will replace and enhance existing habitat values for snowy plovers.

Unless otherwise noted, California breeding survey counts from 2000-2005 are from data reported in Point Reyes Bird Observatory’s summary table “Year 2005 Breeding Season Snowy Plover Survey of California Coast”.

Location numbering, delineation, and acreages presented in this table differ from those in the final rule for critical habitat (U.S. Fish and Wildlife Service 2005).

In compensation for snowy plover habitat lost due to salt marsh restoration, intensively managed salt pond habitat in San Francisco Bay should be sufficient to support an overall population of 500 breeding birds (Action 2.6).

APPENDIX C

SUMMARY OF CURRENT AND ADDITIONAL NEEDED MANAGEMENT ACTIVITIES FOR SNOWY PLOVER BREEDING AND WINTERING LOCATIONS

In May 1998, we requested public land managers (i.e. Federal, State, county and city land managers) and private conservation organizations to complete the western snowy plover management and beach use surveys prepared by the recovery team. We sent a total of 178 sets of surveys to land managers in Washington, Oregon and California, and received responses from almost 70 percent of the recipients. The responses showed there is much variability in the extent and duration of population monitoring. Monitoring at breeding locations ranged from no monitoring to monitoring seven days per week. Monitoring at wintering locations ranged from no monitoring to monitoring one to two days per season. However, most breeding locations receive some degree of monitoring. The responses also showed that many land managers conduct general beach patrols to enforce beach rules and regulations; however, they may not employ wardens to specifically enforce protective measures for snowy plovers.

Survey recipients were asked to include the total costs for snowy plover monitoring and management activities, by location. During the 12-month period from approximately June 1997 through June 1998, all respondents spent a total of approximately $806,000 on snowy plover monitoring, management and public education measures. Approximately 42 percent of the respondents expended funds on snowy plovers. Funds for monitoring and management were spent at 47 breeding/wintering locations and 6 wintering locations, representing about 49 percent of the publicly-owned locations for which surveys were completed (53 out of 107 locations). This results in an average management agency expenditure of approximately $37.00 per acre of breeding/wintering habitat and $1.00 per acre of wintering habitat. However, this figure should be considered a very rough estimate. For some locations with broad management programs for sensitive species (e.g., Camp Pendleton), it was difficult to obtain an accurate assessment of costs associated with snowy plover management because it is combined with management costs for the California least tern. Also, costs associated with providing wardens for protection of snowy plovers could not be separated from enforcement costs for overall enforcement of beach rules and regulations. This

figure also does not include costs associated with most monitoring activities, including those provided by the Point Reyes Bird Observatory, U.S. Geological Survey (Biological Resources Division), and several state agencies such as the Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, and California Department of Fish and Game. In general, costs (listed from least to most expensive) were associated with the following management measures: (1) public information and education (e.g., brochures and on-site docents); (2) exclusionary measures (e.g., signs, symbolic fencing, and exclosures); (3) monitoring; and (4) predator control. However, each of these costs was also dependent on the extent of area covered and the intensity of the problems addressed. Funding sources included State of Washington general fund, County of Santa Cruz, California Coastal Conservancy grant, U.S. Fish and Wildlife Service, Bayfront Conservancy Trust, Port of San Diego, U.S. Navy, U.S. Marine Corps, U.S. Air Force, National Park Service, California Department of Parks and Recreation "District" funds, Federal Emergency Management Agency, Challenge grant, and Broderbund (private computer software company).

During the preparation of this final recovery plan in 2004 and 2005, we updated the information from the 1998 survey based on additional information we received from the recovery team, U.S. Fish and Wildlife Service field office staff, and other comments on the draft recovery plan (*e.g.*, S. Allen *in litt*. 2004, J. Buffa *in litt*. 2004).

Table C-1 provides location-specific summaries of current management activities based on responses to the original surveys and subsequent supplemental information. Current (C) activities are those management measures or activities which were in place at the time of the survey in 1998, or are known to have subsequently been put into effect. Additional (A) activities are those management measures or activities which to the best of our knowledge still need to be initiated or improved to achieve the management goals. For locations where information on current and/or additional management activities by public land managers is not currently available, this information is left blank and referenced as unknown in the comments for those locations.

This table provides preliminary, interim guidance for public land managers, private conservation organizations and private landowners (where known) regarding management measures which should receive emphasis at their locations. In the future, additional management measures for all locations identified in Table C-1 are to be determined and prioritized on a site-specific basis through coordination and discussions between members of each of the six recovery unit working groups because they have on-the-ground, day-to-day, experience about what is currently being done in those areas. Each of the six working groups should use this recovery plan as a guide, but individual land managers and landowners should implement those actions which are most likely to improve habitat for snowy plovers and meet the management goal target breeding numbers necessary for recovery. This should be done in concert with their working group and through adaptive management.

Detailed knowledge of snowy plover abundance and distribution is needed for adaptive management and to determine the success of this recovery effort. Therefore, the recovery team recommends that all land managers of public lands and private conservation lands monitor snowy plover populations at all breeding and wintering locations annually, in accordance with the monitoring guidelines included in Appendix J. The recovery team also recommends that land managers proactively engage in outreach to gain compliance with management measures, and employ wardens to enforce measures where needed. For privately-owned parcels, current and additional management measures are unknown for most locations. Suggested additional measures at these locations include communication and cooperation between public land managers, private conservation organizations, members of the recovery unit working groups, and private landowners. Where needed, development of cooperative agreements with private landowners to conserve snowy plover habitat should be sought. Acquisition of important sites should be sought on a willing-seller basis.

Management Goal Breeding Numbers in Table C-1 represent population targets of breeding adults that we believe can be achieved under a very intensive management scheme (see also discussion in Appendix B). Collectively, these numbers are about 15 percent higher than the recovery criteria subpopulation sizes, but lower than potential carrying capacity.

Management Goal Breeding Numbers for individual sites within the San Francisco Bay recovery unit (Sites CA-25 through CA-47) cannot be determined at this time because management goals for the snowy plover must be considered in concert with habitat restoration needs for other listed species. The overall management goal for San Francisco Bay locations is 500 breeding snowy plovers, which we estimate to be achievable through intensive management of 2,000 acres of salt ponds (see Action 2.6). Locations which show a “0" under Management Goal Breeding Numbers currently support primarily wintering and/or migrating snowy plovers. Actions 1 and 2 in the Stepdown Narrative provides guidance on monitoring and managing wintering and migration habitats.

KEY TO LANDOWNER AND/OR MANAGER:

ARMY	U.S. Army
BLM	U.S. Bureau of Land Management
Caltrans	California Department of Transportation
CDFG	California Department of Fish and Game
CDPR	California Department of Parks and Recreation
CE	U.S. Army Corps of Engineers
City	Cities identified
County	Counties identified
EBRPD	East Bay Regional Park District
FWS	U.S. Fish and Wildlife Service
HARD	Hayward Area Recreation and Park District
MPOSD	Mid-Peninsula Open Space District
MPRPD	Monterey Peninsula Regional Park District
NASA	National Aeronautics and Space Administration-Ames Research Center
NAVY	U.S. Navy
NPS	National Park Service
ODFW	Oregon Department of Fish and Wildlife
OPRD	Oregon Parks and Recreation Department
PGH	Port of Grays Harbor
PO	Port of Oakland
Private	Private landowners (except HARD, MPOSD, TNC, TPL)
PSL	Port of San Luis Harbor District
SDRPJPA	San Dieguito River Park Joint Powers Authority
State	State lands
TNC	The Nature Conservancy
TPL	Trust for Public Land
USAF	U.S. Air Force
USFS	U.S. Forest Service
USMC	U.S. Marine Corps
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WSPRC	Washington State Parks and Recreation Commission

NOTE: In the States of Washington, Oregon, and California, the State holds title to the intertidal zone. In addition, the State of Oregon retains jurisdiction over the area between extreme low tide and the vegetation line and refers to this area as the Ocean Shore. To save space on this table, state ownership of the intertidal zone has not been shown for every location. However, the intertidal zone is an extremely important component of western snowy plover habitat, and the Ocean Shore encompasses most currently occupied plover habitat in Oregon. Also in the State of California, there are inholdings and accreted lands under the jurisdiction of the State Lands Commission which have not been shown on this table.

The following key to current and additional management activities contains most of the management categories identified in the surveys of land managers of public lands and private conservation organizations.

KEY TO CURRENT AND ADDITIONAL NEEDED MANAGEMENT ACTIVITIES:

Access	Restrict public access
Boats	Restrict boats
Contaminant	Contaminant (oil/tarball) removal
Cooperation	Seek landowner cooperation/cooperative agreement
Development	Prohibit/restrict development
Driftwood	Restrict driftwood collection
Enforce	Enforce protective rules/regulations
Enhance	Enhance habitat through creation of ponds/playas for nesting/foraging
Exclosures	Use exclosures
Fence	Direct human use by symbolically fencing sensitive areas
Horses	Restrict horses
Info.& Ed.	Public information and education
Kites	Restrict kites
Livestock	Restrict livestock
Military	Restrict military uses
Monitor	Population monitoring during breeding and/or wintering seasons
OHV's	Restrict off-highway vehicles
Pets	Restrict pets
Predators	Predator control (other than exclosures)
Signs	Use exclusionary signs
Vegetation	Plant and exotic vegetation control
Unknown	Unknown

Current (C) = management measures or activities which are currently in place.
Additional (A) = management measures or activities which need to be initiated or improved to achieve the management goals.

Table C-1. Summary of existing and additional needed management activities at U.S. Pacific Coast snowy plover breeding and wintering locations. Information based on 1998 survey of land managers as supplemented by subsequent information (from western snowy plover recovery team, U.S. Fish and Wildlife Service field office staff, and other commenters).

		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
WA-1	Copalls Spit	6					C		CA			A		C				C	C	A		C	A	WSPRC
WA-2	Damon Point/Oyhut Wildlife Area	12	C						CA			A		CA			C	C	CA			C	A	WDFW
			C						CA					A					C	A			A	WSPRC
			C				C												C	A			A	WDNR
WA-4	Midway Beach	30					C		CA					A					C				A	WSPRC
						A																		Private
														A				CA						WDFW
WA-5	Leadbetter Point/Gunpowder Sands	30	C				C		C		C		C	CA				C	C	C		C	CA	FWS
			C						C					CA				CA				A		WSPRC
OR-1	Columbia River to Necanicum River	4																C		C				OPRD
																								State/U.S. Army
																								Clatsop County
																								City of Gearhart
						A																		Private
	Comments for OR-1: No current management by State/U.S. Army; current management by County and City unknown.																							
OR-2	Nehalem Spit	4							C											C				OPRD
OR-3	Bayocean Spit	16		C													C		C					Tillamook County, OPRD
OR-4	Netarts Spit	4																						OPRD
	Comment: Current management by OPRD unknown.																							

Table C-1. Summary of existing and additional needed management activities at U.S. Pacific Coast snowy plover breeding and wintering locations. Information based on 1998 survey of land managers as supplemented by subsequent information (from western snowy plover recovery team, U.S. Fish and Wildlife Service field office staff, and other commenters).

		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
OR-5	Sand Lake Spits	4							C										C					USFS, OPRD and Tillamook County
OR-6	Nestucca Spit	4																						OPRD
	Comment: Current management by OPRD unknown																							
OR-7	South Beach, Newport	4					C		C										C					OPRD
						A																		Private
	Additional for OR-1, OR-2, OR-4, OR-5, OR-6 and OR-7: Identify and evaluate a core area within each of these locations, and manage it for breeding plovers, initially focusing on habitat improvement of the core area combined with biweekly monitoring during the breeding season. If plovers are observed during the breeding season, then more intensive management (access use exclosures, fence, info. & ed., signs, monitor should be implemented.																							
OR-8	Heceta Head to Siuslaw River	12	C	C					CA		C	C		C			C	C	C	C	C	C	C	USFS, OPRD
																								Lane County
						A																		Private
	Additional for OR-8 (USFS): Increase volunteer interpretation/monitoring. Comment: Current management by County unknown																							
OR-9	Siuslaw River to Siltcoos River	2	C	C					CA		C	C		C			C	C	C	C		C	C	USFS, OPRD
OR-10	Siltcoos River to Threemile Creek	20	C	C			C	C	CA		C	CA		C			C	C	C	CA	C	C	C	USFS, OPRD
OR-11	Threemile Creek to Umpqua River	4					C		C		C			C			C	C					C	USFS, OPRD
OR-12	Umpqua River to Horsfall Beach	20	C				C	C	CA		C	C						C	C		C	C	C	USFS, OPRD
			C						CA		C	C						C				C		OPRD

Table C-1. Summary of existing and additional needed management activities at U.S. Pacific Coast snowy plover breeding and wintering locations. Information based on 1998 survey of land managers as supplemented by subsequent information (from western snowy plover recovery team, U.S. Fish and Wildlife Service field office staff, and other commenters).

		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
	Additional for OR-12: Increase foredune re-shaping from Umpqua River to Tenmile Creek																							
OR-13	Horsfall Beach to Coos Bay, Units 1-3	54	C	C			C		CA		C	C		C				C	C	C	C	C	C	BLM, CE, USFS, ODFW and OPRD
OR-14	Whiskey Creek to Coquille River	0					C											A	C	C				OPRD
						C																		Private
	Additional for OR-14: Monitor, and if nesting occurs, use exclosures.																							
OR-15	Bandon State Park to Floras Lake	54	CA				C	C	CA		C	C		C				C	CA	C	C	C	CA	OPRD, Curry county
																								BLM
						A																		Private
	Additional for OR-15: Vehicle closure from Bandon Beach access South to current closure one mile north of Twomile Creek.																							
OR-16	Euchre Creek	4																A						OPRD, Curry County
OR-17	Pistol River	4																CA						OPRD
OR-18	Sixes River Mouth	4																A						OPRD
	Comment for OR-16: Current management by County unknown.																							
OR-19	Elk River Mouth	4																A						OPRD
						A																		Private
	Additional for OR-16, OR-17,OR-18 and OR-19: Implement biweekly monitoring during the breeding season, and if plovers are observed, then implement appropriate intensive management, including but not limited to access, enforce, exclosures, fence, info& ed. signs, monitor, pets and vegetation.																							

Table C-1. Summary of existing and additional needed management activities at U.S. Pacific Coast snowy plover breeding and wintering locations. Information based on 1998 survey of land managers as supplemented by subsequent information (from western snowy plover recovery team, U.S. Fish and Wildlife Service field office staff, and other commenters).

		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-1	Smith River Mouth	8					C	A	C				C					C	C				A	CDPR
						A																		Private
	Additional for CA-1: If breeding is observed, increase enforcement, prohibit/restrict pets, and add exclosures, fencing, info. & ed., and signs																							
CA-2	Lake Earl	10					C	A	C					A				CA	C				A	CDFG
				C			C	A	C				C	A				CA	C				A	CDPR
																								Del Norte County
						A																		Private
	Additional for CA-2: If breeding is observed, increase enforcement, prohibit/restrict pets, and add exclosures, fencing, info. & ed., and signs																							
	Comment for CA-2: Current management by County unknown.																							
CA-3	Gold Bluffs Beach	0					A	A	C			A		C				C	C	C			C	NPS
							A	A	C					A				C	C	C			A	CDPR
	Additional for CA-3: If plovers found (especially breeding) increase enforcement of vehicle restrictions on wave slope. Monitor, and use exclosures if nesting.																							
CA-4	Stone Lagoon	0					A	A	C					A				C		C			A	CDPR
	Additional for CA-4: Use exclosures if nesting occurs.																							
CA-5	Big Lagoon	16					A	A	A					A				C	C	CA			A	CDPR
	Additional for CA-5: Use exclosures, prohibit/restrict pets, fence, info. & ed., and signs when nesting occurs.																							
CA-6	Clam Beach/Little River	6					A	A	A		A	A		A	A			C	C	CA		A	A	CDPR
							CA		A		A	A		A	A			CA	A	A		A	A	Humboldt County
						A																		Private

Table C-1. Summary of existing and additional needed management activities at U.S. Pacific Coast snowy plover breeding and wintering locations. Information based on 1998 survey of land managers as supplemented by subsequent information (from western snowy plover recovery team, U.S. Fish and Wildlife Service field office staff, and other commenters).

		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
	Additional for CA-6: Prohibit/restrict fireworks, and use exclosures when breeding is observed.																							
CA-7	Mad River Mouth and Beach	12					C		C		A	C		A				C	CA	A			C	BLM
			C				C		C		A			A				C	CA	A	C		C	FWS
							A	A	A		A			A				CA	CA	A	A		A	Humboldt County
						A																		Private
	Additional for CA-7: Prohibit/restrict pets and use exclosures when breeding is observed.																							
CA-8	Humboldt Bay, North Spit	8	C				C		C		A	A		A				C	C	A			A	BLM
						A	C																	City of Eureka
						A																		Private
	Additional for CA-8: Prohibit/restrict pets and use exclosures when breeding is observed.																							
CA-9	Humboldt Bay, South Spit	30				A	A		A		A	A		A				A	A	A			A	Private
CA-10	Eel River, North Spit and Beach	20	A				A	A	C		C	A		A				C	CA	A			A	CDFG
							A	A	A		A	A		A					CA				A	Humboldt County
						A																		Private
	Additional for CA-5: Use exclosures when breeding is observed and prohibit OHV's during breeding season.																							
CA-11	Eel River Mouth to Van Duzen River	40	A				A	A	A									C	C	A		C	A	Humboldt County
																								(Worswick Gravel Bar)
	Additional for CA-11: Use exclosures when breeding is observed.																							
CA-12	Eel River, South Spit and Beach	20				A					A	A		A				A	A					Private

Table C-1. Summary of existing and additional needed management activities at U.S. Pacific Coast snowy plover breeding and wintering locations. Information based on 1998 survey of land managers as supplemented by subsequent information (from western snowy plover recovery team, U.S. Fish and Wildlife Service field office staff, and other commenters).

		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-13	McNutt Gulch	10				A												A						Private
	Additional for CA-13: Seek cooperative agreement to monitor and use exclosures if nests found.																							
CA-14	MacKerricher Beach, 1-2	20					CA		A		A		A	A				C	C	CA		A	C	CDPR 1
			A				CA		A		A	C	A	A				C		CA		A	C	CDPR 2
	Comment for CA-14: Unit 1 is from Ten Mile Beach to Ward Avenue: Unit 2 is Virgin Creek Beach.																							
	Additional for CA-14: Install informational signs at access points to the two beaches; prohibit development or additional access/parking at Ten Mile beyond what currently exists; prohibit boardwalk construction north of Ward Avenue; improve trash control; and remove fence with confusing information at Virgin Creek. Use exclosures when nesting occurs.																							
CA-15	Manchester Beach	0	A				C		A		A		A	A				A	C	C		A	A	CDPR
						A																		Private
	Additional for CA-15: Use exclosures if nesting occurs. Comment: Monitoring by PRBO.																							
CA-16	Salmon Creek	10		C					A		A	A		A				A		A				CDPR
						A																		Private
CA-17	Bodega Harbor	0																						State
CA-18	Doran Spit	0				A								A				C						Sonoma County
	Additional for CA-18: Use exclosures if nesting occurs. Comment: Monitoring by PRBO.																							
CA-19	Dillon Beach	0				A								A				C		A				Private
	Additional for CA-19: Use exclosures if nesting occurs. Comment: Monitoring by PRBO.																							

Table C-1. Summary of existing and additional needed management activities at U.S. Pacific Coast snowy plover breeding and wintering locations. Information based on 1998 survey of land managers as supplemented by subsequent information (from western snowy plover recovery team, U.S. Fish and Wildlife Service field office staff, and other commenters).

		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-20	Point Reyes Beach	50	C	C	A		C		C		C	C	C	C		C	C	C	C	C	A	C	CA	NPS
	Additional for CA-20: Exclude pinnipeds from plover nesting habitat, discourage pinnipeds if they haul out in nesting snowy plover habitat; docent education. Comment: Monitoring by PRBO NPS is restoring 300 acre site by removing beach grass starting in 2005.																							
CA-21	Drakes Spit	4		C	C		C		C			A	C	C			C	C	C	C	A	A	CA	NPS
	Additional for CA-21: Use exclosures if nesting occurs. Monitoring by PRBO.																							
CA-22	Limantour Spit	10	C		C				C		C	C	A	C	C			C	C	C	A	C	CA	NPS
	Additional for CA-22: Exclude pinnipeds from plover nesting habitat; docent education. Discourage pinnipeds if they haul out in nesting snowy plover habitat. Monitoring by PRBO																							
CA-23	Bolinas Spit/Stinson Beach	0				A												A						Private
	Additional for CA-23: Seek cooperative agreement to monitor and use exclosures if nests found.																							
CA-24	Ocean Beach	0							C					C				C	C	C		C	C	NPS
	Additional for CA-24: Use exclosures if nesting occurs. Comment: Monitoring by NPS of wintering snowy plovers.																							
	Crissy Field	0	A	A					C			A		C				C				C	C	NPS
CA-25	Salt Ponds 7A Levee	Unknown	C															C						CDFG
CA-26	Little Island	Unknown																C						CDFG
CA-27	Alameda Naval Air Station	Unknown																						Navy
	Comment for CA-27; No current management by Navy.																							

Table C-1. Summary of existing and additional needed management activities at U.S. Pacific Coast snowy plover breeding and wintering locations. Information based on 1998 survey of land managers as supplemented by subsequent information (from western snowy plover recovery team, U.S. Fish and Wildlife Service field office staff, and other commenters).

		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-28	Alameda South Shore	Unknown		C			C										C	C		C				EBRPD
						A																		Private
CA-29	Dropped for lack of suitable habitat																							
CA-30	Oakland Airport, Units 1-2	Unknown																						PO
	Comment for CA-30: Current management by PO unknown.																							
CA-31	Oliver Salt Ponds, North of Hwy. 92	Unknown	C	C			C			A	A		C	A			C	CA	C	C	CA	C	C	HARD
	Additional for CA-31: Improve summer water conditions to create foraging habitat for breeding plovers.																							
CA-32	Oliver Salt Ponds, South of Hwy. 92	Unknown				A															A			Private
CA-33	Baumberg Salt Ponds	Unknown	C						A	A	A	C	C	A				C	C	C	CA			CDFG
						A																		Private
	Additional For CA-33: FWS: conduct banding study																							
CA-34	Turk Island Salt Ponds	Unknown				A																		Private
CA-35	Coyote Hills Salt Ponds	Unknown	C			C		C	A	A	C	C	C				C	C	C	C	A	C	A	FWS
			A																					Caltrans
	Additional For CA-35: (1) FWS: conduct banding study, and (2) Caltrans: Develop agreement to prohibit/restrict access during breeding season.																							
CA-36	Dumbarton Salt Ponds	Unknown	C				C		C	A	A	C	C	C				C	C	C	A	C	A	FWS
	Additional for CA-36: Conduct Banding study.																							

Table C-1. Summary of existing and additional needed management activities at U.S. Pacific Coast snowy plover breeding and wintering locations. Information based on 1998 survey of land managers as supplemented by subsequent information (from western snowy plover recovery team, U.S. Fish and Wildlife Service field office staff, and other commenters).

		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-37	Plummer Creek Salt Pond	Unknown				A																		Private
CA-38	Mowry Salt Ponds	Unknown	C	C			C		C		A		C					C	C	C	C	C		FWS
						A																		Private
CA-39	Warm Springs Salt Pond	Unknown	C				C		CA	A	A		C	A				C	C	C	CA	C		FWS
						A																		Private
	Additional For CA-39: FWS: conduct banding study																							
CA-40	Knapp Salt Pond	Unknown	C	C			C		C				C					C		C	C	C		FWS
	Additional for CA-40: Assess reasons for lack of recent plover use.																							
CA-41	Alviso Salt Ponds	Unknown				A												C						Private
CA-42	Moffett Field	Unknown	C				C					C	C					C		C		C		NASA
CA-43	Crittenden Marsh	Unknown	C				C					C	C							C		C		NASA
				C			C						C				C	C		C				MPOSD
	Additional For CA-43: FWS: conduct banding study																							
CA-44	Ravenswood Salt Pond Levee	Unknown				A												C			CA			Private

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		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-45	Redwood City Salt Pond	Unknown				A												C			CA			Private
	Additional For CA-45: FWS: conduct banding study																							
CA-46	Redwood Creek	Unknown				A																		Private
CA-47	Middle Bair Island	Unknown				A																		TPL
	Additional for CA-25 through CA-47: See Task 1.7																							
CA-48	Pacifica Beach	0							A									C		A		A		CDPR (City of Pacifica)
						A																		Private
	Additional for CA-48: Use exclosures if nesting occurs. Comment: Monitoring by PRBO.																							
CA-49	Pillar Point	0		C			C						C				C	A	C	C				San Mateo County
						C																		Private
	Additional for CA-49: Use exclosures if nesting occurs.																							
CA-50	Half Moon Bay Beaches	10	C	C					C		A	C	C					C		C	C		C	CDPR
CA-51	Tunitas Beach	4				A																		Private
CA-52	San Gregorio Beach	0		C			C		C				C				C	A	C	C				CDPR
	Additional for CA-52: Use exclosures if nesting occurs.																							

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		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-53	Pomponio Beach	0		C			C						C				C	A	C	C				CDPR
	Additional for CA-53: Use exclosures if nesting occurs.																							
CA-54	Pescadero Beach	6	C	C			C		C				C				C	C		C				CDPR
	Additional for CA-54: Use exclosures if nesting detected. Comment Monitoring by PRBO.																							
CA-55	Gazos Creek	4		C			C		C								C	C		C				CDPR
						A																		Private
	Additional for CA-55: Use exclosures if nesting detected. Comment Monitoring by PRBO.																							
CA-56	Ano Nuevo, Units 1-3	10	C	C			C		C				C				C	C		C			C	CDPR
	Additional for CA-56: Use exclosures if nesting detected.																							
CA-57	Waddell Creek	10																C				C		CDPR
	Additional for CA-57: Use exclosures if nesting detected. Comment Monitoring by PRBO.																							
CA-58	Scott Creek Beach	8	C						C		C	C		C				C	C	C	C			Santa Cruz County
						A																		Private
	Additional for CA-58: Permanent fence/barrier prohibiting off-road vehicle access. Comment Monitoring by PRBO.																							
CA-59	Laguna Creek Beach	8	C				C		C		C	C		C				C	C	C	C	C		TPL (Santa Cruz County)
	Additional for CA-59: Remove or prohibit parking on state and county right-of-way. Comment: Monitoring by PRBO.																							

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		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-60	Baldwin Creek Beach	0																A						CDPR
	Additional for CA-57: Use exclosures if nesting detected.																							
CA-61	Wilder Ranch Beach	16	C	C			C		C		C	C	C	C			C	C	C	C		C	C	CDPR
	Comment for CA-61: Monitoring by PRBO.																							
CA-62	Seabright Beach	0		C			C		C				C				C	C	C	C				CDPR
	Additional for CA-62: Obtain better information about non-breeding plovers and their habitat needs. Comment: Monitoring by PRBO.																							
CA-63	Jetty Road to Aptos	Total 54																						
	Sunset and Manressa State Beaches	18	C	C			C	C	CA		C	C	C	CA		C	C	C	C	C		C	CA	CDPR-Santa Cruz District
	Pajaro River mouth (Beach rd. to	26	C	C			C	C	CA	C	C	C	C	CA	C	C	C	C	C	C	CA	C	CA	CDPR-Monterey District
	State Beach Parking area 26)																							
	Moss Landing State Beach	10	C	C			C	C	CA		C	C	CA	CA		C	C	C	C	C	CA	C	CA	CDPR-Monterey District
	Beach parking lot to mouth of Elkhorn Slough)																							
	Comment for CA-63: Monitoring by PRBO. Seek acquisition of adjacent Foster property on willling-seller basis.																							
CA-64	Elkhorn Slough Mudflat/Salt Pond	80	C	C			C	C	CA	CA			C	CA	C	C	C	CA	C	C	CA	CA	A	CDFG
	(AKA Moss Landing Wildlife Area)																							
	Additional for CA-64: Monitor erosion rate of bank separating Elkhorn Slough from salt ponds. Comment: Monitoring by PRBO.																							

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		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-65	Moss Landing to Monterey	Total 162																						
	Salinas River State Beach																							
	Molera/Potrero (Salinas State Beach from the mouth of Elkhorn Slough to northern boundary of Monterey Dunes Colony)	10	C	C			C	C	CA		C	C	CA	CA		C	C	C	C	C	C	C	C	CDPR, Private
	Monterey Dunes (beach in front of Monterey Dunes Property)	12		C				C	CA		C	C	CA	CA		C	C	C	C	C	C	C	C	CDPR
	North Salinas (beach from south boundary of Monterey Dunes Property to north boundary of Salinas River National Wildlife Refuge; mouth of Salinas River)	20	C	C			C	C	CA	C	C	C	CA	CA		C	C	C	C	C	C	C	C	CDPR
	Salinas River National Wildlife Refuge	40	C	C			C	C	CA	C	C	C	C	CA	C	C	C	C	C	C	C	C	C	FWS
	Martin Property beach	12					C		CA		C	C									C		C	Private
	Lone Star beach and interior areas	32					C		CA		C	C									C			Private
	Reservation Road (Reservation Road to Stilwell Hall on Fort Ord)	16	C	C			C	C	CA		C	C	C	C		C	C	C	C	C	C	C	C	CDPR, Army
	Sand City/Del Monte (southern boundary of Fort Ord to City of Monterey)	20	C	C		A	C	C	CA	C	C	C	C	CA	CA	C	C	C	C	C	C	C	C	Army, Private, City of Sand City, MPRPD, CDPR
			C	C			CA		CA			CA	C	CA		C			C	CA	C	C	CA	Navy
			C	C			CA		CA				C	CA		C	C		C	CA	C		CA	City of Monterey

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		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
	Additional for CA-65: Enhance dunes on Navy property for snowy plover and other sensitive species: Monitor if breeding birds detected. On City of Monterey property, monitor and use signs if breeding birds detected; remove trash manually to avoid mechanical raking. Comments: Monitoring by PRBO. Seek acquisition of Martin, Lone Star, Sandholt, and Sand City small parcels on willing-seller basis.																							
	Comments for CA-63, Ca-64 and CA-65: Predator control performed by U.S. Department of Agriculture, Wildlife Services Branch, for FWS and CDPR.																							
CA-66	Asilomar Beach, Units 1-2	0		C			C		CA				C	C				C	C	A	C			CDPR
						A																		Private
	Additional for CA-66: Use exclosures if nesting occurs. Comment: Monitoring by PRBO.																							
CA-67	Carmel River Mouth	0							C				C					C	C	C	C			CDPR
	Additional for CA-67: Use exclosures if nesting occurs. Comment: Monitoring by PRBO.																							
CA-68	Point Sur	20	C						C									C				C		CDPR
						A										A		A					A	Private
	Additional for CA-68: Monitoring by PRBO. Seek cooperative agreement to allow monitoring on private land, discuss control of European beachgrass, and prevent disturbance from cattle.																							
CA-69	San Carpoforo Creek	10				A																		Private
CA-70	Arroyo Hondo Creek	0				A																		Private
CA-71	Point Sierra Nevada	0				A																		Private
CA-72	Arroyo de la Cruz	0				A																		Private

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		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-73	Sidney's Lagoon	0				A																		Private
CA-74	Piedras Blancas, Units 1-2	0				A																		Private
CA-75	Arroyo Laguna Creek	6																A						Private
	Additional for CA-75: Seek cooperative agreement to monitor and Use exclosures if nesting occurs.																							
CA76	Pico Creek	0				A																		Private
CA-77	San Simeon Beach	0							C									C		CA			C	CDPR
	Additional for CA-77: Use exclosures if nesting occurs. Comment: Monitoring by PRBO.																							
CA-78	Villa Creek	25				A																		Private
CA-79	Toro Creek	16				A												A						Private
	Additional for CA-77: Seek cooperative agreement to monitor and use exclosures if nesting occurs. Comment: Monitoring by PRBO.																							
CA-80	Atascadero Beach	40	C				C		C			C		C				C		C	A	C		CDPR
																								City of Morro Bay
	Comment for CA-80: Monitoring by PRBO. Current management by City unknown.																							
CA-81	Morro Bay Beach	110					C		C		A							C	C	C		C	A	CDPR
											A												A	City of Morro Bay

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		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-82	Avila Beach	0																						PSL
						A																		Private
	Comment for CA-82: Although Avila Beach is proposed for excavation of underlying oil contamination and beach restoration, it is anticipated that restoration will replace and enhance existing habitat values for snowy plovers.																							
CA-83	Pismo Beach/Nipomo Dunes	350																						
	(Pier Ave. to southern State Vehicular Recreation Area riding boundary)								C		C	C						C	C	C		C		CDPR
	(State Vehicular Recreation area riding boundary to Mobil coastal preserve)		C						C					C				C		C		C		CDPR
	(Mobil coastal preserve to Point Sal)								C									A	C					CDPR
																								San Luis Obispo County
																								TNC
						A																		Private
	Comment for CA-83: No current management by County. Current management by TNC unknown.																							
CA-84	Vandenberg Air Force Base	250	CA	C			C		CA		A	CA	CA	CA			CA	C	CA	CA	CA	C	A	USAF
CA-85	Santa Ynez River Mouth/Ocean Beach (aka Vandenberg Air Force Base)	150	CA	C			C		CA		A		C	CA				C	CA	CA	CA	C	A	USAF
	Additional for CA-85: Investigate predator ecology and non-lethal control and deterrence; remove non-native vegetation; and work with CA Coastal Commission to make some beach sectors totally off-limits during the nesting season.																							

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		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-86	Jalama Beach	0																C	C	C				USAF
							C						C						C	C				County
						A																		Private
	Additional for CA-86: Use exclosures if nesting occurs. Comment: Monitoring by PRBO (winter).																							
CA-87	Hollister Ranch	10				A																		Private
CA-88	Devereaux/Sands/Ellwood	25				A																		Private
CA-89	Goleta Beach	0					C						C							C			C	County
						A																		Private
	Additional for CA-89: Use exclosures if nesting occurs.																							
CA-90	Point Castillo/Santa Barbara Harbor	0		C			C						C				C	C	C	C				City of Santa Barbara
	Additional for CA-90: Use exclosures if nesting occurs. Comment: Monitoring by PRBO.																							
CA-91	Carpinteria Beach	0																C						CDPR
	Additional for CA-90: Use exclosures if nesting occurs. Comment: Irregular monitoring by PRBO.																							
CA-92	San Miguel Island, Units 1-8	30	C	C										C				C		C				NPS
	Additional for CA-92: In cooperation with NOAA Fisheries and NPS, identify plover nesting beaches where pinniped access should be limited. Fence off areas to prevent marine mammals from using all habitat. *Note: Boats prohibited/restricted, except Cuyler cove																							

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		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-93	Santa Rosa Island, Units 1-11	130	C	C					A		A			C				C		C	CA	A	C	NPS
	Additional for CA-93: Remove ravens; signage at closure boundary; foot patrols of closure.t. *Note: Boats prohibited/restricted at Skunk Point.																							
CA-94	Santa Cruz Island, Units 1-2	20	C	C			C		C				C				C	C	C	C				TNC
	Additional for CA-94: Feral Pig Control. Rat removal by NPS.																							
CA-95	San Buenaventura Beach	0					A											C	CA	C			C	CDPR
																								City of Ventura
	Additional for CA-95: Use exclosures if nesting occurs. Avoid plover areas during maintenance trash pick-up. Comment: Monitoring by PRBO. Current management by City unknown.																							
CA-96	Santa Clara River Mouth/Mandalay State Beach	60					C							C				C	C	C			C	CDPR
																								Ventura County
																								City of Oxnard
	Additional for CA-96: Current management by County and City unknown.																							
CA-97	Hollywood Beach	4																C						Ventura County
						A																		Private
	Comment for CA-97: Irregular monitoring by PRBO.																							

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		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-98	Ormond Beach	50							C											C				City of Port Hueneme
																								City of Oxnard
						A																		Private
	Additional for CA-98: Current management by City of Oxnard unknown. Irregular monitoring by PRBO.																							
CA-99	Mugu Lagoon Beach	110	C	C										C			C	C			C			Navy
	Additional for CA-99: Use exclosures if warranted.																							
CA-100	San Nicolas Island, Units 1-15	150	C						C					C							C	C		Navy
CA-101	Zuma Beach	0		C			C						C				C	C	C	C				Los Angeles County
	Additional for CA-101: Use exclosures if nesting occurs. Comment: Monitoring by PRBO.																							
CA-102	Corral Beach	0		C			C						C				C	C	C	C				Los Angeles County
						A																		Private
	Additional for CA-102: Use exclosures if nesting occurs. Comment: Monitoring by PRBO.																							
CA-103	Malibu Lagoon/Beach	0					C						C				C	C	C	C				CDPR
	Additional for CA-103: Enhance snowy plover habitat by fencing area on ocean side of historic Adamson House. Comment: Monitoring by PRBO.																							
CA-104	Santa Monica Beach	0		C									C						C	C				City of Santa Monica
	Additional for CA-104: Use exclosures if nesting occurs.																							

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		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-105	Dockweiler to Hermosa Beach	0		C			C						C				C	C	C	C				Los Angeles County
				C			C						C						C	C				City of Hermosa
	Additional for CA-105: Use exclosures if nesting occurs. Comment: Monitoring by PRBO.																							
CA-106	San Clemente Island, Units 1-5	0	C	C			C						C					CA	C	C				Navy
	Additional for CA-106: Use exclosures if nesting occurs. Comment: Irregular monitoring (every other year).																							
CA-107	Huntington Beach	0	C	C			C		C			C	C	C			C	C	C	C	C		C	CDPR
				C			C						C				C			C				City of Huntington Beach
	Additional for CA-107: Use exclosures if snowy plovers nest outside of California least tern preserve. Comment: Monitoring by PRBO.																							
CA-108	Bolsa Chica Wetlands	70	C	C	C	C	C			A		C	C	C	C	C	C	C	C	C	C		A	FWS
CA-109	Newport Beach	0																						Orange County
																								City of Newport Beach
	Additional for CA-109: Use exclosures if nesting occurs. Comment: Current management by County and City unknown.																							
CA-110	Crystal Cove	0		C			C		C				C	C			C	C		C				CDPR
																								Orange County
						A																		Private
	Additional for CA-110: Use exclosures if nesting occurs. Comment: Monitoring by PRBO. Current management by County unknown.																							

Table C-1. Summary of existing and additional needed management activities at U.S. Pacific Coast snowy plover breeding and wintering locations. Information based on 1998 survey of land managers as supplemented by subsequent information (from western snowy plover recovery team, U.S. Fish and Wildlife Service field office staff, and other commenters).

		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-111	Salt Creek Beach	0																	C					Orange County
						A																		Private
	Additional for CA-111: Use exclosures if nesting occurs. Comment: Irregular monitoring by PRBO.																							
CA-112	Doheny Beach	0		C			C		C				C	C			C	C		C				CDPR
																								Orange County
						A																		Private
	Additional for CA-112: Use exclosures if nesting occurs. Comment: Monitoring by PRBO. Current management by County unknown.																							
CA-113	San Onofre Beach	15	A	C			C		C				C				C	C		CA	A		A	USMC (CDPR)
	Additional for CA-113: Comment: Monitoring by USGS-BRD (winter).																							
CA-114	Aliso/French Creek Mouth	40	CA	C			C		C			C	C	C			C	C	C	C	CA	C	CA	USMC
	Additional for CA-114: Comment: Monitoring by USGS-BRD (winter and breeding).																							
CA-115	Santa Margarita River	160	CA	C			C		CA			C	C	C			C	C	C	C	CA	C	CA	USMC
	Additional for CA-115: Comment: Monitoring by USGS-BRD (winter and breeding).																							
CA-116	San Luis Rey River Mouth	0		C									C				C	A	C	C				City of Oceanside
	Additional for CA-116: Monitor, and use exclosures if nesting occurs.																							

Table C-1. Summary of existing and additional needed management activities at U.S. Pacific Coast snowy plover breeding and wintering locations. Information based on 1998 survey of land managers as supplemented by subsequent information (from western snowy plover recovery team, U.S. Fish and Wildlife Service field office staff, and other commenters).

		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-117	Agua Hedionda Lagoon/Beach	10																C		C				CDPR
																								City of Carlsbad
						A																		Private
	Additional for CA-117: Comment: Irregular monitoring by USGS-BRD (winter and breeding). Current management by City unknown.																							
CA-118	South Carlsbad Beach	0					C											C		C				CDPR
	Additional for CA-118: Use exclosures if nesting occurs. Comment: Monitoring by USGS-BRD (winter).																							
CA-119	Batiquitos Lagoon	70	C	C			C		C			C	C	A	C	C	C	CA	C	C	CA	C	A	CDFG
	Additional for CA-119: Comment: Monitoring by USGS-BRD (winter and breeding).																							
CA-120	San Elijo Lagoon/Beach	20	A									A						CA		C	A		A	CDPR
			A									A						CA			A		A	CDFG
			C	C			C					CA		C				CA	C	C	A	C	CA	San Diego County
						A																		Private
	Additional for CA-120: Comment: Monitoring by USGS-BRD (winter and breeding).																							
CA-121	San Dieguito Lagoon/Beach	20	A				C		A									CA		CA	A		A	City of Del Mar
			A	C		A	C		A	A	C	C	A	A	A	C	C	CA	C	CA	A		A	SDRPJPA
	Additional for CA-120: Comment: Irregular monitoring by USGS-BRD (winter and breeding).																							

Table C-1. Summary of existing and additional needed management activities at U.S. Pacific Coast snowy plover breeding and wintering locations. Information based on 1998 survey of land managers as supplemented by subsequent information (from western snowy plover recovery team, U.S. Fish and Wildlife Service field office staff, and other commenters).

		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-122	Los Penasquitos Lagoon/Beach	10	CA						C									CA		C	A		CA	CDPR
																								City of Del Mar
	Additional for CA-122: Comment: Irregular monitoring by USGS-BRD (winter and breeding). Current management by City unknown.																							
CA-123	Mission Bay, Bonita Cove	0																CA						City of San Diego
						A																		Private
	Additional for CA-123: Monitor, and use exclosures if nesting occurs. Comment: Irregular monitoring by USGS-BRD (winter and breeding).																							
CA-124	Mission Bay, Fiesta Island	10																CA						City of San Diego
	Additional for CA-124: Monitor, and use exclosures if nesting occurs. Comment: Irregular monitoring by USGS-BRD (winter).																							
CA-125	South Mission Beach	0																CA						City of San Diego
	Additional for CA-125: Monitor, and use exclosures if nesting occurs. Comment: Irregular monitoring by USGS-BRD (winter).																							
CA-126	Ocean Beach/San Diego FCC	0																CA						City of San Diego
	Additional for CA-126: Monitor, and use exclosures if nesting occurs. Comment: Irregular monitoring by USGS-BRD (winter).																							
CA-127	Naval Air Station/North Island	20	A				C		A				C					CA	C	CA	A		A	Navy
																								City of Coronado
	Additional for CA-127: Comment: Irregular monitoring by USGS-BRD (winter). Current management by City unknown.																							

Table C-1. Summary of existing and additional needed management activities at U.S. Pacific Coast snowy plover breeding and wintering locations. Information based on 1998 survey of land managers as supplemented by subsequent information (from western snowy plover recovery team, U.S. Fish and Wildlife Service field office staff, and other commenters).

		Mgt. Goal	Current (=C) and Additional (=A) Management																					
no.	Location	Breeding Nos. (adult Birds)	Access	Boats	Contaminant	Cooperation	Development	Driftwood	Enforce	Enhance	Exclosures	Fence	Horses	Info. & Ed.	Kites	Livestock	Military	Monitor	OHV's	Pets	Predators	Signs	Vegetation	Owner and/or Manager
CA-128	Naval Air Base Coronado/Silver Strand State Beach	65	A						C			A	C	C				C	C			C	A	Navy
			C						CA			A		A				C	C	C		C	C	CDPR
CA-129	Naval Air Base/Delta Beach Bay	10	C	C			C					C	C	C			C	C	C	C	C	C	C	Navy
CA-130	South San Diego Bay Marine Biological Study Area	0	C	C			C						C					C	C	C		C		Navy (San Diego County)
	Additional for CA-130: Use exclosures if nesting occurs. Comment: Monitoring by USGS-BRD (winter).																							
CA-131	Western Salt Company/South San Diego Bay Unit SDBNWR	30	C	C			C		C	A		A	C	A	C	C	C	C	C	C	CA		A	State (FWS)
CA-132	Sweetwater National Wildlife Refuge	25	C	C			C		C			C	C	C			C	C	C	C	C	C	C	FWS
	Additional for CA-132: Comment: Monitoring by USGS-BRD (winter and breeding).																							
CA-133	Tijuana River Beach	40	C	C			C		CA			C	C	C			C	C	C	C	C	C	C	FWS
			C				C		CA			C						C		C		C		CDPR
	Additional for CA-133: Comment: Monitoring by USGS-BRD (winter and breeding).																							

Note: In California, where landowner and land manager differ, land manager is shown parenthetically.

APPENDIX D

POPULATION VIABILITY ANALYSIS FOR PACIFIC COAST WESTERN SNOWY PLOVERS

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Introduction

In 1993 the Pacific coast population of the western snowy plover (*Charadrius alexandrinus nivosus*) (western snowy plover) was designated as threatened by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973, as amended (16 USC 1531 *et seq.*). To aid

the Western Snowy Plover Recovery Team in developing recovery criteria, the authors developed this population viability analysis for the Pacific coast population of the western snowy plovers.

Population viability analysis is used increasingly as a tool for developing conservation, management or restoration strategies for threatened, endangered, or potentially threatened species. The method is reviewed by Boyce (1992), Burgman *et al*. (1993), Beissinger and Westphal (1998) and Nur and Sydeman (1999). Examples of its use include Haig *et al*. (1993), Maguire *et al*. (1995), Akçakaya *et al*. (1995), and Bustamante (1996). In particular, population viability analyses have been developed for the congener piping plover *Charadrius melodus* (Great Plains population: Ryan *et al.* 1993; Atlantic coast population: Melvin and Gibbs 1996).

General Features of the Population Viability Analysis Model

The model is stochastic. Stochasticity is one of the defining features of Population Viability Analyses in general (Burgman *et al*. 1993). Two types of random variation are incorporated: unpredictable variation in the environment and "demographic stochasticity." Demographic stochasticity can be thought of as follows: even if all relevant features of the environment (including predators, competitors, abiotic factors, *etc.*) impinging on western snowy plovers are known, and even though, on average, survival or reproductive success can be related to these environmental features, there will still be an element of unpredictability regarding the precise number of young or adults that survive or the number of fledglings produced in any time period.

For the population viability analysis, we have used a metapopulation model with six subpopulations linked by dispersal of individuals. A metapopulation is a set of subpopulations among which there is restricted dispersal (Harrison 1994, Nur and Sydeman *in press*). In this population viability analysis, we have incorporated into the metapopulation model the best available estimates on dispersal. However, using the same model structure, one can easily alter the parameter values of dispersal, and, indeed, we do so. An alternative approach would be to treat Pacific coast birds as a single population, with unrestricted mating among all individuals, regardless of location. The latter model assumes that a bird from, say, Oregon is as likely to mate with a bird from San Diego as with a bird from Oregon. Such an assumption is exceedingly unrealistic; hence, we have adopted a metapopulation model. Another virtue of the metapopulation approach is that survival and/or fecundity can be allowed to vary among subpopulations, rather than being assumed homogeneous throughout the species' range. Note

that the Atlantic coast piping plover population viability analysis assumed a single, panmictic population instead of a metapopulation (U.S. Fish and Wildlife Service 1996).

The population viability analysis is carried out using the RAMAS/GIS program which is commercially available (Akçakaya 1997) and has been widely used for population viability analyses. Use of an off-the-shelf program makes modeling convenient and reproducible, but there are attendant limitations regarding input and output. For example, RAMAS/GIS allows one to specify the degree of stochastic variability in survival and reproductive success, but not dispersal. Other limitations are mentioned in the "Discussion." The Western Snowy Plover Recovery Team determined that the cost of developing a specially written program to carry out the population viability analysis was not justified.

The type of model that can be generated using RAMAS/GIS does not incorporate the production and elimination of genetic variation brought about by sexual reproduction (Caswell 1989, Beissinger and Westphal 1998). As a simplification, only one sex is modeled. We have used males because their demographic parameters can be estimated with greater certainty than for females. In addition, there is reason to consider that the availability of males is limiting reproductive success because they are responsible for post-hatching parental care and females can lay clutches for more than one male (Warriner *et al*. 1986).

The western snowy plover population viability analysis projects into the future up to 100 years. Although, there is considerable uncertainty in projecting 100 years, this time-horizon is commonly used and is recommended by Mace and Lande (1991). This time horizon was also used for the Atlantic coast Piping Plover Recovery Plan. We also depict population trajectories for shorter time-horizons.

The population viability analysis indicates trends and quantifies the risk that the total population goes extinct or falls below a **specified threshold**. We used a specified threshold of 50 individuals, but the population viability analysis could be modified by choosing any other threshold value.

The population viability analysis includes different scenarios pertaining to changes in reproductive success resulting from predator management and could be used to model other changes in management practices or the environment, affecting any of the other demographic parameters.

Subpopulations

The Western Snowy Plover Recovery Team has identified six subpopulations of western snowy plovers, each corresponding to a region of the U S. Pacific coast. The population viability analysis assumes restricted dispersal among subpopulations, but unrestricted access to mates within subpopulations. The six subpopulations, with their two-letter or three-letter designations, and estimated population sizes are:

1. Oregon and Washington coast (OR) estimated at 134 plovers;
2. Northern California coast (NC; Del Norte, Humboldt and Mendocino counties) with 50 plovers;
3. San Francisco Bay (SFB; primarily South Bay) with 264 plovers;
4. Monterey Bay (MB; coast of Sonoma, Marin, San Mateo, Santa Cruz and Monterey counties) with 300 plovers;
5. coast of San Luis Obispo, Santa Barbara and Ventura counties (SLO) with 886 plovers;
6. San Diego area (SD; Los Angeles, Orange and San Diego counties) with 316 plovers.

For the OR, MB, and SD subpopulations, intensive monitoring of color-banded individuals was carried out in 1997, and population size was estimated on that basis. For the NC, SFB and SLO subpopulations, information is less complete. Instead, we relied on "window surveys" conducted in 1995, 1991, and 1995, respectively. To account for birds missed during the window surveys we applied a correction factor to the survey numbers for the NC, SFB and SLO subpopulations. Where window surveys were conducted at locations with color banded birds, the number of marked birds known to be at the location was underestimated by about 22 percent. This takes into account both birds known to be present but missed and birds that were double counted. The correction factor used is 1/(1-.222) = 1.286. For the NC and SLO subpopulations, the correction factor was applied to the number of birds counted on window surveys in 1995.

However, for the SFB subpopulation, no window survey has been carried out since 1991. Uncertainty about population trends since 1991 compounds uncertainty about current abundance. We therefore considered there to be an upper bound of 310 individuals (219 individuals observed on the window survey in 1991 x 1.286 x 1.1, to account for modest population growth since 1991) and a lower bound of 219 individuals (population decline since 1991, equal in magnitude to the undercounting during the window survey). For modeling, we used the mean of those two estimates (= 264 individuals).

Conceptual Framework of the Model

The key demographic parameters in the model are: (1) adult survival, (2) juvenile survival, (3) reproductive success, and (4) dispersal. All individuals 1 year or older are considered to be adult, and assumed to breed (see below). The demographic parameters are linked in the population model in the following manner, ignoring dispersal among subpopulations (detailed later) and ignoring any stochastic effects.

The model keeps track of the abundance of each age class (1-year-old, 2-year-old, *etc.*, up to 20-year-old individuals) in each subpopulation. This enumeration by the model is carried out at the onset of the breeding season; this is referred to as a pre-breeding census. In the model, the number of 2-year-olds in year t+1, symbolized $N(2)_{t+1}$ is equal to the number of 1-year-olds in year t, symbolized $N(1)_t$, times the annual survival rate of 1-year-olds, symbolized S_1. Note that S_1 is not constant, but varies stochastically from year to year, and differs among subpopulations. Similar calculations are performed for the number of 3-year-olds, *i.e.*, $N(3)_{t+1} = N(2)_t*S_2$, 4-year-olds, *etc*. In the model, adult survival is assumed to be the same for all ages, *i.e.*, $S_1 = S_2 = ... = S_{19}$, but no adult lives beyond 20 years of age, which is considered maximum age for this species.

The number of 1-year-olds in a given year is equal to the number of fledged chicks produced the year before times the probability that a fledged chick will survive to reach the age of 1 year. If the total number of adults the year before is written $N(A)_t = N(1)_t + N(2)_t + ... + N(20)_t$, then the number of 1-year-olds in year t+1, symbolized $N(1)_{t+1}$, is equal to the product $N(A)_t*F*S_0$, where F is the number of male fledglings produced per male adult in each year, and S_0 is the probability a fledgling survives to 1 year (12 months) of age. Since the sex ratio of fledglings is unknown, we assume a 1:1 ratio. Any non-breeding among adults would act to reduce F; however, all adults are assumed to breed (see below). In the model, F and S_0 also vary among subpopulations and vary randomly among years, with a specified mean and standard deviation.

Parameter Estimates

Adult survival - The best estimates for adult survival came from capture/recapture analyses of Monterey Bay color-banded plovers, a major study population (henceforth Monterey Bay) situated within the MB subpopulation. Additional data for analyses came from color-banded study populations on Oregon beaches (Oregon) and San Diego beaches (San Diego). Note that we distinguish between study areas (Monterey Bay, Oregon and San Diego) and their respective, more inclusive subpopulations (MB, OR, SD). Analyses of survival were carried out using the program SURGE (Lebreton *et al*. 1992, Cooch *et al*. 1996) and for Monterey Bay were based on 777 adults

(361 males, 416 females) followed over 14 years. Sample sizes for Oregon were 108 males and 70 females, followed over 8 years, and for San Diego 91 males and 137 females, followed over 4 years. Since male survival significantly exceeded female survival at Monterey Bay and only males were modeled, we present only estimates for male adults, for the Monterey Bay, Oregon and San Diego study populations.

We fit a two-age class model for male adult survival, in which the first age class covers the first year after first capture, and the second age class covers all subsequent years. Estimates of survival for the first age class can be biased due to behavioral responses to trapping and banding, lower site-fidelity among some first-time captures, and other methodological difficulties. These biases do not apply to survival after the first year of banding (Pradel *et al*. 1997). For this reason, several studies have used only survival estimates from the second age class (*e.g.*, Gaston 1992, Johnston *et al*. 1997); we adopted the same practice.

A potential shortcoming of capture/recapture analyses of survival is that they cannot allow for permanent emigration, though they can allow for temporary emigration (Lebreton *et al*. 1992). A bird which moves permanently out of the study area cannot be distinguished from one that has died. The problem of permanent emigration can be overcome somewhat by enlarging the study area. In our analyses we compare survival estimates from three nested data sets, which differ only in the spatial and temporal extent of resightings. The most restricted data set included only resightings from birds seen during the breeding season in the same study area. In the next, more comprehensive data set, resightings of color-banded birds at other study areas were also included. In the most extensive data set, resightings during the entire year were included, as well as resightings at other study areas. The extent to which survival estimates differ among the three data sets provides insight into the magnitude of the problem of dispersal (permanent emigration).

Male survival estimates for Monterey Bay, for 2nd-year and older adults, were 74, 74, and 75 percent for the three data sets (Table D-1A). In other words, survival estimates differed slightly depending on the spatial extent of coverage and whether winter observations were included. Increasing the study area for Monterey Bay birds (either spatially or through observations outside the breeding season), increased the survival estimates by up to 1 percent. This implies that 1 percent of the individuals, inferred to be dead if observations are only from one study area and only during the breeding season, are inferred to be alive using the data from the enlarged study area. These results suggest that amount of dispersal out of the original study area is not negligible but it is also not great. Since not all breeding areas of Pacific coast western snowy plovers are adequately

surveyed for color-banded birds, we assume that there was additional, **undetected** dispersal out of the study area on the order of 1 percent. If so, then the true adult survival rate is 76 percent.

For the Oregon study population, male survival values were 74 to 75 percent, *i.e.*, nearly identical to those from Monterey Bay (Table D-1A). Estimates for San Diego are somewhat lower, at 71 percent, but the difference between the San Diego estimates and those from Monterey Bay is no greater than the standard error of these estimates (Table D-1A). Among all three sites, survival estimates did not differ to a statistically significant degree. In the population viability analysis, we assume a survival rate of 76 percent for all subpopulations, but also model population trajectories with an adult survival of 75 percent and 77 percent, for all subpopulations. Capture/recapture analyses of Atlantic coast piping plovers resulted in a survival estimate of 74 percent (Melvin and Gibbs 1996). Paton (1994) analyzed survival for Great Salt Lake western snowy plovers over a 3-year period. Survival rates were pooled over the two sexes (unlike our analyses), and differed among years, ranging from 58 percent to 88 percent, with median survival = 73 percent. Thus, survival values from other plover studies are consistent with the survival values used here.

Finally, the year to year variation in male survival for Monterey Bay was estimated to be 5.65 percent (standard deviation). We used this parameter value in our simulations, for all six subpopulations. Note that "catastrophic mortality" (see below), represents additional temporal variation.

Juvenile survival - Table D-1B shows survival estimates for first year birds (from fledging to 12 months of age), by study population and data set. Sample sizes were 1069 fledged young at Monterey Bay, 207 at Oregon and 102 at San Diego. Results were very similar at Monterey Bay and San Diego; Oregon values were somewhat higher but not statistically different from Monterey Bay. We, therefore, used juvenile survival estimates for Monterey Bay for all subpopulations. The different estimates for Monterey Bay, depending on the data set, were 39 percent, 44 percent and 45 percent. Note that for Monterey Bay as we expand the data from just 1 study site to a large network of sites, the survival estimate increases by 5 to 6 percent in absolute terms, and by 15 percent in relative terms. Compare this to the increase in adult survival estimates by 1 percent for the same series of nested data sets (see above). Thus, it is clear that there is quite a bit of dispersal among first-year birds. Undoubtedly, we are still underestimating survival because of permanent emigration. Therefore, we increased the survival estimate to 50 percent. This would imply that among 100 fledged young, 50 survive to age 1, but of these only 39 are inferred to survive based on observations at the single study population, with 11 out of 50 surviving juveniles (or 22 percent)

dispersing out of the single study population. This estimate of dispersal is consistent with that directly observed and included in the population viability analysis (see below). Annual variation in juvenile survival (obtained from Monterey Bay) is also shown in Table D-1B.

Reproductive Success - Here we had empirical data for three study areas, corresponding to three subpopulations (Table D-1C). For Monterey Bay, reproductive success was 0.849 fledged young reared per breeding male in years without predator control and without any exclosures, versus 1.105 fledged young per male in years with predator control and with exclosures. Reproductive success was similar but slightly lower (= 1.04 chicks per male) in Oregon, where intensive management has occurred in all years for which we had data; estimates for Oregon and Monterey Bay are not statistically significantly different for years in which predators were managed. Reproductive success at the San Diego study area, where some (indirect) management activities are thought to have some protective effect on breeding western snowy plovers, is a little more than that observed at Monterey Bay without any management activity, but substantially, and significantly, lower than that observed at Monterey Bay and Oregon with management activity.

Simulations assuming that protective management continues in MB and OR, used the respective, current reproductive success values of 1.105 and 1.04 fledglings per male. For SD we did not use the observed reproductive success of 0.917 chicks per male, because this would have produced a subpopulation that (in the absence of net immigration) would have declined at 1.8 percent per year. Such a decline would have been inconsistent with observations and window surveys, which indicate a relatively stable or perhaps increasing SD subpopulation since 1995. Therefore, for the SD subpopulation, we assume that with current management practices continuing, reproductive success is 0.988 chicks per male, a value that produces a numerically stable subpopulation in the long-term (given the other demographic parameter estimates and assumptions). Reproductive success estimates for San Diego were based on only 3 years of data, and the overall mean of 0.917 may have underestimated the long-term, expected reproductive success.

In the scenarios below we use Monterey Bay past reproductive success (in the absence of intervention) for NC and SFB; *i.e.*, we use that as a best estimate for reproductive success in the absence of predator control/exclosures. We also assume that if management activities cease in MB, OR, and SD regions then reproductive success will be at 0.849 fledged young per male, as well.

For the SLO subpopulation there was considerable uncertainty regarding the appropriate reproductive success value to use. Window surveys indicate that western snowy plover numbers

have fluctuated over time, with no clear trend discernible, except that, whatever the trend, it is not increasing. At best, the SLO subpopulation might be considered stable; at worst the subpopulation is declining. On that basis, we considered there to be an "optimistic" and a "pessimistic" reproductive success value. The optimistic value is that level of reproductive success which would produce a stable, self-sustaining population (given all other assumptions); that value is 0.988 (the same value used for the SD subpopulation). The pessimistic value is 0.849 chicks per male, the same as used for NC and SFB subpopulations. A third possibility is to use an intermediate value (the mean of the optimistic and pessimistic values = 0.919 chicks per male). In our simulations, we consider all three possibilities, to demonstrate the sensitivity of model results to assumptions about SLO reproductive success. However, in all but two series of simulations, we use the intermediate reproductive success value of 0.919 fledged chicks per male, which in the long-term (given other parameter estimates and assumptions) would produce a population decline of 1.8 percent per year.

For annual variation in reproductive success we used a value of 0.157 (standard deviation.), which is the variation observed in reproductive success at Monterey Bay from 1992-1997. We also note that annual variation in reproductive success among the three sites showed weak but not significant correlations. In the scenarios below we assume that all demographic parameters show weak positive correlations (r = + 0.10 between pairs of subpopulations).

RAMAS/METAPOP allows one to add "catastrophic mortality" over and above "regular mortality." Catastrophic mortality can include both reproductive failure and changes in survival of juveniles and adults. It is not clear that western snowy plovers suffer from catastrophic mortality (none was apparent in the data sets analyzed), yet we should not rule it out. On the basis of recommendations of the Western Snowy Plover Recovery Team our simulations include additional mortality due to reproductive failure (see below). We also compare simulations with and without this additional catastrophic mortality.

Dispersal - There are qualitative data indicating dispersal, especially of first-year birds, to/from all three intensively studied areas (Monterey Bay, Oregon, and San Diego). The only extensive quantitative data are from Monterey Bay. These data indicated that 21 percent of individuals hatched in Monterey Bay and later observed breeding, were known to breed in areas other than at Monterey Bay. Results from the SURGE analyses of juvenile survival implied a similar dispersal rate of 22 percent among surviving juveniles (see above). Individuals observed dispersing were seen as far north as Washington and Oregon, and as far south as SLO, but none in the sample were observed going to SD. However, there have been additional observations of Monterey Bay

individuals dispersing to SD. Meanwhile, dispersal from SD (43 individuals born at San Diego), indicated a small percentage going to SLO. Using these results, we assumed the following: a general dispersal rate of 25 percent for first-year males; adult males are assumed not to disperse. In other words, we assumed that the total number of birds dispersing exceeded the number known to have dispersed; *i.e.*, some birds dispersed but were undetected. The exception to these assumed dispersal rates was for the most northern subpopulation (OR, which includes Washington) and the most southern, SD. For these, dispersal rates were assumed to be 20 percent, allowing for reduced dispersal from subpopulations, located on the edge of the metapopulation.

We also assumed dispersal was constant, in the absence of information to the contrary. Thus, dispersal did not increase or decrease as subpopulation size increased or decreased. There is little information on dispersal rates in relation to population characteristics for other, similar species (Nur and Sydeman *in press*). For example, a study of Roseate Terns (*Sterna dougallii*; Spendelow *et al*. 1995) found no relationship of dispersal rates to colony size (either colony of origin or colony of destination). RAMAS/GIS does not allow for stochastic variation in dispersal rates among years. Note also, that the metapopulation model does not include dispersal to or from Baja California. This is equivalent to assuming that the number of immigrants from Baja California to the metapopulation equals the number of emigrants dispersing to Baja California. This assumption of balanced dispersal to and from Baja California may be unrealistic, but we had no data on which to develop a metapopulation model which incorporates Baja California.

To demonstrate the impact of a change (or uncertainty) in dispersal rates, we also carry out simulations in which dispersal rates are reduced by 50 percent and by 100 percent.

Additional Assumptions

Density Dependence - Not much is known about this, for any bird species. Following input from Western Snowy Plover Recovery Team members, we assume a limit on availability of beach habitat, *i.e.*, that there is a region-specific limit on adequate nesting sites. Based on information provided by the recovery team, we estimate the limit, or ceiling, of breeding western snowy plovers to be:

Subpopulation	Ceiling size
OR	300
NC	200
SFB	500
MB	500
SLO	1600
SD	550

These ceilings are about 80 percent greater than current numbers, and are similar to, or slightly in excess of, estimates of target population size, obtained by Western Snowy Plover Recovery Team biologists, on a site by site basis (see Appendix B). A realistic assumption is that ceilings represent the maximum number of individuals that can successfully breed for each subpopulation. Under such an assumption, individuals in excess of the ceiling are still alive but cannot breed successfully in the current year. However, such an assumption cannot be implemented by RAMAS/GIS 2.0. Therefore, we made a more restrictive (and admittedly less realistic) assumption: individuals in excess of ceiling numbers do not survive the current year. This imposes a hard limit on maximum number of individuals in each subpopulation. Note that the metapopulation only reaches ceiling levels under Scenarios 17-19; in the other Scenarios, the metapopulation declines and/or is well below ceiling levels. Note also that there is no decrement in survival until the breeding population size **exceeds** the ceiling for that subpopulation.

Catastrophic Mortality - There is at present no evidence of catastrophic mortality in western snowy plovers, but the 1998 El Niño may prove otherwise[1]. Though it may seem desirable to include catastrophic mortality, the problem is that we have no idea of its magnitude or frequency of occurrence. Thus any quantitative results (when this is included) depend entirely on the assumptions made. On the basis of input from Western Snowy Plover Recovery Team members we assume catastrophic mortality in the form of "reproductive failure." We assume that catastrophes occur, on average, once every 20 years (*i.e.*, in each year with 5 percent probability), and that in a catastrophe year reproductive success is reduced to 50 percent of what it "normally" would have

[1] It is believed that western snowy plovers suffered unusually high winter mortality in the 1998 El Niño and the subsequent La Niña. Point Reyes Bird Observatory plans to examine this issue when appropriate data have been incorporated into the survivorship database (Gary Page, Point Reyes Bird Observatory, pers. comm. 2001).

been. Note that model results are identical whether reproductive success itself is impacted, as part of catastrophic mortality, or whether juvenile survival is impacted. Catastrophes were assumed to occur independently of one another (*i.e.*, the reproductive failure is specific to a subpopulation). We also consider a scenario with no catastrophic mortality and one in which catastrophic mortality includes reduction in adult survival (50 percent reduction compared to "normal" levels of survival, with a 5 percent probability per year) in addition to catastrophic reproductive failure.

All one-year-olds breed - This may be an overestimate but not likely by much; available field data (PRBO, unpubl.) indicate that the actual percent of males breeding is close to 100 percent. If we allow for less than 100 percent breeding among 1-year-olds (or even among older adults), then results presented would be more pessimistic.

Weak, positive environmental correlations among subpopulations - This is a compromise between assuming strong correlations (for which there is no evidence) and assuming no correlation (which at least for survival would seem **unlikely**). Empirical data on reproductive success supports the assumption of weak, positive correlation among subpopulations.

Extinction Threshold

The Atlantic coast Piping Plover Recovery Plan had an objective of keeping the probability of extinction below 5 percent for the entire (meta)population in the next 100 years (U.S. Fish and Wildlife Service 1996). A scenario in which Pacific coast western snowy plovers fall to a few individuals should not, in our opinion, be considered acceptable. Therefore, we consider the endpoint of "quasi-extinction," defined here as 50 individuals, rather than extinction itself (Burgman *et al*. 1993). This follows recommendations of Beissinger and Westphal (1998) and others. If there were as few as 50 individuals we expect that extreme measures would be undertaken to prevent extinction, such as captive breeding (as was the case for the California Condor). Also, an effective population size (N_e) of 50 individuals is considered close to the threshold number below which genetic and demographic forces combine, in the absence of intervention, to produce an "extinction vortex" (Gilpin and Soule 1986). It is difficult to determine what is the actual population size that corresponds to an effective population size of 50; for simplicity, in the results we present the probability that actual population size decreases below 50 individuals, but we recognize that N_e is always less than actual population size.

Results

Deterministic Results

With 0.76 adult survival, 0.50 juvenile survival, and fecundity = 1.105 (see above), the geometric rate of population growth (lambda) is 1.036, or 3.6 percent increase per year. All results in this section assume no stochastic effects (which are treated below) and in particular no catastrophic mortality. With 0.75 adult survival, and all other values the same, the growth rate decreases to .026 per year (lambda = 1.026). To produce a population growth rate of 1.0, requires 0.964 fledged young/male assuming .076 adult survival and .050 juvenile survival; if adult survival is 0.75, 1.003 fledged young/male are required. Note that increasing fecundity by 0.037 chicks per male has an effect equivalent to increasing adult survival by 0.01 (*i.e.*, decreasing adult mortality by 0.01, or 4 percent in relative terms).

Sensitivity analysis for Deterministic Results

A change in adult survival of 0.01 (0.75 to 0.76), produces a change in lambda of .001. A change in fecundity of 0.08 (in relative terms), *e.g.* from 1.00 to 1.08, changes lambda by 2.24 percent. The same is true for a change in juvenile survival, *e.g.*, increasing juvenile survival from 0.50 to 0.54, changes lambda by 2.24 percent. Clearly, a small difference in adult survival (*e.g.*, 1 percent) can have a substantial impact on population trajectory, especially over a 100-year time period.

Stochastic Results

We present results from 19 different scenarios for the Pacific coast western snowy plover metapopulation. Each scenario differs with respect to one or more demographic parameters, or starting population size, or other assumptions (*e.g.*, catastrophic mortality). In all cases, results from 400 replications of each scenario are shown. Scenario 1 is for **"Status Quo"** conditions: current values for reproductive success, etc., are assumed to continue indefinitely, *i.e.*, management activities continue in OR, MB, and SD. Scenario 1 uses our best estimates for the suite of demographic parameters outlined above. This includes 0.76 adult survival and catastrophic reproductive failure, but no other catastrophic mortality. Results for Scenario 1 are summarized in Tables D-2A and D-2B. The overall trajectory for the metapopulation is shown in Fig. D-1A; shown also are the highest and lowest values obtained in the 400 simulations (depicted with diamonds), the mean outcome and also outcomes that are plus or minus one standard deviation (S.D.). Thus, about 16 percent of outcomes will be above the mean + 1 S.D. level and about 16 percent of outcomes will be below the mean - 1 S.D. level. Furthermore, about 68 percent of

outcomes, on average, will be within +/- 1 S.D. of the mean. We also depict two examples of representative population trajectories, out of the total of 400 simulations (Fig. D-1B).

We see that even with continued levels of ongoing management into the future, the prognosis is for a slowly-decreasing metapopulation, one that, on average, declines at 0.92 percent per year (Table D-2A). After 100 years, the metapopulation can be expected to be 39 percent of its original size. The probability that the metapopulation will increase in 100 years is essentially zero (Fig. D-1A). On the other hand, the probability of quasi-extinction (fewer than 50 individuals) is also zero. Fig. D-1C depicts the probability of the metapopulation declining below specified levels. For example, there is a nearly 100 percent chance of declining below 1800 individuals (compared to the estimated 1950 at present), but only a 1 percent chance of declining below 200 individuals. The probability of at least a 50 percent decline after 100 years is 72 percent (Table D-2B). Results for individual subpopulations after 100 years are shown in Fig. D-1D; these show that, in almost all simulations, all six subpopulations are likely to persist for 100 years, but in some cases at very low levels (close to zero).

Sensitivity Analysis of Stochastic Results

In this section, we carry out a sensitivity analysis with respect to demographic parameters. We examine the effect of a change in one parameter (adult survival, juvenile survival, reproductive success, dispersal, or catastrophic mortality) on the future trajectory of the metapopulation, compared to Scenario 1. Such comparisons provide insight into the sensitivity of model outcomes to the assumptions made regarding each parameter, as well as providing insight into the response of the metapopulation to a change in a demographic parameter, either due to environmental alteration or to an anthropogenic effect.

Change in Adult Survival - In Scenario 2 adult survival is assumed to be 75 percent; all other parameter values and assumptions are as in Scenario 1. Compared to Scenario 1, the metapopulation declines at a faster rate - 1.59 percent per year, on average (Fig. D-2, Table D-2). After 100 years, the metapopulation will have declined on average by 80 percent (Table D-2A). The probability of quasi-extinction is 2.8 percent (Table D-2B), with an approximate 95 percent confidence interval about that estimate of 0 to 7.2 percent. There is nearly 100 percent probability that the metapopulation will decline by at least 32 percent after 100 years. The probability of at least a 50 percent decline after 100 years is 96 percent. These results confirm that a small change in adult survival can have potent effects on the long-term metapopulation trajectory. Scenario 3 demonstrates the sensitivity of results to a 1 percent increase in adult survival. The metapopulation

is still expected to decline, but at an even shallower rate compared to Scenario 1 - on average 0.46 percent per year, and 37 percent after 100 years (Table D-2A). The chance of any decline at all after 100 years is reduced to 96 percent. It would require a greater increase in adult survival (to above 78 percent) to produce a metapopulation whose long-term trajectory is essentially stable (Results not shown).

Change in Juvenile Survival - We consider two alternative scenarios. In Scenario 4, juvenile survival is reduced by 10 percent in relative terms, *i.e.*, a reduction of .05 in absolute terms, from 0.50 to 0.45 probability of surviving. A difference in survival of 0.05 is not unreasonably large; it is less than the standard error of the most precise estimate available for juvenile survival (Table D-1). 0.05 is also the quantity by which we incremented the Monterey Bay juvenile survival estimate to account for permanent emigration. Results (Fig. D-3A, Table D-2) under this scenario depict a metapopulation that is quickly declining (at 2.8 percent per year, on average) and quickly approaches critical levels. Under Scenario 4, there is a 42 percent chance of quasi-extinction. The probability of a 50 percent decline is essentially 100 percent. In fact, in 50 percent of the simulations, the metapopulation declines by 96 percent or more.

Scenario 4 shows the stark effects of a 10 percent relative change in juvenile survival. But what about the impact of more subtle changes in juvenile survival? To answer that question, in Scenario 5, we consider a 4 percent decrease, in relative terms, of juvenile survival, from 0.50 to 0.48. Note that from the point of view of a change in **mortality** (rather than survival), a change in juvenile survival from 0.50 to 0.48 implies a 4 percent relative increase in mortality, just as does a change in adult survival from 0.76 to 0.75. Results (Table D-2, Fig. D-3B) in this scenario demonstrate a metapopulation that declines with 100 percent probability, with an average decline of 1.5 percent per year, and a 78 percent decline after 100 years. Moreover, in 100 percent of simulations metapopulation size decreased by at least 26 percent. However, the probability of quasi-extinction is low, 3.5 percent (Table D-2B). We conclude that relatively small changes in juvenile survival will have sizeable impacts on long-term population trends, but will not have large effects on quasi-extinction probabilities.

Change in Reproductive Success - In the age-structured model used in the population viability analysis, a change in juvenile survival of *k* percent is exactly equivalent to a change in reproductive success (fledglings per male adult) of *k* percent. This is because only the product of juvenile survival x reproductive success is modeled. Hence, Scenarios 4 and 5 (discussed above) demonstrate the effects of a 10 percent and 4 percent change, respectively, *in reproductive success*,

just as they do for a change in juvenile survival. We also consider sensitivity of model results to assumptions about reproductive success of just the SLO subpopulation. In Scenarios 1-5 above, an intermediate value of reproductive success was assumed for the SLO subpopulation (0.919 fledged young per male). Scenario 6, instead, assumes an optimistic value of 0.988 fledged chicks per male; *i.e.*, that value of reproductive success which would produce a stable, self-sustaining population in the absence of immigration and emigration. Scenario 7, instead, assumes a pessimistic value of 0.849 fledged chicks per male; *i.e.*, the same reproductive success as assumed for NC and SFB and as observed in Monterey Bay in the absence of intensive management. Results are summarized in Tables D-2A and D-2B. The effect of a 7.5 percent relative change in SLO reproductive success, either an increase (Scenario 6) or a decrease (Scenario 7), is fairly minor. For example, comparing Scenarios 1 and 6, lambda for the metapopulation increases slightly from 0.9908 to 0.9926, a difference of less than 0.2 percent (Table D-2A). The chance of a 50 percent decline for the metapopulation decreases from 72 percent (Scenario 1) to 59 percent (Scenario 6) (Table D-2B). Similarly, comparisons of Scenarios 7 and 1, indicate only minor differences (Table D-2). We conclude that, though reproductive success for SLO cannot be estimated with great certainty, results of the population viability analysis are not very sensitive to assumptions made regarding this parameter, providing they are within a reasonable range (bounded by the optimistic and pessimistic values considered).

Change in Catastrophe - Scenario 8 assumes no catastrophic reproductive failure at all. Compared to Scenario 1, the effect of eliminating catastrophic reproductive failure is to increase lambda slightly, by 0.3 percent (0.9938 instead of 0.9908; Table D-2A). However, the absence of catastrophic failure results in a substantial reduction in risk of metapopulation decline, from 72 percent chance of a 50 percent decline to a 42 percent probability in Scenario 8 (Table D-2B). An even larger impact on the risk of metapopulation decline is observed in Scenario 9, in which catastrophic mortality of adults is added to catastrophic reproductive failure in years of catastrophe. In Scenario 9, lambda decreases substantially, to 0.9763 (Table D-2A). Under this scenario, we expect, on average, a 91 percent decline in metapopulation size. In addition, the risk of quasi-extinction is 29 percent, with a 99 percent probability that the metapopulation decreases by at least 50 percent after 100 years (Table D-2B). These results demonstrate that a relatively rare catastrophic event (5 percent probability per year) can have a large long-term effect on population growth and risk, if it entails a substantial increase in adult (and possibly juvenile) mortality. If catastrophes are as common as is assumed in Scenario 9, then the risk of metapopulation decline will be severely underestimated by any model which does not incorporate catastrophes.

Change in Dispersal - Here we consider the impact of a 50 percent and a 100 percent decrease in dispersal rates (Scenarios 10 and 11, respectively). That is, in Scenario 10 all dispersal rates were reduced by 1/2, and in Scenario 11, we assumed no dispersal whatsoever among subpopulations. The dynamics of the metapopulation as a whole were not much affected by even large changes in dispersal rates (Tables D-2A and D-2B). With a 50 percent reduction in dispersal (Scenario 10), the population growth rate increased slightly to lambda = 0.9914, that is, the metapopulation declined at an average of 0.86 percent per year instead of 0.92 percent (Scenario 1). The probability of quasi-extinction remained essentially zero, and the probability of a 50 percent decline after 100 years was little changed (71 percent instead of 72 percent for Scenario 1). Even when dispersal was eliminated the dynamics were not altered greatly. In the latter case, lambda decreased to 0.9906, almost identical to that observed in Scenario 1. The probability of a 50 percent decline after 100 years increased somewhat, from 72 percent in Scenario 1 to 79 percent in Scenario 11.

A 50 percent reduction in dispersal rates, also had only minor effects on the expected sizes of the six subpopulations after 100 years (Fig. D-4A; cf. Fig. D-1D). The most notable difference is an increased size of the MB subpopulation with reduced dispersal. With the elimination of dispersal, two subpopulations could be expected to go completely extinct with more than 50 percent probability, NC and SFB (Fig. D-4B). We conclude that within the likely range of dispersal rates, model results are not very sensitive to the exact parameter values used.

Changes in Management

We consider the impact of changes in management practice that may increase or decrease reproductive success. It is possible for changes in management practice to impact other demographic parameters, but we consider that possibility less likely.

Scenario 12 assumes "**No Management**". We assume cessation of management in OR, MB, and SD and that the other subpopulations continue as in the present (*i.e.*, as in Status Quo, Scenario 1). In Scenario 12, reproductive success is assumed to be 0.849 chicks per male for OR, MB, and SD, just as it is for NC and SFB. All other parameter values are as in Scenario 1. The expected outcome under this Scenario is for the metapopulation to show a strongly declining trend (Fig. D-5A, Table D-2A). Likelihood of decrease below specified population levels (for the entire metapopulation) is shown in Fig. D-5B. The probability that the metapopulation will decline by at least 50 percent after 100 years is 100 percent. In fact, there is a 100 percent probability of at least a 77 percent decline (Fig. D-5B). The probability of quasi-extinction is 51 percent (Table D-2B).

Clearly, the abandonment of management that protects western snowy plovers is an unpalatable alternative.

Scenario 13 is a modification of Scenario 12. In Scenario 13, metapopulation size is assumed to begin with 3500 individuals, close to, and slightly in excess of, the number of individuals for which there is at present available beach habitat. One can imagine that intensive management resulted in an increase in western snowy plover numbers until a population size of 3500 was reached, but that once reached, management activities ceased. In other words, Scenario 13 differs from Scenario 12 only with respect to starting population sizes. It is also assumed that with a metapopulation size of 3500, all ceiling values are increased by 10 percent (*i.e.*, to 3850 breeding individuals). As expected, the metapopulation shows the same steep population decline as in Scenario 12 (Table D-2A). In one sense, all Scenario 13 does (compared to Scenario 12) is to buy some time for the metapopulation. After 21 years, the metapopulation has decreased from 3500 individuals to about 1950, the starting level for Scenario 5. After 100 years, the probability that the metapopulation has fallen below 50 individuals is 35 percent (cf. to 51 percent for Scenario 5). There is a 100 percent probability that the population will decline at least 85 percent. These results demonstrate that simply increasing population size is not a viable solution for the western snowy plover metapopulation.

We next considered scenarios in which reproductive success is enhanced. In the next four scenarios we assumed that management continues in OR, MB, and SD, as it has, and that, therefore, fecundity and other parameter values continue as at present. In the first of these (Scenario 14), we assume that management activities in SLO (the largest subpopulation) results in an increase in fecundity to that obtained in MB now (*i.e.*, 1.105 chicks fledged per breeding male). Results are shown in Fig. D-6, indicating that, on average, the population declines, albeit at a very slight rate (0.3 percent decline per year; Table D-2A). There is an 85 percent chance of at least some decline, and a 19 percent chance of a 50 percent decline (Table D-2B). The probability of quasi-extinction is zero.

In the next scenario (Scenario 15), it is assumed that management activities at SLO are not quite as effective, and that reproductive success can only be increased to 1.0 fledged chicks per male. In this case, population growth rate declines at, on average, 0.7 percent per year (Table D-2A). As a result, there is a 51 percent probability of at least a 50 percent decline, over 100 years. While, this result is an improvement over the results of the Status Quo scenario (Scenario 1), it would still not be considered a desirable outcome.

An alternative scenario (Scenario 16) is for management action to increase reproductive success in NC and SFB, with SLO remaining as it is now. Results of Scenario 16 are a slight decline, just as in Scenario 14 (0.3 percent decline per year; Table D-2A). However, results from this scenario indicate less variability of outcome (Fig. D-7) compared to Scenario 14, in which SLO reproductive success was enhanced. As a result, the probability of a 50 percent decline is only 6 percent (Table D-2B). The probability of quasi-extinction is zero.

Comparison of results from Scenarios 14 and 16 indicate that increases in reproductive success of either SLO or SFB and NC would be effective in stabilizing western snowy plover numbers, and reducing the risk of substantial population decline in the future.

None of the scenarios presented above result in likely population increase. We therefore considered three additional metapopulation scenarios (Scenarios 17-19). In Scenario 17, management at SLO, NC, and SFB are such that all three subpopulations achieve fecundity of 1.105 chicks reared per breeding male (with the other three subpopulations as assumed above). Under this scenario the metapopulation does show an increase, but a surprisingly shallow increase: lambda = 1.0013 (Table D-2A), an annual growth rate of 0.13 percent per year. At the end of 100 years, the metapopulation is expected to grow by a total of 14.4 percent, on average. The relatively flat trajectory is surprising because we expected numbers to show an increase to close to ceiling levels, an 87 percent increase if all ceiling levels were attained. It turns out that some subpopulations achieved ceiling levels while others did not (Fig. D-8). Fig. D-8 demonstrates that (under assumptions of the model), OR, NC, SFB, and MB, were on average close to their ceiling levels, but SLO and SD are not. SLO and SD numbers would increase much further if excess individuals at other subpopulations (above ceiling levels) were to disperse to SLO and SD; however, such selective dispersal was not incorporated into the simulations, nor is it possible to do so using the RAMAS/GIS 2.0 program. Therefore, we consider the results from Scenario 17 to be somewhat unrealistic, since they incorporate unrealistic assumptions about dispersal when subpopulation size is at or near ceiling levels. A more sophisticated modeling program is required to incorporate assumptions about the dependence of dispersal on population size relative to population ceiling size.

Finally, we considered two scenarios in which population increase can be expected to reach 3000 western snowy plovers within a 25 year period. In the first of these (Scenario 18), reproductive success is assumed to be 1.3 chicks per male for all subpopulations. This level of reproductive success is high, but attainable; in 1998, western snowy plovers in the Monterey Bay study area

achieved this level of reproductive success. This scenario assumes that with sufficiently intensive management, all subpopulations will be able to achieve this level of reproductive success at some time in the future. Under this scenario, there is an 82 percent chance of the population reaching 3000 or more birds at the end of 25 years (see Table D-3). At first the size of the metapopulation increases rapidly, but the rate of growth slows down beyond year 10 (Fig. D-9), and then shows very slow growth beyond year 15.

The last scenario (Scenario 19) assumes that reproductive success of 1.2 chicks fledged per male is achieved for all subpopulations. Under this scenario, there is a 57 percent chance that the metapopulation will contain 3000 or more individuals after 25 years. The median outcome after 25 years is 3110 individuals, which is only 540 less than the overall maximum allowed for the metapopulation. Scenarios 18 and 19 demonstrate that there is a reasonably high probability of achieving at least 3000 birds within 25 years, provided that reproductive success averages 1.2 or more chicks per male over all subpopulations.

Discussion

In all modeling exercises, the results are sensitive to the assumptions. In this case we have tried to make assumptions explicit and we have examined the influence of the assumptions (or assumed values) on model results. The strength of the current analysis is that demographic estimates were based on data gathered from study populations within the Pacific coast metapopulation. An important feature of the population viability analysis is the use of a metapopulation structure that allows estimates for parameters to vary among subpopulations. We consider it highly desirable for population viability analyses to incorporate such flexibility.

Reproductive Parameters

That we could allow for subpopulation-specific parameters is a boon, yet the lack of available estimates for several of the subpopulations constitutes a drawback to the population viability analysis. In particular, no demographic parameter estimates are available for the SLO subpopulation, which is estimated to contain 45 percent of the entire metapopulation. Obtaining fecundity estimates for this subpopulation, as well as for NC and SFB, should be a priority. Even when we assumed that reproductive success in SLO was sufficiently high to produce a self-sustaining population, the metapopulation, on average, showed a decline at 0.74 percent per year, under the Status Quo conditions ("optimistic" scenario, Scenario 6). On the other hand, if reproductive success in SLO is as low as 0.849 chicks per breeding male ("pessimistic" Scenario,

Scenario 7) then the metapopulation would be expected to decline at a faster rate, at 1.1 percent per year. Though it would be desirable to obtain estimates from the SLO subpopulation itself, the sensitivity analyses demonstrated that results were not unduly sensitive to the estimate of reproductive success for this subpopulation, if SLO reproductive success was within the range of values modeled.

Dispersal

Theoretical studies have demonstrated that dispersal among subpopulations will reduce the chance of extinction of the metapopulation (Burgman et al. 1993, Harrison 1994), compared to a set of isolated subpopulations. In this case, we had reasonably good empirical data from the Monterey Bay study population, indicating dispersal rates of 20 percent to 25 percent among first-year birds. An area of uncertainty was whether dispersal rates varied with density (Beissinger and Westphal 1998). Recent observations of western snowy plovers indicate that dispersal occurs at high and low densities, and therefore we did not include density-dependent dispersal in the modeling. However, there may be a threshold effect: once a breeding area (*e.g.*, beach) is saturated, dispersal from that area may be enhanced. Future modeling could address this possibility, and its implications. Though our knowledge of dispersal was incomplete, it did not appear that model results were very sensitive to assumed dispersal rates. In particular, a 50 percent relative reduction in dispersal had almost no discernible effect on the metapopulation trajectory, persistence, or on subpopulation composition. This provides us with some confidence in model results despite the acknowledged uncertainty in dispersal rates.

Adult and Juvenile Survival

The sensitivity analysis (Scenarios 2-11) demonstrated a strong effect of inclusion of catastrophic mortality of adults. It is possible that the El Niño of 1998 will demonstrate such catastrophic mortality, but such a phenomenon cannot be demonstrated until completion of the 1999 breeding season, at the earliest. The sensitivity analysis also confirmed the sensitivity of metapopulation trajectory to moderately large changes in reproductive success and/or juvenile survival. We did not examine the sensitivity of results to a moderately large long-term change in adult survival, but even a small change (1 percent change in absolute survival) had a noticeable effect on metapopulation trajectory. Nevertheless, the probability of quasi-extinction was low whether adult survival was 0.75 (Scenario 2), 0.76 (Scenario 1), or 0.77 (Scenario 3). We conclude that, in general, the results shown are applicable, assuming that adult survival was between 0.75 and 0.77. We consider it unlikely that adult survival was much lower than 0.75. At the same time, there is no support for assuming that adult survival was greater than 0.77. Adult survival would have to be greater than

0.78 (Results not shown) to produce a metapopulation that is likely to grow, and even then it would only be growing slowly.

In most Scenarios, we assumed 0.50 juvenile survival. Though juvenile survival was surely at least 0.45, it is debatable just how much greater it is than 0.45. Thus, our results could be considered a bit liberal, or optimistic. If juvenile survival was actually lower than 0.50 (as in Scenarios 4 and 5) population trends would be more pessimistic.

Limitations to the Population Viability Analysis

There are several limitations to the population viability analysis. First, we did not include risk to the metapopulation due to genetic factors. Such a simplification (ignoring genetic factors) is consistent with recommendations of Beissinger and Westphal (1998). Genetics would become much more important to consider if metapopulation size would likely decrease to low levels, that is, 50 or fewer. However, population viability analysis results here indicate decrease to such low levels unlikely.

Second, we did not take into account an "Allee effect," which is a decrease in survival or reproductive success with a decrease in population size, usually due to social factors. For example, Allee effects can arise if individuals have difficulty securing mates when density is low. However, we believe that as long as metapopulation size remains at 50 or more (see above), Allee effects are not likely important.

The use of a packaged program (RAMAS/GIS) had the advantages of convenience, reproducibility, and general availability. Balancing that were limitations of that particular program. As already mentioned, dispersal was modeled at a constant rate and does not vary stochastically. Dispersal cannot vary with the size of the target population. Nor can one specify a constant number of dispersers. Thus, for example, one cannot specify balanced dispersal (dispersal from the population exactly equals dispersal to that population). Furthermore, with RAMAS/GIS dispersal cannot be modeled as a threshold phenomenon (e.g., dispersal only for those in excess of carrying capacity). Even if dispersal could be modeled in very sophisticated ways, we are limited by the lack of information regarding dispersal. Other limitations of RAMAS/GIS included the requirement that temporal covariation of population parameters is 100 percent. If it is a very good year for survival, the program assumes it is a very good year for reproductive success. There are many limitations on modeling density dependence with RAMAS/GIS. For example, we could not model a "ceiling

effect" on reproductive success (*i.e.*, individuals in excess of the ceiling do not reproduce), and had to assume that excess individuals were dead.

Tentative Conclusions

Results from this population viability analysis highlight the need for increased management of Pacific coast western snowy plovers and their habitats. Under status quo scenarios, even with intensive management in some areas, the population is almost certain to decline. Without question, ceasing current management efforts (area closures, predator exclosures, and predator control) would be disastrous for the Pacific coast population. The Western Snowy Plover Recovery Team, however, has identified population growth as a prerequisite to recovery. The most direct means to increase population size will be to enhance reproductive success throughout the western snowy plover range. The model suggests that productivity of **at least** 1.0 chicks fledged per breeding male per year should result in a stable population, if our estimates of adult and juvenile survivorship are accurate. Productivity of 1.2 or more chicks fledged per breeding male should increase population size at a moderate pace before growth slows as the metapopulation approaches its ceiling. Population growth would be hastened, of course, if survival of adults or juveniles can also be improved. Under this population growth scenario, the metapopulation could increase to 3000 individuals within the relatively short time span of 25 years. Recovery is plausible. It will require, however, short-term intensive management and long-term commitments to maintaining gains.

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Table D-1. Western snowy plover demographic parameter estimates.

A) Percent adult male survival, for males, excluding first-year after banding.

	All Observations (including Winter)	Expanded Area (Breeding Season only)	Single Study Area (Breeding Season only)
Monterey Bay	74.7 ± 1.9	74.3 ± 1.9	73.7 ± 3.6
Oregon	74.5 ± 13	74.3 ± 8.5	73.6 ± 18
San Diego	71.3 ± 9.0	71.3 ± 9.0	71.3 ± 16

Notes: Observed between-year standard deviation in Monterey Bay = 5.65 percent; mean adult male survival used in the population viability analysis is 76 percent (also 75 percent and 77 percent, see text).

B) Percent Juvenile (1st Year) survival, post-fledging.

	All Observations (including Winter)	Expanded Area (Breeding Season only)	Single Study Area (Breeding Season only)
Monterey Bay	45 ± 15	44 ± 6.7	39 ± 12
Oregon	51 ± 40	49 ± 53	44 ± 65
San Diego	45 ± 22	43 ± 15	42 ± 16

Notes: Between-year standard deviation = 6.8 percent for Monterey Bay. Juvenile survival used in population viability analysis = 50 percent (also 48 percent and 45 percent, see text).

C) Fecundity (chicks reared to fledging, per adult male).

Study Population	Years	Mean	Between-year standard deviation
Monterey Bay w/o predator control	1984-1991	0.849	0.173
Monterey Bay w/ predator control	1992-1997	1.105	0.157
Oregon	1993-1997	1.040	---
San Diego	1995-1997	0.917	---

Table D-2. Summary of stochastic results, after 100 years (400 simulations each scenario).

A. Summary of long-term population trajectories.

Sce-nario No.	Description	Mini-mum	X - S.D.	Mean	X + S.D.	Lamb-da	Percent Change
1	Status Quo (SQ)	61	410	771	1131	0.9908	-61
2	SQ but 75 percent adult survival	0	127	391	654	0.9841	-80
3	SQ but 77 percent adult survival	182	817	1232	1647	0.9954	-37
4	Juvenile survival or reproductive success reduced 10 percent	0	5	118	231	0.9723	-94
5	Juvenile survival or reproductive success reduced 4 percent	3	134	437	740	0.9851	-78
6	SQ but optimistic SLO reproductive success estimate	28	511	930	1348	0.9926	-52
7	SQ but pessimistic SLO reproductive success estimate	28	306	639	972	0.9889	-67
8	SQ, no catastrophic mortality	147	669	1044	1419	0.9938	-46
9	Catastrophic mortality includes survival and reproductive failure	0	0	177	362	0.9763	-91
10	Dispersal reduced by 1/2	85	453	825	1196	0.9914	-58
11	No dispersal	7	448	757	1066	0.9906	-62
12	No management	0	5	86	166	0.9692	-96
13	Start with 3500 total; no management	0	16	116	215	0.9722	-94
14	Improve SLO reproductive success to 1.105 chicks	198	934	1445	1957	0.9970	-26
15	Improve SLO reproductive success to 1.0 chicks	80	560	975	1389	0.9931	-50
16	Improve NC and SFB reproductive success to 1.105 chicks	601	1138	1440	1742	0.9970	-26
17	Improve reproductive success at SLO, NC and SFB to 1.105 chicks	1018	1741	2230	2718	1.0013	14.4

Note: The last column shows mean total percent decline after 100 years, except for Scenario 17, for which percent increase is shown.

Table D-2. Summary of Stochastic Results, continued

B. Probability of Quasi-extinction and Probability of Specified Declines during 100 years.

Sce-nario No.	Description	Probability of Quasi-Extinction, percent[1]	Probability of any decline, as percent	Probability of 50 percent decline, as percent	Median percent decline[2]
1	Status Quo (SQ)	0	100	72	61
2	SQ w/ 75 percent Adult Survival	2.8	100	96	83
3	SQ w/ 77 percent Adult Survival	0	96	27	36
4	Juvenile Survival/reproductive success reduced 10 percent	42	100	100	96
5	Juvenile Survival or reproductive success reduced 4 percent	3.5	100	92	81
6	SQ + optimistic SLO reproductive success estimate	0.3	100	59	54
7	SQ + pessimistic SLO reproductive success estimate	0.3	100	83	69
8	SQ, no catastrophic reproductive failure	0	100	42	46
9	Catastrophic mortality includes survival and reproductive failure	29	100	99	94
10	Dispersal reduced by 1/2	0	100	71	59
11	No dispersal	0.3	100	79	64
12	No management	51	100	100	97
13	Start with 3500; no management	35	100	100	97
14	Improve SLO reproductive success to 1.105 chicks	0	85	19	26
15	Improve SLO reproductive success to 1.0 chicks	0.3	99	51	50
16	Improve NC and SFB reproductive success to 1.105 chicks	0	97	6	25
17	Improve reproductive success at SLO, NC and SFB to 1.105 chicks	0	30	0	12[2]

[1] - Standard error of the estimate of Probability of Quasi-extinction is $\pm$ 2.2 percent in all cases.

[2] - Median percent increase in total population size.

Table D-3. Summary of results for growth scenarios, at the end of 25 years.

Sce-nario No.	Description	Median outcome after 25 years, N	Probabi-lity of 3000+ after 25 years, percent	Population size reached after 25 years with 80 percent probability, N	Percent annual growth rate in first 15 years[1]
18	Improve reproductive success to 1.3 chicks per male in all subpopulations	3341	82	3018	3.35
19	Improve reproductive success to 1.2 chicks per male in all subpopulations	3110	57	2740	2.95

[1] - Annualized growth rate, calculated for first 15 years.

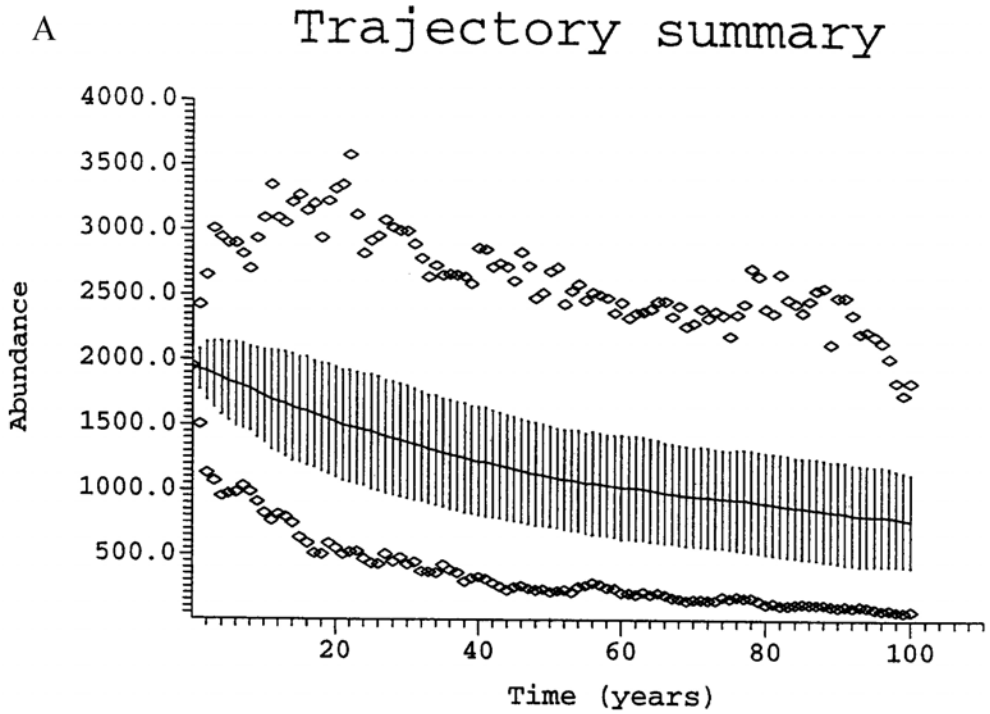
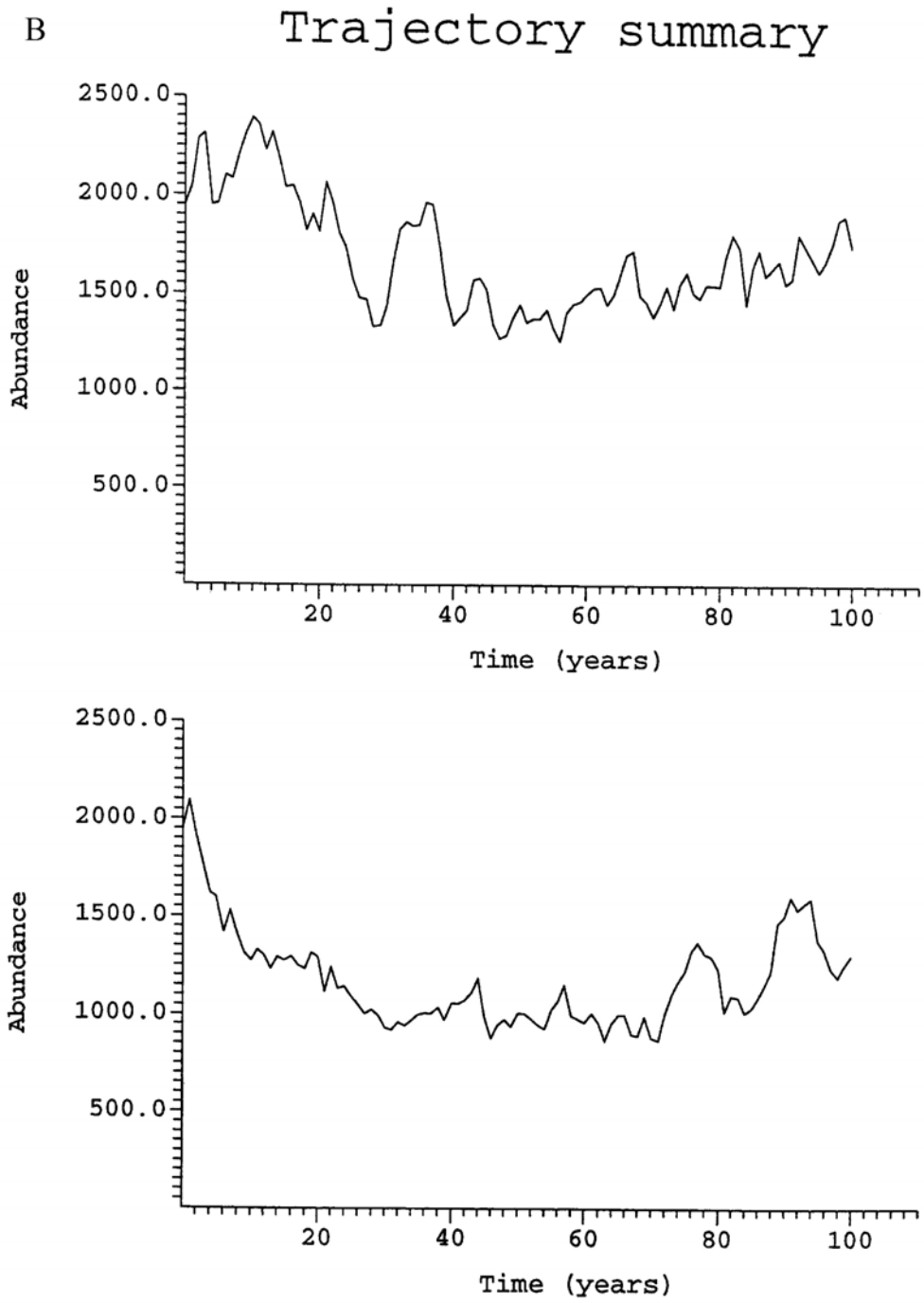
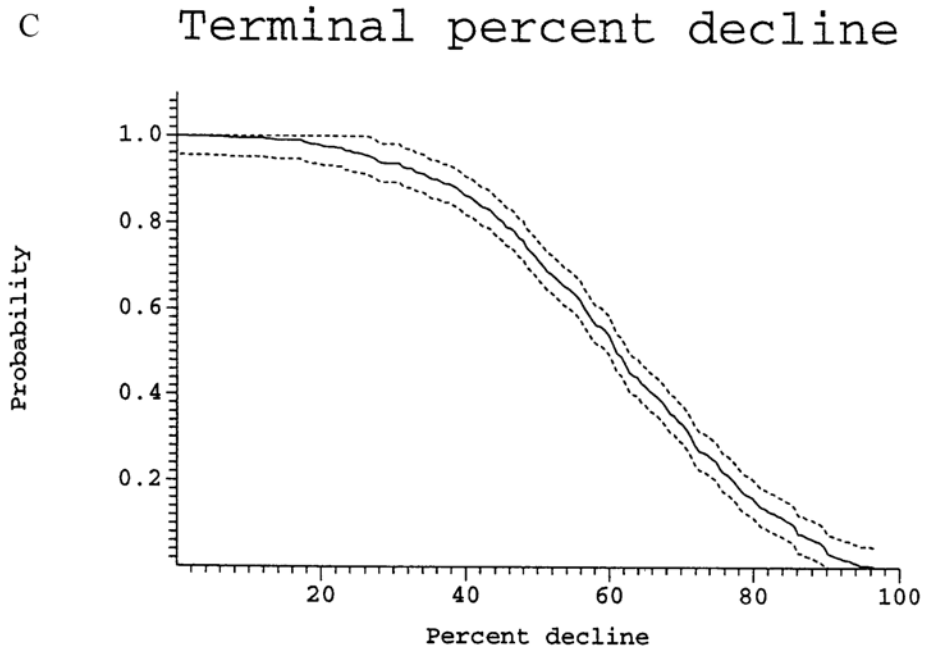


Figure D-1. Scenario 1: Status Quo (see text). A) Population trajectory for the metapopulation. Diamonds indicate maximum and minimum (400 simulations, total). Horizontal line indicates mean trajectory. Vertical lines connect mean +/- 1 standard deviation of outcome. B) Population trajectories for two sample simulations (among 400), under Scenario 1. C) Probability that after 100 years the metapopulation will have declined below specified level. Dotted lines indicate approximate 95 percent confidence interval. D) Abundance for each subpopulation (abbreviated as in text) at the end of 100 years. Bars indicate means, vertical lines with bars indicate + 1 standard deviation. Diamonds show maximum (among 400 simulations).

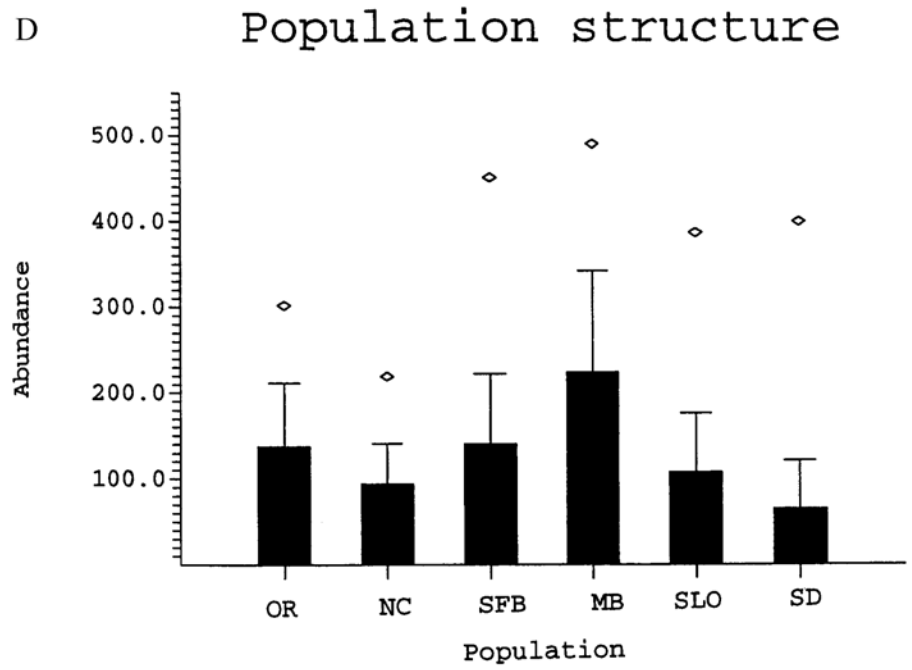
B


Trajectory summary
2500.0
2000.0
1500.0
1000.0
500.0
Abundance
20
40
60
80
100
Time (years)
2500.0
2000.0
1500.0
1000.0
500.0
Abundance
20
40
60
80
100
Time (years)

C


Terminal percent decline
Probability
1.0
0.8
0.6
0.4
0.2
20
40
60
80
100
Percent decline

D


Population structure
Abundance
500.0
400.0
300.0
200.0
100.0
OR
NC
SFB
MB
SLO
SD
Population

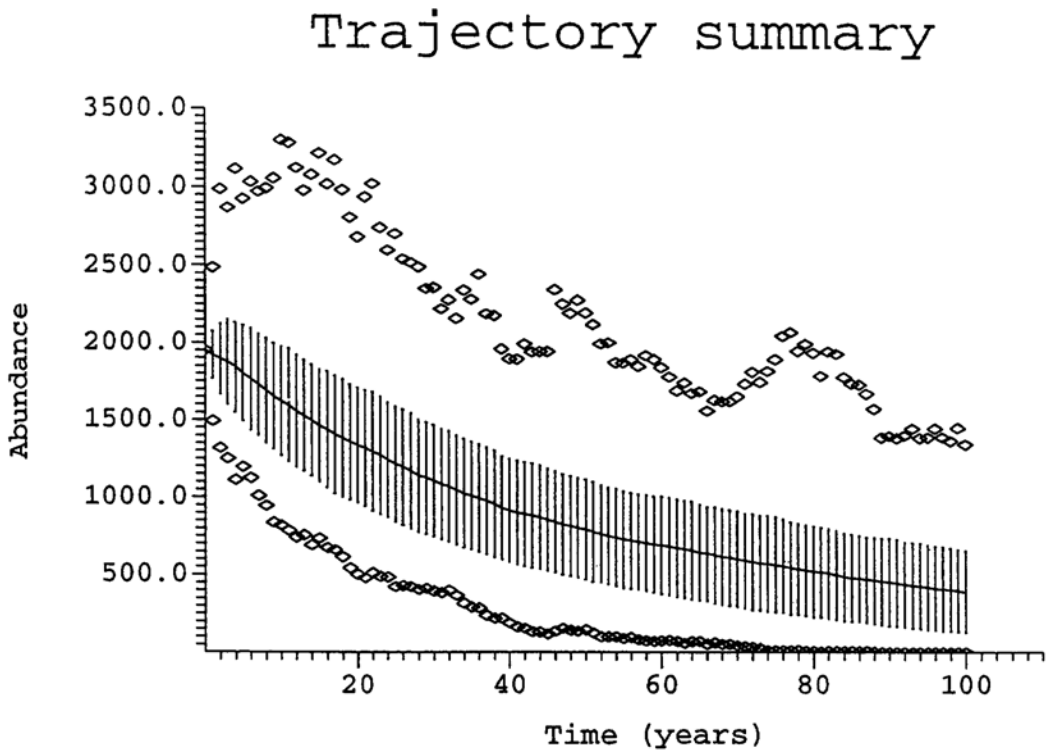


Figure D-2. Scenario 2: Status Quo with 75 percent adult survival instead of 76 percent. Population trajectory for the metapopulation. Diamonds indicate maximum and minimum (400 simulations, total). Horizontal line indicates mean trajectory. Vertical lines connect mean +/- 1 standard deviation of outcome.

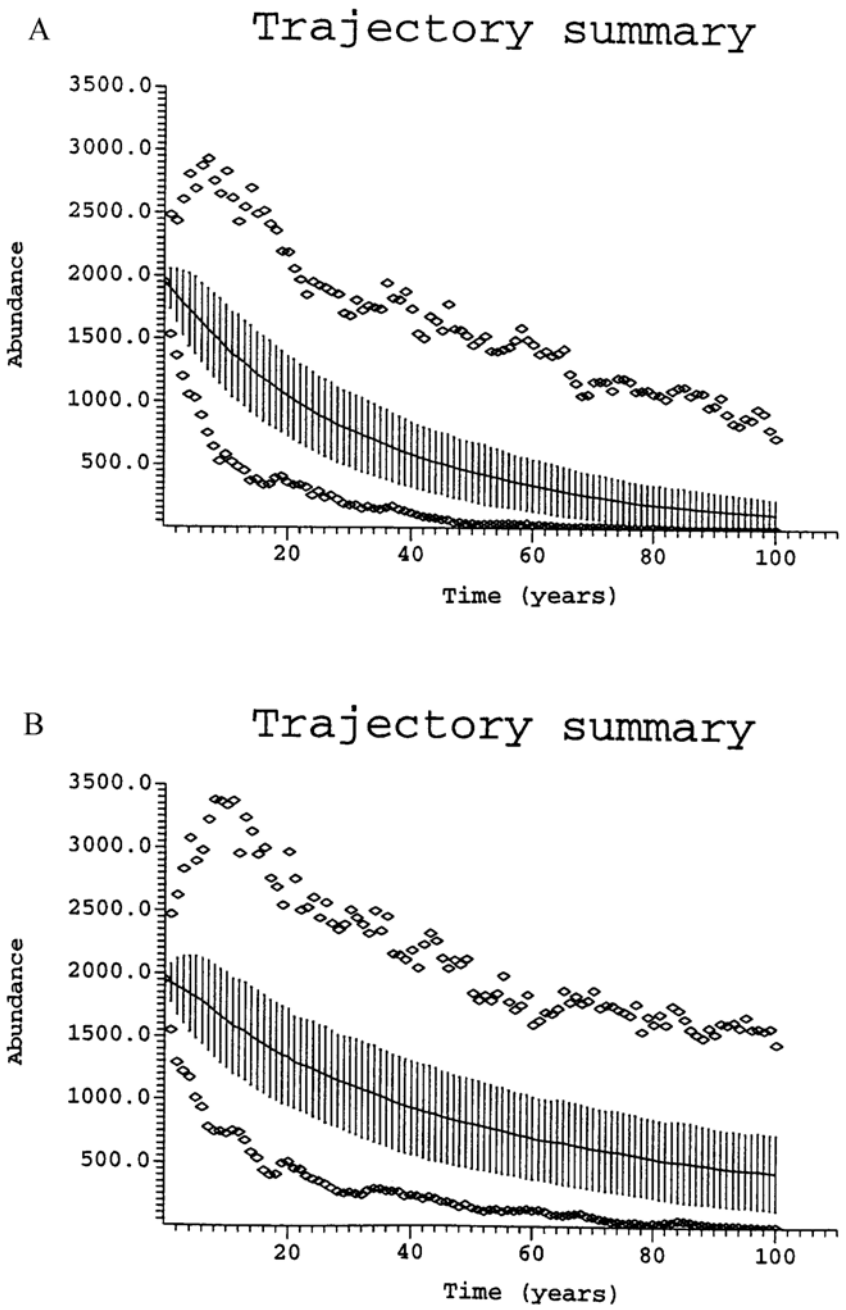


Figure D-3. Scenarios 4 and 5: Status Quo with reduction in juvenile survival (equivalently, reproductive success) by 10 percent (A) and by 4 percent (B). In each Figure panel: Population trajectory for the metapopulation. Diamonds indicate maximum and minimum (400 simulations, total). Horizontal line indicates mean trajectory. Vertical lines connect mean +/- 1 standard deviation of outcome.

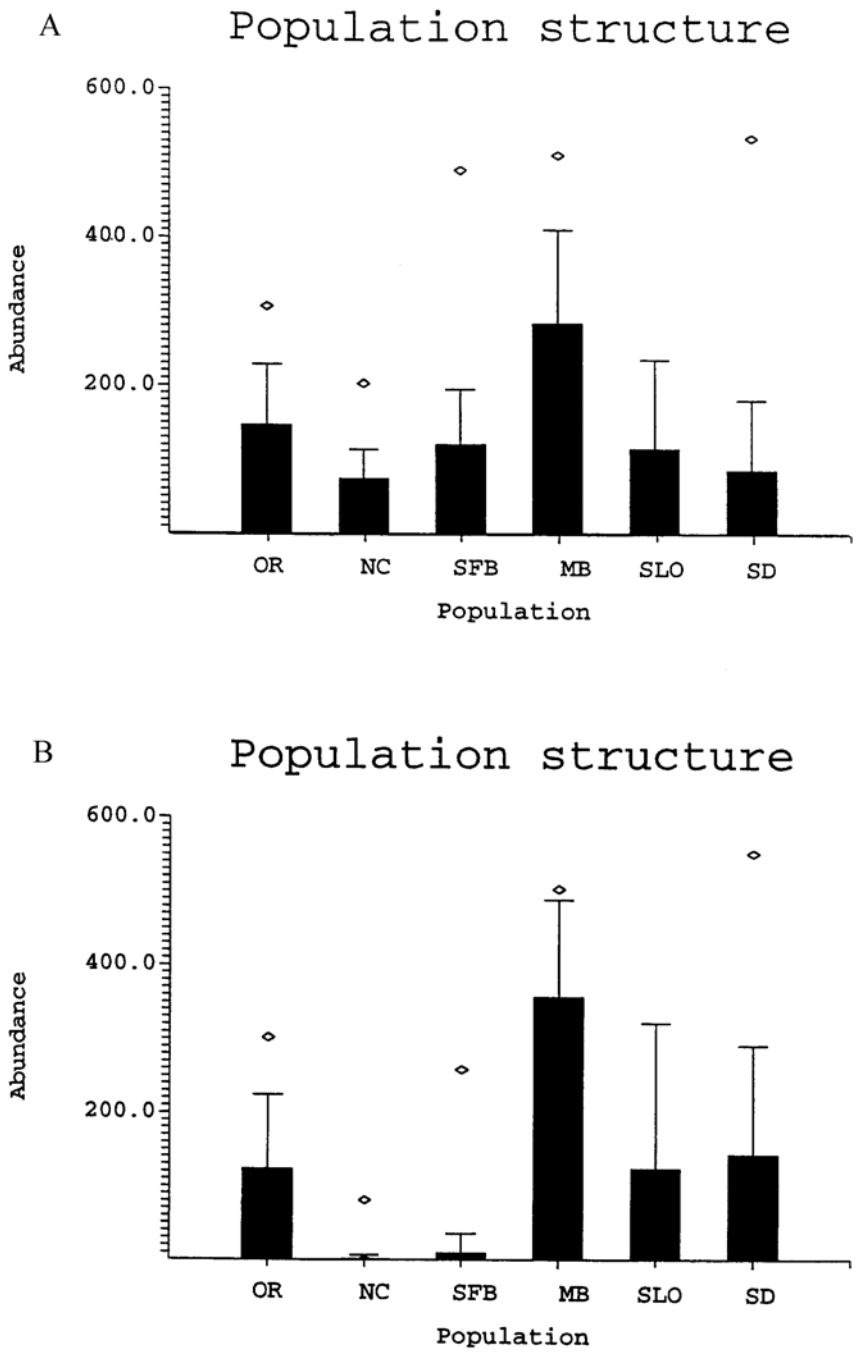


Figure D-4. Scenarios 8 and 9: Status Quo with reduction in dispersal. A) Dispersal reduced by 1/2 (Scenario 8). B) No dispersal (Scenario 9). For each Figure panel: Abundance for each subpopulation at the end of 100 years. Bars indicate means; vertical lines with bar indicate +1 standard deviation. Diamonds show maximum (among 400 simulations).

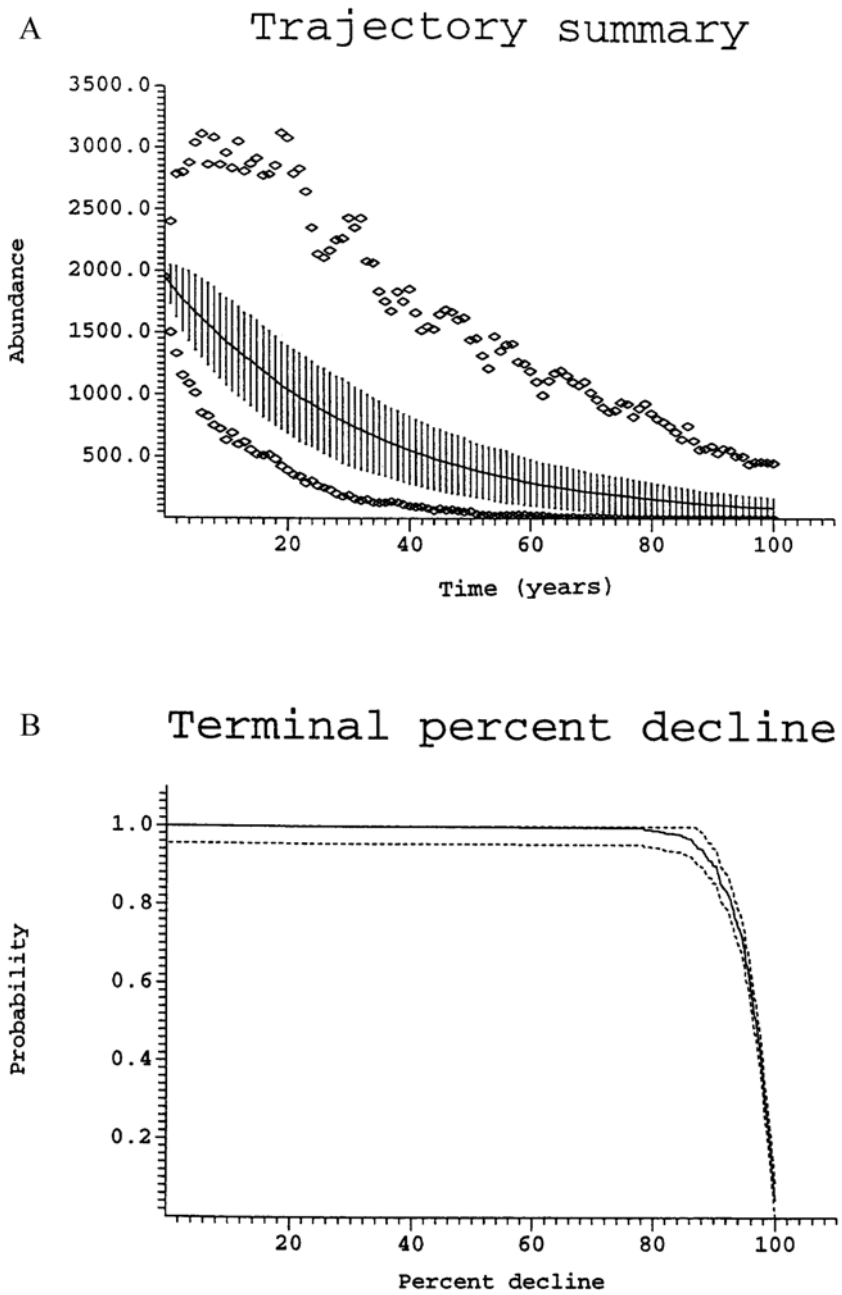


Figure D-5. Scenario 12: No Management. A) Population trajectory for the metapopulation. Diamonds indicate maximum and minimum (400 simulations, total). Horizontal line indicates mean trajectory. Vertical lines connect mean +/- 1 standard deviation of outcome. B) Probability that at the end of 100 years the metapopulation will have declined below specified level. Dotted lines indicate approximate 95 percent confidence interval.

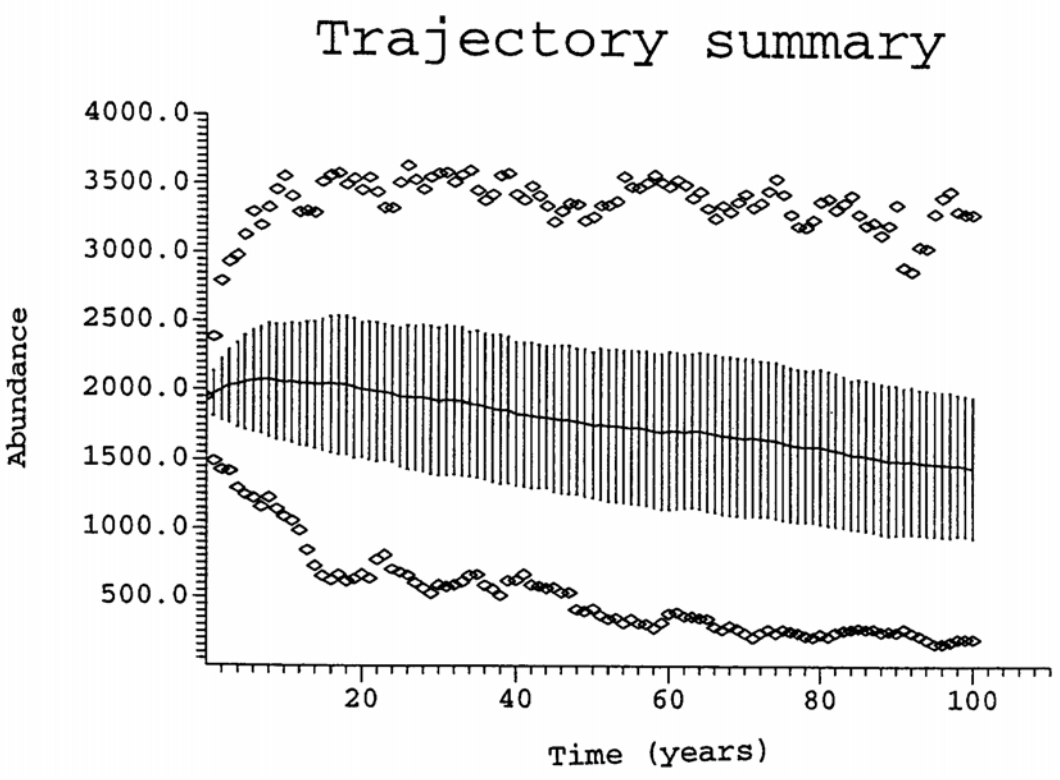


Figure D-6. Scenario 14: Improve reproductive success in San Luis Obispo/Santa Barbara/Ventura subpopulation and Status Quo elsewhere; see text. Population trajectory for the metapopulation. Diamonds indicate maximum and minimum (400 simulations, total). Horizontal line indicates mean trajectory. Vertical lines connect mean +/- 1 standard deviation of outcome.

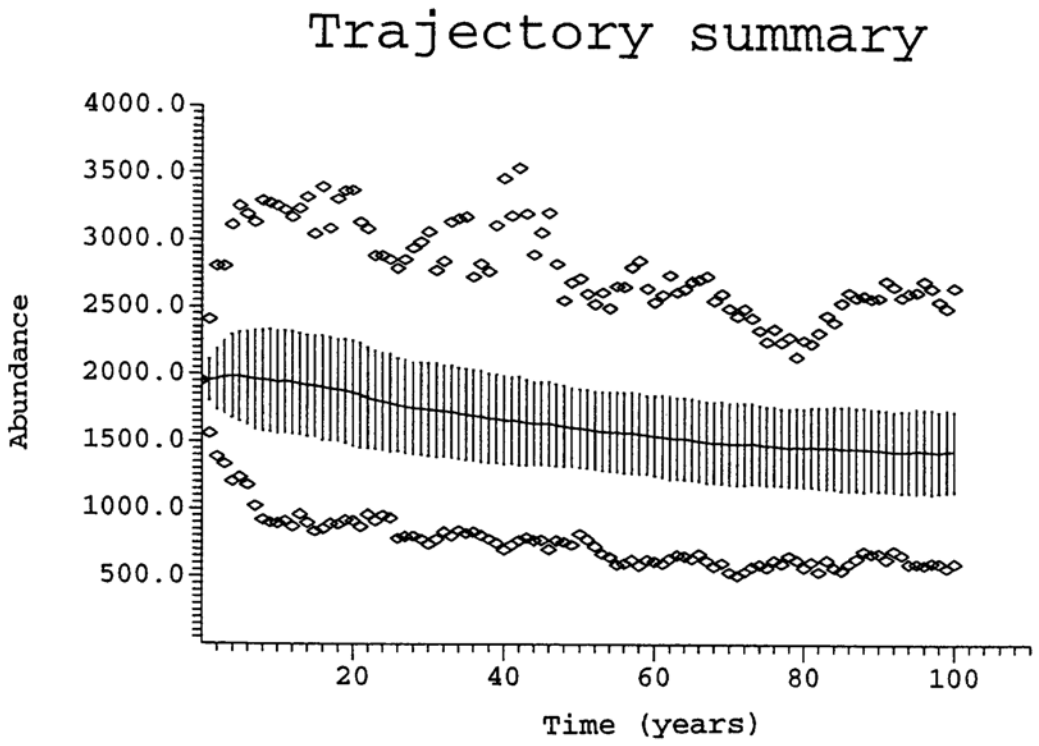


Figure D-7. Scenario 16: Improve reproductive success in San Francisco Bay and Northern California Coast subpopulations, Status Quo elsewhere; see text. Population trajectory for the metapopulation. Diamonds indicate maximum and minimum (400 simulations, total). Horizontal line indicates mean trajectory. Vertical lines connect mean +/- 1 standard deviation of outcome.

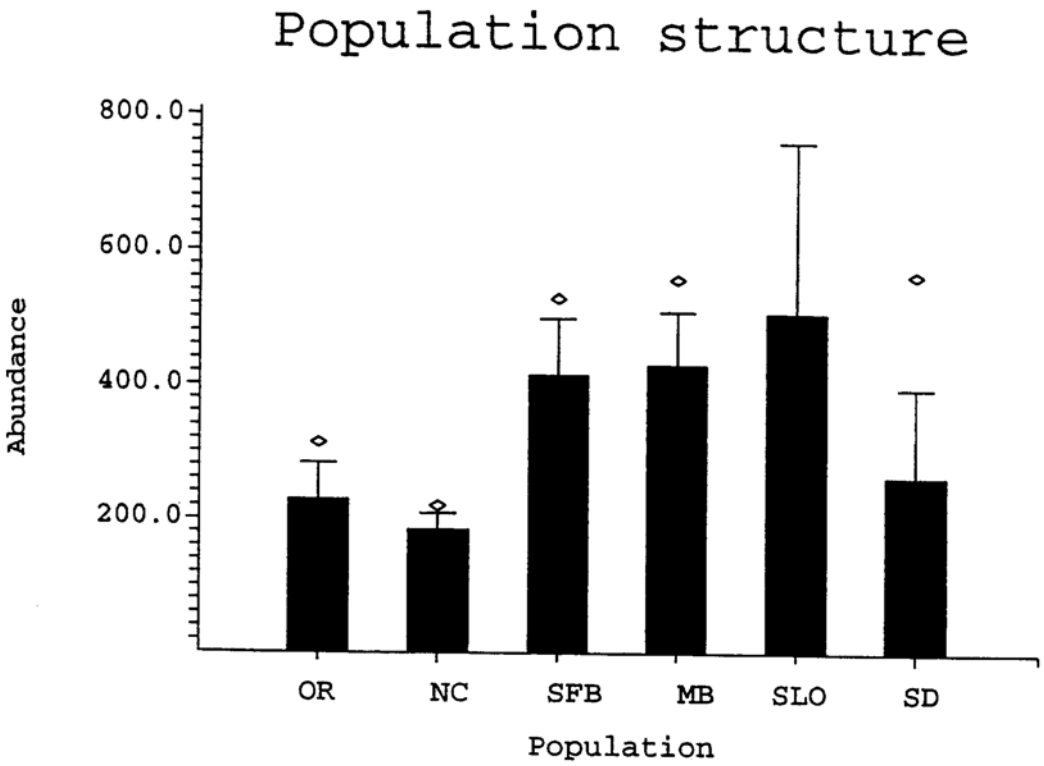


Figure D-8. Scenario 17: Management at all areas (see text). Abundance for each subpopulation at the end of 100 years. Bars indicate means; vertical lines with bars indicate + 1 standard deviation. Diamonds show maximum (among 400 simulations).

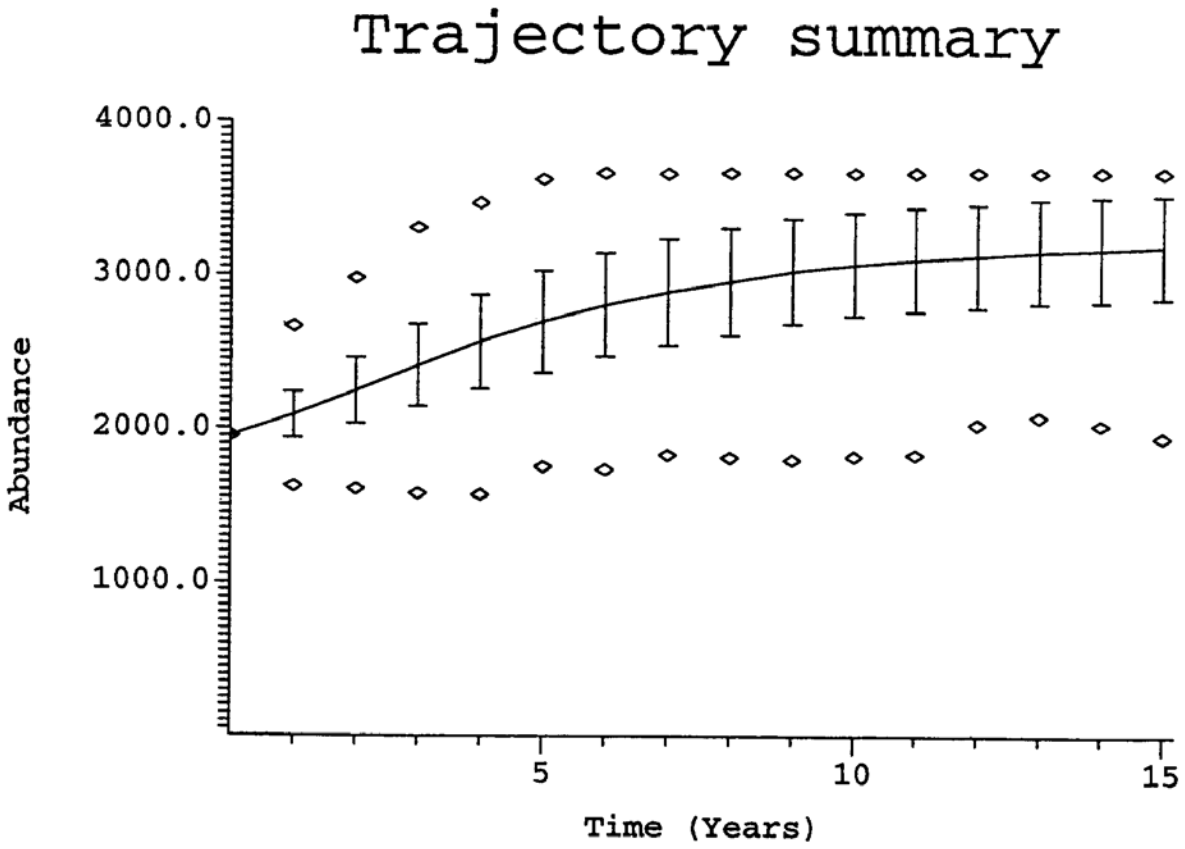


Figure D-9. Scenario 18: Recovery of western snowy plovers assuming 1.3 chicks fledged per male in all subpopulations. Population trajectory for the metapopulation is shown for first 15 years of the scenario. Diamonds indicate maximum and minimum (400 simulations, total). Horizontal line indicates mean trajectory. Vertical lines connect mean +/- 1 standard deviation of outcome.

APPENDIX E

ASSOCIATED SENSITIVE SPECIES OF THE COASTAL BEACH-DUNE ECOSYSTEM AND ADJACENT HABITATS

We, the U.S. Fish and Wildlife Service, are committed to applying an ecosystem approach to conservation to allow for efficient and effective conservation of our nation's biological diversity (U.S. Fish and Wildlife Service 1994*a*). In terms of recovery plans, it is our policy to incorporate ecosystem considerations in the following manner:

(1) Develop and implement recovery plans for communities or ecosystems where multiple listed species, candidates and species of concern occur.

(2) Develop and implement recovery plans for threatened and endangered species in a manner that restores, reconstructs, or rehabilitates the structure, distribution, connectivity, and function upon which those listed species depend. In particular, these recovery plans shall be developed and implemented in a manner that conserves the biotic diversity of the ecosystems upon which the listed species depend.

(3) Expand the scope of recovery plans to address ecosystem conservation by enlisting local jurisdictions, private organizations, and affected individuals in recovery plan development and implementation.

(4) Develop and implement agreements among multiple agencies that allow for sharing of resources and decision making on recovery actions for wide-ranging species (U.S. Fish and Wildlife Service 1994*a*).

Improved habitat conditions for co-occurring species within the coastal beach-dune ecosystem will undoubtedly occur through attainment of western snowy plover recovery objectives. Many listed, proposed, or candidate fish and wildlife species, and federally recognized species of concern occur in habitats within or adjacent to this ecosystem (Table E-1). Some of these species are included in existing or developing recovery plans, and actions to recover the western snowy

plover will also contribute to implementation of those recovery plans (*e.g.*, beach layia, Howell's spineflower, Menzies' wallflower, Monterey gilia, Monterey spineflower, Sonoma spineflower, Tidestrom's lupine, Myrtle's silverspot butterfly, Smith's blue butterfly, California least tern, American bald eagle, American peregrine falcon, California brown pelican, Pacific pocket mouse, tidewater goby, coho salmon, and steelhead trout) (Table E-1). Other sensitive species which are not covered by regulatory processes or existing recovery planning efforts should also benefit from implementation of the western snowy plover recovery plan through improvements in coastal beach, dune, and adjacent habitats where their ranges coincide with the western snowy plover (*i.e.*, beach invertebrates and other rare plants included in Table E-1). Marine mammals, which use the coastal beach-dune ecosystem and are protected under the Marine Mammal Protection Act of 1972 (16 USC 1361 *et seq.*), also would benefit from conservation of western snowy plover habitat. However, marine mammals are addressed primarily because of the potential need to manage these species when they usurp western snowy plover nesting habitat (*e.g.*, pinnipeds) or become stranded in western snowy plover breeding areas (*e.g.*, cetaceans). This appendix contains brief species accounts for the sensitive species listed in Table E-1.

Federal Status

Endangered: Any species which is in danger of extinction throughout all or a significant portion of it's range.

Threatened: Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Species of concern: Federally-recognized sensitive species for which further biological research and field study are needed to resolve its conservation status.

Table E-1. Associated sensitive fish, wildlife, and plants.

Taxon (Scientific Name)	Federal Status/State Status
Federally-listed plants	
Beach layia (*Layia carnosa*)	Endangered/Endangered (CA)
Coastal dunes milk vetch (*Astragalus tener* var. *titi*)	Endangered/Endangered (CA)
Hoffman's slender-flowered gilia (*Gilia tenuiflora* var. *hoffmanii*)	Endangered
Howell's spineflower (*Chorizanthe howellii*)	Endangered/Threatened (CA)
Island malacothrix (*Malacothrix squalida*)	Endangered
Menzies' wallflower (*Erysimum menziesii*)	Endangered/Endangered (CA)
Monterey gilia (*Gilia tenuiflora* ssp. *arenaria*)	Endangered/Threatened (CA)
Monterey spineflower (*Chorizanthe pungens* var. *pungens*)	Threatened
Soft-leaved Indian paintbrush (*Castilleja mollis*)	Endangered
Sonoma spineflower (*Chorizanthe valida*)	Endangered/Endangered (CA)
Tidestrom's lupine (*Lupinus tidestromii*)	Endangered/Endangered (CA)
Federally-listed animals	
El Segundo blue butterfly (*Euphilotes battoides allyni*)	Endangered

Taxon (Scientific Name)	Federal Status/State Status
Morro shoulderband snail (*Helminthoglypta walkeriana*)	Endangered
Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*)	Endangered
Smith's blue butterfly (*Euphilotes enoptes smithi*)	Endangered
California brown pelican (*Pelecanus occidentalis californicus*)	Endangered/Endangered (CA)
California least tern (*Sterna antillarum browni*)	Endangered/Endangered (CA)
Pacific pocket mouse (*Perognathus longimembris pacificus*)	Endangered
Tidewater goby (*Eucyclogobius newberryi*)	Endangered
Coho salmon (*Oncorhynchus kisutch*)	Varies by geographic area
Steelhead trout (*Oncorhynchus mykiss*)	Varies by geographic area
Federally-proposed plants	
La Graciosa thistle (*Cirsium loncholepis*)	Proposed Endangered/Threatened (CA)
Nipomo mesa lupine (*Lupinus nipomensis*)	Proposed Endangered/Endangered (CA)
Federal Candidate Animals	
Streaked horned lark (*Eremophila alpestris strigata*)	Candidate
Animals delisted or proposed for delisting	

Taxon (Scientific Name)	Federal Status/State Status
American bald eagle (*Haliaeetus leucocephalus*)	Endangered (1978); Threatened (1995); Delisted (2007)/ Threatened (WA);Endangered (CA)
American peregrine falcon (*Falco peregrinis anatum*)	Delisted (1999)/Endangered (WA, CA)
Plant species of concern	
Northcoast phacelia (*Phacelia insularis* var. *continentis*)	Species of concern
Beach spectacle pod (*Dithyrea maritima*)	Species of concern/Threatened (CA)
Pink sand-verbena (*Abronia umbellata* ssp. *breviflora*)	Species of concern/Endangered (OR)
San Francisco spineflower (*Chorizanthe cuspidata* var. *cuspidata*)	Species of concern
Surf thistle (*Cirsium rhothophilum*)	Species of concern/Threatened (CA)
Animal species of concern	
Barrier beach tiger beetle (*Cicindela latesignata latesignata*)	Species of concern
Belkin's dune fly (*Brennania belkini*)	Species of concern
Gabb's tiger beetle (*Cicindela gabbi*)	Species of concern
Globose dune beetle (*Coelus globosus*)	Species of concern
Little bear scarab beetle (*Lichnanthe ursina*)	Species of concern

Taxon (Scientific Name)	Federal Status/State Status
Mimic tryonia snail (*Tyronia imitator*)	Species of concern
Morro blue butterfly (*Icaricia icarioides morroensis*)	Species of concern
Mudflat tiger beetle (*Cicindela trifasciata sigmoidea*)	Species of concern
Oblivious tiger beetle (*Cicindela latesignata obliviosa*)	Species of concern
Oso Flaco flightless moth (*Areniscythris brachypteris*)	Species of concern
Oso Flaco patch butterfly (*Chlosyne leanira*)	Species of concern
Oso Flaco robber fly (*Ablautus schlingeri*)	Species of concern
Point Conception Jerusalum cricket (*Ammopelmatus muwu*)	Species of concern
Point Reyes blue butterfly (*Icaricia icarioides* ssp.)	Species of concern
Rude's longhorn beetle (*Necydalis rudei*)	Species of concern
Salt marsh skipper (*Panoquina erans*)	Species of concern
Sandy beach tiger beetle (*Cicindela hirticollis gravida*)	Species of concern
White sand bear scarab (*Lichnanthe albopilosa*)	Species of concern

Marine Mammals (all protected under the Marine Mammal Protection Act and some protected under the Endangered Species Act)

Pinnipeds:
California sea lion (*Zalophus californianus*)
Guadalupe fur seal (*Arctocephalus townsendi*)
Harbor seal (*Phoca vitulina richardsi*)
Northern elephant seal (*Mirounga angustirostris*)
Northern fur seal (*Callorhinus ursinus*)
Steller sea lion (*Eumetopias jubatus*)

Cetaceans:
Gray whale (*Eschrichtius robustus*)
Sperm whale (*Physeter macrocephalus*)
Blue whale (*Balaenoptera musculus*)
Humpback whale (*Megaptera novaeangliae*)
Minke whale (*Balaenoptera acutorostrata*)
Killer whale (*Orcinus oraca*)

Federally-listed plants

Beach layia *(Layia carnosa)* is a small succulent plant in the sunflower family (Asteraceae). Until recent surveys, 17 California occurrences of *Layia carnosa* located in 8 dune systems from Santa Barbara County to Humboldt County had been found. Currently, 21 populations are known. Although the species range is relatively unchanged, at least five historical occurrences are thought to be extirpated. The species is restricted to coastal sand dunes. In northern California, it occurs in the northern dune scrub community; in Monterey County, the species occurs in the central dune scrub community. It generally occurs behind the northern foredune community, occupying sparsely vegetated open areas on semi-stabilized dunes. The species also will occur in open areas, such as along trails and roads. The largest populations are in Humboldt County. Three of the historic Humboldt County occurrences were on the Samoa Peninsula in the Humboldt dune system, and two have been extirpated (U.S. Fish and Wildlife Service 1998*a*). In 1995, a small population was rediscovered on Vandenberg Air Force Base (D. Keil

pers. comm. 1995 *in* U.S. Fish and Wildlife Service 1998*a*). The threats to *Layia carnosa* include displacement by invasive, non-native vegetation, recreational uses such as off-road vehicles and pedestrians, and development.

Beach spectacle pod *(Dithyrea maritima)* is a low-growing dune perennial in the mustard family (Brassicaceae or Cruciferae). *Dithyrea maritima* grows in the active foredune habitat of coastal sand dune systems, mainly at the base of the small transverse dunes. The range of the species has been greatly reduced from its historic distribution (Morey 1989). Historically, *Dithyrea maritima* was found just north of the Palos Verdes Peninsula along the coastal dune strip including Hermosa and Redondo Beaches, Los Angeles County. The current mainland distribution is patchy, occurring from Surf, in western Santa Barbara County, north to the Morro Bay sand spit, San Luis Obispo County. Approximately 14 populations are known to still exist. A small Channel Islands population is known from San Miguel Island and scattered locations of the plant occur on the west end of San Nicolas Island. A single location in Baja California, Mexico, just south of San Quintin was documented for this species in 1886. The Los Angeles populations have been extirpated since the early 1930's, and the species has not been seen in Mexico for over 100 years (Rollins 1979). The largest known extant population is on Vandenberg Air Force Base in Santa Barbara County. It occurs intermittently along the coast from Shuman Creek to Purisima Point. *Dithyrea maritima* is extremely vulnerable to physical damage and habitat deterioration caused by foot traffic and off-road vehicle activities. Foot traffic is a continuing threat at Surf Beach on Vandenberg Air Force Base, and occasional errant off-road vehicles from the Nipomo Dunes State Vehicular Recreation Area continue to degrade habitat of the species as does the continued operation of oil fields. Within the Nipomo Dunes State Vehicular Recreation Area all but one small population of *Dithyrea maritima* has been eliminated by off-road vehicle activity. This remaining population is in an unrestricted area subjected to off-road vehicle use and is consequently threatened by habitat degradation (Morey 1989).

Coastal dunes milk vetch *(Astragalus tener* var. *titi)* is a diminutive annual herb of the pea family (Fabaceae). Colonies of the milk-vetch occur on a relatively flat coastal terrace within 30 meters (100 feet) of the ocean beach and 8 meters (25 feet) above sea level. Two historical locations from Los Angeles County (Hyde

Park in Inglewood and Santa Monica) and two from San Diego County (Silver Strand and Soledad) were annotated by Barneby as *Astragalus tener* var. *titi* (Barneby 1950). The only known extant population of this species occurs along 17-Mile Drive on the western edge of the Monterey Peninsula on land owned by the Pebble Beach Company and the Monterey Peninsula Country Club. It is unlikely that suitable habitat remains at the Los Angeles locations, since they have been heavily urbanized. In San Diego County, the Silver Strand area is owned by the Department of Defense (Miramar Naval Weapons Center), and a portion has been subjected to amphibious vehicle training exercises. Another portion of Silver Strand has been leased by the Navy to the California Department of Parks and Recreation for development of a campground and recreational facilities. Numerous unsuccessful searches for the plant have been made in these locations since 1980 (Ferreira 1995, California Natural Diversity Data Base 1997). This species is currently threatened with alteration of habitat from trampling associated with recreational activities, such as hiking, picnicking, ocean viewing, wildlife photography, equestrian use, and golfing. Due to the fragmented nature of the plants habitat and the human uses that surround it, the species is vulnerable to extinction from random events. The species is also threatened by competition from two non-native plants, fig-marigold (*Carpobrotus edulis*) and cut-leaf plantain (*Plantago coronopus*) (U.S. Fish and Wildlife Service 1998*b*).

Hoffman's slender-flowered gilia *(Gilia tenuiflora* ssp. *hoffmannii)* is a small, erect annual herb in the phlox (Polemoniaceae) family. It has been collected from three extant populations on Santa Rosa Island (C. Rutherford and T. Thomas *in litt.* 1994). One population occurs at the type locality near East Point on Santa Rosa Island, California, where it occurs as a component of dune scrub vegetation (Thomas 1993). A partially-fenced population was found in 1994 on stabilized dunes at Skunk Point, Santa Rosa Island. The third population corresponds reasonably well with a 1941 specimen of Reid Moran which was collected between Ranch and Carrington Point. Threats to *Gilia tenuiflora* ssp. *hoffmannii* are soil loss, habitat alteration, competition from non-native grasses, cattle grazing, and elk and deer browsing (U.S. Fish and Wildlife Service 1999*a*). It is also vulnerable to random extinction by such events as storms, drought, or fire. The small number of populations and limited number of individuals make the species vulnerable to randomly, naturally occurring events.

Howell's spineflower *(Chorizanthe howellii)* is an herbaceous annual in the buckwheat family (Polygonaceae). It occurs in coastal dunes and adjacent sandy soils of coastal prairies at elevations ranging from sea level to 37 meters (120 feet). In coastal dunes, it is associated with yellow sand verbena (*Abronia latifolia*) and Menzies' wallflower (*Erysimum menziesii*) (California Department of Fish and Game 1985). The species occurs in areas of relatively mild maritime climate, characterized by fog and winter rains. *Chorizanthe howellii* is known, both historically and currently, from only one area north of Fort Bragg in Mendocino County, California. Three populations are known in the dune system south of Ten Mile River in that county. One extended population is located in MacKerricher State Park, with a portion of one occurrence extending beyond State park land to include adjacent private property (California Department of Fish and Game, California Natural Diversity Data Base). The other populations occur on private lands. The majority of this species occurs within MacKerricher State Park, where recreational and maintenance activities were described as the main threats to the continued existence of this species (U.S. Fish and Wildlife Service1998*a*). Recreational activities historically included off-road vehicle use and hiker and equestrian traffic that caused habitat degradation. In addition, dune habitat is being invaded by non-native plants such as iceplant (*Carpobrotus edulis*), European beachgrass (*Ammophila arenaria*), and burclover (*Medicago polymorpha*), which can outcompete and displace native species and can be a serious threat to *Chorizanthe howellii*. Conservation measures undertaken for this species have included the elimination of off-road vehicle use, management of invasive, non-native plants including iceplant, European beachgrass, and burclover, and the revegetation of this species and *Erysimum menziesii* in MacKerricher State Park. The Park has redirected an equestrian trail away from occupied habitat. The Park has also developed the MacKerricher State Park Ten Mile Dunes Restoration Plan that describes measures to protect and enhance the habitat for this species within the Park.

Island malacothrix *(Malacothrix squalida)* is an annual herb in the sunflower family (Asteraceae). It has been collected from two locations along the north shore of Santa Cruz Island. Green collected it near Prisoner's Harbor in 1886, but the species was not seen on the island again until Philbrick and Benedict collected it in 1968 near Potato Harbor (Rutherford and Thomas *in litt.* 1994). Two

populations are also known from Middle Anacapa Island. Threats to *Malacothrix squalida* are soil loss, habitat alteration resulting from sheep grazing, feral pig rooting, and seabird nesting. The species is also vulnerable to random extinction by such events as storms, drought, or fire. The small numbers of isolated populations and restricted number of individuals also make the species vulnerable to reduced reproductive vigor (U.S. Fish and Wildlife Service 1999*a*).

Menzies' wallflower (*Erysimum menzies*ii) is a member of the mustard family (Brassicaceae or Cruciferae) it may be a biennial or a short-lived perennial depending on the particular population. It is restricted to coastal dunes in Humboldt, Mendocino, and Monterey Counties. The species is recognized to have three subspecies which are geographically distinct, *E. menziesii* ssp. *menziesii, E. menziesii* ssp. *eurekense*, and *E. menziesii* ssp. *yadonii*. This species occurs on coastal sand dunes in Monterey County from Point Pinos south to Cypress Point and in the Marina Dunes; in Mendocino County from Fort Bragg north to Ten Mile River; and in Humboldt County on the Samoa Peninsula (North Spit) of Humboldt Bay from the southern tip of the North Spit to the Lanphere-Christensen Dunes Preserve, and on the South Spit of Humboldt Bay. In Monterey, the species occurs on coastal strand, close to the high tide line, but protected from wave action. The species has high exposure to strong wind, salt spray, and occasional wave action from storms and high tides. Habitat also occurs in recent bluff scrub, and open, sparsely-vegetated dunes. Subspecies *menziesii* is located in Monterey and Mendocino Counties. It occurs in 10 isolated populations along the Monterey Peninsula from Point Pinos to Cypress Point. The Mendocino County populations range from Ten Mile River south to Fort Bragg. Many of the populations are associated with MacKerricher State Park, except for the Pudding Creek population which is near Fort Bragg. Subpecies *eurekense* occurs in Humboldt County from the coastal dunes of the South Spit to the Lanphere-Christensen Dunes Preserve. Extant Humboldt County populations of the subspecies *eurekense* have six recorded occurrences (California Natural Diversity Data Base 2003) in the Lanphere-Christensen Dunes Preserve, northwest of Mad River Slough, north of Manila (Samoa Peninsula), U.S. Coast Guard Station (Samoa Peninsula), and the South Spit (Humboldt Bay). *Erysimum menziesii* ssp. *yadonii* is restricted to six populations in the vicinity of the Marina Dunes, two at Marina State Beach, and the others at the RMC Lonestar Cement Company property approximately 0.8

kilometer (0.5 mile) south of the Salinas River Lagoon, Monterey County, California. California Natural Diversity Data Base occurrences for subspecies *yadonii* are found in the following habitats: coastal dunes, foredunes, and coastal strand; for subspecies *eurekense*, occurrences are in coastal dunes and foredunes; and for subspecies *menziesii*, occurrences are in coastal strand, coastal dunes, central dune scrub, and northern dune scrub. The species is threatened by invasion by non-native plant species, industrial and residential development, and trampling by recreational users such as pedestrians, equestrians, and hang-gliders. Off-road vehicle recreation, which historically degraded habitat for the species, is again threatening the species (U.S. Fish and Wildlife Service 1998*a*). The displacement of subspecies *menziesii* by the invasive non-native iceplant (*Carpobrotus* sp.) is a threat to Monterey County populations and the populations north of Fort Bragg. In Monterey County, additional threats include browsing by deer (attempts to plant seedlings are successful only with caging of the plants), recreational land uses, coastal erosion, sand mining activities, and the deposition of dredged material from adjacent wetlands (U.S. Fish and Wildlife Service 1998*a*).

Monterey gilia *(Gilia tenuiflora* ssp. *arenaria)* is a member of the phlox family (Polemoniaceae). This species grows in sandy soils of dune scrub and maritime chaparral habitat in the coastal dunes of Monterey County. The species occurs most commonly in sites with limited exposure to strong winds, salt spray, and waves. It grows in open areas and wind-sheltered openings in the low-growing dune scrub vegetation or in areas where the sand has experienced some disturbance, such as along trails and roads. The species is usually tolerant of small amounts of drifting sand. Monterey Bay dune populations occur from Moss Landing to Monterey, along coastal and inland dunes. Monterey Peninsula populations occur in the vicinity of Spanish Bay and Asilomar State Beach. One of the largest populations known of this species was recently discovered at Fort Ord in 1993; preliminary estimates indicate that as much as 60 percent of the species may occur at Fort Ord (U.S. Fish and Wildlife Service 1998*a*). The species is threatened by encroachment of invasive, non-native plant species, sand mining trampling by equestrians and pedestrians, and habitat removal for commercial and residential development. Off-road vehicle activities and golf course development have historically degraded habitat for this species (U.S. Fish and Wildlife Service 1998*a*).

Monterey spineflower *(Chorizanthe pungens* var. *pungens)* is an herbaceous annual in the buckwheat family (Polygonaceae). It occurs in areas of relatively mild maritime climate, characterized by fog and winter rains. This species occurs in coastal dunes, coastal scrub, and further inland on sandy soils derived from ancient stabilized dunes, dating to the Ice Age (Pleistocene); it tends to occur on bare sandy patches where there is little vegetative cover (Zoger and Pavlik 1987). Sites on Fort Ord where this species was found included firebreaks, along roadsides, in sandy openings between shrubs, the central portion of the firing range, and areas where military activities resulted in frequent habitat disturbances. It occurs from the Monterey Peninsula (Monterey County) northward along the coast to southern Santa Cruz County, and inland to the Salinas Valley (Reveal and Hardham 1989; Ertter 1990). Early collections by Gambel in 1842 indicated that this species historically occurred as far south as San Simeon near the northern boundary of San Luis Obispo County; however, in recent times this species has not been found south of the Monterey Peninsula (Reveal and Hardham 1989). The species is currently known from seven populations with the largest number of plants occurring at Fort Ord. In 1992, Jones & Stokes Associates found this species in almost all the undeveloped areas on the western half of Fort Ord (U.S. Army Corps of Engineers 1992). Populations of the species also are found on California Department of Parks and Recreation lands at Manressa, Sunset, Salinas River, and Asilomar State Beaches and Fort Ord Dunes State Park (C. Roye *in litt.* 1996). In 1987, a survey of 6 properties in the Marina Dunes found a total of 43 individuals of *Chorizanthe pungens* var. *pungens* occurring on 5 of the 6 properties surveyed: Marina State Beach, Granite Rock Company, Gullwing, RMC Lonestar Cement Company, and Martin properties (Zoger and Pavlik 1987). Habitat loss, conversion from agricultural use, residential development, activities at military institutions, and invasion by non-native plants were identified as the primary threats to this species. Hikers and equestrians may trample these plants at various locations throughout its range. The conversion of the Fort Ord military base to other uses, including educational and scientific research facilities, may pose threats to this species if new buildings are constructed; however, large portions of this plant's habitat on Fort Ord are to be reserved for open space. Populations of this species at Sunset State Beach are threatened by recreational activities and are subject to trampling. Invasive non-native species which were introduced as part of dune stabilization programs (i.e., European beachgrass (*Ammophila arenaria*) and

iceplant (*Carpobrotus edulis*)) are also a threat to these populations. This plant at Sunset State Beach may be enhanced by a restoration program established for the removal of non-native species (Ferreira 1989). Restoration of dunes at the Naval Post Graduate School in Monterey where it occurs also may be beneficial. Personnel from Marina State Beach and Asilomar State Park have implemented an aggressive eradication program for invasive, non-native plants, have conducted dune revegetation, and protected dune habitat from recreational uses (*i.e.*, use of raised wooden walkways). The State has installed interpretive signs that educate park visitors on the sensitivity of dune habitat and endangered plant species. Designating large portions of Fort Ord as open space will provide conservation opportunities for this species (U.S. Fish and Wildlife Service 1998*a*).

Soft-leaved Indian paintbrush *(Castilleja mollis)* is a presumably partially parasitic perennial herb in the figwort family (Scrophulariaceae). Two collections of this species were made by F. H. Elmore from Point Bennett on San Miguel Island in 1938 (Heckard *et al.* 1991); despite recent searches, this plant has not been seen on the island since then (S. Junak pers. comm. 1994). *Castilleja mollis* is known from two areas on Santa Rosa Island, Carrington Point in the northeast corner of the island, and west of Jaw Gulch and Orr's Camp (this location also referred to as Pocket Field) along the north shore of the island. At Carrington Point, the plant is associated with stabilized dune scrub vegetation that is dominated by goldenbush (*Isocoma menziesii* var. *sedoides*), lupine (*Lupinus albifrons*), and Pacific ryegrass (*Leymus pacificus*). Goldenbush is likely a host plant to the soft-leaved Indian paintbrush, providing water and nutrients (U.S. Fish and Wildlife Service 1998*a*). At the Pocket Field location, the paintbrush is associated with non-native iceplant (*Carpobrotus* sp. and *Mesembryanthemum* sp.), native milkvetch (*Astragalus miguelensis*), and alien grasses. Threats to *Castilleja mollis* are soil loss, habitat alteration, cattle grazing, deer and elk browsing, deer bedding, and competition with alien plant taxa (S. Chaney pers. comm. 1994). Because of the small numbers of isolated populations and individuals, this species is also vulnerable to random extinction by such events as storms, drought, or fire. Small numbers of populations and individuals also make the species vulnerable to random naturally occurring events (U.S. Fish and Wildlife Service 1998*a*).

Sonoma spineflower *(Chorizanthe valida)* is an herbaceous annual in the buckwheat family (Polygonaceae). The species is found in areas of relatively mild maritime climate, characterized by fog and winter rains. It occurs exclusively in the sandy soil of a coastal prairie near Abbott's Lagoon, at an elevation of approximately 12 meters (40 feet). This site is adjacent to the dune system which stretches about 19 kilometers (12 miles) from Tomales Point to Reyes (Cooper 1967). The only known extant population of *Chorizanthe valida* (California Natural Diversity Data Base) is located in the Lunny pasture adjacent to Abbott's Lagoon in Point Reyes National Seashore (Davis and Sherman 1990). Historically, the plant was more widespread on the peninsula. The population is located in a pasture that has been grazed for over a century. Changes in grazing or trampling could alter the vegetation structure that has allowed the plant to persist. Increased grazing or trampling may increase seedling mortality, and reduced grazing and trampling may allow surrounding vegetation to outcompete *Chorizanthe valida* (U.S. Fish and Wildlife Service 1998*a*).

Tidestrom's lupine *(Lupinus tidestromii*) is a low, creeping perennial member of the pea family (Fabaceae). This species grows in active dune ecosystems and on partially stabilized coastal dunes. With its prostrate habit, it can survive partial burial, providing local dune stabilization. It occurs from sea level to 7.6 meters (25 feet). Several of the occurrences on the Monterey Peninsula are on remnant dunes in the yards of private residences. It occurs in the mild maritime climate of the central California coast, growing in coastal scrub communities in association with Menzies' wallflower (*Erysimum menziesii*) and sand gilia (*Gilia tenuiflora* ssp. *arenaria*). This species occurs from the Monterey Peninsula in Monterey County northward to the south bank of the Russian River near its mouth in Sonoma County. Clark and Fellers (1986) identified three populations of this species in Point Reyes National Seashore, extending from Abbott's Lagoon to Point Reyes Station. The major threats to *Lupinus tidestromii* include loss of habitat due to development, trampling by hikers and equestrians, and livestock grazing. Two populations on the Monterey Peninsula were eliminated by construction of a golf course; mitigation plantings were implemented. Other populations on privately-owned sites in Monterey are potentially threatened by residential and recreational development. At the time of listing, the populations in Asilomar State Park and Point Reyes National Seashore were subject to trampling

by hikers, a problem that is now corrected by controlled pedestrian routes. Additionally, cattle grazing on the dune system near Dillon Beach presents a potential threat of trampling to this species. Many sites are also threatened by the invasion of non-native species, such as iceplant *(Carpobrotus* sp.) and European beachgrass (*Ammophila arenaria*) (U.S. Fish and Wildlife Service 1998*c*). Asilomar State Beach has developed a management plan for dune enhancement. This plan proposes restoration of native dune vegetation, control of invasive, non-native species, monitoring and mitigation of human-use impacts, and changing visitor use patterns. Boardwalks have been constructed to direct visitors away from sensitive dune areas and allow beach access while minimizing trampling of dune vegetation (C. Roye *in litt.* 1996).

Federally-listed animals

El Segundo blue butterfly. The El Segundo blue butterfly (*Euphilotes battoides allyni*) is a member of the Order Lepidoptera and Family Lycaenidae. It is endemic to the formerly expansive El Segundo sand dunes near Los Angeles, California. The El Segundo blue butterfly is currently found at only two sites, on about 32 hectares (80 acres) at the west end of the Los Angeles Airport runways, and on an approximately 0.8-hectare (2-acre) lot at the Chevron oil refinery in El Segundo. Adult butterflies can be found from mid-July to early September at both sites. The emergence of adult butterflies occurs with the peak flowering period of its primary food plant, the seacliff buckwheat (*Eriogonum parvifolium* Sm. in Rees (Polygonaceae)). The coastal buckwheat *(Eriogonum cinereum)* is a secondary food plant at the Los Angeles Airport. Both buckwheats are used as larval and adult food plants. Historically, the coastal dunes inhabited by this butterfly were altered by urbanization, industrialization, highway construction, sand mining, and planting of non-native ground covers, especially iceplant. Invasion of non-native plants and insufficient suitable habitat are the primary limiting factors affecting its survival (U.S. Fish and Wildlife Service 1985).

Morro shoulderband snail. The Morro shoulderband snail (*Helminthoglypta walkeriana*), also commonly known as the banded dune snail, belongs to the Class Gastropoda and Family Helminthoglyptidae. It occurs in coastal dune and sage scrub communities. Throughout most of its range, the dominant shrub associated

with the snail's habitat is mock heather (*Ericameria ericoides*). This species is found only in western San Luis Obispo County. At the time of listing, the Morro shoulderband snail was known to be distributed near Morro Bay. Its currently known range now includes areas south of Morro Bay, west of Los Osos Creek, and north of Hazard Canyon. This species has also been reported near San Luis Obispo City and south of Cayucos (Roth 1985). The survival of the Morro shoulderband snail is threatened by the destruction of its habitat (due to increasing development) and degradation of its habitat due to invasion of non-native plant species (*i.e.*, veldt grass), structural senescense of dune vegetation, and unauthorized recreational use (*i.e.*, off-road vehicle activity).

Myrtle's silverspot butterfly. The Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*) is a member of the Order Lepidoptera and Family Nymphalidae. The current distribution of the butterfly is Sonoma and Marin Counties (Launer *et al.* 1992). This butterfly inhabits coastal dunes, coastal prairie, and coastal scrub at elevations ranging from sea level to 300 meters (1,000 feet) (Launer *et al.* 1992). Populations of the Myrtle's silverspot butterfly are seriously threatened by several factors. Urban development has extirpated and is currently threatening populations of Myrtle's silverspot. The spread of non-native iceplant, grasses, and forbs is a competitive threat to the several plant species which either provide nectar sources for the adults or a food source for the larvae. Two populations are currently protected at Point Reyes National Seashore; however, there is no management plan for the conservation of these two populations (U.S. Fish and Wildlife Service 1998*a*).

Smith's blue butterfly. The Smith's blue butterfly (*Euphilotes enoptes smithi*) is a member of the Order Lepidoptera and Family Lycaenidae. It occupies coastal sand dunes, inland sand dunes, serpentine grasslands, and coastal cliffside chaparral communities. The Smith's blue butterfly is currently found in San Mateo, Santa Cruz, and Monterey Counties (Arnold 1991; U.S. Fish and Wildlife Service 1984). At the time of listing, the Smith's blue butterfly was known primarily from the mouth of the Salinas River to Del Rey Creek in California (U.S. Fish and Wildlife Service 1984). Its current range is from southern Santa Cruz County to the Monterey-San Luis Obispo County line and inland to the Salinas Valley (Arnold 1991). It typically occurs in foredunes and rear sand dunes in the Monterey Bay

region (U.S. Fish and Wildlife Service 1998*a*). South of the Carmel River, the species also occurs in grassland and coastal scrub and the interface between these two habitat types (U.S. Fish and Wildlife Service 1998*a*). The Smith's blue butterfly's distribution is limited to the occurrence of its host plants (buckwheat). Non-native plants (*e.g.*, iceplants, Kikuyu grass, genista) are known to invade the habitats where the host plants occur (Norman 1994). The Smith's blue butterfly's habitat is also threatened by heavy foot and off-road vehicle traffic. Landslides, sand mining, and urbanization are also reasons for the decline and threats to the butterfly's survival.

California brown pelican. The California brown pelican (*Pelecanus occidentalis californicus*) is a conspicuous bird along the coasts of California and Baja California, Mexico. It typically has a bright red gular pouch (basal portion) during the breeding season. The breeding distribution of the California brown pelican ranges from the Channel Islands of southern California southward to Islas Isabela and Tres Marias off Nayarit, Mexico. Nesting habitat includes islands with steep, rocky slopes. Between breeding seasons, pelicans migrate along the Pacific Coast, ranging as far north as Vancouver Island. Brown pelicans inhabit Oregon part of the year. They roost on the North Spit of Coos Bay, Oregon, and on estuaries along the Oregon Coast (E.Y. Zielinski and R.W. Williams *in litt.* 1999). Brown pelicans prefer salt water habitats year-round, where an adequate and consistent food supply is available. Brown pelicans are colonial nesters and require nesting grounds that are free from both mammalian predators and human disturbance. They also depend on estuarine habitat, including roost sites. This habitat has been extremely reduced along the California coast (U.S. Fish and Wildlife Service 1983).

California least tern. The California least tern (*Sterna antillarum browni*) is the smallest tern in the United States. The birds are about 23 centimeters (9 inches) in length and have a wingspan of about 51 centimeters (20 inches). The least tern historically nested along sandy beaches close to estuaries and embayments along the coast of California from San Francisco Bay to Baja California, Mexico. Human encroachment along California beaches for recreation, residential, and industrial development has severely diminished the availability of suitable nesting habitat. The majority of the least tern population currently is concentrated in

southern California within Los Angeles, Orange, and San Diego Counties. The loss of nesting habitat range-wide in conjunction with increased loss of foraging areas, human disturbance, and predation at remaining breeding colonies resulted in a Federal designation of endangered status in 1970 (U.S. Fish and Wildlife Service 1970).

Pacific pocket mouse. The Pacific pocket mouse *(Perognathus longimembris pacificus*) is a small rodent species that is endemic to the immediate coast of southern California from Marina del Rey and El Segundo in Los Angeles County, south to the vicinity of the border of Mexico in San Diego County (Hall 1981, Williams 1986, Erickson 1993). The species inhabits, or was known to inhabit, coastal strand habitats, coastal dunes, river alluvium, and coastal sage scrub growing on marine terraces (Grinnell 1933, Meserve 1972, Erickson 1993). Available data indicate that the historical distribution of the Pacific pocket mouse was much more extensive prior to the large-scale development of the coastal lowlands of southern California. Between 1894 and 1972, the Pacific pocket mouse was recorded from 8 general locales and 29 specific localities from Los Angeles County south to the border of Mexico in San Diego County. Approximately 80 percent of all Pacific pocket mouse records were from 1931 or 1932 (Erickson 1993). Prior to the rediscovery of the Pacific pocket mouse on the Dana Point headlands in Orange County, California (Brylski 1993), the species had not been observed in over 20 years. In 1995, Pacific pocket mice subsequently were discovered near two historically occupied locales on Camp Pendleton Marine Corps Base in San Diego County, California. Current occupied habitat for the Pacific pocket mouse is estimated to be less than 400 hectares (988 acres). None of the eight historic locales are protected and all have been damaged by or are threatened by habitat destruction or fragmentation, fire, or other disturbances.

Tidewater goby. The tidewater goby (*Eucyclogobius newberryi*) is a small fish characterized by large pectoral fins and a ventral sucker-like disk formed by the complete fusion of the pelvic fins. Gobies are mainly tropical and tend to be bottom dwelling, shallow bay and marine intertidal animals. The tidewater goby ranges from Agua Hedionda Creek, Carlsbad, San Diego County, north to Lake Earl, Del Norte County (Irwin and Soltz 1984). They are common in San Luis Obispo County streams and uncommon from San Francisco Bay to Humboldt Bay

(Moyle 1976). Threats include coastal development, dredging of coastal waterways, coastal road construction, and upstream diversions (U.S. Fish and Wildlife Service 1994*b*).

Coho salmon. The general biology of coho salmon (*Oncorhynchus kisutch*) is described in detail in McMahon (1983), Hassler (1987), and Sandercock (1991). The coho salmon is an anadromous species; coho salmon generally return to their natal streams to spawn after spending 2 years in the ocean. The spawning migrations begin after heavy late-fall or winter rains breach the sandbars at the mouth of coastal streams, allowing the fish to move into them (Moyle *et al.* 1989). Spawning occurs in small to medium-sized gravel at well-aerated sites, typically near the head of a riffle (Moyle 1976). These streams have summer temperatures seldom exceeding 21 degrees Centigrade (70 degrees Fahrenheit). Emergent fry utilize shallow near-shore areas, whereas optimal habitat conditions for juveniles and sub-adults seem to be deep pools created by rootwads and boulders in heavily shaded stream sections. Because of dramatic declines in population numbers, the National Marine Fisheries Service was petitioned to list this species coast wide. As a result, the species is listed as threatened in southern Oregon, northern California, and along the central California coast. It is listed as endangered in the upper Columbia River, Washington, and as threatened in Puget Sound, Washington, and the lower Columbia River (in Washington and Oregon). Causes of coho salmon declines in California and other states include incompatible land-use practices such as logging and urbanization, loss of wild stocks, introduced diseases, over harvesting, and climatic changes.

Steelhead trout. Steelhead trout (*Oncorhynchus mykiss*) are also anadromous fish. Adult steelhead typically spawn in the spring, from February to June (Moyle 1976), in gravel riffles. Optimum temperatures for growth range from 13 to 21 degrees Centigrade (55 to 70 degrees Fahrenheit) (Moyle 1976). Steelhead typically spend 2 to 3 years in freshwater (Moyle 1976). Like coho fry, steelhead fry reside in near-shore areas. In the presence of coho juveniles, steelhead juveniles tend to utilize riffles. The National Marine Fisheries Service was petitioned to list this species coastwide. Steelhead trout are listed as threatened along the northern, central, and south-central California Coast, and endangered in southern California and the Central Valley.

Federally-proposed plants

La Graciosa thistle (*Cirsium loncholepis)* is a short-lived, spreading, mound-like or erect and often fleshy, spiny member of the sunflower family (Asteraceae). This plant is endemic to the coastal wetlands of southern San Luis Obispo County and northern Santa Barbara County from the Pismo Dunes lake area and south historically to the mouth of the Santa Ynez River. The historic distribution of the species included areas that have been converted from wetland habitat to agriculture and development. Currently, the species is restricted to marshes and the edges of willow thickets in damp swales in the Guadalupe dune system (Hendrickson 1990). Groundwater pumping, off-road vehicle use, and coastal development are continuing threats to this species (California Department of Fish and Game 1992).

Nipomo mesa lupine *(Lupinus nipomensis)* is an annual member of the pea family (Fabaceae). This plant grows in stabilized, back dune habitat in the southwestern corner of San Luis Obispo County. The plant occurs as 1 extended population in 5 occurrences with fewer than 700 plants. The high quality occurrences are situated in dune swales and contain a higher diversity of native annuals. This plant requires pockets of bare sand, probably indicating a low tolerance for competition (Walters and Walters 1988). Impacts from off-road vehicles continue to degrade habitat, and the species is threatened by further habitat degradation resulting from expansion of introduced weedy plants. This plant is also threatened by coastal development (U.S. Fish and Wildlife Service 1998*c*).

Federal candidate animal

Streaked horned lark. The streaked horned lark (*Eremophila alpestris strigata*) is found in lowland areas of western Washington and Oregon. The streaked horned lark, as is typical of all horned larks, nests on the ground in sparsely vegetated sites in short-grass dominated habitats, such as prairies, fallow agricultural fields, lightly to moderately grazed pastures, seasonal mudflats, airports, and dredged materials islands in the Columbia River (Gabrielson and Jewett 1940, Altman 1999, Rogers 1999*a*). However, they also are found in dune habitats along the coast (Rogers 1999*a*), where their distribution in Washington coincides with western snowy plover nesting habitat. The streaked horned lark is currently a

candidate for listing and has been extirpated from much of its range, particularly in Washington. In 2000, 58 streaked horned larks (51 males and 7 females) were detected at the 11 known breeding sites in the south Puget Sound lowlands and the outer coast (MacLaren 2000). The breeding population in Oregon is estimated to include less than 200 pairs (Altman 1999). The species is most common in the central Willamette Valley, particularly in and around Baskett Sough National Wildlife Refuge. Little information is available for the Oregon Coast. The greatest threat to the streaked horned lark is the loss of habitat. Native prairies and grasslands have been virtually eliminated throughout the range of the species as a result of human activity. In coastal areas, the introduction of Eurasian beach grass (*Ammophila arenaria*), currently found in high densities on most of coastal Oregon and Washington, has drastically altered the structure of dunes on the outer coast. The tall, dense, leaf canopy of this plant creates unsuitable habitat for streaked horned larks (Rogers 1999*b*, MacLaren 2000). The vegetation density of this beach grass has increased in the fore and secondary dunes where this species is likely to nest (Wiedemann 1987).

Animals delisted or proposed for delisting

American bald eagle. The bald eagle (*Haliaeetus leucocephalus*) is a large eagle, weighing up to 7 kilograms (15.5 pounds) and measuring 84 to 95 centimeters (33 to 37 inches) in length in the northern race (Stalmaster 1987). Bald eagles are found in coastal areas throughout the year, but are present in greatest numbers around seabird and marine mammal colonies, waterbird concentrations, and estuaries where food abundance is highest and easily available. Marine mammals and seabirds are available primarily as carrion in the beach/dune ecosystem on a temporary or localized basis. Use of this ecosystem by bald eagles is therefore likely to be opportunistic, occur most frequently during the migration and wintering periods, and be greatest where reliable food sources occur nearby. The bald eagle historically ranged throughout North America except extreme northern Alaska and Canada, and central and southern Mexico. The population was estimated at 250,000 to 500,000 eagles. However, populations began to decline significantly in the mid- to late-1800's as eagles were killed, prey numbers were reduced, and nesting habitat was destroyed. In the 1940's, the use of DDT and other organochlorine pesticides became widespread, causing further declines in

numbers. In 1963, only 417 active nests were reported in the lower 48 states (U.S. Fish and Wildlife Service 1995). The number of occupied territories has greatly increased since the banning of DDT and other organochlorines and habitat protection and other recovery measures have been instituted. The bald eagle was delisted (removed from the list of endangered and threatened species) in the lower 48 states on August 8, 2007 (U.S. Fish and Wildlife Service 2007).

American peregrine falcon. The American peregrine falcon is a medium-sized raptor. Three subspecies of the peregrine falcon (*Falco peregrinus*) are recognized in North America (Brown and Amadon 1968). The Peale's falcon (*Falco peregrinus pealei*) is a year-round resident of the northwest Pacific Coast, from northern Washington through British Columbia to the Aleutian Islands. The arctic peregrine falcon (*Falco peregrinus tundrius*) nests in the tundra of Alaska, Canada, and Greenland and is typically a long-distance migrant, wintering as far south as South America. The American peregrine falcon (*Falco peregrinus anatum*) occurs throughout much of the remainder of North America, from the subarctic boreal forest south to Mexico. American peregrine falcons that nest in subarctic areas generally winter in South America, and those that nest in lower latitudes exhibit variation in migration behavior or are nonmigratory (Yates *et al.* 1988). The most common habitat characteristic of this species is the presence of tall cliffs which serve both as nesting and perching sites for roosting and hunting. Also required is a source of nearby water (river, coast, lake, wetland, *etc.*) which supports populations of small- to medium-sized resident or migratory birds upon which the American peregrine falcon preys. Organochlorine pesticides were the primary cause of a rapid and significant decline in the number of American peregrine falcons in many areas of North America between the 1940's and early 1970's. The American peregrine falcon was removed from the list of endangered and threatened wildlife on August 25, 1999 (U.S. Fish and Wildlife Service 1999*b*).

Plant species of concern

Northcoast phacelia *(Phacelia insularis* var. *continentis)* is a delicate, annual plant in the borage family (Boraginaceae). The California Natural Diversity Data Base lists occurrences for variety *continentis* in the following habitats: coastal terrace,

coastal bluff, coastal scrub, and some stabilized dunes. Clark and Fellers (1986) found that var. *continentis* is restricted to sandy or rocky soils; at Point Reyes, it is found with annual grasses, annual lupines (*Lupinus* spp.), goldfields (*Lasthenia macrantha*), bedstraw (*Galium* sp.), and thistle (*Cirsium* sp.). They also found it only occurs in Marin and Mendocino Counties, California. There are four localities where the plant has been found at Point Reyes, Marin County, in either 1983 or 1984. Two of the populations were found near the tip of the Point Reyes Peninsula (lighthouse and Chimney Rock areas); the other two populations were found along the north and south side of Abbott's Lagoon. *Phacelia insularis* var. *continentis* has also been found at dunes along the coast at Fort Bragg, Mendocino County, including Gold Beach and along Ten Mile Beach, MacKerricher State Park (S. Smith *in litt.* 1994). Dr. Gregory Lee (*in litt.* 1984) reported his suspicion that construction near the Point Reyes lighthouse in the early 1980's may have adversely impacted this population. Both Mendocino County populations are threatened by invasive weeds, trampling by people and horses, and cattle grazing; the Gold Beach population is also threatened by development (S. Smith *in litt.* 1994).

Pink sand-verbena *(Abronia umbellata* ssp. *breviflora)* is a succulent, prostrate herb in the four o'clock family (Nyctaginaceae). It blooms in delicate pink flowers arranged in umbellate heads. *Abronia umbellata* ssp. *breviflora* is confined to sand dunes and disturbed sandy areas along the Pacific Coast (Meyers 1990). Historically, populations of this species were known from beaches along the Pacific Coast from Vancouver Island, British Columbia, south to northern California (Kaye 1997). The species is now believed to be extinct in British Columbia and Washington, and is known from only a few populations in Oregon and California (Kaye 1997). The pink sand-verbena is frequently found in association with yellow sand verbena (*Abronia latifolia*). In northern California, this plant has been found at Gold Bluffs Beach in Prairie Creek State Park, Redwood National Park, and the southern end of the Samoa Peninsula in Humboldt County (Meyers 1990, Arguello 1994). It also has been found at MacKerricher State Park in Mendocino County and Point Reyes National Seashore in Marin County (Duebendorfer 1987). In Oregon, pink sand verbena has been reestablished as part of western snowy plover habitat restoration projects at the North Spit of Coos Bay, Tenmile and Tahkenitch Creeks, and Siltcoos River

mouths. The U.S. Bureau of Land Management, U.S. Forest Service, and Oregon Department of Agriculture have been experimenting with broadcast seeding and out-planting of greenhouse stock as part of Challenge Cost Share Programs. Reestablishment appears successful. However, it is too early to state whether the populations are self-sustaining (E.Y. Zielinski and R.W. Williams *in litt.* 1999). Threats to *Abronia umbellata* ssp. *breviflora* include habitat encroachment by European beachgrass (*Ammophila arenaria*), destruction by vehicular traffic, human recreational use, and driftwood collection where the *Abronia* is locally abundant (Meyers 1990, Arguello 1994).

San Francisco spineflower *(Chorizanthe cuspidata* var. *cuspidata)* is an annual herb in the buckwheat family (Polygonaceae). Most populations occur on coastal sand dunes; a few occur on weakly consolidated sandstone. Usually found in the rear sand dunes on more stabilized, consolidated soils, this plant occurs along the California coast from San Mateo County to southern Sonoma County. It has been found at Dillon Beach and Point Reyes National Seashore in Marin County (Howell 1970), and southwestern portions of the Presidio, San Francisco (Howell *et al.* 1958).

Surf thistle *(Cirsium rhothophilum)* is a fleshy, gray tomentose, bush-like or low-mounded biennial to short-lived perennial member of the sunflower family (Asteraceae). This species is known from Pismo Beach, Oso Flaco Lake, Nipomo Mesa, and the Guadalupe dunes in San Luis Obispo County, and from the coastal dunes from Point Sal to Point Conception, Santa Barbara County. This plant typically occurs only in the strip of habitat between the wind-blown beach and the stabilized dunes, a zone that for the majority of its distribution is only a few meters (several feet) wide. Vegetative reproduction is uncommon for this plant in habitats dominated by species that have vigorous vegetative reproduction (Zedler 1979, Zedler and Frazier 1991). Vandenberg Air Force Base contains 57 percent of the recorded locations, with 80 percent of the total number of plants of *Cirsium rhothophilum*. Foot access to the Vandenberg dune system via Surf, California, allows some recreational trampling to occur and aggressive competition and displacement by non-native species continue to threaten the species. Nine locations occurring just to the south and north of the base are subject to threats from facility development at Point Conception by the U.S. Coast Guard, cattle

grazing and trampling impacts, habitat disturbance from oil production on private lands, and trampling by beach users at a small county park. The populations in the Pismo Dunes State Vehicular Recreation Area continue to be threatened by destruction from recreational vehicle activity.

Animal species of concern

Barrier beach tiger beetle. See Tiger beetles section.

Belkin's dune fly. The Belkin's dune fly (*Brennania belkini*) is a member of the Order Diptera and Family Tabanidae. The adult resembles a bee. The range of this fly includes coastal sand dunes from Playa del Rey, Los Angeles, County, south to Ensenada, Baja California Norte, Mexico (Middlekauff and Lane 1980). The Belkin's dune fly breeds only on coastal sand dunes. Threats to this fly include destruction of coastal dunes by off-road vehicles, urban development, and dune stabilization with non-native plants.

Globose dune beetle. The globose dune beetle (*Coelus globosus*) belongs in the Order Coleoptera and Family Tenebrionidae. It is a dark, flightless beetle, about 6 to 8 millimeters (0.3 inch) long. The globose dune beetle inhabits foredunes and sand hummocks immediately bordering the coast. This flightless beetle spends most of its life buried under the sand, beneath native dune vegetation. The beetle often lives around the bases of beach bursage (*Ambrosia chamissonis*), saltbush (*Atriplex leucophylla*), sea-rocket (*Cakile edentula*), and yellow sand-verbena (*Abronia latifolia*) (Doyen 1985). The globose dune beetle's range was formally from coastal Mendocino County south to Baja California Norte, Mexico. Its current patchy distribution occurs in Mendocino County (Ten Mile River), Sonoma County (Bodega Head), Marin County (Point Reyes), San Mateo County (Butano Creek), Santa Cruz County (north of the mouth of the Pajaro River), Monterey County (Salinas River and Point Sur), Santa Barbara County (Dos Pueblos Canyon), Ventura County (Punta Gorda), Los Angeles County (Venice and Topanga), San Diego County (Tijuana River), and the California Channel Islands (except for San Clemente). The globose dune beetle's habitat is threatened by development, heavy foot or vehicle traffic, and the invasion of non-native beach grass (*Ammophila*) or iceplants (*Carpobrotus* and *Mesembryanthemum*).

Little bear scarab beetle. The little bear scarab beetle (*Lichnanthe ursina*) is a member of the Order Coleoptera and Family Scarabaeidae. This beetle varies in color from light brown to nearly black. Its flight behavior is characterized by males flying close to the sand surface in search of females (Carlson 1980). The little bear scarab beetle occurs on coastal dunes at Point Reyes and likely in Sonoma, Marin, San Francisco, and San Mateo Counties (U.S. Fish and Wildlife Service 1998*a*). This species has been found at Dillon Beach and Point Reyes Beach, Marin County and Ocean Beach, San Francisco County (Carlson 1980).

Mimic tryonia snail. The mimic tryonia snail (*Tyronia imitator*) is also commonly known as the California brackish water snail. It belongs in the Class Gastropoda and Family Hydrobiidae. The shell of the mimic tryonia snail is 3 to 5 millimeters (0.1 to 0.2 inch) long; the fine spiral shell has four to five whorls (Taylor 1978). The mimic tryonia snail inhabits coastal brackish water sloughs, lagoons, and estuaries. Historically, this snail was distributed from Salmon Creek Lagoon, Sonoma County (California) to Ensenada, Baja California (northern Mexico). Its current patchy distribution is now found in the counties of Alameda, Santa Clara, San Mateo, San Luis Obispo, Monterey, Santa Barbara, San Diego, Ventura, Los Angeles, and Orange. The dredging and filling of lagoons and estuaries for flood control and other purposes (*e.g.*, creation of small boat harbors and construction of roads) have destroyed mimic tryonia snail habitats, and closed the lagoons' and estuaries' mouths. This action has created an unsuitable freshwater environment for this snail.

Morro blue butterfly. The Morro blue butterfly (*Icaricia icarioides morroensis*) belongs to the Order Lepidoptera and Family Lycaenidae. This butterfly has a wingspan of 27 millimeters (1 inch) and can be distinguished from other subspecies of *icarioides* by its true blue coloration (Sternitzky 1930). The Morro blue butterfly inhabits sand dune areas. It feeds on *Lupinus chamissonis*, a large blue-flowered beach lupine (Murphy 1988). The Morro blue butterfly is distributed along the coast in San Luis Obispo County and at two localities outside of its Morro dune area, Nipomo Mesa (9.7 kilometers (6 miles) south of Arroyo Grande) and south of Oso Flaco Lake (Murphy 1988). Historically, its range probably extended south to coastal Los Angeles County (Emmel and Emmel 1973) and on the San Antonio Terrace, Vandenberg Air Force Base (Sheridan 1994).

The Morro blue butterfly's population decline is mainly due to the destruction of its habitat. Heavy use of off-road vehicles and urbanization (*e.g.*, housing development and nuclear power plant construction) have destroyed many of the Morro blue butterfly's habitat localities.

Oso Flaco patch butterfly, Oso Flaco robber fly, and Oso Flaco flightless moth. The Oso Flaco patch butterfly (*Chlosyne leanira*) is a member of the Order Lepidoptera and Family Nymphalidae. This butterfly is highly restricted in distribution and little is known of its biology. The Oso Flaco patch butterfly inhabits the Oso Flaco sand dunes of San Luis Obispo County. Adults have been found in late April and early May. This general dune area is threatened by development and off-road vehicle traffic. The Oso Flaco robber fly (*Ablautus schlingeri*) is a member of the Order Diptera and Family Asilidae. Robber flies have the top of the head hollowed out between the eyes. Adults are predaceous and attack a variety of insects, such as wasps, bees, dragonflies, grasshoppers, tiger beetles, and other flies. The larvae feed chiefly on the larvae of other insects. The Oso Flaco flightless moth (*Areniscythris brachypteris*) is a member of the Order Lepidoptera and Family Scythridae. The historic range of the Oso Flaco robber fly and Oso Flaco flightless moth is in California.

Point Conception Jerusalem cricket. The Point Conception Jerusalem cricket (*Ammopelmatus muwu*) is a member of the Order Orthoptera and Family Stenopelmatidae. Habitat for this species is coastal dunes. The historic range of this cricket is in Santa Barbara County, California.

Point Reyes blue butterfly. The Point Reyes blue butterfly (*Icaricia icarioides* ssp.) is a member of the Order Lepidoptera and Family Lycaenidae. The species pupate in the ground and their larval food is *Lupinus chamissonis*. The Point Reyes blue butterfly occurs in foredunes and rear dunes in the Point Reyes area (U.S. Fish and Wildlife Service 1998*a*). This butterfly is believed to be extinct in San Francisco, California (Powell 1981).

Rude's longhorn beetle. The Rude's longhorn beetle (*Necydalis rudei*) is a member of the Order Coleoptera and Family Cerambycidae. This reddish-brown beetle has a robust form. Its pubescense is moderately dense and golden.

Distinguishing features are the barely, longitudinally impressed, and shining pronotal disk, dilated antennal segments, and shining, coarsely punctate elytra[1] (Linsley and Chemsak 1972). The Rude's longhorn beetle inhabits the coastal sand dunes of San Luis Obispo County. The larvae are found on the root crown and lower stem of mock heather (*Ericameria ericoides*) (Linsley and Chemsak 1972). Oviposition occurs on the stem or root crown at ground level, and the larvae feed upon these areas. The larva forms a pupal chamber in the stem.

Salt marsh skipper (a/k/a wandering skipper). The salt marsh skipper (*Panoquina erans*) is a member of the Order Lepidoptera and the Family Hespariidae. This butterfly is olive brown, with light spots on the upper portion and undersides of the forewings (Donahue 1975). Although restricted to tidelands and estuarine habitats, the salt marsh skipper is widely distributed along the narrow coastal strand from Santa Barbara and Ventura Counties, California, to the southern tip of Baja California, Mexico (Murphy 1988). Historical records include occurrences of this species at Huntington Beach and Doheny Beach in Orange County, California; and Imperial Beach in San Diego County, California (Murphy 1988). At the Tijuana Slough National Wildlife Refuge, San Diego County, California, adult butterflies have been observed at the barrier beach, tidal channel, and tidal creek near tidal flats (Nagano 1982*a*). They have also been found at the Bolsa Chica wetlands (MITECH 1990). The threats to habitat for the salt marsh skipper include development and habitat conversion.

Tiger beetles (including Barrier beach tiger beetle, Gabb's tiger beetle, Mudflat tiger beetle, Oblivious tiger beetle, and Sandy beach tiger beetle). Tiger beetles are members of the Order Coleoptera and Family Cicindelidae. They are highly active terrestrial predators, eating any arthropod they can overpower. They are fast runners and agile fliers, making them hard to approach. They are most active on warm sunny days from spring to fall, on mud or sand, near permanent bodies of water. Tiger beetle larva build vertical burrows in the sand in the same area as adults. They are commonly found along the southern California coastline (Nagano 1982*b*). Threats to tiger beetles include oil spills, urban expansion, and increased recreational beach use, especially off-road vehicles, which can crush the burrows of the larva.

The range of the barrier beach tiger beetle (*Cicendela latesignata latesignata*) is from San Pedro, Los Angeles County, south to the Orange/San Diego County line and from Mission Bay, San Diego County, to the Cape region of Baja California, Mexico (Nagano 1982*b*). Habitats of this subspecies include mudflats and sandy areas in coastal estuaries. It has been found at the Tijuana Estuary National Wildlife Refuge (Nagano 1982*a*), the Border Field State Park in San Diego County (Nagano 1982*b*), and Silver Strand in San Diego County (Rumpp 1979).

The range of the Gabb's tiger beetle (*Cicendela gabbi*) is from San Pedro, California, south along the coastline to the Cape region of Baja California, Mexico. Gabb's tiger beetles inhabit mudflats and salt flats in estuarine areas. This subspecies has been found at the Tijuana Estuary National Wildlife Refuge (Nagano 1982*b*).

The range of the mudflat tiger beetle (*Cicendela trifasciata sigmoidea*) is from Morro Bay, San Luis Obispo County, south to the Cape region of Baja California, Mexico. The habitats of this subspecies are mudflats and dark-colored moist to wet sand in coastal estuarine areas. This subspecies has been found at the Tijuana Estuary National Wildlife Refuge (Nagano 1982*b*).

The oblivious tiger beetle (*Cicendela latesignata obliviosa*) inhabits the seashore from La Jolla north to the Orange County line, including Mission Beach and the mouth of the Santa Margarita River at Camp Pendleton, San Diego County (Nagano 1982*b*); it has also been found at the estuary of Los Penasquitos Creek in San Diego County (Rumpp 1979).

The range of the sandy beach tiger beetle (*Cicendela hirticolis gravida*) is from the San Francisco Bay region south along the coast to Baja California Norte, Mexico. This subspecies is generally found on sand in estuarine areas, and has been found at Point Mugu Naval Air Station, Ventura, California, and the Tijuana Estuary National Wildlife Refuge, San Diego County, California (Nagano 1982*b*).

<u>White sand bear scarab beetle</u>. The white sand bear scarab beetle (*Lichnanthe albopilosa*) is a member of the Order Coleoptera and Family Scarabaeidae. A distinguishing characteristic of the white sand bear scarab beetle is the presence of

white setae[1]along the elytra[2]and dorsum[3] (Carlson 1980). The elytra are light brown and the clypeus is rectangular. Males range in length from 13.5 to 15 millimeters (0.5 to 0.6 inch); whereas the females are slightly larger, ranging in length from 15 to 17.5 millimeters (0.6 to 0.7 inch) (Carlson 1980). The white sand bear scarab beetle is found in the coastal sand dunes of San Luis Obispo and Santa Barbara Counties. The activity period of the adults is probably from mid-morning to mid-afternoon on sunny days. Little is known regarding this beetle's life history. The white sand bear scarab beetle's habitat is threatened by development and off-road vehicle use.

Marine mammals

California sea lion**.** *Zalophus californianus* are an eared seal (Family Otariidae) that display strong sexual dimorphism. Females are smaller than males, measuring 1.8 meters (6 feet) long and weighing around 113 kilograms (250 pounds). Males measure 2.3 meters (7.5 feet) and weigh around 338 kilograms (750 pounds). The fur coloration is brown to tan. California sea lions were hunted commercially in the mid to late 1800's for their hides and for glue stock. By the 1930's, only 7,000 California sea lions were seen in California. They were given special protection by the California Department of Fish and Game and the Marine Mammal Protection Act of 1972. The population recovered rapidly, and Bonnell *et al*. (1983) estimated the world population to be 156,000, 50 percent of which resides in California. Currently, the non-breeding range of California sea lions extends from British Columbia, Canada, south to Tres Marias Islands in Mexico, and the breeding range extends from the Farallon Islands south to the tip of Baja California, Mexico. Archaeological data, though, indicate that California sea lion rookeries were in existence prior to 100 years ago in Oregon. All pinnipeds require birthing on land. The breeding season occurs in May through July but most pups are born in June. Pupping and breeding sites are primarily on sandy beach and rocky flat areas on islands. The largest breeding colony occurs on San Miguel Island, California. After the breeding season, seals migrate away from their breeding grounds but still come onshore to rest at traditional haul out sites. In recent years, immature sea lions are increasingly present on northern California

1. setae- slender, typically rigid or bristly, and springy parts/organs of animals or plants.
2 elytra- thickened, sclerotized anterior wing in beetles and other insects, serving to protect the posterior wings.
3. dorsum-entire dorsal surface of an animal or upper surface of an appendage or part.

haul-out sites such as Ano Nuevo, Point Reyes, and the Farallon Islands during the summer. Sea lions will stampede into the water when resting onshore and disturbed by people on foot, low flying aircraft, or vessel traffic. Chronic human disturbance causes California sea lions to abandon rookeries.

Guadalupe fur seal. *Arctocephalus townsendi* is distinguished from other fur seals by its large head and long, pointed snout. Currently, the species breeds only on Isla de Guadalupe, off Baja California, Mexico (Fleischer 1978). Like the northern fur seal, they have a thick layer of underfur that prevents heat loss and gives buoyancy by trapping air. Males are much larger than females, measuring 1.8 meters (6 feet) in length and weighing about 158 kilograms (350 pounds), compared to the average weight of 45 kilograms (100 pounds) for females (Orr and Helm 1989). Historically, the Guadalupe fur seal ranged from the Farallon Islands south to Revillagigedo Islands off of Mexico; however, the species was nearly exterminated by commercial seal hunters (Fleischer 1978). Currently, their range is from Guadalupe Island, Mexico, north to the California Channel Islands. The estimated population at Guadalupe Island in 1977 was less than 2,000 seals (Bonnell *et al*. 1983). The Guadalupe fur seal is currently rare. Guadalupe fur seals prefer to haul out on solid rocky shores at the base of cliffs; however, they also occur on sandy beaches on San Miguel Island, California. The breeding season extends from late spring to summer and most pups are born in June.

Harbor seal. Harbor seals, also known as the common or spotted seal, are the smallest and the most widespread of all pinnipeds in the eastern Pacific (Bigg 1981). Males are only slightly larger than females and both measure around 1.5 to 1.8 meters (5 to 6 feet) in length and weigh 58.5 to 90 kilograms (130 to 200 pounds). Harbor seals are the only pinniped species found throughout the northern latitudes of the world and are separated into five subspecies based on morphology and geography. The subspecies found in California ranges from the Bering Sea, Alaska, south to Isla San Martin, Baja California, Mexico (Bigg 1981). Rough estimates of the total population of harbor seals of the subspecies, *Phoca vitulina richardsi*, range from 300,000 to 350,000 (Boveng 1988). However, there is not a free exchange of seals throughout this range, and instead, the population is comprised of regional stocks. For example, seals on the southern Channel Islands, and in central and northern California are thought to form separate stocks (Boveng

1988). Sixty percent of seals counted in 1987 occurred north of San Francisco. Point Reyes and the southern Channel Islands were the areas of highest concentration accounting for 15 and 22 percent, respectively. Bonnell *et al*. (1983) considered Point Reyes to be the most important harbor seal hauling ground in central and northern California. Harbor seals characteristically congregate onshore in groups to rest and rear their young at traditional sites that are generally used year round. The abundance onshore at any particular location varies with season, time of day, state of sea, tide, age and sex class, and human disturbance (Brown and Mate 1983, Allen *et al*. 1985, Yochem *et al*. 1987). The substrates upon which they prefer to haul out range from rocky intertidal areas to tidal mudflats and sandy beaches. They are a nearshore seal and are found primarily in protected bays and estuaries. Harbor seals are the least pelagic (ocean-going) of the pinnipeds and haul-out on an almost daily basis (Yochem *et al*. 1987). Daily activity pattern studies indicate that seals spend between 30 to 44 percent of the time per day resting, and 56 to 70 percent either traveling to feeding areas or engaged in foraging activities. Seals, though, are seasonally abundant onshore with more seals hauled out during the breeding (March through June) and molt (June through August) periods than during the winter (Yochem *et al*. 1987). Harbor seals breed throughout their geographic range; however, there is a latitudinal birthing cline. Seals are born progressively later in the season as one moves north from Baja California, Mexico, where pups are born in February, to Alaska, where they are born in June. Harbor seals generally feed alone or in small groups in nearshore waters and at night on primarily small benthic and schooling fish (Bigg 1981).

Northern elephant seal. Northern elephant seals (*Mirounga angustirostris*) are the largest in size of all pinnipeds, weighing up to 2,300 kilograms (5,083 pounds). Adult males physically mature at 9 years with secondary sexual characteristics such as a large proboscis (long flexible snout). Females lack these features and are much smaller in size. The current world population is estimated at around 150,000. The population is expanding rapidly, doubling every 5 years with growth rates averaging around 14 percent per year (LeBoeuf and Laws 1992). Associated with this rapid increase has been the colonization of many areas along the mainland California coast. At Point Reyes Headland, for example, the colony has grown at an average rate of 16 percent per year and is expanding onto adjacent

beaches (Allen *et al.* 1989). Northern elephant seals prefer to congregate onshore in large groups on sandy or cobblestone beaches with a gradual slope. There is a pronounced annual pattern in seal abundance onshore with seals most abundant during the molt (April through July) and breeding season (December through March). The breeding range extends from southern Oregon to Baja California, Mexico. Currently in California, elephant seals breed on the southern Channel Islands (Santa Barbara County), Ano Nuevo Island and mainland (San Mateo County), the Farallon Islands (San Francisco County), Diablo Cove (San Luis Obispo County), Cape San Martin (Monterey County), Point Reyes (Marin County), and Point Saint George (Del Norte County). There is also a new colony in southern Oregon near Cape Blanco. The protracted molt period is due to seals of different age and sex classes molting in sequence; however, peak numbers occur in April and May when immatures and adult females are onshore. When onshore, seals remain hauled out continuously, fasting.

Northern fur seal. Fur seals are members of the family of eared seals (Family Otariidae) and are unique among seals because of a thick layer of underfur that insulates them from their environment. Northern fur seal (*Callorhinus ursinus*) males weigh about four times more than females, measuring up to 2 meters (6.6 feet) and weighing 270 kilograms (600 pounds). Fur seals were hunted for their fur but were given special protection by the North Pacific Fur Seal Convention in 1911. The population recovered until 1974 when it began to decline at an average annual rate of 5 to 8 percent. In 1985, the United States ceased annually harvesting fur seals, and the Marine Mammal Commission has designated northern fur seals a depleted species (Marine Mammal Commission 1988). The current world population of northern fur seals is around 1 million. The breeding population on San Miguel Island is around 11,000. The first documentation of northern fur seals breeding on San Miguel Island was in 1961, and between 1969 and 1978, the rate of increase in pups grew 46 percent annually from a total of 28 to 635 pups. Northern fur seals lead a mostly pelagic life (9.5 months) and come onshore only during the breeding season, from May to August. San Miguel Island is the southernmost breeding location of the northern fur seal. The breeding colonies occur in the north Pacific extending from Robben Island in the Okhotsk Sea, the Pribilof Islands, and Commander Islands of Alaska, south to San Miguel Island, California, and more recently the Farallon Islands of California. Fur seals

have a polygynous reproductive system whereby males hold territories with females. Females give birth to a single pup, and a few days after giving birth, females go on feeding cycles at sea, returning to nurse pups on land. Unattended pups form pods on the beach until females return. The pups remain at rookeries until November and then go to sea (Orr and Helm 1989).

Steller sea lion. Steller sea lions (*Eumetopias jubatus*) are the largest member of the family of eared seals, Otariidae, and are sexually dimorphic in size and appearance. Males weigh 1 metric ton (2,204 pounds) and are about 2.9 meters (9.5 feet) long, whereas females weigh about 0.2722 metric ton (600 pounds). The mane and roar of the adult males gives the impression of an African lion, and accounts for their name (Orr and Helm 1989). Steller sea lions are widely distributed around the Pacific from Hokkaido, Japan, north to the Bering Sea and south to the Southern California Bight. The breeding range of Steller sea lions, however, has been shrinking steadily in California since the 1930's and more sharply throughout the range since the 1960's (King 1983, National Marine Fisheries Service 1992). The number of animals in the central Gulf of Alaska has declined about 52 percent (down 2.7 percent per year) from 140,000 in 1956 to 1960 to 68,000 in 1985. The species was listed as threatened under the Endangered Species Act in 1991. In Oregon, the estimated population is around 3,000 animals concentrated at only a few coastal rocky locations (Bonnell *et al*. 1983). In California up until the 1970's, Steller sea lions bred regularly in small groups on San Miguel Island, the Farallon Islands, and at Point Reyes Headland, but no pups have been born at San Miguel Island or Point Reyes Headland since then. The population of Steller sea lions in California is currently estimated to be around 2,000 animals (Bonnell *et al*. 1983). Steller sea lions are present on haul-out sites year round, but the highest numbers occur between June and August during the breeding season. Steller sea lions give birth and breed on sloping, flat rocky areas and cobblestone or coarse sand beaches that are protected from high waves. A female may nurse a yearling and newborn at the same time but nursing usually lasts from 32 to 44 weeks. Steller sea lions eat primarily fish and squid but also will prey on crustaceans and mammals. They are believed to feed on what is seasonally abundant. They also feed on harbor seals, northern fur seal pups, and sea otters (Antonelis and Fiscus 1980).

Cetaceans. There are several federally-listed species of large whale that occur in the inshore waters of California, Oregon, Washington, and Baja California, Mexico. Blue, sperm, and humpback whales are still listed as endangered under the Endangered Species Act, and good population estimates are lacking. On occasion, whales are known to strand onshore when alive or dead. Examples of stranded cetaceans in California include gray whale (*Eschrichtius robustus*), sperm whale (*Physeter macrocephalus*), blue whale (*Balaenoptera musculus*), and humpback whale (*Megaptera novaeangliae*). Other species occur regularly nearshore, are not listed, but are protected by the Marine Mammal Protection Act. Examples of these species include minke whale (*Balaenoptera acutorostrata*) and killer whale (*Orcinus orca*). Most species have recovered in number substantially during the past two decades. The current population estimate of eastern Pacific gray whales is 24,000, and in 1993 the species was removed from the endangered species list (Marine Mammal Commission 1996).

Humpback and gray whales regularly occur in coastal areas. Both species engage in long migration from northern latitudes south during the winter months, and both forage in the Bering Sea. Much is known of the migratory habits of the gray whale which travels close to shore and calves in lagoons of Baja California, Mexico, and in southern California; however, less is known of where humpback, blue, or sperm whales calf. Given the species' ability to travel great distances, calving could occur anywhere in the Pacific Ocean. Despite their recovery, whales remain vulnerable to the effects of various human activities including coastal development, commercial whale watching, oil and gas development, and salt recovery operations in breeding lagoons of Baja California, Mexico. Development in breeding lagoons is of particular concern because whales have departed from lagoons temporarily when underwater noise levels were excessive. Every year whales are entangled and drowned in fishing nets or hit by ships (Marine Mammal Commission 1996).

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APPENDIX F

U.S. FISH AND WILDLIFE SERVICE
EXCLOSURE PROTOCOLS FOR SNOWY PLOVER NESTS

July, 1999

The purpose of these protocols is to provide standard guidelines for permittees who have been approved to use exclosures to protect nests of the coastal population of the western snowy plover (*Charadrius alexandrinus nivosus*). Information presented here is based on work conducted in California and Oregon, scientific literature describing use of exclosures to protect Atlantic coast piping plovers, and personal communications with biologists protecting plovers with exclosures.

These protocols are periodically revised. Therefore, prior to using them, please contact us (the U.S. Fish and Wildlife Service) to make sure they are the most up-to-date version. Permittees who want to make modifications to these protocols should confer with us and obtain permission prior to making changes to the exclosure designs described in these protocols.

I. Determine Whether Exclosures Are Appropriate

Exclosures should be used only if nest success of plovers is low because of predation or human impacts (i.e., off-road vehicles, horses, high public use areas). Exclosures should be used only when other less intrusive alternatives to protect nests are not appropriate, effective, or practical.

Alternatives include closing breeding areas to public use during the breeding season (March 1 through September 30) or portions thereof, if human disturbance is a limiting factor in nest success. Barriers (e.g., fences) may be used in some breeding areas (i.e., peninsulas, levees, etc.) to prevent people and/or predators from disturbing or destroying nests. These alternatives can effectively protect nests (and possibly chicks) without disclosing individual nest locations or causing disturbance to the adults.

II. Goals of Exclosure Use

Rimmer and Deblinger (1990) described their goals in designing an exclosure to protect Atlantic coast piping plovers. These goals shall be met when designing and implementing any predator exclosure program for the western snowy plover:

A. predators should be unable to penetrate an exclosure;
B. exclosures should allow unimpeded movements of plover adults and chicks between the nest, foraging, and roosting areas, etc.;
C. plover breeding behavior should not be significantly disrupted.

Exclosures shall <u>not</u> be erected:

A. when a nest is close to high tideline and will be flooded;
B. if there is a potential conflict with other endangered species.

Exclosures shall be removed approximately three days prior to hatching if exclosures are used as perches by kestrels (*Falco sparverius*) or loggerhead shrikes (*Lanius ludovicianus*). Exclosures should be removed immediately if they are being used as perches by predators of adult snowy plovers, such as merlins (*Falco columbarius*) and peregrine falcons (*Falco peregrinus*).

III. Exclosure Design and Construction

Presented in this section are protocols for two exclosure designs which the Service has determined to effectively deter ground and aerial predation on snowy plover nests. Both 5 x 5 centimeter (2 x 2 inch) and 5 x 10 centimeter (2 x 4 inch) mesh has been used effectively for both triangular and circular exclosures. The selected mesh size should be monitored closely and may need to vary by location or situation, depending on threats and problems that snowy plovers face. For example, small mammals (e.g., skunks) potentially may be able to get through 5 x 10 centimeter (2 x 4 inch) mesh, and 5 x 5 centimeter (2 x 2 inch) mesh could potentially slow down the speed with which adult snowy plovers can move through the mesh, thereby jeopardizing their survival. If evidence shows that snowy plover adults are being lost during the breeding season, efforts should be made to determine the cause and if exclosure mesh size is a factor, appropriate modifications to mesh size should be made. The design and construction of the triangular and circular exclosures are as follows:

A. The Triangular Exclosure

In central coastal California, 254 triangular exclosures were erected from 1991 to 1993 (Parker *et al.* 1992; U.S. Fish and Wildlife Service unpubl. data; Point Reyes Bird Observatory unpubl. data).

A total of 3 protected nests were preyed upon by mammals (1 non-native red fox, 2 skunks) (Point Reyes Bird Observatory unpubl. data). Although Deblinger et al. (1992) made no recommendation for the style of exclosures to use, it should be noted that triangular exclosures experienced no predation during their study. Tops should only be used on the triangular exclosure when avian predation has been documented and is a potential problem. Figure 1 shows the design of a triangular exclosure.

Exclosures shall be:

1. triangular in shape with a minimum perimeter of 22.8 meters (75 feet);
2. made of metal mesh fence (5x5 or 5x10 centimeters - 5 centimeters (2 inches) wide, 5 centimeters (2 inches) high or 5 centimeters (2 inches) wide, 10 centimeters (4 inches) high), 3 pre-cut sides each 7.6 m (25 feet) in length (5x10 centimeters (2 x 4 inches)) is the minimum in red fox areas);
3. supported by at least 6 sturdy metal 154-centimeter (5-foot) fence posts;
4. have a fence height of at least 122 centimeters (4 feet) above the sand (with another 4 inches of overhang), and buried 20 cm (8 inches) in soft earth or sand;
5. erected in under 30 minutes without tops, 45 minutes with tops;
6. erected around complete clutches (usually 3 eggs) unless accelerated predation rates warrant construction prior to the clutch completion;
7. erected by a minimum of 2 persons, 1 person must have been trained by an experienced exclosure builder;
8. colored nylon webbing along the top edge may be used to alert birds to presence of the structure and therefore avoid “bird strikes.”

Methods for construction of triangular exclosures:

1. prior to construction, assign tasks to individuals to avoid confusion during set-up;

2. upon arrival at the nest site, cover the nest with a bright object (hat, rag, etc.) to shade the eggs from the sun and prevent the nest from accidentally being stepped on;
3. use a rope as a guide to simulate the perimeter of the exclosure with the nest centered within the rope outline;
4. pound six 1 centimeter (0.4 inch) x 244 centimeter (8 foot) steel reinforcement bars (rebar), three corners and three supports, approximately 122 centimeters (4 feet) into the ground;
5. dig a trench, at least 20 centimeters (8 inches) deep, around the perimeter (follow the guide rope);
6. carefully place the three 7.60 meter (25 foot) long walls, made of mesh wire, into the trenches,
7. fasten the wire to the rebar posts using standard, brass hog rings (or wire), removing all slack from the wire and insuring the wire will be buried at least 20 centimeters (8 inches);
8. bend the top 10-15 centimeters (4-6 inches) of wire outward at a 45 degree angle to discourage mammalian predators from climbing over the exclosure;
9. refill the trenches, insuring that the wire lies flush with the sand surface, allowing plovers to move freely through the exclosure;
10. rake the area to remove footprints and level the sand;
11. upon completion, leave the area immediately.

If a top is included, tops should be:

1. made of black seiners twine (or comparable material), avoid using clear monofilament line or fish netting;
2. twine should be set in parallel rows 15 centimeters (6 inches) apart.

Methods for construction of tops:

1. prior to exclosure set-up, ready enough wood strapping (2.5 x 5 centimeters) (1 x 2 inches) to be attached to two sides of the exclosure;
2. on the wood strapping, place small hooks, used to hold the twine, at 15 centimeter (6 inch) intervals;
3. after completion of exclosure perimeter, attach wood strapping (2.5 centimeters x 5 centimeters) (1 x 2 inches) along 2 sides of the exclosure with bailing wire;

4. attach twine to hooks creating parallel rows as you move along the exclosure, ensuring the twine is taut;
5. if twine loosens, tighten it by wrapping it around the hooks.

B. <u>The Circular Exclosure</u>

In Oregon, a circular exclosure design with a top has proven an effective means of deterring ground and aerial predation on snowy plover nests. In one study at sites along the Oregon Coast in 1990 to 1993, 85 percent (n=66) of plover nest with exclosures hatched compared to only 15 percent (n=67) of unprotected nests (Stern 1994). The circular exclosure maximizes the distance between the edge of the exclosure and the nest. Figure 2 shows the design of a circular exclosure.

Exclosures shall be:

1. generally circular in shape with a 20.3 meter (66 foot, 7 inch) perimeter;
2. made of 122 centimeter tall mesh fence with 5 x 5 or 5 x 10 centimeter (2 x 2 inch or 2 x 4 inch) mesh size;
3. supported by eight 154 centimeter (5 foot) tall steel posts;
4. achieve a fence height of 106.7 centimeters (3 feet, 6 inches) above ground with 20 centimeters (8 inches) buried;
5. erected in under 60 minutes, including top;
6. erected by a minimum of 2 persons, with one person previously trained by an experienced exclosure builder;
7. erected around complete clutches unless accelerated predation rates warrant construction prior to the clutch completion;
8. colored nylon webbing along the top edge may be used to alert birds to presence of the structure and therefore avoid “bird strikes.”

Methods for construction of exclosures:

1. prior to arrival at the nest site wipe oil off of the 20.3 meter (66 foot, 7 inch) length of metal mesh fence, connect ends to each other, making sure that no sharp points protrude at the place of joining, then role up the fence;
2. prior to arrival at the nest site, assign tasks to individuals, and provide training and explanation to new exclosure builders;
3. upon arrival at the nest site, place a cap over the eggs to protect the eggs from the sun, and to mark the location of the nest. If permit allows handling of eggs, float the eggs to determine incubation stage;

4. unroll fencing material so that the middle of the fence is about 10 meters (33 feet) from the nest, and the fence ends are equidistant from the nests;
5. have each person take a fence post in hand or place it nearby;
6. have one person pick up the top half of fence, and at once lift and pull the fence to extend over and beyond the nest, then gently stand up the exclosure;
7. place the two fence posts inside the exclosure and have both persons stretch the fence slightly;
8 have one person pound in the first fence post, then assist the second person to pound in the second fence post;
9. pound in remaining fence posts at equal distances, gently stretching fencing to attain desired configuration;
10. dig a 20 centimeter (8 inch) trench underneath the bottom of the fence, pull the fence down into the trench, then refill with sand;
11. level the sand around the exclosure with horizontal stretches of mesh;
12. pound all fence posts in further so that the tops are about 5 centimeters (2 inches) below the top of the wire;
13. upon completion, leave the area immediately.

If a top is included, it should be:

1. made of black seiners twine (or comparable material), avoid using clear monofilament line or fish netting;
2 twine should be set in parallel rows 15 centimeters (6 inches) apart.

Methods for construction of tops:

1. extend the twine across the exclosure, tying ends off on each parallel row;
2. each row should have the same degree of tightness;
3. Run one row of twine in perpendicular direction, bisecting each row at midpoint, thus providing support to the rows of twine.

III. **Timing of Exclosure Set-up**

Exclosures may not be erected under the following conditions:

A. on windy (> 20 mph) or rainy days
B. 2 hours or less before sunset

C. less than 1.5 hours after sunrise
D. when the air temperature exceeds 80 degrees Fahrenheit
E. during constant or steady rain.

IV. Monitoring Exclosures

Exclosures must be monitored at least twice per week. Information gathered should include:

1. fate of the eggs
2. presence or absence of incubating bird and mate
3. status of exclosure
4. presence of predators
5. other disturbances.

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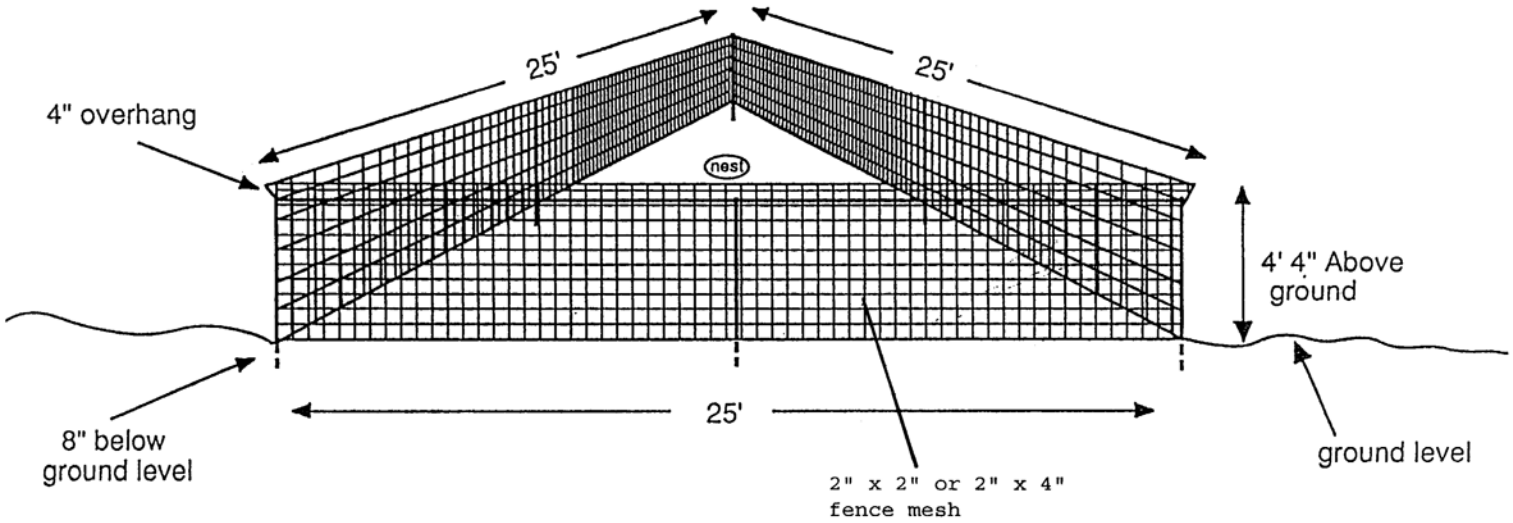
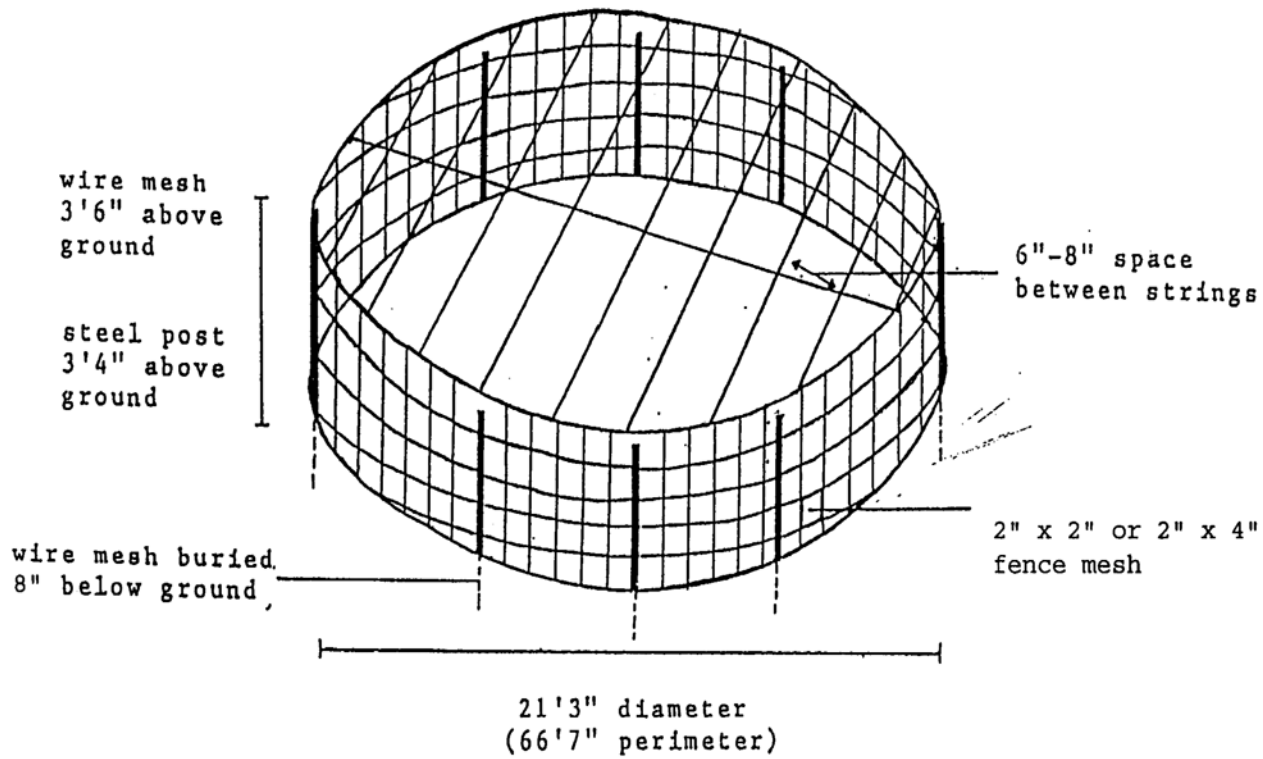


SOURCE: M. PARKER, SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE

Figure F-1. Triangular Exclosure Design



SOURCE: M. STERN, THE NATURE CONSERVANCY

Figure F-2. Circular Exclosure Design

APPENDIX G. PRIORITIES FOR RECOVERY OF THREATENED AND ENDANGERED SPECIES

(Priority System Developed and Used by the U.S. Fish and Wildlife Service)

Degree of Threat	Recovery Potential	Taxonomy	Priority	Conflict
High	High	Monotypic Genus	1	1C 1
	High	Species	2	2C 2
	High	Subspecies	3	3C 3
	Low	Monotypic Genus	4	4C 4
	Low	Species	5	5C 5
	Low	Subspecies	6	6C 6
Moderate	High	Monotypic Genus	7	7C 7
	High	Species	8	8C 8
	High	Subspecies	9	9C 9
	Low	Monotypic Genus	10	10C 10
	Low	Species	11	11C 11
	Low	Subspecies	12	12C 12
Low	High	Monotypic Genus	13	13C 13
	High	Species	14	14C 14
	High	Subspecies	15	15C 15
	Low	Monotypic Genus	16	16C 16
	Low	Species	17	17C 17
	Low	Subspecies	18	18C 18

C: Indicates some conflict between the species' conservation and construction of development projects or other forms of economic activity.

The national recovery priority assigned to the Pacific coast population of the western snowy plover is 3C, indicating a subspecies with high threat and high recovery potential.

APPENDIX H

CONSERVATION TOOLS AND STRATEGIES

Rights and Interests in Land that Can be Acquired

Right or Interest	Explanation	Advantages	Disadvantages
Fee simple ownership	Full title to land and all rights associated with land.	Owner has full control of land. Allows for permanent protection and public access.	Most costly. Ownership responsibility includes liability and maintenance.
Conservation easement / development rights (If used for snowy plover habitat, access to monitor snowy plover populations should be added to conservation easement)	A partial interest in property transferred to an appropriate non-profit or governmental entity either by gift or purchase. As ownership changes, the land remains subject to the easement restrictions.	Less expensive than fee simple. Landowner retains ownership and property is taxed at a lower rate. Easement may allow for some development. Potential income and estate tax benefits from donation.	Public access may not be guaranteed. Easement must be enforced. Restricted use may lower resale value. If the easement has a "sunset" then permanent protection is not guaranteed.
Fee simple / leaseback	Purchase of full title and leaseback to previous owner or other lessee. May impose land use restrictions.	Allows for comprehensive preservation program of land banking. Income through leaseback. Liability and management responsibilities assigned to lessee.	Public access is not guaranteed. Land must be appropriate for leaseback (e.g., agricultural).
Lease	Short or long-term rental of land.	Low cost for use of land. Landowner receives income and retains control of property.	Does not provide equity and affords only limited control of property. Temporary.
Undivided Interest	Ownership is split between different owners, with each fractional interest extending over the whole parcel. Each owner has equal rights to entire property.	Prevents one owner from acting without the consent of the others.	Several landowners can complicate property management issues, especially payment of taxes, future sale, land uses, and access.
Deed Restriction	Voluntary or imposed restriction on land use placed on title by landowner.	Can prevent impacts to or protect habitat and/or open space values as long as landowner retains the restriction.	Is easily removed from property title by property owner without government. knowledge. Does not guarantee even short-term protection.

Ways that Title Can Be Acquired

Technique	Explanation	Advantages	Disadvantages
Fair market value sale*	Land is sold at its highest and best use value.	Highest income (cash inflow) to seller.	Most expensive. Greatest capital gains.
Bargain Sale*	Part donation/part sale - property is sold at less than fair market value.*	Tax benefits to seller since difference between fair market value and sale price is considered a charitable contribution. Smaller capital gains tax.	Seller must be willing to sell at less than fair market value.
Charitable Gift	A donation by landowner of all interest in property.*	Allows for permanent protection without direct public expenditure. Tax benefits to seller since property's fair market value is considered a charitable contribution.	Seller must be willing to donate.
Bequest	Landowner retains ownership until death.*	Management responsibility usually deferred until donor's death.	Date of acquisition is uncertain. Donor does not benefit from income tax deductions. Landowner can change will, will may contain land use conditions unfavorable to open space/ habitat use.
Donation with reserved life estate	Landowner donates during lifetime but has lifetime use.	Landowner retains use but receives tax benefits from donation.	Date of acquisition is uncertain.
Land exchange	Exchange of developable high habitat/open space land for land with equal development potential but less habitat/open space value.	Low-cost technique if trade parcel is donated. Reduces capital gains tax for original owner of protected land.	Properties must be of comparable value. Complicated and time consuming.
Eminent domain (government)	The constitutional police power of government to take private property for public purpose upon payment of just compensation.	Provides government with a tool to acquire desired properties if other acquisition techniques are not workable.	Can be expensive. Can have negative political consequences. Can result in expensive and time consuming litigation.
Tax foreclosure (government)	Government acquires land by tax payment default.	Limited expenditure. If land is not appropriate for public open space, it can be sold or exchanged.	Competitive sealed bidding risk.

Technique	Explanation	Advantages	Disadvantages
Purchase of a Deed of Trust (1st)	Government acquires land by defaulted loan (private institution) payment and subsequent foreclosure.	Land can be acquired at a distressed sale price.	Can be complicated and result in conflict with local Tax Collector/Assessor
Agency transfer (government)	Certain government agencies may have surplus property inappropriate for their needs that could be transferred to a parks agency for park use.	Limited expenditure.	Time consuming with possible conflicts with local government.
Restricted auction (nonprofit)	Government restricts the future use of property to open space, then sells.	Property sold to highest bidder but restriction lowers price and competition.	It may be difficult for a nonprofit to convince government that a restriction will serve to benefit the general public. Can be expensive.

* There are different ways of financing, i.e.: cash, mortgage, owner financed, lease/option, etc. with some means having greater tax benefits than others for the seller and some means more easily financed by government than others. Conservation easements also can be acquired by these means.

Management and Ownership Options Following Purchase by Non-profit Organization

Technique	Explanation	Advantages	Disadvantages
Conveyance to public agency	Non-profit organization acquires and holds land until public agency is able to purchase.	A non-profit organization can enter the real estate market more easily than government, and can often facilitate a sale when the government agency would be unable.	Must have a public agency willing and able to buy within a reasonable time frame. Private fund raising can be difficult.
Conveyance to another non-profit organization	Non-profit organization acquires and holds land until another non-profit organization has been established or is able to finance acquisition.	Allows immediate acquisition even though acquiring group cannot or is not willing to hold property.	Requires existence or establishment of ultimate land holder that has solid support, funding and the ability to manage land.
Management by non-profit organization	Non-profit organization retains ownership and assumes management responsibilities.	Ownership remains within the community; local citizens can provide responsible care and management.	Land must fit criteria of acquiring organization. Organization must assume long-term management responsibilities and costs.
Saleback or leaseback	Non-profit organization purchases property, limits future development through restrictive easements or covenants, and resells or leases back part or all of property. May involve subdivision of property.	Acquisition is financed by resale or leaseback. Resale at less than fair market value (because of restrictions) makes land affordable for buyer. Sale can finance preservation of part of site.	Complex negotiations. A leaseback means the nonprofit organization retains responsibility for the land.

Financing Options for Government

Financing Option	Explanation	Advantages	Disadvantages
General fund appropriation	Appropriation from primary government funds.	Avoids interest and debt service cost.	Budget allocations unpredictable. Might not provide sufficient funds, and competes with other programs.
Bond act	Borrowing money through insurance of bonds. Usually approved through local or statewide referendum.	Distributes cost of acquisition. Does not impact general funds.	Requires approval of general public. Can be expensive - interest charges are tacked on to cost of project.
Land and Water Conservation Fund	Federal funds provided to local governments on a 50/50 matching basis for acquisition and development of land for public use.	Cost of acquisition for local government is lowered by subsidy.	Federal release of these funds is uncertain and has been extremely limited to date. Competition is extreme.
State grant/low interest loans	States provide matching grants or low interest loans for municipalities to acquire open space.	Encourages localities to preserve open space by leveraging local funds. Donated lands may be used as a match.	Localities must compete for limited funds and be able to match state funds.
Real estate transfer tax	Acquisition funds obtained from a tax on property transfers. Percentage and amount exempted varies with locality.	Growth creates a substantial fund for open space acquisition. Enables local communities to generate their own funds for open space protection.	Places greater burden on new residents than on existing residents. Can inflate real estate values. Effective only in growth situations.
Land gains tax	Capital gains tax on sale or exchange of undeveloped land held for a short period of time. Tax rate varies depending on holding period.	Discourages speculative development. Has a regulatory and revenue impact.	Can inflate real estate values and slow market.
Payment in lieu of dedication	Local government requires developers to pay an impact fee to a municipal trust fund for open space acquisition.	New construction pays for its impact on open space.	Acquisition funds depend on development. May be lack of accountability for funds. Legality of method depends on relationship of open space to new development.

Financing Option	Explanation	Advantages	Disadvantages
Special assessment district	Special tax district for area benefitted by a public benefit project.	Users finance acquisition and management.	Increases taxes. Timely and costly to implement. Requires 2/3 voter approval in California.
Tax return check off	On state income tax forms, a filer may appropriate a small amount of taxes owed toward revenues for natural lands acquisitions.	Convenient and successful means of generating funds.	Vulnerable to competition from other worthwhile programs.
Other funds/taxes	Taxes on cigarettes, sales, gasoline, and natural resource exploitation; revenue from fees and licenses for boat, off-road vehicle, and snowmobile use, park entry, hunting, etc.	Income from fees and licenses pays for resources.	Revenues from taxes can be diverted for other uses unless dedicated to open space. Fees create pressures for money to be spent on special interest uses.
Sale or transfer of tax default property	Sale of tax default property can provide a fund for open space acquisition. Also, if site meets criteria, it can be transferred to appropriate agency for park use.	Funds for acquisition are acquired with little cost to taxpayers.	Need to assure that sale proceeds are specially allocated to open space acquisition. Might not provide a significant income. Very political process.

Financing Options for Non-Profit Organizations

Financing Option	Explanation	Advantages	Disadvantages
Loan from institutional or private lender	Conventional loan from bank or savings and loan or private source, such as a foundation or corporation.	Less time-consuming process than fund raising.	Long-term financial commitment for non-profit organization. Higher interest costs than owner financing. Mortgage lien.
Installment sale	Buyer pays for property over time.	If seller financed, can lower taxes for seller. Buyer can negotiate better sale terms (lower interest rates).	Long-term financial commitment for non-profit organization. Mortgage lien.
Fund-raising	No- or low-interest loans are acquired through program related investments from foundations, non-standard investments from corporations, or charitable creditors (community members).	Community fund-raising creates publicity and support.	A long, uncertain, and time consuming process.
Revolving fund/loans or grants	A public or private organization makes grants to localities or non-profit organizations for land acquisition based on a project's revenue generating potential.	Encourage projects with revenue generating potential.	Projects with low revenue- generating potential have lower priority.
Partial development/ saleback or lease	Non-profit organization purchases property, limits future development through restrictive covenants, and resells or leases back part or all of property.	Acquisition is financed by resale or leaseback. Sale can finance preservation of part of site.	Complex negotiations. If leaseback, non-profit organi-zation retains responsibility for land. Finding buyer for restricted property may be difficult, and land value will be lowered by restrictions.

Government Financial Incentives for Conservation

Incentive	Explanation	Advantages	Disadvantages
Preferential assessment	Under state laws, agricultural and forest districts can be established to assess land as farmland or forest land rather than at its highest and best use.	Promotes resource conservation and management. Especially benefits landowners in areas with development pressure. Tax base loss can be partially reclaimed through penalty tax on landowners who terminate enrollment.	Voluntary participation. Does not provide long-term protection. Minimum acreage for entry. Strength of program depends on penalty from withdrawals. Local government bears burden of reduced tax base.
Purchase of development rights	Local or state government purchases development rights to maintain land in farm use.	Landowner can derive income from selling development rights and continue to own land. Lower property value should reduce property taxes.	Can be costly, particularly in a community with high real estate values.
Land conservation grants	State programs pay or otherwise enable landowners to preserve land, enhance wildlife, and provide public access.	Landowners derive revenues from preserving land without selling interests in land.	Provision of public expenditures.

Safe Harbors Agreements

Incentive	Explanation	Advantages	Disadvantages
Create incentives by removing restrictions under section 9 of Endangered Species Act. Allows "take" of listed species beyond baseline conditions (i.e., those lands or animals protected at time of signing of agreement).	Private landowners and non-Federal property owners encouraged to restore, enhance and maintain habitats for listed species in return for assurances that additional land-use restrictions as a result of voluntary conservation actions will not be imposed.	Could garner non-Federal landowner's support for species conservation on non-Federal lands. By reducing fear of future additional property use restrictions under Endangered Species Act, landowners may enhance their lands for listed species. Could reduce habitat fragmentation and increase population numbers of listed species.	Could adversely affect snowy plover by serving as sink for birds attracted to enhanced habitat, only to have habitat later lost to development. May not be adequate incentives other than public relations value, and may not offer value over traditional Habitat Conservation Plans. Opportunities may be few in states with strong coastal protection regulations.

Regulatory Techniques - Growth Control

Technique	Explanation	Advantages	Disadvantages
Phased growth	Permits a limited amount of growth each year.	Effective as a comprehensive planning strategy.	There must be an equitable system to approve development. Future development pressures difficult to predict.
Moratorium	Legal postponement or delay of land development.	Useful as an interim measure during the formulation of a master development plan.	Provides only a temporary solution and can create a rush on land development prior to taking effect.
Transfer of development rights	An owner of publicly-designated land can sell development rights to other landowners whose property can support increased density.	Cost of preservation absorbed by property owner who purchases development rights.	Difficult to implement. Preservation and receiving areas must be identified.

Regulatory Techniques - Zoning and Subdivision Provisions

Technique	Explanation	Advantages	Disadvantages
Large lot zoning	Large minimum lot sizes restrict the density of the development.	An established land use control used as part of a comprehensive plan.	Since zoning is subject to change, not effective for permanent preservation. Can increase real estate values and infrastructure costs can foster urban sprawl.
Performance zoning	A zone is defined by a list of permitted impacts (based on natural resource data and design guide-lines) as opposed to permitted uses.	Directs development to appropriate places based on a comprehensive, environ-mentally-based plan. Can be implemented through cluster development.	Difficulties in implementation since environmental impacts can be hard to measure and criteria are hard to establish. Plan can be expensive to prepare.
Carrying capacity zoning	Based on the ability of an area to accommodate growth and development within the limits defined by existing infrastructure and natural resource capabilities. Often called Current Planning Capacity.	Zoning is based on an area's physical capacity to accommodate development. Can be implemented through cluster development.	Requires a comprehensive environmental inventory for implementation. Determining carrying capacity can be a difficult process, subject to differing opinions, quality-of-life assumptions, and changing technologies.
Cluster Zoning/planned unit development (PUD)	Maintains regular zoning's ratio of housing units to acreage but permits clustered development through undersized lots, thus allowing for open space preservation. A PUD provision allows clustering for a large, mixed-used development.	Flexibility in siting allows preservation of open space areas within development site. Can reduce construction and infrastructure costs.	Open space often preserved in small separate pieces, not necessarily linked to a comprehensive open space system. May increase processing time for development approval. Lack of infrastructure can inhibit technique.

Technique	Explanation	Advantages	Disadvantages
Preservation overlay zoning	At discretion of municipality, overlay zones with development restrictions can be established to protect agricultural and natural areas, scenic views, and historic neighbor-hoods.	Special zones have regulations specific to the needs of a unique area and may be subject to mandatory clustering, performance standards, special permits, and site plan and architectural review.	Language in special district ordinance must be specific enough to avoid varying interpretations.
Exaction	As a condition of obtaining subdivision approval, local government requires developers to pay a fee or dedicate land to a municipal trust fund for open space. Also, states can require open space set-asides as part of environmental review.	New construction pays for its impact on open space.	Acquisition funds dependent on residential development. Commercial development often not subject to exaction fees. Difficult to calculate developer's fair share of costs. New case law restrictions.
Conservation density subdivisions	Permit developers an option of building roads to less expensive specifications in exchange for permanent restrictions in number of units built. Roads can be public or private.	Increases open space and reduces traffic. Discourages higher densities to pay for the higher cost of road building.	Requires enforcement of easements. Private roads limit public access and require homeowner association maintenance.

Regulatory Technique - Conservation/Mitigation Banks

Technique	Explanation	Advantages	Disadvantages
Conservation/ mitigation banks	Wildlife habitat areas are restored and permanently protected by selling credits to offset development impacts elsewhere.	Could advance regional habitat conservation by allowing mitigation credits at sites recognized to be high priority for regional conservation in exchange for areas of minimal habitat value.	If not carefully considered and development projects are not consistent with all Federal and state laws, could facilitate habitat loss. Environ-mentally controversial.

APPENDIX I

SUMMARY OF POTENTIAL FUNDING SOURCES FOR RECOVERY ACTIONS (Partial List)

Funding Program	Explanation	Funding Agency/ Organization
Adopt-a-Beach	Annual grant program to enrolled Adopt-a-Beach managers (Federal, state, local and nonprofit land managers). Designed to strengthen and encourage current Adopt-a-Beach programs, including public education, clean-up and enhancement of beaches. Average grant is $6,000.	California Coastal Commission
Borderlands Initiative	Joint U.S.-Mexico grant program for conservation of Mexico's fish, wildlife and plant resources. Priority given to projects that strengthen Mexico's capacity for sustainable management of its biological diversity which result in on-the-ground conservation actions. Annual grant program funding up to $50,000 for long-term training project; $30,000 for short-term training projects; and $25,000 for all other proposals.	U.S. Fish and Wildlife Service (cooperative programs with Mexico)
Coastal Ecosystem Program for San Francisco Bay	Program works in partnership with Federal, state and local governments, private organizations and individuals to protect and restore coastal habitats. Emphasizes on-the-ground habitat enhancement projects, developing information for decision makers, and public outreach. Annual funding is approximately $260,000. Average number of projects funded is 13-18 per year.	U.S. Fish and Wildlife Service

Funding Program	Explanation	Funding Agency/ Organization
Coastal Resources Grant Program	Annual grant program requiring local contributions. Part B grants can be awarded to coastal counties and cities with approved local coastal programs for coastal resources management activities, including projects which provide for the protection of wetlands, floodplains, estuaries, beaches, dunes, and fish and wildlife and their habitats within coastal areas. Annually provides approximately $600,000 for Part B grants; individual projects are generally limited to $100,000 each. Part A grants can be used for planning, assessment, mitigation, permitting, monitoring and enforcement, and for other activities related to offshore energy development, consistent with the State of California's coastal management program. Annually provides approximately $3 million; grant applications are generally limited to $500,000 for Part A grants.	State of California Resources Agency

Funding Program	Explanation	Funding Agency/ Organization
Conserving California Landscapes	Five-year (commenced 1998), $175 million initiative to preserve natural ecosystems and agricultural resources in 3 regions of California, including the Central Coast, which extends from the Golden Gate to the Santa Ynez River and the western drainage of the coastal watersheds, including the Big Sur coast, the watersheds of Elkhorn and Watsonville Sloughs, and select resources of San Luis Obispo, Santa Cruz, and San Mateo Counties. Provides grants and loans to enable private land trusts, other nonprofit groups, and public agencies to protect threatened California resources, to work with private landowners to maximize natural values on their lands, and to help communities achieve working landscapes. Provides grants to non-profit organizations for land acquisition, requiring 50 percent matching funds; grants for policy and planning relating to conservation (e.g., imple-mentation of county general plans); and program-related investments.	The David and Lucille Packard Foundation

Funding Program	Explanation	Funding Agency/ Organization
Federal Challenge Cost-Share Program	Program available to U.S. Forest Service and U.S. Bureau of Land Management to provide internal means of augmenting partnership funds for projects benefitting fish and wildlife resources. Requires matching funds by partner(s). Program also available to U.S. Fish and Wildlife Service. Highest priority is for projects providing endangered species recovery habitat. Projects on U.S. Fish and Wildlife Service refuges also have high priority. Requires matching funds by non-Federal partner(s).	U.S. Forest Service and U.S. Bureau of Land Management National Fish and Wildlife Foundation
Partners for Fish and Wildlife	Voluntary cost-sharing program with private landowners for fish and wildlife habitat restoration. Priority given to projects which benefit migratory birds, anadromous fish, and threatened and endangered species. Grants for projects can range from $1,000 to over $25,000.	U.S. Fish and Wildlife Service
Wetlands Reserve Program	Voluntary program offering private landowners the opportunity to protect, restore and enhance wetlands on agricultural lands. Covers up to 100 percent reimbursement for restoration costs.	U.S. Department of Agriculture, Natural Resources Conservation Service

Funding Program	Explanation	Funding Agency/ Organization
Whale's Tail Grant Program for Coastal Marine Education	Annual grant program funded by sale of Whale's Tail license plates, which have been available in California since 1998. Aimed at encouraging development of programs to teach California children and the general public to value and take responsibility for the health of the State of California's marine and coastal environments. Funds docent programs and educational projects (e.g. educational videos). Priority given to educational projects/programs for school children and to underserved populations (e.g., urban areas). Grants range from $1,500 to $10,000.	California Coastal Commission
Santa Barbara County Coastal Resource Enhancement Fund	Annual grant program that requires fees from major oil and gas projects offshore Santa Barbara County. Environmental review of these projects determined that the construction, operation, and eventual abandonment causes significant adverse impacts to four categories of coastal resources: environmentally sensitive resources, aesthetics, recreation, and tourism. Annually, this fund provides approximately $700,000 to enhance coastal resources. Typical projects include coastal acquisitions, improvements at existing coastal parks and beach accesses, and educational programs about the marine environment. These grants vary from a few thousand dollars to a few hundred thousand dollars.	Santa Barbara County

APPENDIX J

MONITORING GUIDELINES FOR THE WESTERN SNOWY PLOVER, PACIFIC COAST POPULATION

Contents

Introduction.....J-1
Training and Qualifications J-2
Responsibilities.....J-4
Population Monitoring.....J-5
Methods for Population Monitoring J-5
Demographic Monitoring.....J-5
Reporting.....J-6
Reporting Color Bands J-7
Coordinating with Other Projects J-7
Public Interactions J-8
Habitat Monitoring.....J-8
Disturbance Monitoring.....J-8
Predator Monitoring.....J-8
Suggested Readings J-9

Western Snowy Plover Breeding Window Survey Protocol J-10
Western Snowy Plover Winter Window Survey Protocol.....J-16
Western Snowy Plover Field Survey Form - Breeding Window Survey J-22
Western Snowy Plover Field Survey Form - Winter Window Survey.....J-24

Introduction

Western snowy plover populations must be monitored to determine progress toward recovery. Monitoring will be most efficient when its elements relate specifically to recovery objectives. Several types of biological monitoring are expected to provide information that will allow assessment of the recovery effort. However, a single monitoring prescription cannot address the varied research and management needs throughout the western snowy plover range. This protocol provides general guidance so each monitoring effort can be consistent with all others, even when specific methods differ from site to site. These guidelines relate to Federal requirements, but prospective surveyors must also assure that their activities comply with requirements under state law.

Two types of monitoring relate directly to recovery criteria:

Population:	Distribution and abundance.
Demographics:	Reproductive success, adult survival, juvenile survival, dispersal.

Other types of monitoring relate indirectly to recovery criteria:

Habitat:	Availability, suitability, enhancements.
Disturbance:	People, pets, vehicles, kites, horses, etc.
Predators:	Presence and impacts of corvids, gulls, raptors, shrikes, coyotes, foxes, skunks, house cats, opossums, other avian and mammalian predators.

Training and Qualifications

Prospective snowy plover surveyors should have good vision, the ability to spend several hours in the sun, and the ability to walk long distances in loose sand. In addition, the U.S. Fish and Wildlife Service has developed minimum training requirements for western snowy plover survey, management, and research activities. Five activity levels are recognized:

Level 1	Winter surveys, or surveys outside known nesting areas.
Level 2	Breeding season surveys and censuses.
Level 3	Erecting exclosures around nests.
Level 4	Breeding season studies or surveys that include handling eggs.
Level 5	Banding and color marking adults or chicks.

While activity levels 1 through 5 are increasingly intrusive, they are not strictly sequential. For example, a field worker may receive training and be certified at level 3, but cannot participate in level 1 or 2 activities without training specific to those levels.

No section 10(a)(1)(A) permit is required for Level 1 activities, but training is encouraged. Level 2, 3, 4, and 5 activities require a section 10(a)(1)(A) permit from the U.S. Fish and Wildlife Service. Field workers must be certified at the appropriate activity level to qualify for a permit, or to work independently under the holder of an existing permit.

Classroom instruction (or equivalent field instruction) will be made available for those involved with snowy plover surveys, management, and research (recovery task 1.1.5). At least 4 hours of instruction are required, on topics including:

1. Biology, ecology, and behavior of snowy plovers;

2. Identification of adult plovers, their young, and their eggs;
3. Threats to plovers and their habitats;
4. Survey objectives, protocols, and techniques;
5. Regulations governing the salvage of carcasses or eggs;
6. Special conditions of the existing Recovery Permit;
7. Other activities (for example: banding, determining incubation stage, erecting exclosures).

In addition, field instruction is required for activity levels 2, 3, 4, or 5. Instruction should take place under the direct supervision of a 10(a)(1)(A) permit holder. Activities for field training include:

1. Locating, identifying, and monitoring nests (levels 2, 4, and 5);
2. Handling eggs and capturing and handling adults or chicks (levels 4 and 5);
3. Erecting exclosures around nests (level 3).
4. Specifics on the target activity for which a permit has been issued;
5. Practical field exercises;
6. Field review of appropriate classroom topics.

Previous experience with snowy plovers, piping plovers, or other closely-related species will not substitute for the training described above. Further detail on obtaining permits, or becoming certified to work under an existing permit, is available through these offices:

CALIFORNIA

U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825
(916) 414-6600

U.S. Fish and Wildlife Service
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003
(805) 644-1766

U.S. Fish and Wildlife Service
Arcata Fish and Wildlife Office
1125 16th Street, Room 209
Arcata, California 95521-5582
(707) 822-7201

U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
6010 Hidden Valley Road
Carlsbad, California 92011
(760) 431-9440

OREGON

U.S. Fish and Wildlife Service
Newport Fish and Wildlife Office
2127 S.E. OSU Drive
Newport, Oregon 97365-5258
(541) 867-4550

U.S. Fish and Wildlife Service
Oregon State Office
2600 SE 98th Avenue, Suite 100
Portland, Oregon 97266
(503) 231-6179

WASHINGTON

U.S. Fish and Wildlife Service
Western Washington Office
510 Desmond Dr SE, Suite 102
Lacey, Washington 98503
(360) 753-9440

Responsibilities

For effective rangewide monitoring, the network of participants must understand their roles and responsibilities. The following framework is suggested.

The *recovery leader* (recovery task 7) facilitates the work of recovery unit working groups to ensure comparable and consistent monitoring is undertaken throughout the Pacific coast range of the western snowy plover. The recovery leader also produces an annual report that describes results of monitoring throughout the population's range.

Recovery unit working groups (recovery task 3.1.1) should ensure thorough coverage of important sites in their units. They should collate data, prepare summary reports, and ensure appropriate data are submitted to the recovery leader.

Coordinators are landowners, land managers, wildlife managers, or other individuals responsible for monitoring activities at one or more sites. They recruit and train observers for their site(s) and ensure data are reported to recovery unit working groups. They coordinate with recovery unit working groups, beach managers, enforcement leaders, and other affected people to ensure an effective, responsive, and safe survey and management effort. Coordinators may also be observers.

Observers are field workers responsible for completing surveys and reporting results promptly to coordinators.

Population Monitoring

Population monitoring will provide information on distribution and abundance at all breeding and wintering locations listed in Appendix B. Results will be used to assess progress toward recovery criterion 1 and to guide local management, protection assessments, and planning.

The primary source of population data will be two annual, rangewide "window surveys" using the methods outlined below. The breeding season window survey should take place between late May and mid-June. The winter season window survey should take place between December 1 and January 31. Breeding season surveys sample the coastal population of the western snowy plover, while winter season surveys also include individuals from the inland population that winter on Pacific beaches intermingled with coastal population birds. Surveys at adjacent

sites should occur on or near the same date, to avoid double-counting individuals moving among sites. All sites occupied in recent years should be surveyed within the window period. Unoccupied sites with suitable habitat should be surveyed as time permits.

Although not all plovers are detected during window surveys, an index of abundance will be obtained for each surveyed site. To relate population indices to recovery criteria, site-specific correction factors will need to be determined. Recovery task 4.3.1 will guide the effort to produce correction factors that will improve abundance estimate accuracy and usefulness.

Methods for Window Surveys

The current survey protocol for the breeding season window survey is reproduced below (Attachment J-1). The protocol for winter window surveys (see Attachment J-2) is generally similar, but during this period no nesting activity is in progress and surveyors collect data on habitat type where plovers are seen in order to assess habitat associations in the nonbreeding season. Sample field survey forms (Attachments J-3 and J-4) are also included below.

Demographic Monitoring

Population demographic monitoring will provide information on reproductive success, adult and juvenile survival, and dispersal. Results will be used to assess progress toward recovery (criterion 2) and to refine the Population Viability Analysis.

Precise data on productivity, survival, and dispersal will require most plovers within the studied population to be uniquely identifiable by color bands. Recovery task 4.3.2 will guide the effort to establish appropriate sampling methods for annually estimating reproductive success.

While the duration and intensity of monitoring required to obtain precise demographic data will be impractical at some plover nesting sites, coarse data are valuable and should be collected. Such data may be obtained through nest searches, nest monitoring, and careful population monitoring. At sites with limited resources, monitors should focus on accurate population monitoring, as described above, but should also attempt to record these breeding parameters:

Egg-laying dates
Number of nests
Number of eggs per nest
Egg-loss dates and causes

Hatching dates
Number of eggs hatched
Hatching success = number of eggs hatched/total number of eggs laid
Clutch success = number of clutches with at least 1 egg hatched/total number of nests
Age (in days) of chicks or juveniles at last observation
Fledging success = number of juveniles capable of flight or reaching age 28 days/number of eggs hatched
Reproductive success = number of chicks fledged/number of males
Causes of chick loss

Reporting

A repository for survey data has been established within the U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office. Initially, only window survey data will be deposited. Other information (demographic data, for example) should be retained by coordinators and shared with recovery unit working groups. As survey procedures are developed and refined, additional data will be centralized by the recovery leader.

Reports of window survey data should include:

- Location and location code (Appendix B, or assigned by Arcata Fish and Wildlife Office for new locations);
- Survey date, start time, end time, high tide time, tidal stage, wind speed;
- Survey coordinator and observers;
- Number of adult males, adult females, unsexed adults, and chicks and juveniles.

Standard field survey forms have been developed (Attachments J-2 and J-3). Winter window survey data should be reported before February 15; summer window survey data should be reported before July 1. Data should be submitted to coordinators and/or recovery unit working groups for compilation and submittal to the recovery leader at the U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office.

Each year, the recovery leader will tabulate, summarize, and share window survey results with participants and other interested parties.

Reporting Color Bands

Color band reports should be submitted to the recovery unit working group, the Point Reyes Bird Observatory, or the Bird Banding Laboratory. Standard U.S.

Fish and Wildlife Service aluminum band numbers should be reported to the Bird Banding Laboratory.

USGS Biological Resources Division
Bird Banding Laboratory
12100 Beech Forest Road, Suite 4037
Laurel MD 20708
1-800-327-2263
bbl@usgs.gov

Point Reyes Bird Observatory
4990 Shoreline Hwy
Stinson Beach CA 94970

Coordinating with Other Projects

Snowy plovers share some of their breeding and wintering sites with other sensitive species, such as least terns or marine mammals. Where these species are found in, or adjacent to, snowy plover sites, survey coordinators, researchers, and land managers should plan ahead to avoid conflicts and should consult with recovery unit working groups.

Public Interactions

Snowy plover observers often encounter members of the public while in the field. When responding to public questions or complaints, field workers are distracted from the task at hand, which can compromise the accuracy and safety of surveys.

Observers should carry educational pamphlets for distribution to curious members of the public, but should refrain from conversing at length about plovers or other issues until surveys are complete.

Field workers observing illegal, prohibited, or unauthorized activities should notify law enforcement authorities as soon as possible. Observers should carry a contact list and a communication device (e.g., 2-way radio, cellular phone) for this purpose.

Habitat Monitoring

Habitat is an important factor limiting snowy plover abundance, distribution, and productivity. Careful assessment of habitat characters include determining

substrate characteristics and composition of vegetation in both managed and unmanaged areas. These must be the topic of specific habitat monitoring and research. Field workers are encouraged, however, to describe in general terms any changes in the quality or quantity of snowy plover habitat in monitored areas.

Disturbance Monitoring

Human-related activities directly and indirectly affect snowy plover abundance, distribution, and productivity. Effects of various types (e.g., people, pets, vehicles, kites, horses) and levels of disturbance must be determined through dedicated research. Field workers are encouraged, however, to describe in general terms the nature and extent of human-related disturbances in monitored areas.

Predator Monitoring

Observing predation on snowy plovers, or their eggs or chicks, is a rare event. However, some sign of predator identity is often available at plundered nests and should be noted by observers. Predator presence in monitored areas should also be noted (e.g., corvids, gulls, raptors, other avian predators, coyotes, foxes, house cats, opossums, other mammalian predators). Extensive predator monitoring is beyond the scope of snowy plover surveys, but should be undertaken when predator removal is considered, or when specific detail on predators is needed.

Suggested Readings

The preceding sections are necessarily abbreviated. Further information and guidance will be obtained during certification training sessions. In addition, the following reading should contribute to a better understanding of plover monitoring methods.

Blodget, B. G., and S. M. Melvin. 1996. Massachusetts tern and piping plover handbook: A manual for stewards (first edition). Massachusetts Division of Fisheries and Wildlife, Westborough. ~100 pp.

Although this document pertains to least terns and piping plovers, it contains instructive material on census techniques (8 pages), form instructions (3 pages), nest-finding procedures, and addressing enforcement issues.

Goldin, M. R. 1994. Recommended monitoring and management methodology and techniques for piping plovers (*Charadrius melodus*). Unpublished report to U.S. Fish and Wildlife Service, Hadley, Massachusetts. The Nature Conservancy, Providence, Rhode Island. 15 pp + attachments.

Personable instructions for field workers in the piping plover range. Includes "The Three Plover Commandments: I. Thou shalt be very, very patient and never disturb or harass a plover intentionally; II. Thou shalt never, ever walk through a plover nesting area without first looking wherest thou places each and every foot, each and every step of the way; III. Thou shalt record data simply and meticulously."

ATTACHMENT J-1

WESTERN SNOWY PLOVER BREEDING WINDOW SURVEY PROTOCOL - FINAL DRAFT

03/05/07

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BACKGROUND AND INTRODUCTION

The Pacific Coast population of the Western Snowy Plover (*Charadrius alexandrinus nivosus*) was listed as threatened in 1993 under the U.S. Endangered Species Act. Since then, population recovery status has been assessed annually through range-wide breeding and winter season window surveys. The primary purpose of the breeding survey is to obtain a minimum estimate of the number of breeding plovers at current, historic, and potential breeding sites over time. An auxiliary purpose is to re-sight banded individuals. The breeding window survey provides information on the regional distribution and abundance of Snowy Plovers. Surveys are conducted during non-migratory periods, over a narrow time frame to minimize the chance of recounting birds moving between sites.

Since all plovers are not detected on a single survey, window surveys do not represent a total count, but give an index of population size. This protocol aims to standardize breeding season survey methodology to minimize geographic and annual disparity in the quality of the count. Despite all attempts to standardize survey methodology, it must be stressed that window survey results are only an index. Underlying any comparison of indices is the assumption that detection rate does not vary from one count to the next. However, there is likely some annual variability in the proportion of plovers detected during the window survey. Thus, comparisons of survey results across the population range and between years should be limited. Assuming this

protocol is followed strictly every year and assuming no unusual weather events, disturbance, or change in habitat or management actions, these window survey results should successfully identify a major change in Snowy Plover abundance or distribution.

Should there be any range-wide or extensive change in nest monitoring, habitat, or habitat management, it will be essential to assess detectability in conjunction with this window survey. If detection rates change greatly, comparison of indices would be rendered meaningless. For example, currently many sites are surveyed during the window survey by nest monitors. However, if nesting was no longer being monitored, the window survey would be conducted entirely by "naïve" observers (those unfamiliar with the number of pairs at a site and their specific nest locations). We would expect that a "naïve" observer might detect a lower proportion of birds than someone with prior knowledge of the birds and nest locations. Hence, this "naïve" count is likely to be lower than prior counts, not due to a negative trend in plover population size, but rather due to a decline in detection rate. Only by assessing detectability can we conclusively determine whether such a change represents an actual decline in population size.

Incorporating methods to assess detectability might also be useful in determining whether these methodologies are sufficient to detect small changes in population size and in accurately interpreting trends. In the past, banding observations and results from intensive nest monitoring have been used to interpret window survey indices and determine a correction factor. It may also be possible to get a statistical measure of detectability and error on past window surveys using a "double sampling" or "repeated measures" approach, assuming additional site surveys were conducted around the time of the window survey. In the future, a "double sampling" approach should be considered as a method to assess detectability, since unlike other methods (i.e., distance sampling, double observer) it would not require any change in the survey methodology. It would only require that at least two surveys be conducted within a short time frame, according to the methodology described in this protocol. If this approach is chosen, but it is not possible to conduct multiple surveys at all sites, it is important that the subset of sites be randomly selected.

TIMING AND METHODOLOGY

The survey window is one week long and specific dates are chosen each year by the U. S. Fish and Wildlife Service (FWS), to fall sometime between May 24 and June 7. Survey coordinators for each designated survey area should provide survey protocol and maps to trained surveyors. For each survey site, the amount of area covered should be standardized in addition to the site name. The most appropriate survey conditions and number of surveyors should be decided by field tests and be consistent from year to year. It is important to cover a site with the same number of surveyors each year to make consecutive counts as comparable as possible. Surveying at high tide is optimal as it will allow for more thorough coverage. Do not attempt to survey during a high or rising tide if there is any chance that surveyor's safety will be jeopardized (i.e., difficult passage through a narrow or rocky region during incoming tide). To maximize detection surveys should be conducted during good weather and high visibility. On sunny days, visibility is best early in the morning or in the evening; visibility may be good at any hour on an overcast day. Rainy, foggy, or excessively windy conditions (15 mph or greater) are not suitable for surveying, however a slight drizzle or strong breeze (5-10 mph) is acceptable.

At most sites, a minimum of two surveyors is recommended to complete each

survey; one surveyor will suffice at very narrow beaches (less than 50 m wide). Reading band combinations should be attempted AFTER the birds encountered have been tallied and recorded, and ONLY if band-reading does not detract from the accuracy of the bird count. The following methodology should be used:

1. **All beaches should be covered in the same manner - in one pass.** There should be one very careful pass to tally the number of birds on each beach segment, as this is the most consistent approach over long periods of time.
2. **Surveyors should walk in unison along the entire length of the beach as designated on map(s) provided by the survey coordinator.** One surveyor should walk along the wrackline (high tide line) while the second surveyor walks along the base of the foredune. The person closest to the foredune should always walk slightly ahead of the other surveyor (approximately 25 m). If only one person is conducting the survey, they should walk the wrackline along the survey length and in a zig-zag pattern through wider portions of route, to ensure complete coverage.
3. **On mud flats, salt pans, and other non-beach habitats, surveyors should cover habitat in a similar manner - in one pass, walking in unison.** If habitat is relatively linear, it should be covered as described for beach surveys. If habitat is very broad, surveyors should simultaneously walk as many parallel transects as is necessary to cover all habitat, with transects no more than 50 m apart. These transects should run parallel to any shoreline. If there are not enough surveyors to accomplish this, then surveyors may zig-zag instead of walking a straight transect line. Remember that the number of surveyors and methodology used must remain constant from one year to the next.
4. **Surveyors should alternate between walking and scanning for Snowy Plovers with binoculars.** While walking, surveyors should scan the area 20 m ahead and to either side. Every 50 m, surveyors should stop and scan at least 100 m ahead of them with binoculars (distance may be shorter based on site-specific conditions). This way habitat is searched at least twice and from different angles increasing the chances of detecting birds. If one observer has a spotting scope, they should follow the binocular scan with a scan through the scope as far ahead as possible. If a bird is sighted far ahead, look for distinguishing landmarks that will enable finding its location. Birds may hide as they are approached, making them difficult to see.
5. **Surveyors closest to the foredune should watch the ground carefully for plover tracks, nests, and chicks while walking.** Their ability to search with the naked eye for plovers is much more constrained than the person's at the wrack line. Consequently, the pace of the survey needs to be slow enough to allow the person closest to the foredune to watch the ground and make frequent short stops to look ahead for plovers. Surveyors risk trampling chicks which are much harder to detect than nests. If surveyors detect males or females performing distraction displays, they should recognize they are probably very close to chicks and should move away with extreme caution, looking very carefully where each foot is placed.
6. **If there is a very broad area of beach, the person walking near the foredune should walk in a zig-zag pattern through that location.**

Alternatively, two or more observers could walk parallel through the area. There is a risk of stepping on a nest or chick in either instance, and surveyors should be as careful about this as when they walk at the base of the foredune, as described earlier. If the foredune is low and/or gently sloping, hummocky areas with little or no vegetation should also be checked for plovers.

7. **In certain situations it may be necessary to drive all or a portion of the length of the survey route**. If this is necessary, the survey must be conducted in the same manner every year (driving the same portions each year). Clearly delineate the portions driven on the map and the portions covered by foot. Also make a note of the time spent surveying by vehicle and by foot. Drive slow enough not to flush plovers or other shorebirds **(5-10 mph)**. The survey will not be considered complete unless all suitable habitat is surveyed. In order to do this it may be necessary to walk some portions of the route that are not accessible by vehicle. An example would be a spit with a large amount of logs, or wide, hummocky section of beach.
8. **A one-way pass of the survey route is considered sufficient, and surveyors may either exit the beach at the same access point or at a different access point from the one used to enter beach**.

The surveyor(s) may attempt to read bands ONLY after birds at a given location on the survey route have been accurately counted and recorded. When reading color bands, the following methodology should be used:

1. When a plover is sighted at close range, check for color bands and record combination if present before notifying other observers (See *Reading color bands*). If a plover is seen at too great a distance for reading color bands, notify other team members immediately by radio, hand signals, voice, or by walking towards them. While keeping track of plover, coordinate with team members and try to approach the bird from different angles; this will increase the likelihood of color bands being visible to at least one observer.
2. Unless the surveyor is very experienced in reading color bands and familiar with the specific color banded individuals at their survey site, other surveyor(s) on the team should try to read each birds band combination; this is an important accuracy check. This may be done be using a spotting scope if available, or by approaching birds closely and using binoculars.
3. In certain circumstances, it may be desirable to approach birds in order to read the bands (i.e., make roosting birds stand up), but in others it is desirable not to try and read bands at all (i.e., birds performing distraction displays). Simply avoiding birds whose bands can not be read, and returning to the site a second time to attempt to read bands could lead to further disturbance. If it is permissible to approach roosting birds by making them stand, great care must be taken not to cause them to fly ahead of the observer as it will confound the count going forward. DO NOT APPROACH a bird on a nest or an adult with chicks. DO NOT APPROACH a female head-bobbing, a male tail-dragging, birds copulating, nest scraping, birds performing a broken wing display, or an adult with chicks. These are strong indicators that birds are breeding in the area or will breed soon and it is very important that you DO NOT DISTURB them; leave the area quickly and carefully.

4. Spend no more than 5 minutes obtaining any single color band combination and if there are multiple color-banded individuals in an area, limit the time spent band reading to no more than 15 minutes. This limitation is necessary because spending long amounts of time in any one area may result in an increased detection rate (relative to other areas and relative to past and future surveys). After determining color band combinations, carefully walk around birds and continue the survey.

Data collection must be standardized for all surveys and for all sites. The following methodology should be used at all beach segments:

1. Field data should be collected on a datasheet, and location of plovers and area covered should be marked on a map.
2. At the beginning of the survey the recorder should fill out preliminary portions of the data sheet or within their notebook record: date, survey location, observers, start time, weather, and tides (See Appendix A).
3. While it is best for one member of the team to act as official recorder, all members of the team must have a pencil and data sheet or field notebook so that they can record sex, age, and color combination, if applicable, for each bird.
4. Record the sex as male (M), female (F), or unknown/uncertain (U). Report the age as Adult (A), Juvenile (J) (similar to adult but edges of back feathers and wing coverts are pale), Chick (C) (incapable of flight) or Unknown (U).
5. If two or more birds are seen, record any birds that are seen standing less than 3 m apart as a possible pair. Also record any nests or breeding behavior (See *Notifications*).
6. Where there are relatively few birds observed, make note of plumage characteristics (i.e., very pale neck band) so that it may be distinguished from other unbanded birds. Plumage differences between some males and females are difficult to discern, particularly if birds are not seen together. Collection of this data may be time-consuming if there are a lot of plovers and should not be done if it detracts from the accuracy of the bird count.
7. Record end time upon leaving the beach, or leaving the portion of beach within survey route.
8. Indicate on a map the area of coverage in addition to the location of plovers seen. If driving, indicate the section that was driven, and what section, if any, was surveyed on foot. Also make a note on the data sheet of the time spent surveying by vehicle and the time spent surveying by foot.
9. Submit a data sheet and map with specific locations to the FWS within a week after the survey.

ADDITIONAL DATA COLLECTION AND NOTIFICATIONS

Human use/recreational activities: Note information such as presence of beachwalkers, number of dogs (on-leash and off-leash), number of horses, number of all-terrain vehicle/off-road vehicles, street legal vehicles, and activities such as surf-fishing, kite-flying, clamming, camping, etc.

Predator monitoring: Egg and chick predators are one of the primary threats to Snowy Plovers on the Oregon Coast, and to the persistence of the entire Pacific Coast

population. Therefore, during all surveys it is important to collect information on predator presence in the survey area. The most common and visible nest predators are corvids (crows and ravens). Periodically count the total number of corvids seen in the survey area while scanning with binoculars. To avoid recounting the same bird twice, do not sum the number of corvids seen from different places along the survey route unless you are relatively certain that they are different birds. Usually this means the surveyor will record the maximum corvids seen from any one point along the survey route.

Record any additional predators or evidence seen. Record owls, hawks, foxes, skunks, racoons, opossums, coyotes or other predators. If a surveyor is familiar with mammal tracks, predator tracks can also be reported.

Notifications: Report immediately: 1) any illegal activity to law enforcement; or 2) any illegal activity to the appropriate state or federal agency if the activity is in violation of any state or federal laws concerning protected species (i.e., Migratory Bird Treaty Act, Endangered Species Act).

Report to the FWS immediately after the survey (providing band combination if known): 1) any dead or injured bird; 2) any birds observed at unoccupied beaches or in areas where they haven't been seen in recent years; 3) any nests with eggs or adults with chicks; or 4) any females head-bobbing, males tail-dragging, or birds copulating or nest scraping. These are strong indicators that birds are breeding in the area or will breed soon and the reproductive status of individuals may not be known by officials.

Report birds with bands and/or uncertain band status immediately after the survey to the lead person designated as the one to whom observers report color bands combinations in each survey region. This should be the most knowledgeable person about the likely band combinations that could be seen and the importance of the particular combinations should they be reported. It may be necessary to reschedule a visit to the site to check or re-check bands.

SURVEYOR EDUCATION AND PREPAREDNESS

Equipment: Required equipment includes a good pair of binoculars (suggested magnification 8-10x and aperture of at least 40 mm.), waterproof field notebook or clipboard and data sheets, site map, pencil, and timepiece. A spotting scope is recommended. If a spotting scope and tripod are needed, please contact the FWS as soon as possible. Suggested equipment includes a cell phone, contact list, rain jacket, and rain pants. Optional equipment includes a global positioning devise (GPS unit).

Qualifications and training: Required qualifications for Snowy Plover surveyors are the ability to walk several miles in dry sand, have good vision, and be familiar with identification of Snowy Plovers and other similar species Semipalmated Plovers, Sanderling, Killdeer). The following suggested training complies with recommendations and regulations set forth in the Western Snowy Plover (*Charadrius alexandrinus nivosus*) Pacific Coast Population Draft Recovery Plan. Given funding limitations, it may not be possible to adhere to all of the following suggestions. However, at the very least, four hours of field instruction should be required for every individual that searches for or monitors nests.

Based on the Draft Recovery Plan, four hours of classroom instruction is strongly recommended for individuals conducting Breeding Window Surveys. Topics to be covered during classroom instruction are taken directly or adapted from the Draft Recovery Plan and may include:

1. Biology, ecology, and behavior of Snowy Plovers.
2. Identification of adult plovers, their young, and their eggs.
3. Threats to plovers and their habitats.
4. Survey objectives, protocols, and techniques.
5. Regulations governing the salvage of carcasses or eggs.
6. Special conditions of the existing recovery permit.
7. Other activities (for example: reading color bands, tracking, predator identification, determining incubation stage, erecting exclosures).

It is strongly recommended that surveyors receive field instruction if:

1. They have never previously participated in any type of Snowy Plover survey,
2. They do not have extensive field experience distinguishing between Snowy Plovers and other shorebird species (for example: killdeer, semipalmated sandpipers, sanderlings),
3. They have little or no experience around nesting plovers, or,
4. They have no experience reading color bands

Inexperienced surveyors should partner with experienced surveyors regardless of training until they are comfortable with snowy plover identification and survey methods.

Reading color bands: Throughout the plovers range, all sites have the potential to have color banded birds. Color bands allow biologists to keep track of productivity, movement patterns, and survivorship. Aluminum bands, provided by the U.S. Fish and Wildlife Service, are used in addition to plastic bands; both are usually covered with colored tape.

Most birds have two color bands on each lower leg. Both the bands on a leg may be the same or different colors. Birds sometimes lose bands so that they could have only one band on one leg and two on another, or only one band on either leg. Some birds have a single band of two colors on one leg. These are created by wrapping a thin strip of tape that is different in color from the underlying band on the top, bottom, or center of the color band. Thus a single band could be described as white over red or if the red tape were in the middle as white/red/white (W/R/W).

Colors frequently seen are aqua (A, light blue), dark blue (B), dark green (G), lime (L, light green), red (R), yellow (Y), and white (W). Other colors used on the Pacific Coast but not as frequently seen in Oregon are: orange (O), violet (V), pink (P), brown (N), and black (K). Tape occasionally peels off revealing metallic (silver) band (S).

Color bands are read top down from the belly to the foot of the bird (Figure 1). Colors on the birds left leg are read first, then the colors on the right leg are read. For example, if a bird has two aqua bands on its right leg and a white band on top of a red band on its left, its combination would be: white, red, aqua, aqua. This combination would be recorded WR:AA

ATTACHMENT J-2

WESTERN SNOWY PLOVER WINTER WINDOW SURVEY PROTOCOL
FINAL DRAFT
03/05/07

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BACKGROUND AND INTRODUCTION

The Pacific Coast population of the Western Snowy Plover (*Charadrius alexandrinus nivosus*) was listed as threatened in 1993 under the U.S. Endangered Species Act. Since then, population recovery status has been assessed annually through range-wide breeding and winter season window surveys. The primary purpose of the winter survey is to obtain a minimum estimate of the number of wintering plovers at current, historic, or potential wintering sites over time. An auxiliary purpose is to re-sight banded individuals. The winter survey is conducted during a migratory period, when inland and coastal plovers can overlap in distribution and can not be distinguished visually. Therefore, the winter survey does not represent a count of the Pacific Coast population, but a minimum count of coastal and inland birds combined.

Since all plovers are not detected on a single survey, window surveys do not represent a total count, but give an index of population size. This protocol aims to standardize winter season survey methodology to minimize geographic and annual disparity in the quality of the count. Despite all attempts to standardize survey methodology, it must be stressed that window survey results are only an index. Underlying any comparison of indices is the assumption that detection rate does not vary from one count to the next. However, there is likely to be some annual variability in the proportion of plovers detected during the window survey. This may be particularly true during winter, since cold, wet, and windy weather are associated with low detectability

and yet such conditions may be unavoidable. Furthermore, double counting is likely to be a larger problem during winter, because birds may be in larger aggregations and may move more frequently or over a larger geographic area than during the nesting season. Thus, the window survey may be useful in identifying occupied sites, tracking banded populations, and possibly detecting large shifts in distribution. However, comparisons of survey results across the population range and between years should be limited.

TIMING AND METHODOLOGY

Surveys are conducted sometime between December 1 and January 31, during a one week window chosen by the U.S. Fish and Wildlife Service (FWS). Survey coordinators for each designated survey area should provide survey protocol and maps to trained surveyors. For each survey site, the amount of area covered should be standardized in addition to the site name. The most appropriate survey conditions and number of surveyors should be decided by field tests and be consistent from year to year. It is important to cover a site with the same number of surveyors each year whenever possible to make consecutive counts as comparable as possible. Most sites are extremely difficult to access during winter high tides as waves often beat against the foredune create dangerous situations. Therefore, surveys should not be attempted if the surveyor's safety is in jeopardy (i.e., difficult passage through a narrow or rocky region during incoming tide). To maximize detection, surveys should be conducted during good weather and high visibility. On sunny days, visibility is best early in the morning or late evening; visibility may be good at any hour on an overcast day. Cold, foggy, rainy, or excessively windy (15 mph or greater) conditions are not suitable for surveying, however a light drizzle or strong breeze (5-10 mph) is acceptable.

At most sites, a minimum of two surveyors is recommended to complete each survey; one surveyor will suffice at very narrow beaches (less than 50 m wide). Reading band combinations should be attempted AFTER the birds encountered have been tallied and recorded, and ONLY if band-reading does not detract from the accuracy of the bird count. The following methodology should be applied:

1. **All beaches should be covered in the same manner - in one pass.** There should be one very careful pass to tally the number of birds on each beach segment as this is the most consistent approach over long periods of time.
2. **Surveyors should walk in unison along the entire length of site as designated on the survey map.** One surveyor should walk along the wrackline (high tide line) while the second surveyor walks along the base of the foredune. The person closest to the foredune should <u>always</u> walk ahead of the surveyor at the wrackline (approximately 25 m). If only one person is conducting the survey, walk the wrackline along the survey length and in a zig-zag pattern through wider portions of route, to ensure complete coverage.
3. **Surveyors should alternate between walking and scanning for Snowy Plovers with binoculars.** While walking, surveyors should scan the area 20 m ahead and to either side. Every 50 m surveyors should stop and scan at least 100 m ahead of them with binoculars (distance may be shorter based on site-specific conditions). This way habitat is searched at least twice and from different angles increasing the chances of detecting birds. If one observer has a spotting scope, they should follow the binocular scan with a scan through the scope as far ahead as possible. If a bird is sighted far ahead, look for distinguishing landmarks that will enable finding its location. Birds may

hide as they are approached, making them difficult to see.

4. **Surveyors closest to the foredune should watch the ground carefully for plover tracks while walking.** Their ability to search is much more constrained than the person's at the wrack line. Consequently, the pace of the survey needs to be slow enough to allow the person closest to the foredune to watch the ground and make frequent short stops to look ahead for plovers.
5. **If there is a very broad area of beach, the person walking near the foredune should walk in a zig-zag pattern through that location.** Alternatively, two or more observers could walk parallel through the area. If the foredune is low and/or gently sloping, hummocky areas with little or no vegetation should also be checked for plovers.
6. **In certain situations it may be necessary to drive all or a portion of the length of the survey route.** If this is necessary, the survey must be conducted in the same manner every year (driving the same portions each year). Clearly delineate the portions driven on the map and the portions covered by foot. Also make a note of the time spent surveying by vehicle and by foot. Drive slow enough not to flush plovers or other shorebirds **(5-10 mph)**. The survey will not be considered complete unless all suitable habitat is surveyed. In order to do this it may be necessary to walk some portions of the route that are not accessible by vehicle. An example would be a spit with a large amount of logs, or wide, hummocky section of beach.
7. **A one-way pass of the survey route is considered sufficient, and surveyors may either exit the beach at the same access point or at a different access point from the one used to enter beach.**

The surveyor(s) may attempt to read bands ONLY after birds at a given location on the survey route have been accurately counted and recorded. When reading color bands, the following methodology should be used:

1. When a plover is sighted at close range, check for color bands and record combination if present before notifying other observers (See *Reading color bands*). If a plover is seen at too great a distance for reading color bands, notify other team members immediately by radio, hand signals, voice, or by walking towards them. While keeping track of plover, coordinate with team members and try to approach the bird from different angles; this will increase the likelihood of color bands being visible to at least one observer.
2. Unless the surveyor is very experienced in reading color bands and familiar with the specific color-banded individuals at their survey site , the other surveyor(s) on the team should try to read each birds band combination; this is an important accuracy check. This may be done be using a spotting scope if available, or by approaching birds closely and using binoculars.
3. In certain circumstances, it may be desirable to approach birds in order to read the bands (i.e., make roosting birds stand up). This is more desirable than avoiding the birds and returning to the site a second time to attempt to read bands as this would lead to further disturbance. If it is permissible to approach roosting birds by making them stand, great care must be taken not to cause them to fly ahead of the observer as it will confound the count going forward.
4. Spend no more than 5 minutes obtaining any single color band combination

and if there are multiple color-banded individuals in an area, limit the time spent band reading to no more than 15 minutes. This limitation is necessary because spending long amounts of time in any one area may result in an increased detection rate (relative to other areas and relative to past and future surveys). After determining color band combinations, carefully walk around birds and continue the survey.

Data collection must be standardized for all surveys and for all sites. The following methodology should be used at all beach segments:

1. Field data should be collected on a datasheet, and location of plovers and area covered should be marked on a map.
2. At the beginning of the survey the recorder should fill out preliminary portions of the data sheet or within their notebook record: date, site, start time, weather, high tide time, approximate wind direction and speed, and observers (See Appendix A).
3. While it is best for one member of the team to act as official recorder, all members of the team must have a pencil and data sheet or field notebook so that they can record sex for each bird.
4. Record the sex as male (M), female (F), Hatch Year (HY; chick or juvenile, appearing similar to adult but edges of back feathers and wing coverts are pale), or unknown (U). Hatch year birds reach adult status by Jan 1. Unless the surveyor is confident they can make the determination between hatch year or adult status based on plumage, it is not necessary to distinguish adult from hatch year and record on data sheets.
5. Mark the location of bird(s) on the map and record coordinates if a GPS unit is available. If two or more birds are seen, record which birds were seen together.
6. Record end time upon leaving the beach, or leaving the portion of beach within survey route.
7. Indicate on a map the area of coverage in addition to locations or birds seen. If driving, indicate the section that was driven, and what section, if any, was surveyed on foot. Also make a note on the data sheet of the time spent surveying by vehicle and the time spent surveying by foot.
8. Submit data sheet to the FWS by February 15th

ADDITIONAL DATA COLLECTION AND NOTIFICATIONS

Habitat information: To increase understanding of Snowy Plover winter habitat associations, winter window surveyors should record the specific habitat where plovers are seen and the general beach habitat in the vicinity of plover sightings (See Appendix A). Record plover location as: wet sand, wrackline, mid-beach (above wrackline but below the base of foredune), or foredune (at the base of a foredune, on a foredune, or at a break in the foredune). Record general habitat type as: linear beach, estuary mouth, overwash area (break in foredune), restoration plot, or barrier island/peninsula

General site information is necessary to compare use and availability, and to evaluate the potential habitat at sites where birds are not detected. Please estimate the percentage of survey beach that is greater than 50 m in width (from high tide line to foredune). If all habitat is less than 50 m in width, estimate the maximum beach width. Record the general types of beach habitat found at the survey site (as described above).

Human use/recreational activities: Note information such as presence of beachwalkers, number of dogs (on-leash and off-leash), number of horses, number of all-terrain vehicle/off-road vehicles, street legal vehicles, and activities such as surf-fishing, kite-flying, clamming, camping, etc.

Predator monitoring: Egg and chick predators are one of the primary threats to Snowy Plovers on the Oregon Coast, and to the persistence of the entire Pacific Coast population. Therefore, during all surveys it is important to collect information on predator presence in the survey area. The most common and visible nest predators are corvids (crows and ravens). Periodically count the total number of corvids seen in the survey area while scanning with binoculars. To avoid recounting the same bird twice, do not sum the number of corvids seen from different places along the survey route unless you are relatively certain that they are different birds. Usually this means the surveyor will record the maximum corvids seen from any one point along the survey route.

Record any additional predators or evidence seen. Record owls, hawks, foxes, skunks, racoons, opossums, coyotes, or other predators. If a surveyor is familiar with mammal tracks, predator tracks can also be reported.

Notifications: Report immediately: 1) any illegal activity to law enforcement; or 2) any illegal activity to the appropriate state or federal agency if the activity is in violation of any state or federal laws concerning protected species (i.e., Migratory Bird Treaty Act, Endangered Species Act).

Report to the FWS immediately after the survey if you see a dead bird, one that appears injured, or if you observe a bird in an area where they haven't been seen in recent years. Report birds with bands and/or uncertain band status immediately after the survey to the lead person designated as the one to whom observers report color bands combinations in each survey region. This should be the most knowledgeable person about the likely band combinations that could be seen and the importance of the particular combinations should they be reported. It may be necessary to reschedule a visit to the site to check or re-check bands.

SURVEYOR EDUCATION AND PREPAREDNESS

Equipment: Required equipment includes a good pair of binoculars (suggested magnification 8-10x and aperture of at least 40 mm.), waterproof field notebook or clipboard and data sheets, site map, pencil, and timepiece. A spotting scope is recommended. If a spotting scope and tripod are needed please contact the FWS as soon as possible. Suggested equipment includes a cell phone, contact list, rain jacket, and rain pants. Optional equipment includes a global positioning devise (GPS unit).

Qualifications and training: Required qualifications for Snowy Plover surveyors are the ability to walk several miles in dry sand, have good vision, and be familiar with identification of Snowy Plovers and other similar species Semipalmated Plovers, Sanderling, Killdeer). The following suggested training complies with recommendations and regulations set forth in the Western Snowy Plover (*Charadrius alexandrinus nivosus*) Pacific Coast Population Draft Recovery Plan. Given funding limitations, it may not be possible to adhere to all of the suggestions listed below. Based on the Draft Recovery Plan, four hours of classroom instruction is strongly recommended for individuals conducting Winter Window Surveys. Topics to be covered during classroom instruction are taken directly or adapted from the Draft Recovery Plan and may include:

1. Biology, ecology, and behavior of Snowy Plovers.
2. Identification of adult plovers.

3. Threats to plovers and their habitats.
4. Survey objectives, protocols, and techniques.
5. Regulations governing the salvage of carcasses.
6. Special conditions of the existing recovery permit.
7. Other activities (for example: reading color bands, tracking, predator identification, determining incubation stage, erecting exclosures).

It is strongly recommended that surveyors receive field instruction if:

1. They have never previously participated in any type of Snowy Plover survey,
2. They do not have extensive field experience distinguishing between Snowy Plovers and other shorebird species (for example: killdeer, semipalmated sandpipers, sanderlings), or,
3. They have no experience reading color bands

Inexperienced surveyors should partner with experienced surveyors regardless of training until they are comfortable with snowy plover identification and survey methods.

Reading color bands: Throughout the plovers range, all sites have the potential to have color banded birds. Color bands allow biologists to keep track of population numbers, productivity, movement patterns, and survivorship. Aluminum bands, provided by the U.S. Fish and Wildlife Service, are used in addition to plastic bands; both are usually covered with colored tape.

Most birds have two color bands on each lower leg. Both the bands on a leg may be the same or different colors. Birds sometimes lose bands so that they could have only one band on one leg and two on another, or only one band on either leg. Some birds have a single band of two colors on one leg. These are created by wrapping a thin strip of tape that is different in color from the underlying band on the top, bottom, or center of the color band. Thus a single band could be described as white over red or if the red tape were in the middle as white/red/white (W/R/W).

Colors frequently seen are lime (L, light green), aqua (A, light blue), red (R), yellow (Y), dark blue (B), dark green (G), and white (W). Other colors used on the Pacific Coast but not as frequently seen in Oregon are: orange (O), violet (V), pink (P), brown (N), and black (K). Tape occasionally peels off revealing metallic (silver) band (S).

Color bands are read top down from the belly to the foot of the bird (Figure 1). Colors on the birds left leg are read first, then the colors on the right leg are read. For example, if a bird has two aqua bands on its right leg and a white band on top of a red band on its left, its combination would be: white, red, aqua, aqua. This combination would be recorded WR:AA

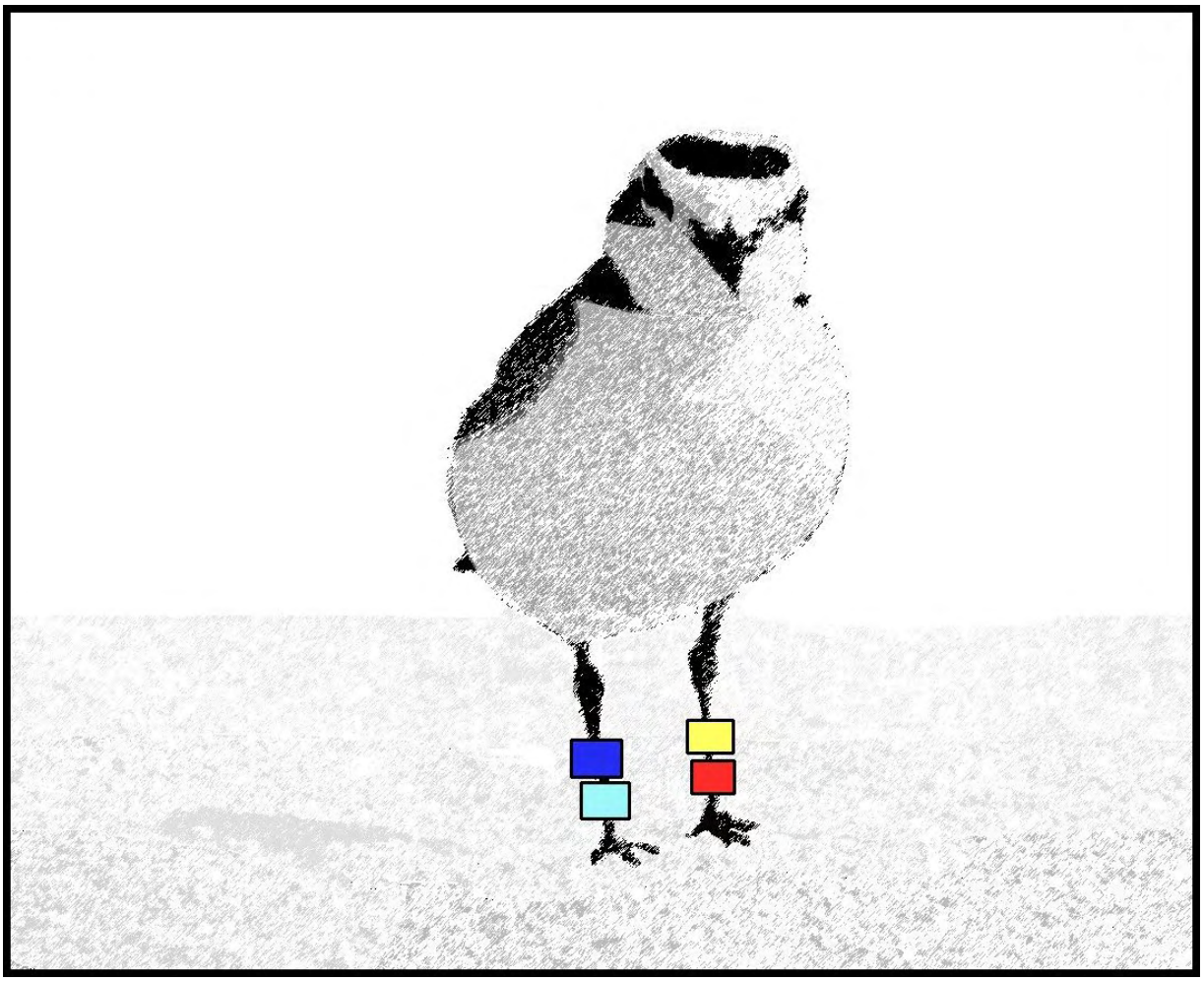


Figure J-1. Example of banded Snowy Plover. In this picture the bird has a yellow band (Y) above a red band (R) on its left leg and a blue band (B) above an aqua band (A) on its right leg. This combination should be recorded as YR:BA.

APPENDIX K

INFORMATION AND EDUCATION PLAN

for the

WESTERN SNOWY PLOVER PACIFIC COAST POPULATION

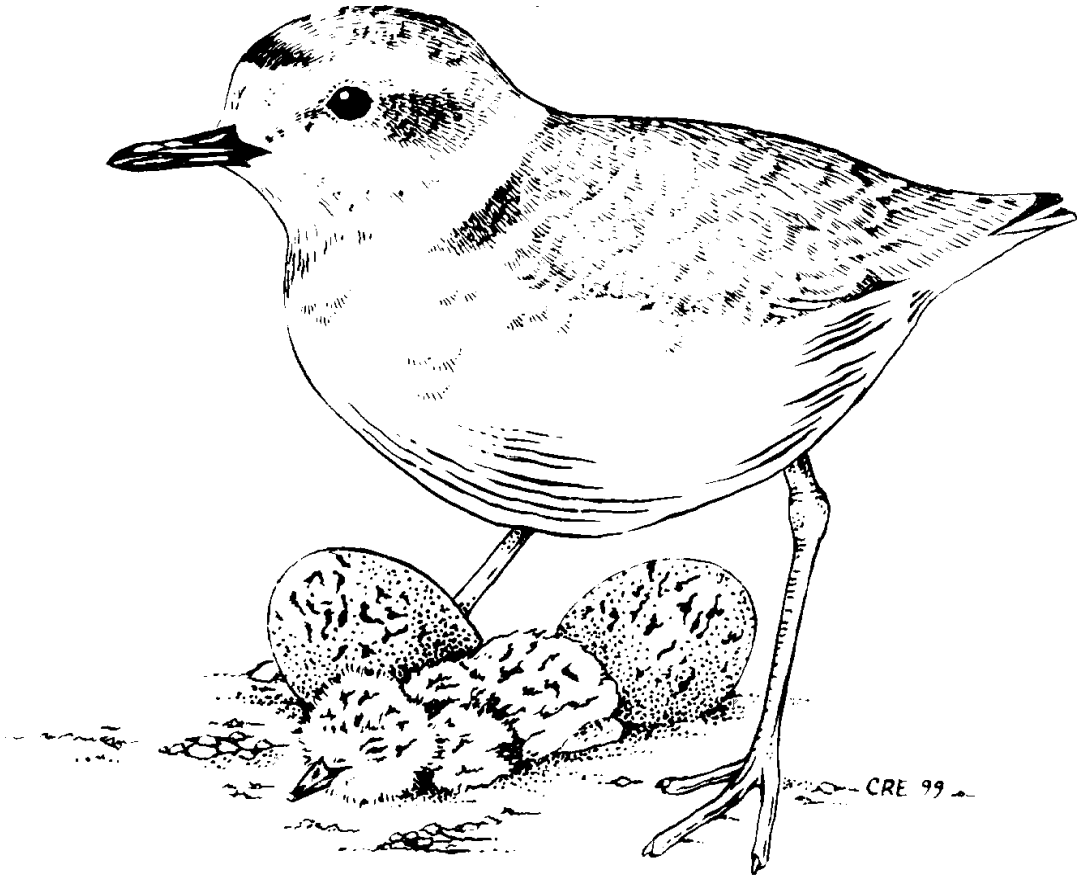


Table of Contents

Page

Introduction K-3

Plan Goals K-4

Current Situation K-4

Key Messages K-6

Target Audiences K-9

Information and Education Guidelines K-11

Materials and Forums K-13

Strategies for Reaching Audiences K-16

Actions K-17

Responsibilities K-25

Attachment A - Cost Estimates K-26

Attachment B - Current and Available Products K-32

Attachment C - Volunteer Program K-35

INTRODUCTION

Public awareness of the western snowy plover's plight is a significant component of its recovery. Increased awareness can lead to greater acceptance and compliance with management measures. Increased awareness may also inspire advocates and volunteers to assist with monitoring and habitat restoration. This Information and Education Plan describes current interpretation activities along with actions and ideas for future work. Key messages, target audiences, strategies, costs, and volunteer management are among some of the elements addressed. This plan has been patterned after successful efforts employed for the piping plover, as well as programs focused on other species, such as the peregrine falcon and Kirtland's warbler.

This plan provides direction for an expanded and continuing effort to reach all those who have a stake in the recovery of the snowy plover. At the broadest level, this effort extends to the public-at-large as concern for endangered species increases, while at the same time demand for public beach access continues to grow. Attention will also be focused upon groups and individuals who have a particular interest in the bird's recovery.

Recreational activities and demographics vary greatly along the Pacific Coast. Therefore, this plan has been written as a programmatic document; to be used for overall guidance and to generate ideas for regional plans. Ideally, interpretive strategies should be written for specific locations or land ownerships. At a minimum, individualized plans should be developed for the six recovery units described in the Western Snowy Plover Recovery Plan.

While several of the described actions may already be in motion, the recommended time frame for initiating all actions is 2 to 5 years. These actions are an integral part of snowy plover recovery, and funding for implementation must be supported accordingly. Although budget constraints may prevent development of a complete program, some recommended actions can still be pursued even where budgets are limited.

The Western Snowy Plover Recovery Plan calls for the development and implementation of public information and education programs. This Information and Education Plan provides guidance regarding the information and education activities described therein. Specific activities outlined in the recovery plan include: (1) apprise volunteers, Federal, state and local resource/regulatory agencies, and local planning departments of threats to breeding and wintering snowy plovers; (2) develop and maintain updated information and education materials on snowy plovers; (3) alert landowners and beach users about access restrictions within snowy plover habitats; (4) provide trained personnel to facilitate protective measures and public education; and (5) establish a repository and distribution network for information and education materials.

PLAN GOALS

The primary goal of this Information and Education Plan is:

- To increase compliance with management efforts to protect and enhance snowy plover populations and their habitat.

Secondary goals are:

- To stimulate public interest, understanding, and support of research and management actions which in turn will increase compliance levels.

- To provide land managers, private landowners, and recreational interest groups with guidance to implement a snowy plover information and education program.

- To stimulate public concern and understanding of unique Pacific coast beach-dune ecosystems that support numerous and diverse aquatic and terrestrial species, including special status species.

- To develop internal and external support necessary for funding western snowy plover management programs.

These goals will be accomplished through the information and education program described in subsequent sections.

CURRENT SITUATION

The western snowy plover has received sporadic media attention, due both to the growing issue of conflicting beach uses and to specific controversies raised by restrictions at popular beaches. Controversy peaked during the public comment period for proposed critical habitat designation.

A number of outreach activities have been undertaken by various management agencies. Posters and brochures have been distributed to the public over the past 5 years, primarily in the vicinity of snowy plover nesting areas. More personalized activities have included a video, slide programs, forums, and other presentations. Attachment B provides a list of outreach products developed to date.

Existing information and education programs were reviewed to provide guidance and a basis for outlining activities in this appendix. The following sections summarize effective outreach tools and outreach needs.

EFFECTIVE OUTREACH TOOLS

Partnerships

Partnerships can include working groups and cost share programs. The Oregon and Monterey Working Groups are excellent examples of effective partnerships. Cooperation between resource and land management agencies, researchers, interest groups, and private individuals increase effectiveness of outreach efforts and bring more resources - both expertise and money - to the table. For example, each year the Oregon Working Group jointly funds a plover monitoring and protection program. This single contract is cost-effective and provides a standardized method of data collection along the Oregon coast.

Multi-Disciplinary

Effective management of western snowy plovers requires cooperation between different and often divergent interests working together using a positive, unified approach. Snowy plover management needs to incorporate input from biologists, land managers, interpretation specialists, and various interest and user groups to reach recovery goals.

Dedicated Conservationists

The exceptional commitment of professional and volunteer conservationists has been, and should continue to be, an important factor in snowy plover recovery.

Communications Techniques

The key to increased public understanding and awareness is using a variety of communication techniques and methods of distribution. Current public outreach includes a variety of techniques such as videos, brochures, posters, on-site programs, slide presentations, and news releases.

OUTREACH NEEDS

Improved Internal Communications

Many people within resource management agencies are not getting information about the snowy plover program and the role they can or should play. Improved dissemination of information and coordination between all levels of staff is needed.

Coordination

When agencies, groups, and individuals work independently, work is not done in an efficient, cost effective, or cohesive manner. Working as a team can alleviate inconsistent messages and prevent redundancy in work.

Targeted Audiences

Different groups of people will view snowy plover management in different ways. The range of western snowy plovers includes a large geographic area that incorporates both small towns and large cities with diverse political views, ethnic and socioeconomic groups, literacy levels, environmental values, attitudes about government regulations, etc.

People also use beaches for recreation in a wide variety of ways. Communications intended for different groups and geographic areas need to be designed to address their different perspectives.

Information
Little information is available on how the various target audiences feel about plover management. Experiences of agency personnel indicate that public sentiment varies considerably. An increased understanding will help managers design effective interpretive signs and programs.

Decreased Use of Jargon
Many communications products to date contain a large amount of technical jargon. This not only fails to communicate with readers or viewers, but may even make them antagonistic.

Increased Personalized Communication
The most effective communications, particularly with local residents, are those delivered via a "one-on-one" approach . Although many outreach strategies such as brochures and videos are cost effective and reach wide audiences, they may not sufficiently capture attention or promote understanding.

KEY MESSAGES

Different audiences have different questions, concerns, and values that need to be addressed to effectively meet the goals of this plan. Knowing your audience(s) will enable you to design a practical outreach strategy and product specifically tailored to their issues. The following key messages address some of the most frequently asked questions. Although many of the following key messages apply to all target audiences, several may be site- or zone-specific. Individual plans should choose key messages appropriate to their audience(s). Sentences within parentheses reflect considerations to tailor messages to individual plans or outreach materials.

Saving Endangered Species and Ecosystems

1. All species, no matter how small or seemingly insignificant, are a critical component of the earth's biodiversity. Maintaining native species diversity is key to sustaining healthy ecosystems capable of adapting to constant change.

2. Snowy plovers and other endangered species are like the miner's canary -- they are a barometer of the health of the ecosystem.

3. The coastal beach-dune ecosystem includes unique and increasingly rare habitats along the Pacific Coast. Several species are found in this system and no other.

Snowy Plover Plight and Biology

4. Snowy plovers lay their well-camouflaged eggs on bare ground. Newly hatched chicks are the size of a cotton ball and are very difficult to see. Therefore, snowy plovers are extremely vulnerable to trampling of nests and chicks, to disturbance-related nest abandonment, and adult/chick separation. (Beach users must understand some basic aspects of snowy plover biology to comprehend the need for special protective measures for this species).
5. All wildlife have distinct habitat needs. Specialized species, like the snowy plover, have specific adaptations, and therefore live in only one or a few habitats.

6. Habitat destruction is the main cause of the Pacific Coast snowy plover's decline. Habitat has been lost from development and recreational conflicts, and introduction of non-native plant species. Loss of beach-coastal dune habitat also affects other plants and animals tied to this unique landform.

7. Historically, western snowy plovers nested on beaches along the entire Pacific Coast. Now they are rarely seen.

8. When a population reaches extremely low numbers, it becomes vulnerable to even the smallest losses. If disturbances are combined (e.g., due to weather, heavy predation, and recreational disturbances), extinction of the snowy plover could occur.

Predation

9. Keep beaches litter free. Litter on the beach can attract predators. Crows, ravens, raccoons, skunks, feral cats, and introduced red foxes prey on snowy plovers and their eggs.

10. Feeding wildlife can attract and unnaturally concentrate predators in or near snowy plover habitat -- Do not feed the wildlife.

11. Exotic predators have hunting strategies to which native prey species have not adapted.

12. Feral cats can be a threat to western snowy plovers. Feral cats should not be fed, and managed feral cat colonies should not be allowed in areas managed for natural wildlife values. Transport unwanted cats to an animal shelter where they have a chance to be adopted. Do not abandon cats in natural areas. Millions of birds are killed annually by cats. Report feral cats observed in natural areas to land managers.

13. Predators of snowy plovers, such as non-native red foxes, may have

to be controlled. Removal of predators is sometimes necessary in cases where non-lethal methods are not effective or cost prohibitive. Sterilization of predators does not prevent them from killing snowy plovers. If no other effective option is available, predators shall be removed in a humane manner.

Recreation Conflicts and Desired Behaviors

14. Agencies are mandated by law to protect endangered species - this may require removal of all other uses. Lack of compliance may lead to increased restrictions and beach closures. Your cooperation will keep restrictions to a minimum.

15. Many people believe that just one person can't possibly harm the plovers. But, if just one person enters a closed area, a parent snowy plover will likely leave the nest. Without the parent, the eggs or chicks are exposed and vulnerable to predation or harsh weather.

16. Guidelines for using beaches in a way that protects snowy plover habitat should be specific. Beach recreationists need to understand that by their very presence, wildlife may be disturbed.

17. Specific sites and types of recreation affect snowy plovers in different ways. Develop key messages targeted to a specific audience explaining how their activity impacts plovers and how modifying their activity can reduce or eliminate these impacts.

18. Your cooperation will help increase the number of snowy plovers on our beaches. You can help by <u>fill in the blank</u>…(e.g., respecting restricted areas; leaving your pets at home or keeping them on a leash; keeping kites, fires and camping sites well away from nesting areas; observing birds at a distance; and keep beaches litter free).

19. Information for off-road vehicle users will focus on off-road vehicle-related impacts, ways to coexist (primarily through land allocation initiatives), and possible means of support that this user group could provide. In an effort to elicit a little empathy for the plight of the plover, the information presented may possibly draw upon parallels between plovers and off-road vehicle users and the impacts to both with a "loss of space."

20. Sunbathing, beachcombing and other non-motorized recreation near snowy plover nesting areas are not benign activities to snowy plovers. Beach users can easily disturb breeding plovers. (Address how activities observed at specific locations such as picnicking, straying into nesting areas to retrieve errant Frisbees™, and loud behavior affect breeding plovers).

21. Equestrians, joggers, hikers, and other non-motorized beach users can aid in western snowy plover recovery by adhering to wet sand restrictions. Through cooperation, there can be plenty of beach for people and wildlife alike without a need for further restrictions.

22. Kite flying and fireworks are two activities that disturb nesting birds from greater distances than other activities.

23. Dogs cause a variety of impacts when unrestrained on beaches. They can disturb or kill a variety of wildlife species, including nesting snowy plovers. Migrating shorebirds can lose important fat reserves from being chased by dogs. Dogs can also destroy fragile beach vegetation.

24. Get Involved. Your participation can help increase compliance levels and snowy plover recovery, thus decreasing the need for further restrictions. Contact your state wildlife agency for further information.

25. Boaters should be made aware that their access to beaches and estuaries poses a threat to snowy plover nesting. Traditional signing methods for restricted areas may be readily missed by boaters.

26. While many user groups may not always act in ways that protect snowy plovers and beach habitat, they do have a fundamental appreciation for the outdoors. Increased awareness can set the stage for identifying possible areas of common interest and communicating our responsibility to protect the snowy plover when conflicts are inevitable.

27. Occasionally researchers or managers may be seen within restricted areas. These activities are monitored and performed within strict guidelines to minimize disturbance. This minimal disturbance is considered a worthwhile trade-off for increased understanding of plover biology that can in turn help recovery efforts. As an example, experimental predator exclosures were found to increase hatching rates upwards of fifty percent.

TARGET AUDIENCES

Audiences who have a stake in western snowy plover conservation and who should be the target of outreach efforts are described below. Each of these target groups influences or has the potential to influence plover management in a significant way. Audiences include those who will be affected by snowy plover management actions.

Regional and site-specific planning teams need to first evaluate audiences particular to their location. Strategies and key messages can then be tailored to these audiences.

Public at Large
In general, this alludes to a national constituency, although on a practical level it primarily includes people who live along the West Coast. Coordination of recovery efforts for Pacific Coast snowy plover populations and the Atlantic Coast piping plover may bring attention of plover issues to a national audience. However, the activities in this plan are targeted toward the Pacific Coast. Consider Key Messages: 1-9, 11, 14, 16 and 26.

General Interest Groups
Particular groups which may prove most receptive to information and education efforts include: civic organizations, scouts and other service organizations; environmental education and outdoor learning centers; and conservation groups. Consider Key Messages: 1-8, 14-18, 20, 23, 24, 26 and 27.

Beach Users and Coastal Recreation Interest Groups
Individuals and groups who most directly affect and are affected by efforts to manage and protect snowy plover habitat on public beaches include sunbathers and other summertime recreationists, surf fishermen, off-road vehicle enthusiasts, boaters, surfers (wave and wind), campers, hikers/walkers/joggers, people who bring their pets to beaches and equestrians. While often sympathetic to recovery efforts (especially following public outreach), these constituencies have frequently proven to be strongly opposed to habitat protection -- naturally enough, considering the trade-offs they must make. Messages may be somewhat different for individual users versus organized groups which are usually resident. Consider all Key Messages.

Local Communities
Communities with economic and quality-of-life ties to the beach environment have a strong and direct interest in snowy plover recovery efforts. Also, there are often many different voices speaking on behalf of the community, including those promoting tourist dollars and jobs, those defending traditional maritime industries such as fishing and clamming, those concerned with overcrowding and the quality of the environment, and those who support less tangible values such as individual freedom and community self-rule. While these interests can be found among the public-at-large, they are generally felt and expressed much more cogently in the vicinity of the "action." The local community thus comprises not one audience, but a conglomeration of different audiences related by proximity. However, regional or individual outreach programs may want to develop specific messages targeting user groups within a given community or surrounding area. Consider all Key Messages.

Schools
School age children may help reach out to other household members with their knowledge and enthusiasm. Provide buttons, posters, pencils, litter bags and other materials. Consider Key Messages: 1-8, 14-18, 20, and 23-26.

Public Officials and Land Managers
Through their role as public servants these individuals often represent the myriad interests of the three preceding audiences. However, most are required to bring in the added perspective of stewardship responsibilities. They may also be interested in non-beach use aspects of plover management, such as predator control and habitat restoration. These topics can be a key concern to some audiences (especially predator control issues). Consider Key Messages: 3-8 (depending on knowledge level), 11, 13, 14-18, 23, 26 and 27.

Private Landowner
These individuals can provide invaluable support. Many landowners have cooperated by allowing research and management to proceed on their lands. Reaching this audience is extremely critical, but can be a time-consuming process. Consider Key Messages: 1-10, 15-18, 20, 23, 24, 26 and 27.

Conservation/Environmental Groups
These groups will generally be strong advocates of snowy plover recovery. They constitute an audience in their own right, but they can also be a conduit of information and education to more general audiences. However, these groups may also be interested in beach access for activities such as hiking, camping, and bird watching. Their compliance should therefore not be taken for granted. Consider Key Messages: 1-8 (depending on knowledge level), 9-18, 20, 23, 24 and 26.

INFORMATION AND EDUCATION GUIDELINES

The following guidelines should be considered in developing regional or site specific information and education. Evaluation is fundamental to the success of all plans. Be sure to incorporate routine assessment.

Biological

- Ensure the biological needs of the western snowy plover as identified in the recovery plan are the focus of outreach activities.

- Emphasize the importance of the entire beach and dune ecosystem.

- Incorporate and highlight with current and national issues such as biodiversity, neotropical migrants, human population growth, international conservation, Western Hemisphere Shorebird Reserve Network and Watchable Wildlife.

Logistical

- Incorporate evaluation. Develop questions to assess effectiveness of program and individual materials.

- Use a team approach. Establish a regional working group if one is not in existence. Utilize this combined expertise and additional resources for an effective and coordinated method.

- Communicate consistently to all land management agencies.

- Communicate continuously. Education is a process, not a single event. Target audiences, issues, management activities, and western snowy plover recovery actions are constantly changing.

- Land management agencies should include staff in all outreach efforts.

Specific Tips (Messages)

- Discuss negative aspects, concerns, and failures as well as successes. Be honest with people.

- Reward and acknowledgment of effort is important to consider when developing messages. Be sure to provide the reasoning behind compliance and provide alternatives.

Specific Tips (Methods)

- Communicate alternatives to restrictions imposed by snowy plover management such as bringing a leash, visiting another beach, or using a different trail.

- Communicate with local people "face to face" to the extent possible.

- Communicate in a way that is understandable to target audiences.

- Incorporate other languages if needed. Avoid jargon and don't put too many messages in one medium.

- Identify your target audience and be sure your methods and messages are targeted for that audience.

- Involve local people in the process of communicating snowy plover information. Invite participation in a regional working group.

MATERIALS AND FORUMS

Direct Contact
Land managers have found one-on-one interaction with beach-users to be the most effective and well received of any outreach method. On-site interpreters can provide explanation to sometimes confusing restrictions, as well as a conscience to those who want to violate a closure. They also provide valuable feedback to the program and provide answers to questions from the public.

Brochures
Brochures can furnish basic facts about snowy plover biology and the need for its protection. They lend themselves to modification for more specific audiences, such as off-road vehicle users and pet owners, by focusing on the particular conflicts caused by certain activities. Maps of restricted areas at specific locations can also be added through modification or as an insert.

Brochures are well suited to on-site audiences. Snowy plover monitors have reported that being able to hand out information to beach-users is valuable. These items provide a handy reason to approach a stranger. Most are happy to receive this information and listen to a summary from a monitor. Brochures can also be distributed through commercial outlets, incorporated into presentations and interpretive programs, or mailed.

Fact Sheets/Flyers/Trading Cards
One-page fact sheets (or multi-page pamphlets) involve minimal production effort and cost. They consist primarily of typed information in a format that can be easily copied. Along with standard information, fact sheets and flyers can address points of concern for particular audiences and locales. They can also be used as summaries updating snowy plover recovery efforts. Fact sheets can be handed out at distribution points that serve user groups (e.g., entrance points), used in meetings, or mailed. Trading cards provide information and a photograph in an appealing package. These cards work well for handing out at nesting locations.

Restaurant Placemats and Table Tents
While waiting for their meal at a restaurant, many people will read materials placed on tabletops. Advertisers take advantage of this vulnerability by placing ads on tri-fold "table-tents" and placemats. Information could be condensed from brochures onto these formats. This forum would be especially useful for tourists and communities near plover sites and could be placed in hotel rooms to inform visitors of a nearby snowy plover nesting beach.

Posters
Attractive posters illustrating the snowy plover with a short caption have also been developed. Use of these posters in displays and around nesting areas is eye-catching. New posters could be developed to complement videos or other materials.

Maps
Colored maps showing specific habitats, restricted areas, designated trails and/or population/species range can be useful in meetings and publications. Large maps that can be reduced could serve both purposes. Maps may be most useful in conjunction with fact sheets and signs.

Curriculum
Curriculum could be developed for different age groups. Supplemental teacher packets and hand-outs could focus on biodiversity using the snowy plover as a case study.

Newsletters/Postcards
Newsletters are useful during important decision-making processes, especially those that actively consider public input. A standard newsletter format that can be modified for particular purposes could expedite public information and involvement. Postcards can also be used as a modified version of a newsletter. Planning and conflict mediation processes may benefit from information exchange through newsletters. Recovery status is well-suited to a newsletter format.

Interpretive Exhibits and Portable Displays
An interpretive exhibit can convey a variety of information about the plover and recovery efforts. A standard exhibit could be designed for both indoor and outdoor display. This display could be permanent or portable for use in schools and at conferences and meetings. A more elaborate exhibit could incorporate slide-tape or video displays. Ideally, this type of exhibit could be built into interpretive facilities.

Signs
High-quality interpretive signs explaining seasonal aspects of snowy plover behavior and habitat use can be used on site, either near parking areas and beach access routes or directly adjacent to nesting areas. A clear portrayal of the direct link between plover survival and human activities, with suggestions for appropriate behaviors, is important. Directional signs (closed areas, nesting sites) should be consistent across agency and ownership lines.

Media Releases
Public notices and news articles informing the public of beach closures, planning efforts, habitat restoration projects, recovery successes, etc. are issued as an ongoing effort. Unofficial stories and features can also be used to solicit interest. As an example, slides could be sent to weather reporters with verbiage for them to discuss while doing their

broadcast. The use of press releases in connection with conservation planning will be a significant aspect of recovery efforts in the future.

Radio Messages
Messages on special Traveler Information frequencies could alert beach users and summer recreationists to beach closures, and could provide capsule information about the need for protection of snowy plover habitat. Public service messages on commercial and public radio stations could also promote protection of snowy plover habitat and elicit general support for such protection among a variety of general audiences.

Web Sites/CD-ROM
Access to the Internet is an effective means of communication that can reach a variety of audiences at relatively low cost, especially if skills for web site development exist within an agency or are donated. Updates and other site maintenance require an investment of time. A master web site could be developed and operated by the U.S. Fish and Wildlife Service with links to other agency plover homepages. These local homepages can also be area- and site-specific. A CD-ROM could include portions of a video program, ideally with interactive elements.

Video Programs
Video programs can allow the distribution of accurate information in a popular form. These videos can be used in a variety of settings, including interpretive facilities, public meetings, classrooms, and for television broadcast. Regional- or site-specific videos addressing coastal dune ecosystem needs and variable local audiences which have an interest in snowy plover conservation are recommended.

Slide-Tape Program
In situations where video display terminals are not available, a slide-tape program could be used, both as part of exhibits and during presentations. The slide-tape program could potentially be customized for certain audiences. Slide programs with a script instead of a tape back-up could provide a cheaper alternative.

Speaking Engagements
Articulate and persuasive speakers could be engaged to address various groups, either in conjunction with audio-visual programs or on their own. Presentations to general interest and advocacy groups could introduce a forum for constructive dialogue and education. Participation in Fourth of July festivities or other summer activities could provide outreach opportunities.

Private Meetings
Meetings held during the course of consultations and negotiations regarding habitat protection can provide a forum for education as well as information exchange about the snowy plover.

Public Meetings
Public meetings may occur during the course of conservation planning processes and through environmental review for the designation of critical habitat for the snowy plover. These meetings could be used to air various concerns about land use conflicts and to gather support for habitat protection. Ultimately, strategies to protect plover habitat with the least possible impact on other interests may develop from the discussions in these meetings.

STRATEGIES FOR REACHING AUDIENCES

This Information and Education Plan is designed to use two means to disseminate information and gain support. The first strategy is to reach general target audiences through a variety of methods. The second strategy is to reach affected parties through official planning and consultation processes. To this end, actions developed for this plan consider the following:

- A variety of activities will be directed toward stimulating the interest and support of the general public, including specific target audiences, for the snowy plover's recovery; and

- Planning, consultation, and negotiation processes will be used to elicit the cooperation of affected parties such as beach users, landowners, and managers. Particular emphasis will be placed on public information as a component of the consultation process.

Materials and programs that can effectively increase understanding of snowy plover issues among beach users and local communities are an immediate priority. These materials will be developed and distributed by land managers, the U.S. Fish and Wildlife Service, and regional working groups as funds allow. Materials such as annual updates of recovery activities, information packets focusing on habitat protection, and teaching packets will be developed for specific audiences.

Distribution of materials and programs will "fan out" from key areas of concern, such as the vicinity of closed beaches and areas designated for critical habitat. In addition, major media contacts and visitor centers will be identified for initial contacts. In this way, the snowy plover information and education program will reach both the key target audiences and the broadest possible segment of the general public in as short a time as possible.

As an adjunct effort, a fairly standardized public involvement process will be followed during the course of planning and consultation processes for the snowy plover, in order to expedite education of the involved parties.

Whenever possible, information and education activities for the snowy plover will also be used as an opportunity to stimulate public concern for broader or less-prominent endangered species issues. Using "spin-off" techniques to raise awareness of other endangered species issues during snowy plover recovery activities could prove beneficial in gathering broad-based support.

ACTIONS

The following eighteen actions should be undertaken to achieve the goals of this Information and Education Plan. The list is in general order of priority. For each action, the target audience(s) and a brief description are provided.

INITIAL ACTIVITIES
In the short term, these activities lay the groundwork for future outreach efforts, or are already underway and need to be completed (varies regionally).

Action 1. Develop regional western snowy plover information and education working groups.

Audience: Biological resource and land management agencies, conservation/environmental groups, other interested parties.

Description: Establish a working group dedicated to the implementation of an information and education program for each region described in the recovery plan. These groups will coordinate and customize outreach efforts to their local needs. Regional resources will then be combined to accomplish tasks, develop a regional communication strategy, and apply for grant opportunities.

Each working group will coordinate snowy plover outreach efforts by maintaining current information on the programs of other working groups. In review, they will seek to identify areas of overlap; and possibly combine efforts to effectively reach a broader, even national audience. This could prove particularly true for activities such as widely-circulated articles, public service announcements, curriculum, exhibits, and press releases.

As appropriate, the working group will draw other agencies and individuals into this effort to inform and educate the public. They will assist any agency or individual involved or interested in plover recovery to design a program that draws from or augments strategies in this plan. Especially encouraged is coordination with individuals representing law enforcement, recreation, interpretation, management, and other disciplines.

Action 2. Develop a master mailing/contact list for each region.

Audience: All

Description: Include the following for each region:

- Media contacts
- Chambers of Commerce and similar groups
- Affected businesses (beach recreation concessionaires)
- Special interest groups and affected beach-users
- Conservation groups
- Local government leaders
- Affected landowners
- Federal, state, county and city land management agencies
- Civic groups and schools
- Commercial outlets for off-highway vehicle enthusiasts, pet owners (e.g., pet shops and veterinary clinics), sunbathers, surfers, and other beach recreationists
- Other interested individuals or groups
- Respondents to press releases, Federal Register notices, meeting attendees, etc.

Initiate development of the mailing list by defining target areas and providing field personnel, refuge managers, outdoor recreation planners, and others with this plan and/or other instructions for compiling their contacts. Consolidate the lists into a sortable, automated data base. Update/expand the list on a continual or periodic basis.

Action 3. Implement a media relations campaign.

Audience: Public at large, beach user groups, local communities, tourists.

Description: Use various opportunities for exposure of snowy plover issues such as habitat restoration projects, beginning or end of nesting seasons and successful partnerships between affected user groups. Development of many of these action items will also provide a chance for media exposure or assistance in disseminating information to target audiences through television, radio, newspaper, and magazines. News releases on specific stories or a general information package can be developed to generate media interest. Consider public service announcements and paid programming (commercials or ads) if needed.

Action 4. Develop customized materials for key target audiences.

Audience: The highest priorities are:

- Affected communities

- Beach user groups
- Tourists
- Landowners and managers
- Agency personnel

Description: Materials will summarize reasons for implementation of management measures and how users can help in snowy plover recovery. General flyers could be developed with inserts available for explanations of site specific circumstances (e.g. maps or messages to particular user groups). As funding allows, develop customized fact sheets or pamphlets (using a standard question and answer format), brochures, slide tape programs, and/or videos for special audiences. Important audiences include sunbathers, pedestrians, surfers and other beach recreationists, off-road vehicle enthusiasts, surf fishermen, campers, equestrians, and pet owners.

Active involvement of these groups in information development will assure responsiveness to questions and concerns about what effect snowy plover recovery efforts will have on their pursuits. Solicit ideas from the various user groups about how protection of the plover can be achieved while still allowing individuals to pursue their interests. Incorporate feedback in a question/answer or discussion format to address specific concerns of each user group in the most direct way possible.

Develop annual updates regarding the progress made in the snowy plover's recovery and future needs in terms of both research and management. Distribute these to landowners and land management agencies, either during consultation and negotiation procedures or via the mailing list, as appropriate. Use these updates to invite feedback about their current concerns and any support they may want to offer.

Develop customized brochures, flyers, signs, posters, placemats, and restaurant "table tents." Design some materials for groups inclined to support plover protection, outlining how they can most effectively provide their support. Augment this effort with customized presentations and video showings. Post interpretive signs where appropriate.

When appropriate, bring into play the bigger picture of endangered species. Use the plover situation as a catalyst for building upon the growing concern of the general public about environmental issues. Pursue these efforts within environmental education and interpretive settings where it is likely that the snowy plover will be one among a variety of topics.

Action 5. Develop customized regional displays.

Audience: All

Description: Develop a standard display that can be exhibited in visitor centers, on kiosks, on portable stands for use in meetings, classrooms, etc. When possible, erect kiosks with the display near posted closures. When feasible, incorporate a video display or slide-tape program into the exhibit.

Action 6. Establish site-specific western snowy plover outreach programs.

Audience: All

Description: Outreach requires significant time and energy to fully inform the public. A skilled outreach coordinator would be useful for this recovery effort; this person should be well versed in the biological issues related to snowy plovers and have experience with the public.

Action 7. Develop on-site monitoring programs.

Audience: Beach user groups

Description: Face-to-face contact is an effective technique to educate beach users and increase compliance with management measures. Volunteers or paid employees would be stationed near nesting locations to explain restrictions, monitor compliance, and distribute brochures. Encourage Friends groups to adopt a site.

Action 8. Establish coordinated clearinghouse for western snowy plover outreach materials.

Audience: Agency personnel, local governments, conservation/environmental groups.

Description: Provide repository of existing materials for use as templates or to be copied to prevent "reinventing the wheel." Announce the availability of new materials to interested individuals and agencies identified on the mailing list.

ONGOING OR PERIODIC ACTIVITIES

Activities which occur on a continuing basis or at different times throughout the year need to be pursued in as timely a manner as possible over the foreseeable future.

Action 9. Continue or expand current efforts to distribute customized materials to key target audiences.

Audience: All

Description: Expand distribution to include various groups on the mailing list. As appropriate, distribute outreach materials at local town and land use planning meetings.

Distribute outreach materials to specific distribution points near snowy plover habitat.

Outlets to consider:

Canoe/kayak retailers	Wind/Water surfing retailers
Surf/dive retailers	Kite retailers
Outdoor and fish bait retailers	Pet shops
Horse riding/rental establishments	OHV rental and retailers
Campgrounds	Veterinary clinics
Local mailings to target groups	Local motels
User group associations	Tourist bureaus
Visitor centers	Local restaurants
Offices that issue fishing and camping permits	

Action 10. Follow a standardized public outreach process during recovery plan release, agency planning and large section 7 consultations.

Audience: All

Description: Use the following planning guidelines for public outreach to gather comments and understanding of the process and decision:

At a Minimum:

- Develop a project-specific mailing/contact list, using the master mailing list as the basic source. Include government officials, agency and organization representatives, affected landowners, media contacts, and interested individuals.

- Issue press releases <u>if</u> informing the general public about the planning effort is warranted.

- Distribute a fact sheet/pamphlet and cover letter to all interested parties. Use maps when appropriate.

- Inform all interested parties of the outcome of the decision-making process.

- Distribute a customized fact sheet during meetings with agencies and landowners. This fact sheet will explain various means of protecting nesting plovers and managing their habitat.

- Use maps when appropriate.

Optional:

- Actively solicit public input via newsletters, public scoping meetings, and meetings with involved parties.

- Inform the public that all input will be considered and utilized as appropriate.

- Distribute available educational materials to involved groups. Give presentations upon request.

NESTING SEASON ACTIVITIES

Outreach activities will be intensified during snowy plover nesting season. Direct appeals for public cooperation and vigorous efforts to heighten public awareness are critical to nesting success. These activities will be pursued seasonally.

Action 11. Implement a media exposure effort.

Audience: All

Description: Launch a broad-based media exposure effort at least 2 weeks prior to the start of season and again at the beginning of the high-use summer season. Inform beach-users of the presence of nesting snowy plovers and educate them about responsible behavior on beaches with plovers. Use the system put into place in Action number 3. Provide volunteers with a “talking points” and "tip sheet" about how to communicate effectively when approached by the media.

Action 12. Implement a nest site outreach and monitoring program.

Audience: All

Description: Train volunteer wardens each nesting season in appropriate outreach techniques. Provide wardens with materials to distribute, and expand the roles of individuals who demonstrate a particular interest in plover protection and rapport with the public. Train biologists and volunteers to respond to local compliance or Endangered Species Act violations and threatening situations through established protocols. Obtain required permits to dispose or transport dead or injured birds.

Set up a transport system with local rehabilitation centers that are qualified and equipped to handle injured shorebirds.

As appropriate, schedule meetings with beach user groups to offset potential conflicts in any given area. Publicize beach closures and distribute customized materials as described above.

Action 13. Conduct "by invitation" tours.

Audience: All

Description: There is no better way to communicate what plover management is all about than to have people accompany a knowledgeable, enthusiastic expert into the field. A significant effort should be made to get key people on the tours (the best way is to ask). Groups to include are: chambers of commerce, agency employees, community leaders, legislators, media, school groups, and conservation organization leaders. Special meetings or presentations should be given before or after the tours.

Action 14. Enlist corporate support for plover protection.

Audience: All

Description: Manufacturers of suntan lotion, recreational equipment, pet food, off-highway vehicles, as well as local businesses could be approached for providing support. If this strategy is pursued, a prospectus-type brochure should be prepared explaining the public service aspects <u>and</u> the marketing advantages that could be gained by promoting an image of environmental responsibility. Corporate support could range from underwriting recovery projects to making a simple statement of support in their advertisements or on their packaging (the milk carton route). Regional working groups should research and solicit grant opportunities as an avenue to corporate support.

OPTIONAL ACTIVITIES

As opportunity allows, expand the snowy plover information and education program, selecting from among the following activities.

Action 15. Develop educational curriculum.

Audience: Schools, environmental educators, interpreters, youth clubs, civic groups.

Description: Develop curriculum with lesson plans and activities targeted to grade levels. Utilize materials from other activities, such as brochures, posters, fact sheets, maps, videos, or a slide-tape program.

Modify the above teaching package into a fairly standardized presentation for civic and school groups, and other general interest organizations. Inform key groups of the availability of such a program through the mailing list or through notices in brochures.

Action 16. Produce videos.

Audience: All

Description: Produce customized video(s) for specific audiences. Ideally, several videos could be produced; each targeted to a different audience. Otherwise, produce a 15-minute video to use primarily in educational and planning settings; and a 30-second public service announcement to use in informational and commercial contexts.

Announce availability of the videos to field office staff and through the mailing list. Provide press releases to distribute them to the media, commercial outlets, and for public and private functions. Also, distribute copies of the videos to key visitor contact points, including Federal and state facilities. In particular, distribute the educational video to individuals whose property is located within or near important breeding and wintering sites.

If possible, designate a video coordinator for each region to oversee a marketing strategy, to handle requests and generate interest, and to design a presentation which incorporates the 15-minute video as a major component. In particular, they will emphasize distribution of the video to target audiences with important breeding and wintering sites within or near their property or use areas.

Action 17. Produce a short radio message for seasonal airing.

Audience: All

Description: Produce a short radio message for seasonal airing on particular traveler information frequencies, including visitor information frequencies if possible. Also if possible, use the audio portion of the proposed new video for airing over commercial stations, or develop a public service announcement specifically for radio broadcast. Corporate sponsors could be effective by making a statement of support during their own commercials.

Action 18. Coordinate snowy plover information and education program with Mexico.

Audience: Mexican authorities, biologists and educators.

Description: Share plans, information and products with interested parties in Mexico. Establish contacts and information exchange programs. Efforts should be made to establish an international conservation program between the U.S. Fish and Wildlife Service and Mexico's National Institute of Ecology, Ministry of Environment, Natural Resources and Fisheries. Coordinate with existing programs such as Partners in Flight, North American Waterfowl Management Plan, and the Borderlands Initiative.

RESPONSIBILITIES

Assistance to agencies who manage snowy plover habitat is an ongoing activity that occurs primarily under section 7 of the Endangered Species Act. In particular, U.S. Fish and Wildlife Service works closely with the Oregon Working Group, the Monterey Working Group and resource agency staff to implement nesting area closures, information and education efforts, predator control, and other management actions to protect plover habitat. State agencies also play a role in plover management in their oversight of state wildlife regulations and the Coastal Zone Management Act. Although these Federal and state agencies provide oversight and support to plover management, ultimately responsibility lies with individual land managers. Local land managers need to ensure that snowy plover information and education efforts are appropriately and adequately implemented to support protection of snowy plovers at sites under their jurisdiction.

Western snowy plovers range over three states, through numerous counties and other jurisdictions, making a coordinated outreach effort difficult and complicated. Regional working groups will ideally reduce some of this complication. However, there needs to be a means for connection between these groups. The U.S. Fish and Wildlife Service is best suited to play a leadership role in providing advice and coordination and can also be valuable clearinghouse for existing materials. The U.S. Fish and Wildlife Service should assure that long-term funding is allocated to support a staff position to coordinate outreach efforts as part of other recovery plan implementation duties. Partnerships will be the key to employing an effective information and education program aimed at recovering the Pacific Coast population of the western snowy plover.

ATTACHMENT A

COST ESTIMATES FOR ACTIONS IN THE INFORMATION AND EDUCATION PLAN FOR THE WESTERN SNOWY PLOVER

A. Initial Activities

ACTION	DESCRIPTION	COST ESTIMATES
1. Regional Western Snowy Plover I&E Working Groups	Approximately 0.50 FTE per recovery unit to coordinate meetings, develop communication strategy, apply for funds, and oversee task implementation. Two meetings of working group per year.	**Personnel** $84,000 per FTE **Meetings, Goods and Services** $6,500
2. Master Mailing/ Contact List for Each Recovery Unit	Approximately three weeks of clerical time per recovery unit for compilation and data entry of initial list.	$3,600
3. Media Relations Campaign	Approximately 0.25 FTE staffing per recovery unit	$84,000 per FTE

INFORMATION AND EDUCATION PLAN COSTS

(Initial Activities Continued)

ACTION	DESCRIPTION	COST ESTIMATES
4. Customized Materials for Key Target Audiences		**Fact Sheets** (per 3,000) *Development and printing* $200-$500 *Distribution* $300-$960 **Tricolor Brochures** (per 3,000) *Development and Printing* $1,750-$2,800 *Distribution* $300-$960 **Slide Shows** *Development and Production* $300-$1,500 *Reproduction of six copies* $300-$900 **Signs** $1000 - $5,000 **15 Minute Video** *Development and Production* $15,000-$60,000 *Reproduction of 200 copies* $600-$1,000 *Distribution of 200 copies* $250-$500 **Radio Message Production** $1,000-$3,000 **Radio Message Distribution** $800-$2,000 **Web Page** $1,500-$15,000 **Bi-Annual Regional Newsletters** *Development and Distribution* $2,850- $3,500

INFORMATION AND EDUCATION PLAN COSTS

(Initial Activities Continued)

ACTION	DESCRIPTION	COST ESTIMATES
5. Develop Customized Displays for Recovery Units		$500-$2,000
6. Establish Site Specific Outreach Programs	Approximately 0.50 FTE per recovery unit to monitor sites, train and supervise volunteers and distribute information.	**Personnel** $84,000 per FTE **Goods and Services** $ 9,000
7. Onsite Monitoring Program	Approximately 2 FTE per recovery unit to monitor sites, train and supervise volunteers, and distribute information.	**Personnel** $84,000 per FTE **Goods and Services** $ 9,000
8. Coordinated Clearinghouse for I&E	Approximately 0.05 FTE per recovery unit.	$4,200

INFORMATION AND EDUCATION PLAN COSTS

B. Ongoing or Periodic Activities

ACTION	DESCRIPTION	COST ESTIMATES
9. Continue or Expand Current Efforts To Distribute Customized Materials to Key Target Audiences		$1,500-$12,000
10. Standardized Public Outreach Process During Recovery Plan Release, Agency Planning, and Major Section 7 Consultation		**Project Specific Mailing List** *Clerical costs* $300 **Press Releases** *Development and distribution of 3 press releases* $2,250 **Fact Sheets with Maps (per 3,000)** *Development and printing* $185-$600 **Informing All Parties of Decision-Making Outcomes (through e-mail, mailings, etc.)** $900-$6,500 **Solicit Public Input via Scoping Meetings** $1,800-$3,500

INFORMATION AND EDUCATION PLAN COSTS

C. Nesting Season Activities

ACTION	DESCRIPTION	COST ESTIMATES
11. Media Exposure Effort		**Press Releases** *Development and Distribution per Release* $600-$900 **Radio Message Production** $1,000-$3,000 **Radio Message Distribution** $800-$2,000 **TV Public Service Announcement Production** $1,000-$5,000 **TV Public Service Announcement Distribution** $800-$2,000
12. Nest Site Outreach and Monitoring Program	Approximately 1 FTE per recovery unit.	**Personnel** $84,000 per FTE **Goods and Services** $15,000
13. "By-Invitation" Tours	Approximately 0.10 FTE per recovery unit	$8,400
14. Enlist Corporate Support for Plover	Prospectus Package	**Development** $900 **Printing (500 copies)** $2,500 **Distribution** $800

INFORMATION AND EDUCATION PLAN COSTS

D. Optional Activities

ACTION	DESCRIPTION	COST ESTIMATES
15. Develop Educational Curriculum	Teaching Packet	**Development** $3,000 **Distribution of 750** $3,000
16. Customized Videos	15 minute video	**Video Production** $15,000- $45,000 **Copies of Video** (per 200) $600-$1,000 **Video Customization** $750-$1,500 **Video Distribution** $2,000
17. Short Radio Message for Seasonal Airing	60-second radio message	**Production** $500- 1,000 **Distribution** $1,000-$3,000
18. Coordinate Program with Mexico	Share plans and products	**Production** $500- $2,500 **Distribution** $2,000

ATTACHMENT B

PUBLIC INFORMATION AND EDUCATION MATERIALS FOR THE WESTERN SNOWY PLOVER

TITLE	AUTHOR(S)	TARGET LOCATION	TARGET AUDIENCE	TYPE OF MATERIAL
Siuslaw National Forest Species of Interest: Western Snowy Plover	USDA-Forest Service, Siuslaw National Forest, California	Siuslaw National Forest	General Public	Brochure
Sharing the Pacific Coast with Snowy Plovers: The Life and Times of the Snowy plover	Karen Miller/San Francisco Bay Wildlife Society	Pacific Coast	General Public	Brochure
Threatened Species: Western Snowy Plover	U.S. Fish and Wildlife Service	Pacific Coast	General Public	Fact Sheet
The Western Snowy plover is Threatened with Extinction! You Can Be Part of the Solution	Marina State Beach, California	Local	Potential Volunteers	Fact Sheet with sign-up form
Clamming and Plovers	U.S. Fish and Wildlife Service, Washington	Willapa National Wildlife Refuge	Clammers	Flyer
Traveling Displays (with plover and eggs in case)	Oregon Snowy Plover Working Team	Oregon Coast	General Public	Display
Plight of the Plovers	National Park Service, Golden Gate National Recreation Area, California	Golden Gate National Recreation Area - Ocean Beach, San Francisco, California	Beach Visitors (Dog Owners)	Fact Sheet (2 pages)

PUBLIC INFORMATION AND EDUCATION MATERIALS

TITLE	AUTHOR(S)	TARGET LOCATION	TARGET AUDIENCE	TYPE OF MATERIAL
Usted Puede Ayudar a Proteger al Charrancito Menor Californiano y el Chorlitejo Patinegro Nevado (You Can Help Protect the California Least Tern and the Western Snowy Plover)	The Nature Conservancy of California	Guadalupe-Nipomo Dunes	Spanish speaking beach visitors	Brochures
Key Facts about the Snowy Plovers at Ocean Beach	Nancy Read, Vandenberg Air Force Base, California	Ocean Beach within Vandenberg Air Force Base, California	Media reporters (TV and newspaper)	Fact Sheet
Naval Operational Training and Natural Resources Conservation Brochure	Naval Amphibious Base, Coronado, California	Local	Navy Audiences	Brochure
Sharing the Beach: How you can help the Western Snowy Plover	Oregon Working Team	Oregon Coast	General Public	Brochure
Plover Biology, Plight and Recovery Efforts	U.S. Fish and Wildlife Service, Oregon	Oregon Coast	General Public	Flyer
Plover Biology, Plight, ESA...	U.S. Fish and Wildlife Service, Oregon	Pacific Coast	General Public	Flyer
Trading Cards (laminated) with plover picture on front and narrative on back	Marina State Beach 61 Reservation Road Marina, CA 93933	Pacific Coast	General Public	Handout

PUBLIC INFORMATION AND EDUCATION MATERIALS

TITLE	AUTHOR(S)	TARGET LOCATION	TARGET AUDIENCE	TYPE OF MATERIAL
Slide Show	Oregon Snowy Plover Working Team	Oregon Coast	General Public	Slide Show
Video entitled "Life at the Ocean's Edge, the Western Snowy Plover and the California Least Tern."	La Purisima Audubon Society in association with Pygmy Mammoth, Productions, California	Central California Coast	General Public	Video
Closed Area Sign (English and Spanish versions)	California Dept. of Fish & Game and Point Reyes Bird Observatory	Point Reyes	Beach Visitors	Directional Sign
Closed Area Sign	U.S. Fish and Wildlife Service, Washington	Willapa National Wildlife Refuge	Beach Visitors	Directional Sign
Closed Area Signs (Nest in Peace and Do Not Disturb) both Carsonite posts and traditional	Oregon Snowy Plover Working Team	Oregon Coast	Beach Visitors	Directional Sign
Oregon Coastal Treasure Sign	Oregon Snowy Plover Working Team	Oregon Coast	Beach Visitors	Interpretive Sign
Web Site	Bureau of Land Management, Oregon	Oregon Coast - BLM Sites	General Public	Web Site
Plovers, Pets and People - Sharing the Beach	Oregon Snowy Plover Working Team	Local	Dog Owners	Poster for Veterinary Offices

ATTACHMENT C

VOLUNTEER PROGRAM
FOR THE
WESTERN SNOWY PLOVER

Table of Contents

Page

1. Introduction K-37
   Purpose and Goals
   The Value of Volunteers
      Who Are Volunteers?
      Advantages and Disadvantages
   Volunteer Opportunities

2. Volunteer Background Logistics K-39

   Volunteer Eligibility
      Background Checks
      Medical Condition
   Registering Volunteers
      Recommended Forms
   Legal Authority and Requirements
   Worker's Compensation Insurance and Tort Liability
   Risk Management
   Equipment and Vehicle Use
   Passes and Parking

3. Creating and Managing a Volunteer Program K-43
   Starting a New Program
   Duty Statement
   Recruitment
      Recruiting Opportunities by Personal Contact
      Other Recruiting Opportunities
      Interviewing and Selection
   Orientation/Training
      Orientation
      Training

Page

Program Leadership
Assessment and Review
Problem Solving
Motivation, Recognition, and Rewards
Additional References

4. Forms (Attached) K-53
Volunteer Application
Volunteer Service Agreement (Individual)
Volunteer Group Services Agreement
Parental/Guardian Permission
Special Project or Activity Sign-In
Volunteer Hours Record
Volunteers Orientation Checklist
Volunteer Evaluation
Program/Project Evaluation
Award Application

Introduction

Purpose and Goals

The following information is provided as guidance to managers of western snowy plover habitat who may need to use volunteer help to accomplish tasks of western snowy plover management (including survey work) and habitat protection. Under the overall goal of the recovery of this species, the purpose of this appendix is to give some guidance on setting up and managing a program of volunteers, with tips from other resource managers currently using volunteers as part of the western snowy plover recovery effort. The ideas covered in this appendix are meant to offer suggestions from which the program manager can choose to start a new volunteer effort or enhance an existing volunteer program, depending on the needs of each western snowy plover habitat area, and the need for and availability of volunteer help.

The purpose of a volunteer program is to expand the ability to do work beyond that which existing staff and other resources can accomplish. In addition to helping accomplish the goals of western snowy plover habitat management projects, a successful volunteer program can also increase public awareness on this and other ecological issues. It also helps the public understand their place in the natural world and their role in helping to preserve the planet's biodiversity.

The Value of Volunteers

Volunteers can provide inexpensive help where funds for western snowy plover management and habitat protection work are limited or not available. Working with volunteers also gives the local community opportunities to become actively involved with western snowy plover management. Volunteers can also gain a sense of ownership of their natural resources, which could increase public support for western snowy plover protection, and help the public to better understand coastal beach management decisions.

Volunteers can provide service on a temporary basis (for just one season or project), or make a long-term commitment. A long term commitment could bring consistency to western snowy plover monitoring and data collection.

Who Are Volunteers?

Volunteers are people who give freely of their time and effort to support a cause in which they believe (in this case, sensitive species protection). People volunteer for many reasons. In addition to having an interest in wildlife, birding, and/or the western snowy plover in particular, they have an opportunity to learn about wildlife and habitat protection, to teach others, and share in the hands-on stewardship responsibilities of wildlife managers. Learning something new, getting outdoors, and/or meeting new people are just a few of the reasons that could motivate volunteers while obtaining satisfaction in doing much needed work. Volunteering can also give people opportunities and experiences that supplement those associated with their regular jobs. Volunteers

have different abilities and desires, which must be kept in mind when planning a volunteer effort.

Advantages and Disadvantages

The advantages of volunteer help center around increasing your workforce without accompanying increase in cost. Other advantages can include obtaining needed expertise, fresh perspectives, and enthusiasm for the recovery process.

Volunteers do require some budgeting. The costs and benefits of a volunteer program should be carefully weighed. It must be worthwhile for a manager to use volunteers. Volunteer programs can create unrecognized demands on regular staff and impact program funding. Organizing a volunteer program includes recruiting and training participants. This effort will require a volunteer coordinator. Volunteer work and volunteers have different incentives than career staff (i.e., career advancement and monetary compensation). It can be a challenge to direct volunteers, keep them focused, and maintain a high level of interest and commitment. Supervision of volunteers can become nearly a full-time job, depending on the program, the projects, and the people involved. Monetary costs associated with a volunteer program include training materials, provision of equipment, incentives or awards, and staff time needed for management and supervision.

Volunteer Opportunities

In the western snowy plover recovery effort, there are a number of areas in which volunteers could play a role. Volunteer monitors may be needed in most areas. Monitoring requires a higher level of training, time, and commitment from volunteers. They need to be well-trained in finding and identifying western snowy plovers and willing to spend a fair amount of time to complete the survey work. A regular commitment throughout the breeding season will be necessary. Under careful supervision, there may also be opportunities for volunteers to be involved in plover capture and banding work, erecting exclosures, treating oiled plovers, and/or specimen handling, storage, and tracking.

Volunteers with a talent for numbers can aid in the analysis and/or manipulation of monitoring data, or preparation of the final report. The volunteers who monitor may or may not be interested in the data analysis and report writing aspects of the work.

Volunteers can also be useful for beach patrol and public contact work. Although volunteers cannot give citations, they can give informal warnings and interpret the western snowy plover habitat protections to beach users. This is an important aspect of the western snowy plover recovery effort. If volunteers are monitoring and making public contacts, there may be a conflict in both time and attention to with their work. Effective public contact also takes diplomacy and a certain degree of extroversion along with a dedication to and through knowledge of the species. If possible, separate the jobs

of monitoring and public contact according to the volunteers' preferences. Volunteers can also participate in outreach efforts, and developing interpretive materials such as written articles for newsletters and local newspapers. They can also do other public relations work, including fund raising, which is a specialized skill in itself.

Habitat restoration activities are another area in which volunteers may be useful. Removal of non-natives such as European beach grass, or revegetation with native species (keeping western snowy plover habitat needs in mind) can be gratifying for the volunteer, and can give a balanced view of western snowy plover habitat management as a whole.

Experienced volunteers that have committed to regular participation in the recovery program could also help to operate the program itself. Training new volunteers and organizing the season's work are two areas which would be useful as long as there is program leader oversight.

Unpaid college and high school internships provide the opportunity for students to augment their studies with related work experience. The work performance for those interns receiving academic/course credit for volunteer work usually needs to be formally evaluated, by the project leader to assess the work accomplished by the student.

Volunteer Background Logistics

Volunteer Eligibility
Anyone is a potential volunteer, regardless of gender, race, religion, age, or disability, as long as the individual can adequately perform the work assigned in a safe manner. However, project managers are not required to accept all who volunteer their services. Juveniles under the age of 18 may need to provide acceptable parental or guardian consent. While work permits are not required, they are recommended, and all appropriate labor laws governing the work hours of juveniles should be followed. The program manager should determine minimum age requirements, if necessary, such as for the operation of certain types of equipment.

Background Checks
Background checks are not necessary for western snowy plover volunteers unless the volunteer duties include supervising or having exclusive control over minor children when no other adult supervision is present, or the volunteer has access to confidential records, purchase documents, or master keys and expensive equipment. Background checks are time-consuming (2 weeks to 2 months), and a processing fee is involved.

Medical Conditions
A health questionnaire may not be necessary unless, based on the duty statement, the land manager decides to request one. If the volunteer has indicated a medical condition or

physical limitation which may restrict performance of assigned duties, a health questionnaire may be required, and the prospective volunteer can be allowed to participate only if the described condition or limitation will not impact the volunteer's ability to safely complete the prescribed work, and if it will not place the volunteer in an unsafe work situation.

Registering Volunteers
Volunteers should be registered with the participating agency. Registration can be delegated to the program leader unless confidential information such as social security numbers, drivers' license numbers, or date of birth is requested on the forms, in which case the land manager or agency representative should be responsible for registration.

For the purposes of workers' compensation insurance and tort liability, any disclaimer information must be made available (by distributing copies or posting). Volunteers should read and sign any disclaimer information. An opportunity for all participants to ask questions must be provided.

Recommended Forms
Registration forms should include a Volunteer Application, a Volunteer Service Agreement for long-term volunteers, a Volunteer Group Services (volunteers in an established group), a Parental Permission form for juveniles, and Special Project or Activity Sign-In Form (for short-term projects). Additional registration forms may be necessary depending upon the volunteer's stated health status, and whether the individual will be working alone with juveniles, using vehicles or other specialized equipment, or performing other specific duties. Examples of forms that have been used for volunteer registration may be found at the end of this attachment. These are to provide an example of the kinds of information that can be collected when registering volunteers.

Under the Information Practices Act, all personal information collected from volunteers or volunteer applicants must be kept confidential.

Legal Authority and Requirements
Various land managers (Federal or state governments, local county or city jurisdictions, natural preserve managers, etc.) may have different policies regarding the legal status and management of volunteers. For example, the State of California formally recognized the value of volunteers in 1978 with the California State Government Volunteers Act (Government Code §3110 through §3119.2) which grants state agencies the authority to utilize volunteers under certain general and specific requirements. Other land managers may or may not have similar enabling policies.

Workers' Compensation Insurance and Tort Liability
People can be careless and accidents do happen. In addition to pain and lost work time, such incidents can result in costly workers' compensation claims. Also, unsafe actions of a volunteer resulting in injuries to another can result in tort liability suits filed against the

volunteer and the land manager. Land managers policies can vary on the amount of responsibility assumed for volunteers' mishaps depending on whether the volunteer is long-term or short-term (may not be covered by workers' compensation insurance). A student intern whose salary is paid by outside entities (the school or college foundation) may be covered by that entity, while unpaid student interns who volunteer their time may be covered by the land manager's insurance. Organized groups, such as interest groups, civic and non-profit organizations, and corporations and small businesses, may agree to provide workers' compensation insurance for its volunteering participants.

Workers' compensation insurance is a state-mandated benefit provided by employers to their employees which provides for physical injuries and other medically related disabilities which are caused by work-related actions. Tort liability, as applied to volunteer management is an action by a volunteer which results in personal injury to another person or damage to the property of another. When a properly registered volunteer is acting within the accepted limits and scope of their assigned job responsibilities, the land manager can choose to assume responsibility for tort liability claims.

Risk Management
To reduce the risk of accidents and injuries:

- Volunteers should be given proper supervision;
- Volunteers should not be assigned to do work which they do not feel comfortable completing or willingly agree to perform;
- Volunteers who will operate equipment or machinery in the course of their duties should be able to demonstrate proficiency in its safe operation and a thorough understanding of all applicable safety measures. The age of the volunteer should also be considered;
- Volunteers need adequate training, initial and ongoing if necessary, in any equipment operation (records should be maintained), and in general safe work practices. Personal safety during survey work should be addressed;
- All accidents and injuries should be reported immediately, thoroughly investigated, documented, and analyzed to determine what factors, conditions, or practices contributed to the incidents, so that action can be taken to prevent reoccurrence.

Equipment and Vehicle Use
Volunteers may operate equipment and motor vehicles other than their own during the course of their work or as required in their volunteer duty statement. A number of requirements are necessary:

- The volunteer that will be driving must have the appropriate valid state driver's license (Class A, Class B, or Class C) and be at least 18 years old;

- If volunteers drive agency or private vehicles during the course of their duties, a driving record check could be requested, and a driving test for each type of vehicle to be operated could be given;

- If a volunteer drives a private car during the course of volunteer duties, its use should be authorized by the program leader;

- Each volunteer who will drives should be briefed on proper vehicle operation, maintenance and safety, including the use of seat belts and accident reporting;

- Similar requirements should be considered for volunteer use of other kinds of special equipment;

- Volunteers should not operate law enforcement or emergency vehicles unless the vehicle is clearly marked "out of service";

- Under California Vehicle Code 17151, the driver of a vehicle has the primary liability for accidents arising out of maintenance or use of that vehicle. Accidents must be reported to the volunteer driver's insurance company within 48 hours, which is obligated to provide defense and indemnification for claims;

- If volunteers use personal property or equipment while doing volunteer work, and that personal property is lost, damaged or stolen, the program manager or agency cannot be held liable;

- Volunteers should not use equipment for personal use.

Passes, Parking and Miscellaneous Expenses

Volunteers regularly entering a park or other such control-fee areas in the course of their volunteer duties should be issued a pass that will permit free access. A pass can be in excess of what is needed for the volunteer to accomplish assigned tasks. This pass can also be used as a means of incentive to continue volunteer activities, and as a reward for work accomplished. A regular parking space should be provided if parking is limited. If extended periods in the field are necessary, a campsite or designated camping area should be made available. Also, efforts should be made to reimburse volunteers for miscellaneous expenses associated with completing tasks requested by land managers (e.g., film and processing costs, etc.).

Creating and Managing a Volunteer Program

Starting a New Program
The first step in creating a volunteer program that will meet your needs is to clearly identify those needs in a needs assessment. The needs for western snowy plover management will be site-specific, and may be approached with a variety of tools (e.g., more staff, more or better interpretive materials, etc.). With a clear statement of needs that are carefully identified and analyzed, and with development of potential solutions, the manager can better determine if a volunteer program will best meet those needs.

A needs assessment should include a comprehensive and specific list of all the desired tasks/activities not performed by staff members, and those tasks currently performed by staff where assistance is needed. Specific training or skills not found in existing staff should also be included. The listed items should be ranked according to the commitment of time, training, and supervision that will be needed and which can be made available. Priorities can then be established based on habitat needs and the available levels of support.

For instance, survey work requires a regular program with committed, consistent participants. Special events or a regularly-scheduled program that draws a large number of people or a regularly-scheduled event is more likely to reach a greater number of serious participants, and can have the potential to grow and require more volunteers. Also, for the same effort it takes to publicize a special event, an ongoing one can be listed with occasional updates to keep the listing current. A regular and committed program also has greater potential to increase public awareness of the issue, and to have an impact on the participants' lives. The program can also become popular with volunteer exchanges, colleges, corporations, and other sources of future volunteers, who may contact you for volunteer opportunities. Examples of regularly-scheduled volunteer programs are the Habitat Restoration Program and Stewardship Education Program at Point Reyes National Seashore.

Duty Statement
After a needs assessment is completed, job descriptions or duty statements for every position or function desired should be developed. The descriptions detail volunteer duties or responsibilities, including their performance standards and supervisory chain of command, if appropriate. Duty statements should define the knowledge and skills needed to do the job safely and effectively, and include all training needed to ensure that job performance standards are met. If a Volunteer Service Agreement is used, the duty statement should be attached, or referenced on the form.

Recruitment
Recruitment consists of the many methods from which you can choose to reach volunteers. Begin recruitment only after the rest of the snowy plover program is in place.

Recruitment requires time, patience, and persistence, particularly with a new program. A volunteer program takes time to build momentum and as is does become established, satisfied volunteers will promote the program and may become an important resource for recruiting additional help. An annual recruitment drive can also be considered, with a theme, slogan, and press release.

The first step is to develop a written recruitment message which gathers all information about the volunteer position - parts of this information can be used for the different recruiting methods chosen. The basic recruitment message should cover the following key points:

1. Statement of need, why the job is important;
2. How a volunteer can help solve the problem; and
3. How a volunteer can benefit from doing the job.

Personal contact is the most effective way to recruit volunteers. Other less interactive methods of recruitment include distributed printed material and other media which can reach a greater number of people. A new recruiting tool to consider is the Internet.

Complete information on the program should be compiled, including what the program does, when, where, and what volunteers can do, experience required, and what training encompasses. All recruiting methods must include a contact (name of a specific person, address, and/or phone number) prospective volunteers can reach for further information. A printed information sheet, giving specific information about the program provided, making participation sound fulfilling and fun, should be sent to interested callers, along with reprints of articles about the program or an article about the species. If there is more to the program than survey work, such as habitat restoration or public relations projects, develop a schedule of volunteer events including information on the task(s), locations, dates, and times. Send out the schedule with the information sheet to give volunteers activities to look forward to.

Developing a written recruitment strategy can help to guide volunteer efforts. Such a strategy would cover the following points:

- Volunteer job description;
- Skills and qualities needed to perform the job;
- The types of people most likely to have these qualities (age, gender, education, experience);
- The best sources for finding volunteers;
- Best recruitment techniques or methods to use;
- Benefits to the volunteers; and
- Recruitment officer and/or Program Lead, and why.

Recruiting Opportunities by Personal Contact
The opportunities for recruiting by personal contact are many and diverse, and will depend on the local area and the interests and values of the people who live there. On site, there may be interested individuals among current staff and concessionaires (and/or their families), or among retired staff. Staff and volunteers wearing buttons saying "Ask me about volunteering…" could also help spread the word. The program leader or other trained staff can speak to individuals or groups, and an accompaniment of a slide show or a videotape could help introduce the program.

Student volunteers and interns can be found on nearby college and university campuses and can be reached through college clubs focused on related topic areas. Probably a good way to reach students is by asking professors who teach courses related to ornithology, biology, and conservation or environmental studies for interested students. Other campus recruitment opportunities include student union information networks, college newspapers, and job placement centers.

Special interest groups may be recruited for western snowy plover work that relates to their specific interests, and can be reached through active members or by providing a guest speaker for a meeting. For example, a local chapter of the Audubon Society or another birder organization could adopt a beach or habitat area for regular monitoring activities. Local chapters of other conservation organizations and professional societies (e.g. Cooper Ornithological Society, The Wildlife Society) and their conferences may provide another appropriate venue for the purposes of interesting potential volunteers in helping with the western snowy plover. A possible advantage of mobilizing such groups, including organizations as local hiking groups or off-highway vehicle clubs, is that they may have their own leadership and infrastructure. Often this allows them to maintain their own insurance and makes project supervision easier for the program manager or project leader.

Making presentations at meetings of the local chamber of commerce, philanthropic organizations, community clubs, social functions, and staffing a western snowy plover information booth during special events that take place near the site (such as a state park) or at local fairs and community events are other possible means of recruiting. Related businesses/industries, service organizations, and governmental agencies could be contacted as well. A local community volunteer center or volunteer exchange may provide additional ideas for recruiting, and may be a source of people looking for volunteer opportunities.

Other Recruiting Opportunities
Many more volunteers may be reached by other, less personal means, however these methods are not as immediate and require more work on the part of the recipient to call with further questions or to actually volunteer. Adequate information should be given in any printed appeal including: project description, location, time/day commitment, length of commitment needed, skills needed and the training offered, equipment required and

other logistics, and, most importantly, a contact and a deadline date by which to call. All of these quasi-published methods should have frequent follow-up to keep them current.

Printed materials that can be utilized for recruitment purposes include:

- Articles or ads in the park publications;
- Entries on the managed area's Internet homepage;

- Posters or enticing informational flyers posted in appropriate places such as:

    - colleges and universities,
    - volunteer bureaus,
    - libraries,
    - company/church/community bulletin boards,
    - military base recreation centers, and
    - shopping malls

- Articles in newsletters or journals of related interest groups and professional organizations:

    - entries in job announcement listings for both paid positions and volunteer work in publications.

- Job listing directories such as the American Bird Observatory's Directory of Volunteer Opportunities for Birders which annually lists volunteer birding opportunities from all over the world (contact the administrative offices of the American Birding Association, P.O. Box 6599, Colorado Springs, CO 80934 for more information).

Less-focused printed recruitment methods use the local newspapers, sometimes free of charge for local events listings. An in-depth article appearing each year at the appropriate time would help to alert the community and recruit volunteers as well. A notice or advertisement of the western snowy plover habitat protection program and information on volunteer opportunities in the local newspaper and businesses such as banks can be asked to carry a related message in their advertising.

Other media opportunities include advertising through radio or TV stations - public service announcements may be broadcast free of charge by some stations. A written public service announcement should be prepared and distributed to all stations - if your program is ongoing, you may need to send one regularly or your listing will be dropped. Appearing as a local interest spot on the news or participation in a local talk show can also be effective in reaching the local community.

Interviewing and Selection
Volunteer selection can have a significant effect on the program. Volunteers with the qualities (skills or abilities, outgoing personality for public contact work, etc.) should be appropriate for the project(s).

The interview process lets the potential volunteers know what to expect, familiarizes them with the program and the land management entity/agency before they commit, and indicates the agency's commitment the snowy plover recovery program. The volunteer's qualifications, their ability to do the tasks, their availability, and their willingness to commit to doing the work are all needed information as they are the representatives of the land managing entity/agency. It is also useful to determine whether the job can fulfill the volunteer's needs.

Orientation/Training
Volunteers will be given an orientation on the concepts of western snowy plover habitat protection/management and trained for the specific tasks they will be performing.

Orientation
The orientation can help the volunteers feel welcome and introduce them to the agency or land manager. Job performance expectations will also be outlined.

A formal orientation session should inform volunteers of their assignment . Any liability protection or injury compensation they are eligible for while working within the scope of their assignment as described in their duty statement should be covered at this time. A Volunteer Orientation Checklist (an example is provided in the forms section at the end of this attachment) can be an important tool to insure all pertinent topics are covered.

Training
Training is used to provide the volunteers with the necessary depth of knowledge and the skills needed to do the jobs assigned. Initial on-site training is required, and periodic refresher training can also be incorporated into the program, if needed. Training should be as clear as possible in identifying the skills/knowledge to be learned or refined, should be as job-specific as possible, and should involve experienced volunteers and staff. Be realistic about what can be accomplished in the allotted time, draw on the skills and experiences of those attending, and look for opportunities to train volunteer and existing staff together.

Training materials for western snowy plover volunteers should be based, in part, on information contained in Appendix J, Monitoring Guidelines for the Western Snowy Plover, Pacific Coast Population. The tasks involved in western snowy plover habitat management (including monitoring) are varied, and the training should provide adequate coverage of each aspect. A western snowy plover habitat management program may have volunteers participating in a limited portion of the program. Any one volunteer may do only one task, more than one task, or an individual may be given the opportunity to go

from one task to another sequentially. With tasks as diverse as survey work, public interaction, plover capture and banding (State and Federal permits required), erecting exclosures, treating oiled plovers, data analysis, and specimen handling, storage, tracking, and dispensation, the volunteer (and staff) training could be a challenging part of the program.

Because the U.S. Fish and Wildlife Service requires supervised field training, a training schedule should be established and the volunteers notified by letter, which should include times and locations of training sessions, trainers' names, and a list of all equipment required and other recommended gear. In accordance with the minimum training requirements developed by the U.S. Fish and Wildlife Service, training should include classroom and field instruction. During the classroom instruction, the duty statement should be given to the volunteers and reviewed, safety and equipment use should be discussed, and any other necessary paperwork should be completed. Instruction should be provided regarding who to contact when injured or dead birds are found. A printed training agenda can keep things on track and provide the students with an outline of the course. Written background information should be supplied to the volunteers for further home study. Videos, pictures, and slides will help volunteers to become familiar with the target species. Conveying some of the information while in the field should be considered - people tend to be more receptive to short explanations with real life, visible illustrations than to extended lectures. Lunch periods during training sessions can also be an opportunity to transmit information in a more casual way.

In the classroom, volunteers should be instructed in the biological background information on western snowy plover, its legal status and restrictions, and on the survey and habitat management programs. Information should also be given on the least tern if this species will be included in the survey work. Sanderlings should be covered as well, since they are often confused with western snowy plovers. Field Survey Data Sheets (for western snowy plover and disturbance factors) and detailed instructions for completing them should be distributed, discussed, and reviewed during the field training sessions. Western snowy plover color bands should be discussed. Tips on public contact and outreach information consistent with program goals should be covered, as well as information on other projects involved in western snowy plover habitat management.

Various levels of field instruction are required for winter surveys, breeding season monitoring, plover handling, and banding or marking. A Field Training Checklist should be used to assure that all requirements have been met, and copies furnished to the volunteers. Participants can be certified when the appropriate level of training has been met and the volunteers' names added to an existing Recovery Permit.

Program Leadership

Good program leadership helps volunteers feel productive, successful, supported, recognized, and rewarded. Since volunteers receive no pay for their work, their reward is a feeling of accomplishment and a sense of contributing to the preservation of the

species. A successful program leader keeps volunteer morale and participation high by making them feel wanted, valuable, and a part of the team. Complimenting volunteers for a job well done and showing them how their work helps in the management of western snowy plover habitat gives volunteers a sense of special recognition and accomplishment.

Assessment and Review

Any volunteer effort needs to be assessed periodically to be sure the goals of the program are being met. Evaluation can also be used as a reference for identifying training needs for current and future volunteers. Frequent informal evaluation by the program leader can provide volunteers with feedback on the quality of their work, in addition to identifying potential program-wide problem areas that may need to be addressed with additional training or other actions. In addition to compilation of the data collected, an Annual Program Activity Report should be prepared to assess the program as a whole, and the volunteer program specifically. If personal (rather than program) evaluations are written, copies must be given to the volunteer.

Conversely, when the volunteers can evaluate the program and their training, they can identify its successes and where improvement is needed, things that may not be obvious to the program leader. Ensure that volunteers are given an opportunity to provide written or oral review of the program.

Problem Solving

When working with people, problems can develop. Conflicts or concerns are most quickly resolved if addressed at the lowest level possible. The problem-solving procedure of addressing the issue/situation, generating possible solutions, evaluating all possible solutions, deciding on a solution, and implementation of that solution, can work if everyone is willing to participate in an open and honest manner with a professional work demeanor. Addressing the specific problem (not past conflicts), confronting the issue rather than the person, remaining objective, being creative with solutions, and compromising are good points to remember when trying to solve problems that arise. If problems cannot be resolved verbally at lower levels, a written report may be needed to present the problem for resolution to higher supervisory levels.

Motivation, Recognition, and Rewards

Motivating volunteers to regularly participate, to remain with the program, and to return year after year can be a challenge. Volunteers will stay with the program if they feel that the program has worthwhile goals that are being accomplished, that they are instrumental in helping the program reach its goals, that the program leadership is effective, and that they are stimulated and are enjoying the experience. To get people to return to a program, they must remember their experience positively. A successful program that provides a sense of continuity and commitment not only benefits the projects, but visible continuity (and the completion of large projects) is stimulating to continuing participants.

Special recognition and rewards can also be tools to help increase volunteer consistency and retention.

It is important to acknowledge to the volunteers and to other staff that volunteers are providing an important and valuable service. Volunteers should feel comfortable discussing their work or expressing their concerns. Constructive feedback, both to the volunteers about their work and from them about the program's strengths and weaknesses, can be given informally on-the-job, or more formally, such as in a meeting. If appropriate, they can be included in staff meetings and encouraged to participate. A suggestion box can also be used to solicit suggestions.

Variety can be provided by including volunteers in other, related projects, or tasks can be traded with other volunteer groups, particularly if the volunteers are involved in habitat restoration. Opportunities for increased responsibility within the program can be offered.

Stimulating discussion is a learning tool, an inspiration, and a reward in itself. Topics of interest include the value of nature, western snowy plover and other sensitive species, surveys and habitat restoration. Interpretive hikes on site, perhaps at the end of a training session, are educational and can help communicate the importance of the work to the species and the ecosystem. Volunteers can be encouraged to return in the future to see the changes they have helped to bring about.

For unpaid college and university student interns in the sciences (and others working in the field), volunteering can provide the opportunity to augment their studies with related work experience, which will also make valuable resume material. There is always the opportunity to get future job references, and to make contacts in the field. Some kind of academic credit can be given to field biology students for regular monitoring during the spring semester and other western snowy plover habitat management tasks.

Some programs have used specially designed T-shirts that can be given after a specified amount of volunteer work is done as a form of recognition and reward. Volunteer uniforms are not necessary, but may or may not be desired to identify the western snowy plover volunteers for easy recognition by other staff and the public. Caps, windbreaker/jackets, or other useful items displaying an appropriate logo or patch can also be used as volunteer incentives.

Providing snacks or drinks to volunteers (donated by the management agency/organization) is a courtesy, and taking the volunteers to lunch can be another kind of recognition/reward. A special appreciation picnic, potluck, or barbeque can be planned. Part of the encouragement is in the camaraderie, bonding to the other volunteers, the program, and the information exchange between the participants.

Stories in a newsletter or local newspaper highlighting the volunteers' efforts and the impact they have on the western snowy plover habitat management program can be both recognition and an effective recruiting tool.

Certificates and plaques have been awarded in some programs when a volunteer puts in a designated number of hours. An example of a simple Award Application can be found in the forms section of this attachment. Established awards currently available that recognize volunteers' accomplishments include "The First Lady of California Volunteer Award," and "Take Pride in California", for which volunteers can be nominated. National Volunteers Week, celebrated in mid-April, and "Make a Difference Day" (last Saturday in October), sponsored by USA Weekend and the Points of Light Foundation, can be used as times to recognize volunteers and their efforts.

Additional References

Wilson, M., 1976. Effective Management of Volunteer Programs. Volunteer Management Associates, 279 S. Cedar Brook Road, Boulder, CO 80302.

Volunteer Management Series:
(Published through VMSystems/Heritage Arts Publishing, 1807 Prairie Ave., Downers Grove, IL 60515)

McCurley, S., and R. Lynch, 1989. Essential Volunteer Management.

Vineyard, S. 1981. Finding Your Way Through Volunteer Management.

Vineyard, S. 1984. Marketing Magic for Volunteer Programs.

Vineyard, S., and S. McCurley. 1987. 101 Ways to Raise Resources.

Vineyard, S., and S. McCurley. 1988. 101 Tips on Volunteer Recruitment.

Vineyard, S. 1989. Beyond Banquets, Plaques and Pins: Creative Ways to Recognize Volunteers.

FORMS

Examples of Forms Used in Volunteer Program Management

VOLUNTEER APPLICATION

NAME	HOME PHONE NO.	ALTERNATE PHONE NO.
STREET ADDRESS	CITY/STATE/ZIP CODE	

IF UNDER AGE 18, PROVIDE NAME ADDRESS AND PHONE NO. OF PARENT OR GUARDIAN

HAVE YOU EVER SERVED AS A ☐ Yes *(List locations and approximate dates below.)* ☐ No

POSITION YOU ARE SEEKING	HOW DID YOU HEAR ABOUT OUR VOLUNTEER PROGRAM?

WHY DO YOU WISH TO BECOME A

CURRENT OCCUPATION

HIGHLIGHT YOUR EDUCATIONAL AND EMPLOYMENT BACKGROUND/EXPERIENCES THAT YOU FEEL MAY CONTRIBUTE TO THE VOLUNTEER PROGRAM
(You may attach a resume.)

LIST THREE PERSONS NOT RELATED TO YOU WHO KNOW OF YOUR WORK QUALITY.

Name	Phone No.	Relationship

FOR CAMPGROUND HOST APPLICANTS ONLY

I understand that additional information, such as driver's license, Social Security Account Number and a background check may be required for certain volunteer positions. I hereby certify that all statements made on this application are true and complete.

SIGNATURE DATE

VOLUNTEER SERVICE AGREEMENT

A copy of the volunteer duty statement, or title and location of a master duty statement must be attached.

NAME *(First, MI, Last)*	HOME PHONE NO.	ALTERNATE PHONE NO.

HOME ADDRESS	CITY/STATE/ZIP CODE

CHECK ONE

☐ I am 18 years of age or older. ☐ I am under 18 years of age *(Attach a signed Parental/Guardian Permission Form)*

CHECK ONE

☐ I know of no health limitations which may restrict my performance of assigned duties. ☐ I DO know of health limitations which may restrict my performance of assigned duties.

The following information is to be provided *only* if it is indicated as being required for a specific volunteer position, which may include authorized travel, handling of money, driving a personal vehicle or other duties.

SOCIAL SECURITY NO.	DRIVER'S LICENSE No.: State:	DATE OF BIRTH

I hereby allow *a background check.*

SIGNATURE DATE

▶

SERVICE AGREEMENT

I agree to comply with all policies, regulations, directives and instructions, and to conduct myself in a professional manner, consistent with the same standards as established for employees.

Further, I understand that I will not be compensated for any work performed as a Volunteer, other than for reimbursement of necessary and allowable expenses when authorized in my duty statement

VOLUNTEER ASSIGNED TO	WORK LOCATION

I hereby volunteer my services as a ***Volunteer for the job duties attached.***

VOLUNTEER SIGNATURE DEPARTMENT REPRESENTATIVE DATE

▶ ▶

EMERGENCY NOTIFICATION

IN CASE OF ACCIDENT, SERIOUS ILLNESS OR EMERGENCY, I WOULD LIKE TO HAVE THE FOLLOWING PERSON NOTIFIED.

FIRST

NAME	RELATIONSHIP	HOME PHONE NO.	BUSINESS PHONE NO.

STREET ADDRESS	CITY/STATE/ZIP CODE

SECOND

NAME	RELATIONSHIP	HOME PHONE NO.	BUSINESS PHONE NO.

STREET ADDRESS	CITY/STATE/ZIP CODE

VOLUNTEER SEPARATED ON *(Date)*	SUPERVISOR SIGNATURE
	▶

VOLUNTEER GROUP SERVICES AGREEMENT

SPONSORING GROUP OR ORGANIZATION *(Include name, address, zip code, and telephone number.)*

SPONSORING GROUP OR ORGANIZATION LIAISON *(Include name, address, zip code, and telephone number.)*

PERSON FROM SPONSORING GROUP OR ORGANIZATION TO BE NOTIFIED IN AN EMERGENCY *(Include name, address, zip code, and telephone number.)*

PROJECT DESCRIPTION *(If more space needed, continue on reverse.)*

AGREEMENT BY THE GROUP OR ORGANIZATION

We agree to volunteer our services to accomplish the work described above to assist the with the following conditions:

- ***Roster:*** *We agree to provide with an attendance roster including name, address, and phone number of participants.*
- ***Juveniles:*** *Our group represents that if juveniles (under age 18) are participating, we assume all responsibility for obtaining formal parental/guardian consent for their attendance and participation.*
- ***Waiver of Liability and Hold Harmless Agreement:*** *We understand and acknowledge that does not provide insurance coverage for recognized volunteer groups or for the volunteer activities encompassed by this agreement. We accept the responsibility for providing accident insurance and/or workers' compensation coverage for the individuals participating in this volunteer activity, and if requested, agree to provide evidence of insurance coverage. We agree to indemnify and hold harmless and its employees, officers, sponsors, and agents, from any claim for injury or damages to any person arising out of or in any way connected to this volunteer activity.*
- ***Termination:*** *Either we, or may terminate this agreement, at any time, by notifying the other party in writing.*

GROUP/ORGANIZATION REPRESENTATIVE'S PRINTED NAME AND SIGNATURE TITLE DATE

AGREEMENT BY

accepts this offer, and agrees, while this agreement is in effect, to provide technical guidance and such materials and supplies, equipment, and facilities as are needed and are available to accomplish this project, except as may be specified in an attachment.

REPRESENTATIVE'S SIGNATURE DATE

THIS AGREEMENT WAS ☐ COMPLETED ☐ TERMINATED ON *(Date)*_____

REPRESENTATIVE'S SIGNATURE DATE

PARENTAL/GUARDIAN PERMISSION
FOR JUVENILE VOLUNTEERS

Juveniles are defined as individuals under the age of 18. They may register and become volunteers if they provide written consent from a parent or guardian. reserves the right to accept or deny any juvenile (under age 18) volunteer's application based on:

1) program/operational needs,
2) the applicant's maturity and knowledge,
3) the applicant's demonstrated interest in department programs, and
4) the availability of adult supervision.

Juvenile volunteers must be assigned an adult supervisor. Arrangements for this supervision must be approved by the

NAME OF PARENT OR LEGAL GUARDIAN (Please print)	TELEPHONE NO.
STREET ADDRESS	
CITY/STATE/ZIP CODE	

_____, a juvenile, has my permission to participate in
(Volunteer's Name)
volunteer activities. I have read and agree to the requirements stated above.

☐ I know of no health limitations which may restrict this volunteer's performance of assigned duties.

☐ I DO know of health limitations which may restrict this volunteer's performance of assigned duties.

PARENT OR LEGAL GUARDIAN'S SIGNATURE	DATE
▶	

UNIT/LOCATION	
ACTIVITY/PROJECT	DATE(S) OF ACTIVITY/PROJECT

CHECK ONE:

☐ **Long-Term Volunteer** *(more than 3 days)*: As part of the application process, prospective long-term underage volunteers are required to sign a Volunteer Services Agreement and have this parental permission form signed by the same parent or guardian.

☐ **Short-Term Volunteer** *(3 days or less)*: Volunteer Services Agreement not required.

EVENT SUPERVISOR OR VOLUNTEER PROGRAM LEADER SIGNATURE	DATE
▶	

SPECIAL PROJECT OR ACTIVITY SIGN-IN

LOCATION	ACTIVITY/PROJECT	LEADER	DATE(S) OF ACTIVITY/PROJECT

AGREEMENT, WAIVER AND RELEASE OF CLAIMS
(To be read aloud to the group)

Each of the undersigned agrees as follows:

1. *That I am volunteering my services for the above-described event on a voluntary basis without anticipation of payment of any kind;*
2. *That I will perform assigned tasks which are within my physical capability to the best of my ability, and that I will not undertake tasks that are beyond my ability or physical capability;*
3. *That I am familiar with the safe operation and use of equipment and tools that I may utilize in connection with this volunteer activity, and that I will not undertake to use any equipment or tools with which I am unfamiliar or do not know how to operate safely;*
4. *That I will perform only those tasks assigned, observe all safety rules, and use care in the performance of my assignments;*
5. *That I hereby release and discharge, agree to indemnify and hold harmless, and their agents, employees and representatives, from all claims, demands, actions or judgments which I, or my heirs, executors, administrators or assigns, may have for any and all injuries and damages, known or unknown, caused by or arising out of the above-described activity;*
6. *That I specifically acknowledge that I am engaging in this activity as a volunteer, at my own request and risk, and not as a agent, official, officer or representative, and further acknowledge that I am not entitled to any compensation, benefit or insurance coverage from nor will I make any such claim;*
7. *That I have read this agreement, waiver and release of claims, and understand its terms, and that I voluntarily execute it with full knowledge of its significance.*

SIGNATURE	PRINTED NAME	ADDRESS *(optional)*	TELEPHONE NO. *(optional)*
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERSONS UNDER 18 YEARS OF AGE MAY NOT SIGN THIS FORM *(Use reverse if needed)*

Form OR1114-3 (May, 1993)

Volunteer Hours Record

Date Completed _____
Reassign Volunteer ☐

Name: _____ Supervisor: _____

Job Title: _____ Schedule: _____

In the squares below, indicate the daily number of hours worked. List reimbursements on the back.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
Jan																																
Feb																																
Mar																																
Apr																																
May																																
Jun																																
Jul																																
Aug																																
Sep																																
Oct																																
Nov																																
Dec																																

Reimbursements received *(through travel voucher or imprest)*

Date	Amount	Description	Sub Activity Code

Training - Work Related Training Completed *(formal and informal)*:

Date Completed	Title (or description)	# of Hours	Certified yes or no? (if applicable)

Volunteers

Orientation Checklist

Name _____ **Date** _____

_____

___ Sign Volunteer Service Agreement

___ Discuss volunteer's job description

___ List all property issued (keys, uniforms, books, etc. issued)

___ Overview of history and philosophy of

___ Introduce volunteer to staff

___ Provide tour of the office and other facilities

___ Appearance standards

___ Schedule

___ Sexual harassment, discrimination, and related policies

___ Conflict of interest and standards of professional conduct

___ Worker's compensation and tort liability

___ Provide initial training

___ Review general safety procedures and for specific job responsibilities

___ Explain practices (obtaining supplies, vehicle/equipment operation, telephone use, etc.)

___ Assure that volunteer knows whom to contact to have any other questions answered.

___ Other _____

___ Other _____

___ Other _____

___ Other _____

Lead person completing checklist _____

Date orientation completed _____

EVALUATION FORM I
VOLUNTEER EVALUATION

(To be completed by the volunteer's supervisor upon request of the volunteer at the end of a project, upon termination of the volunteer's tour of duty, or every six months for long term volunteers).

1. Supervisor's Name _____

2. Volunteer's Name _____

3. Volunteer's Dates of Service _____ to _____

4. Office or Field Station _____

5. Projects Completed _____

_____

_____

6. Were the projects completed to your expectations? If not, why? _____

_____

_____

_____

7. Did the volunteer fulfill the criteria established in his/her project description? If not, what was not addressed?

_____

_____

_____

8. What were the volunteer's major strengths in relation to the assigned volunteer duties?

_____

_____

_____

_____

9. What were the volunteer's weaknesses in relation to the assigned volunteer duties?

_____

_____

_____

10. What were the major skills used by the volunteer to complete his/her duties and their proficiency in using these skills?

_____

_____

_____

_____

11. Additional Comments:

_____

_____

_____

_____

EVALUATION FORM II (Optional)
PROGRAM/PROJECT EVALUATION

(To be filled out by the volunteer upon completion of a major project, termination of their tour of duty, or once a year.)

1. Volunteer's Name (optional) _____

2. Dates of Service _____ to _____

3. Office of Field Station _____

4. Project(s) Completed _____

_____

_____

_____

5. Were clear directions provided on the duties you were to perform? Did you receive a copy of your volunteer services agreement?

_____

_____

_____

_____

6. Were you given adequate training for these duties? _____

_____

_____

_____

_____

7. Were you given adequate supervision for these duties? _____

_____

_____

_____

_____

8. How would you improve the volunteer program at this site? _____

_____

_____

_____

9. What are the strengths of the volunteer program? _____

_____

_____

_____

_____

10. Did the volunteer experience meet your expectations? If not, why? _____

_____

_____

_____

_____

11. Additional Comments: _____

_____

_____

_____

_____

AWARD APPLICATION

Name of Recipient:_____

Brief explanation of what the recipient did or does to warrant the award:

Short description of contribution to be placed on award.
(approximately 25 words)

Name of who will sign award:

_____

Date to be placed on award (usually date of presentation):

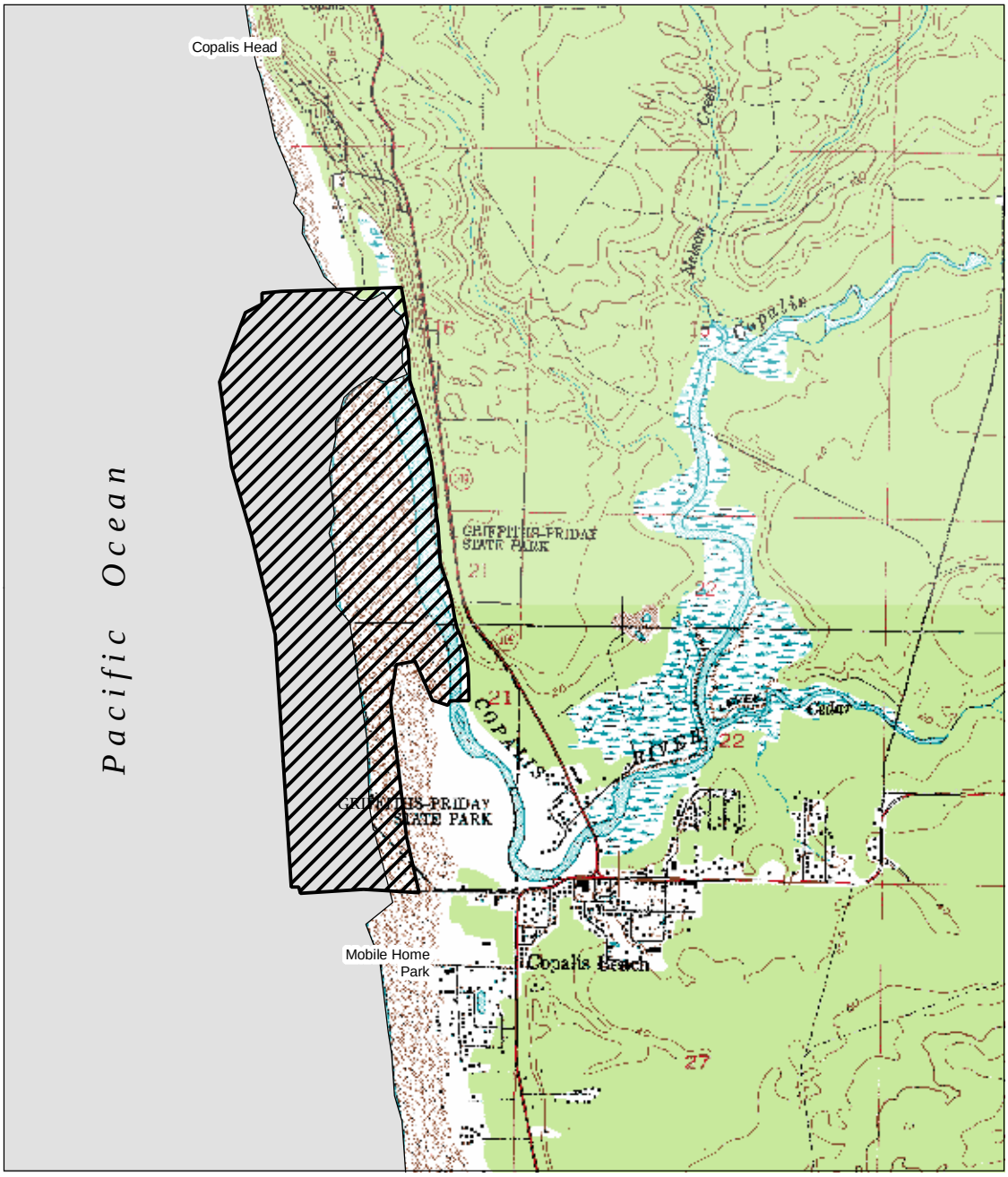
_____

A two-week lead time is requested.

APPENDIX L

MAPS OF SNOWY PLOVER SITES

Figure L - 1. Copalis Spit (WA-1), Grays Harbor County, Washington.



Legend

WSPL Breeding & Wintering Locations

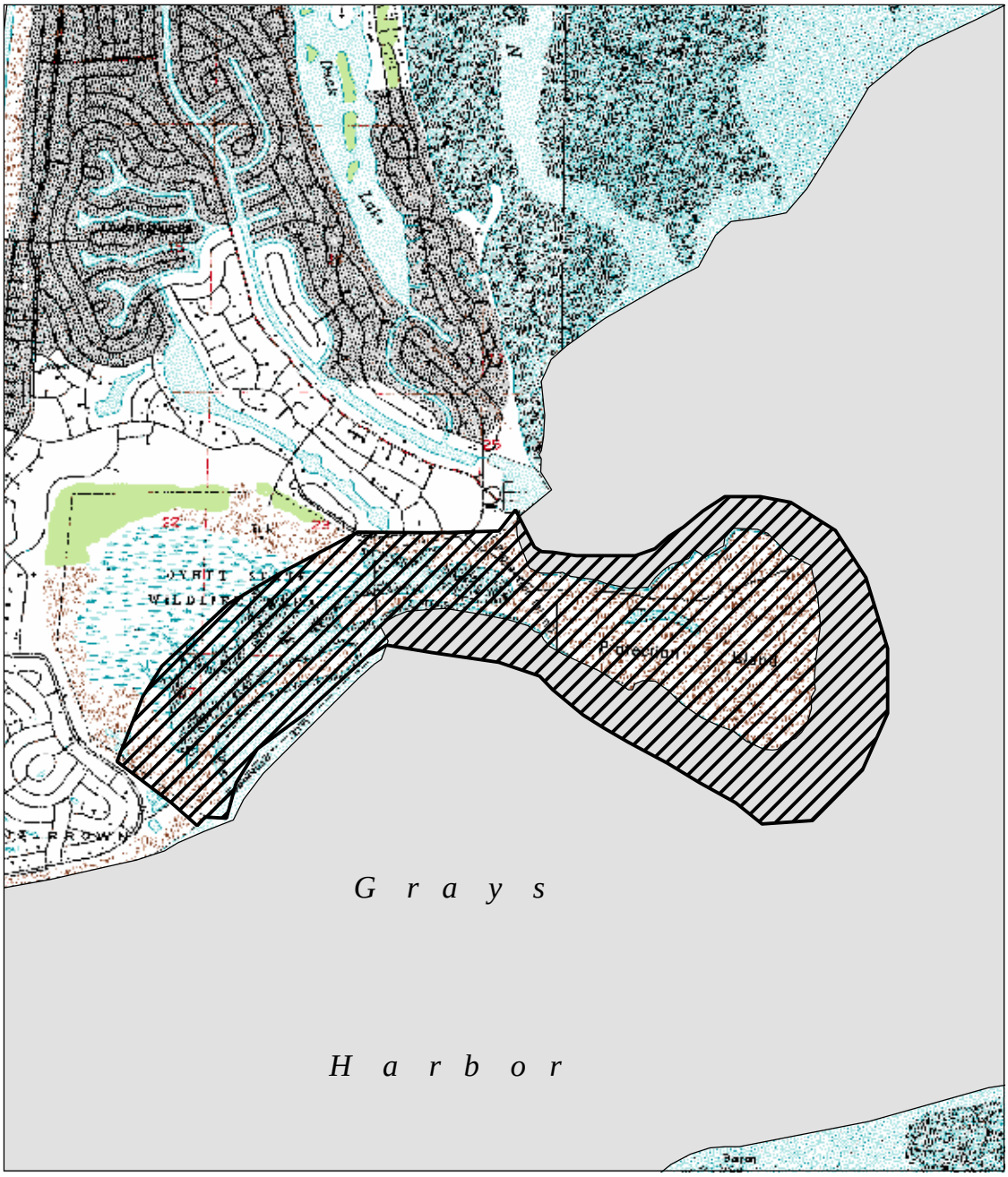
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 2. Damon Point/Oyhut Wildlife Area (WA-2), Grays Harbor County, Washington.



Legend

WSPL Breeding & Wintering Locations

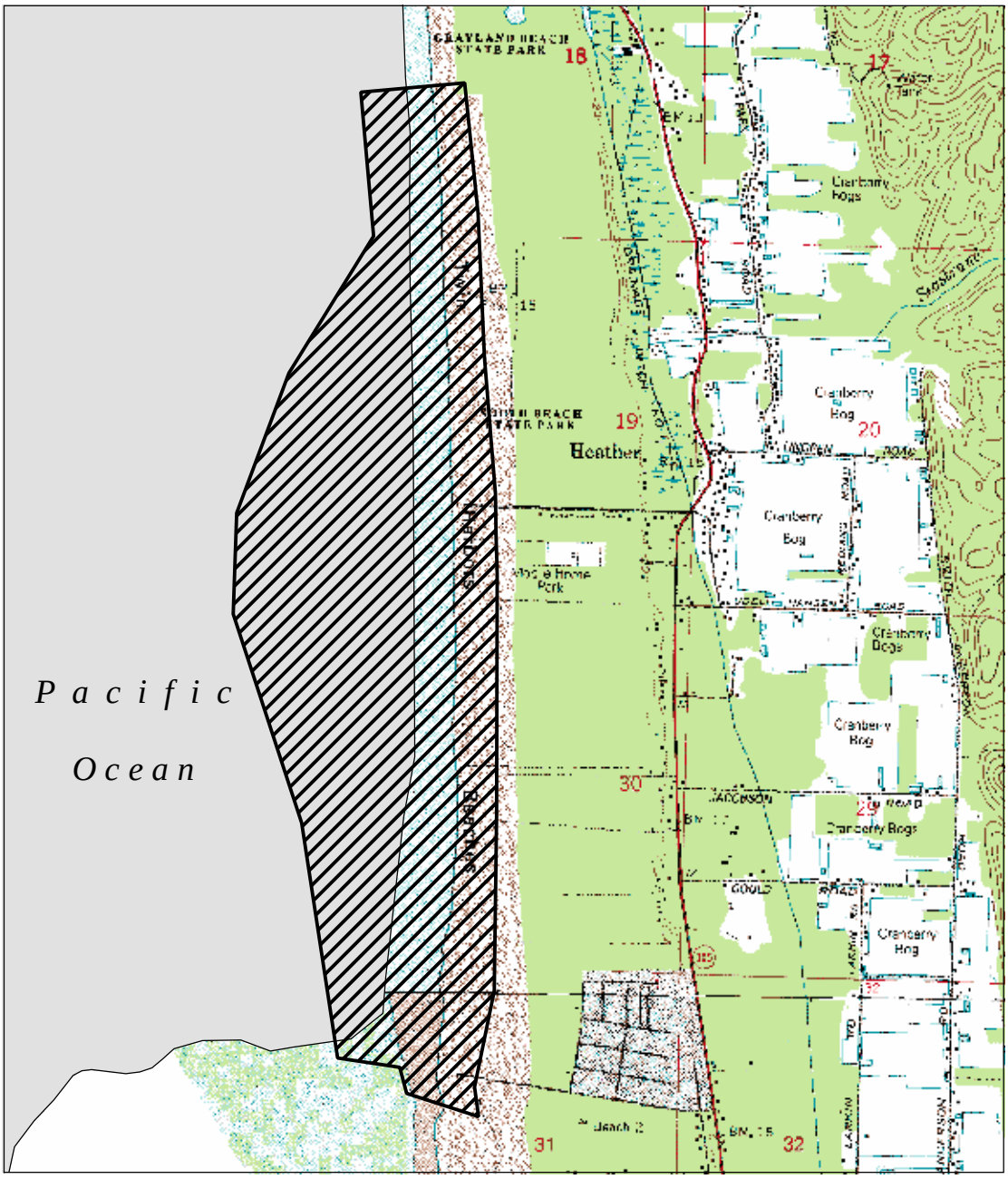
0 0.5 1 Miles

0 1 2 Kilometers

Scale 1: 40,000

N

Figure L - 3. Midway Beach (WA-4), Pacific County, Washington.



Legend

WSPL Breeding & Wintering Locations

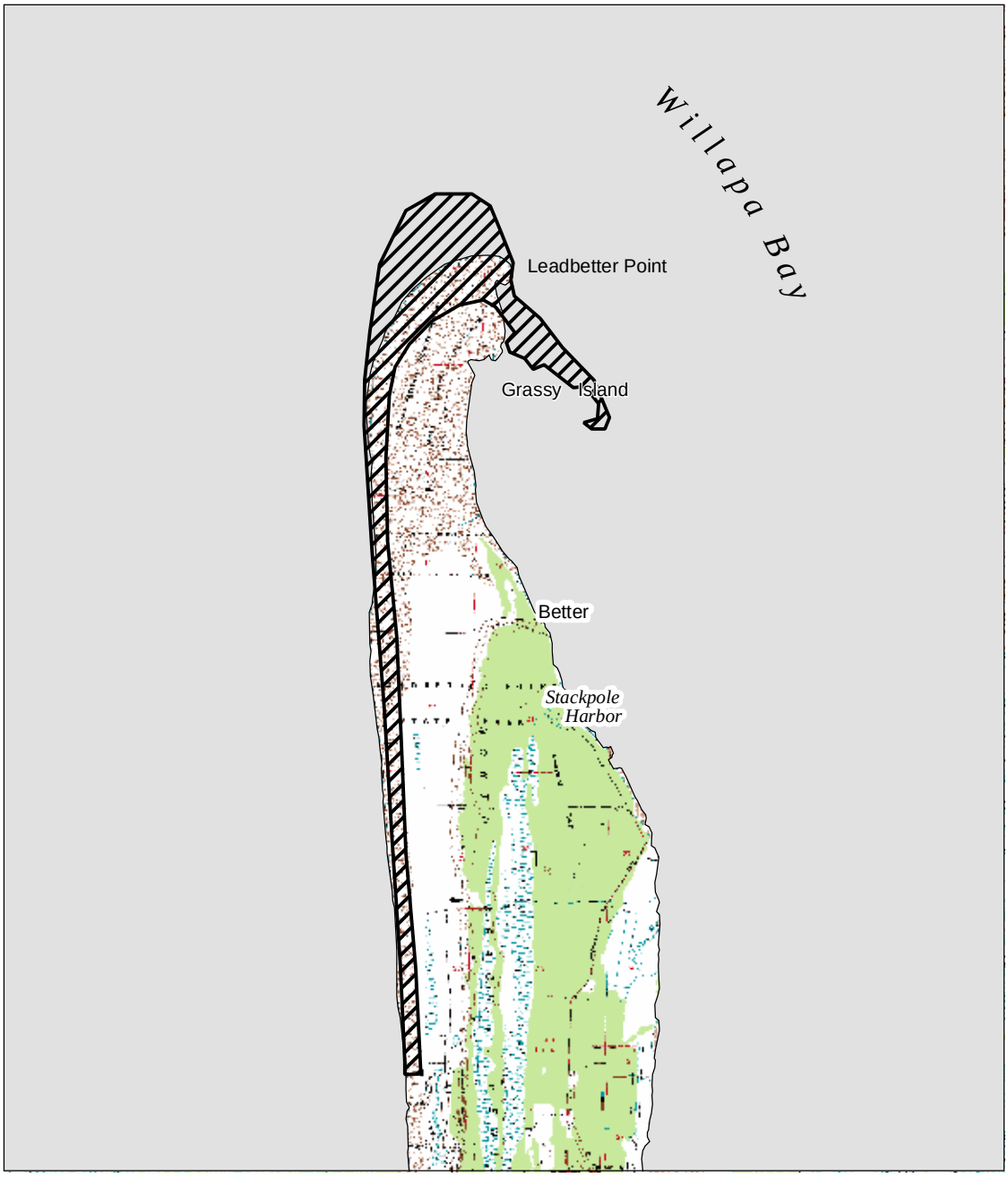
0.3 0 0.3 Miles

0.4 0 0.4 Kilometers

Scale 1: 30,000

N

Figure L - 4. Leadbetter Point/Gunpowder Sands (WA-5), Pacific County, Washington.



Legend

WSPL Breeding & Wintering Locations

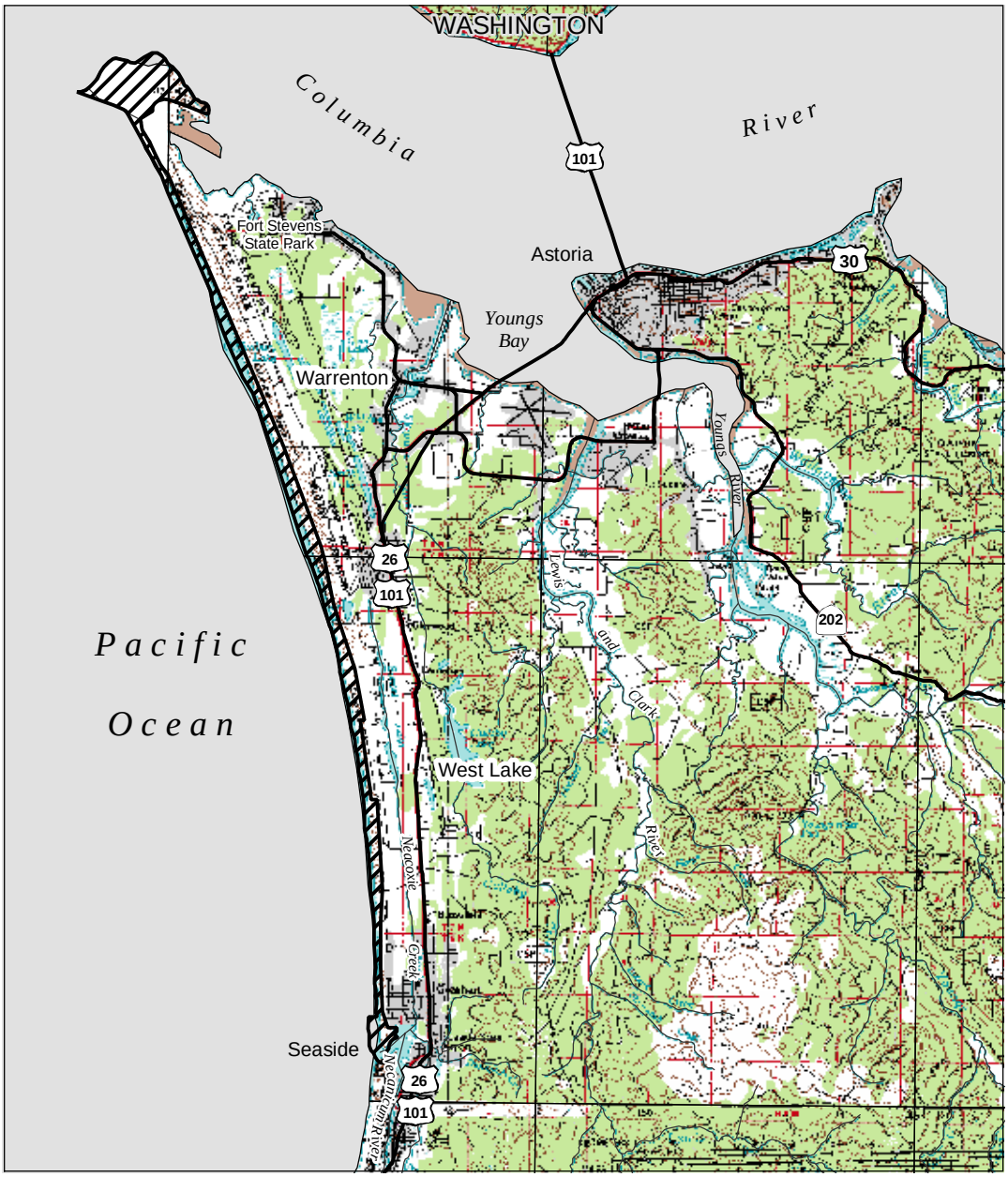
1 0 1 Miles

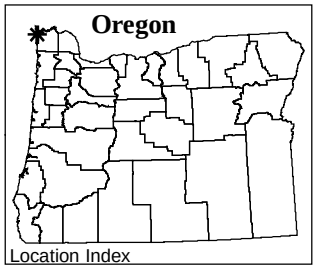
1 0 1 Kilometers

Scale 1: 80,000

N

Figure L - 5. Columbia River to Necanicum River (OR-1), Clatsop County, Oregon.





Legend

WSPL Breeding & Wintering Locations

2 0 2 Miles

3 0 3 Kilometers

Scale 1: 180,000

N

Figure L - 6. Nehalem Spit (OR-2), Tillamook County, Oregon.

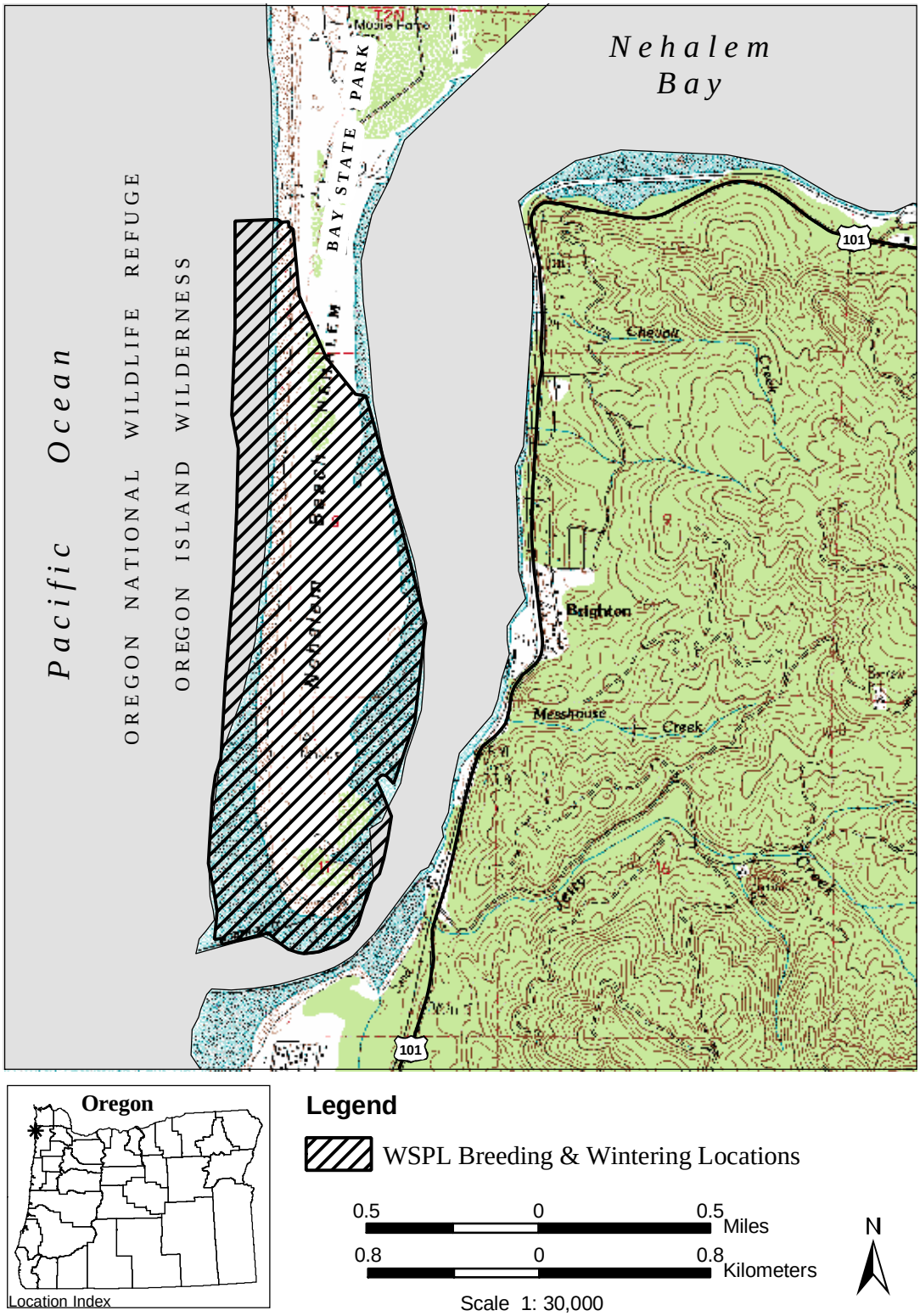


Figure L - 7. Bayocean Spit (OR-3), Tillamook County, Oregon.

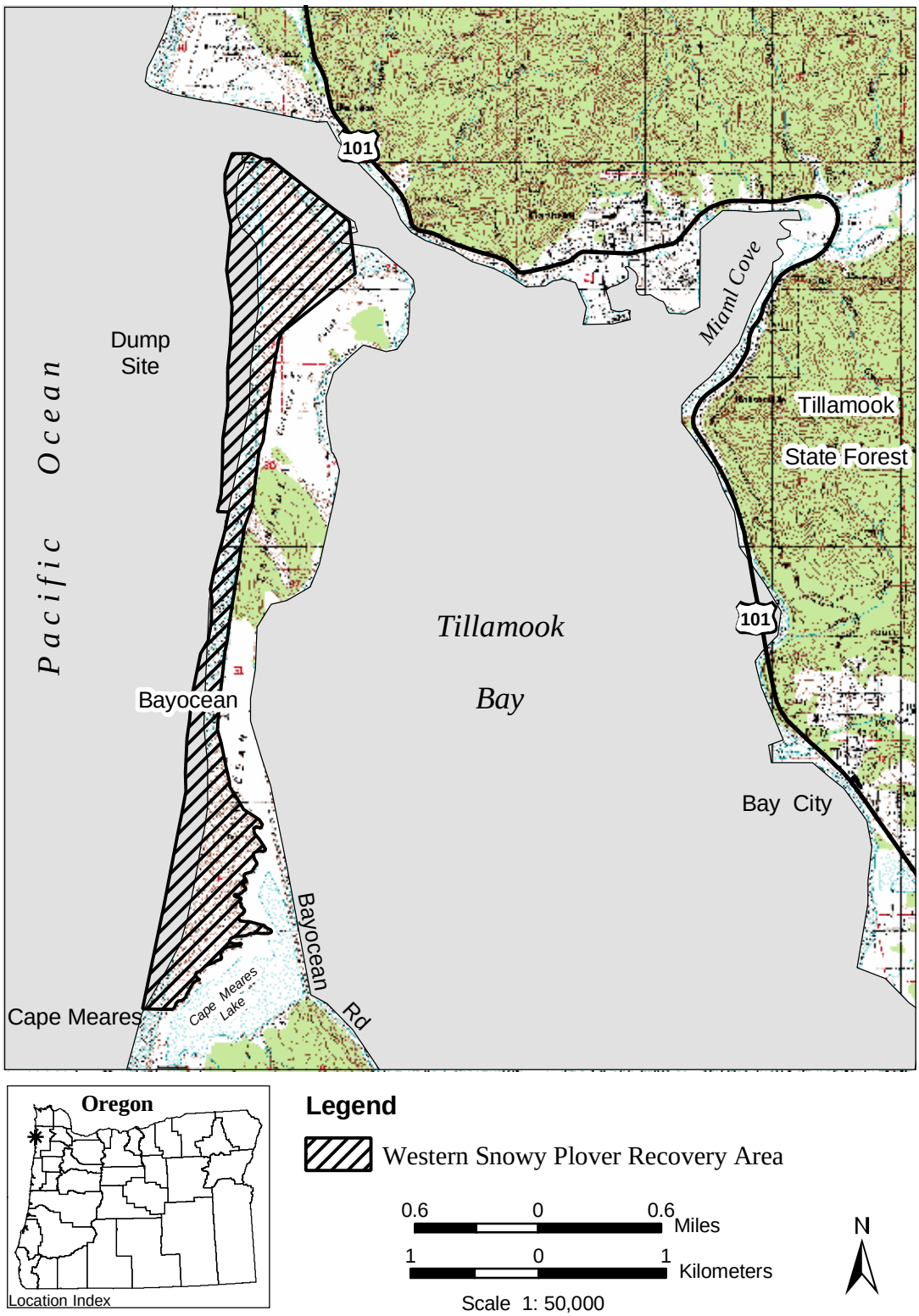
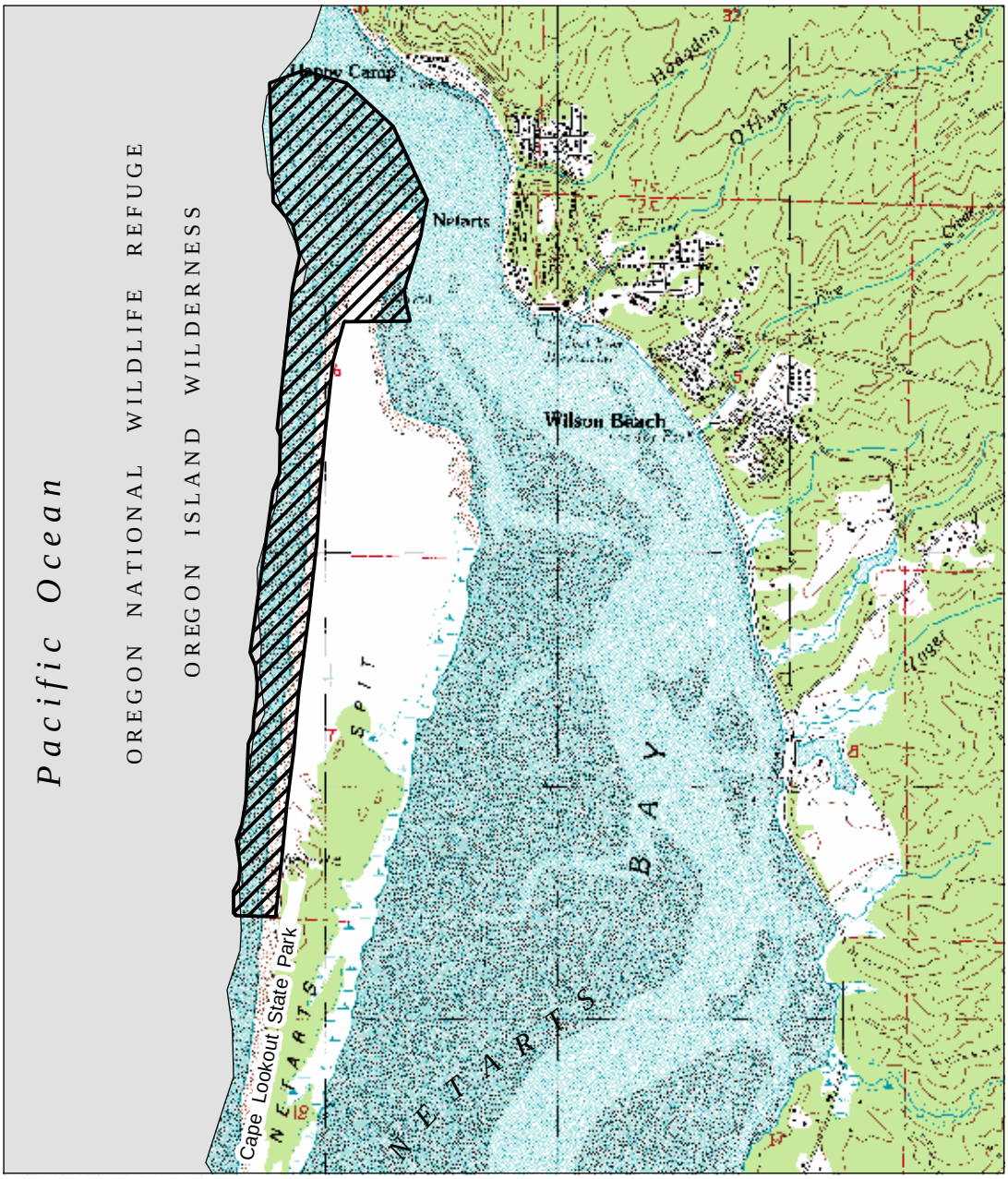
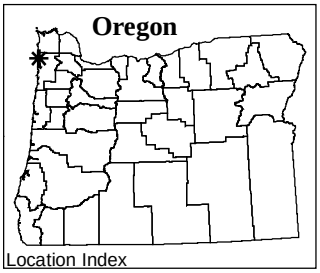


Figure L - 8. Netarts Spit (OR-4), Tillamook County, Oregon.





Legend

WSPL Breeding & Wintering Locations

0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 9. Sand Lake Spits (OR-5), Tillamook County, Oregon.

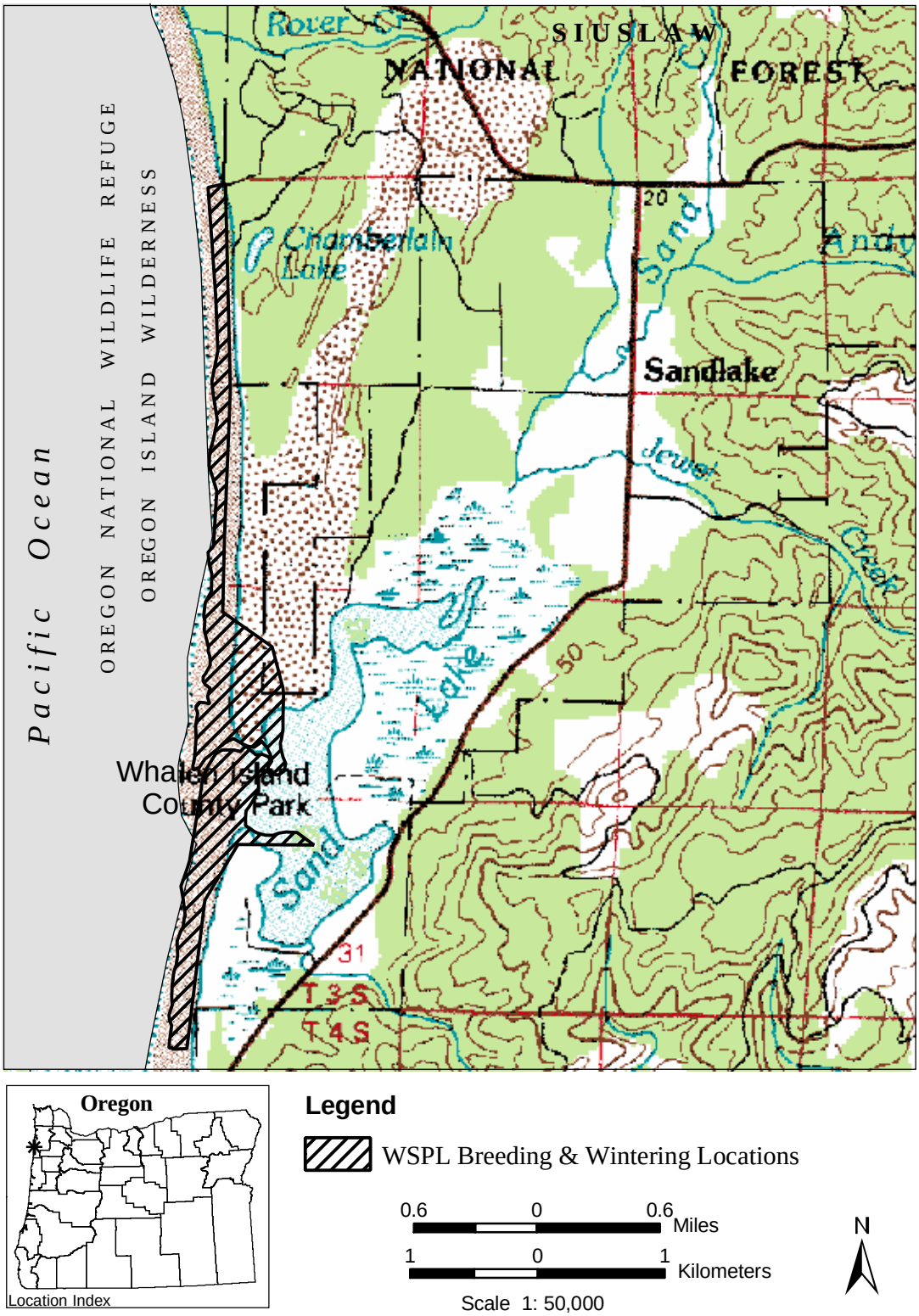
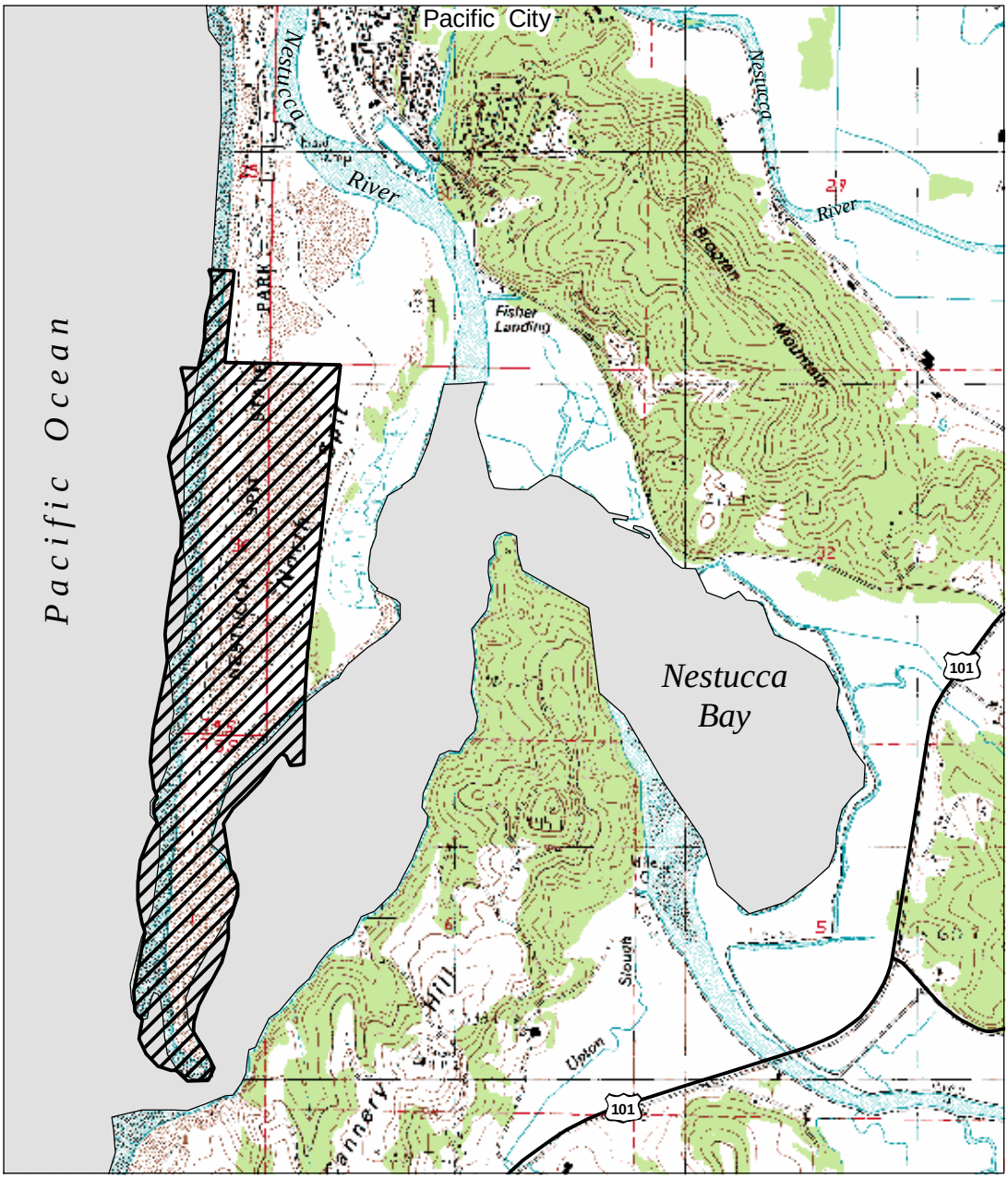
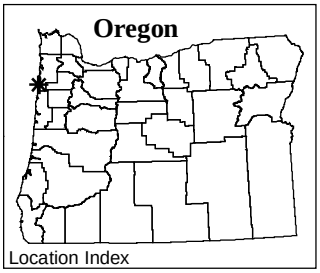


Figure L - 10. Nestucca Spit (OR-6), Tillamook County, Oregon.





Legend

WSPL Breeding & Wintering Locations

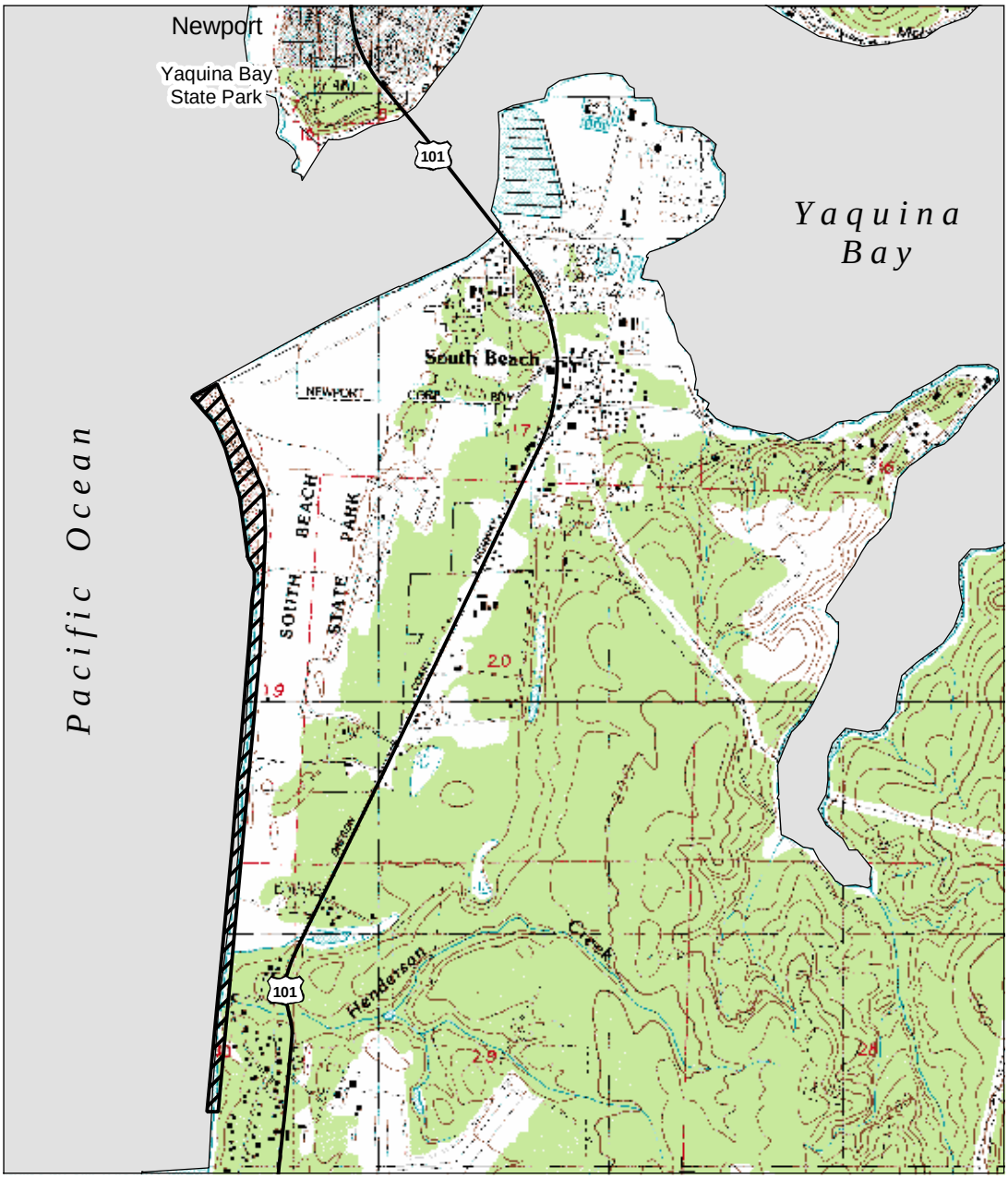
0.5 0 0.5 Miles

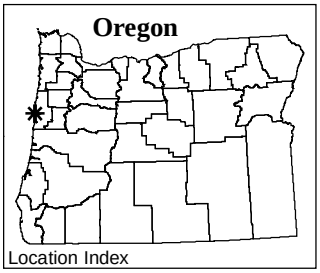
0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 11. South Beach; Newport (OR-7), Lincoln County, Oregon.





Legend

WSPL Breeding & Wintering Locations

0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 12. Heceta Head to Siuslaw River (OR-8), Lane County, Oregon.

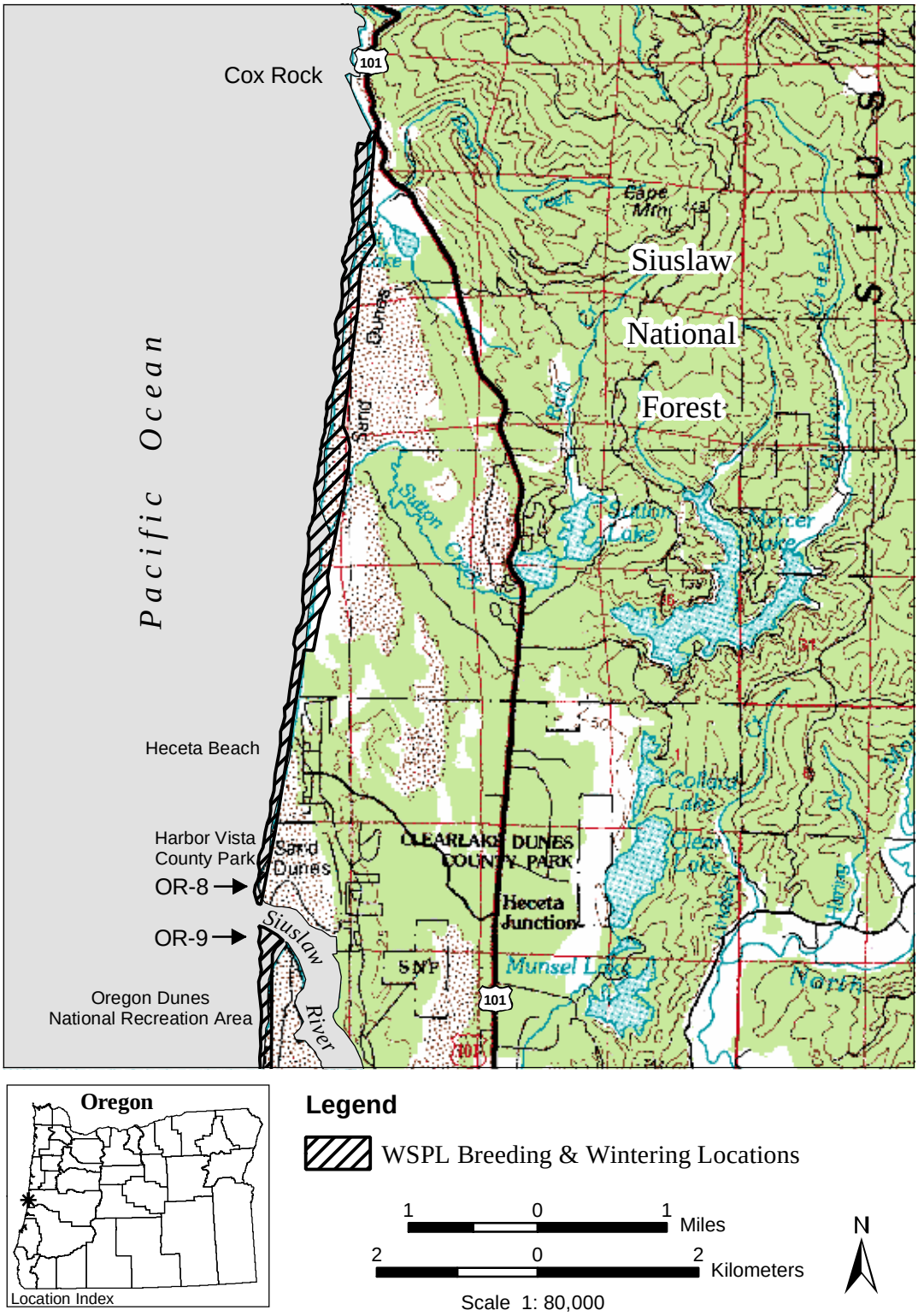
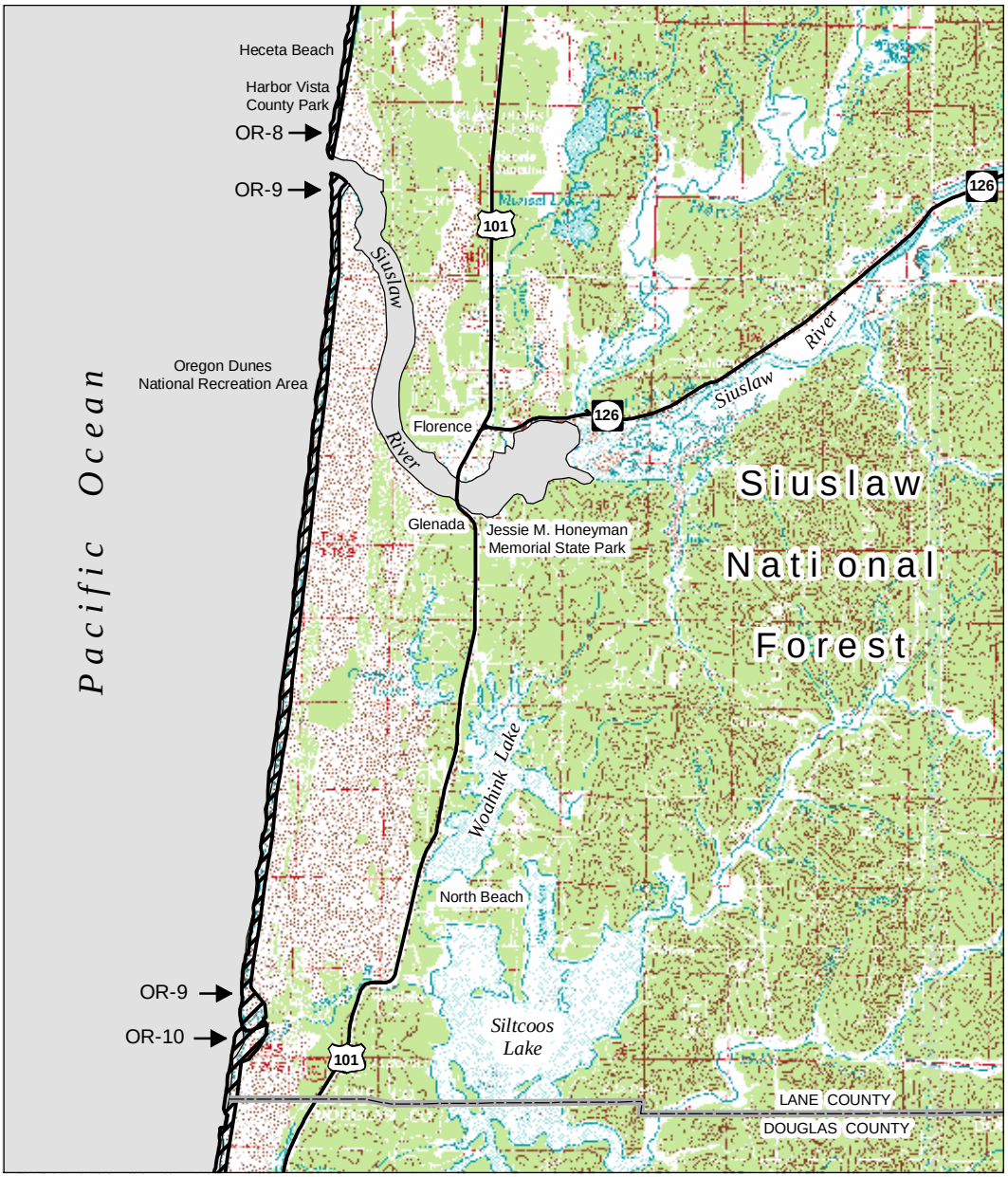
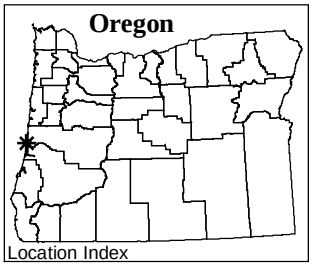


Figure L - 13. Siuslaw River to Siltcoos River (OR-9), Lane County, Oregon.





Legend

WSPL Breeding & Wintering Locations

2 0 2 Miles

3 0 3 Kilometers

Scale 1: 130,000

N

Figure L - 14. Siltcoos River to Threemile Creek (OR-10), Douglas County, Oregon.

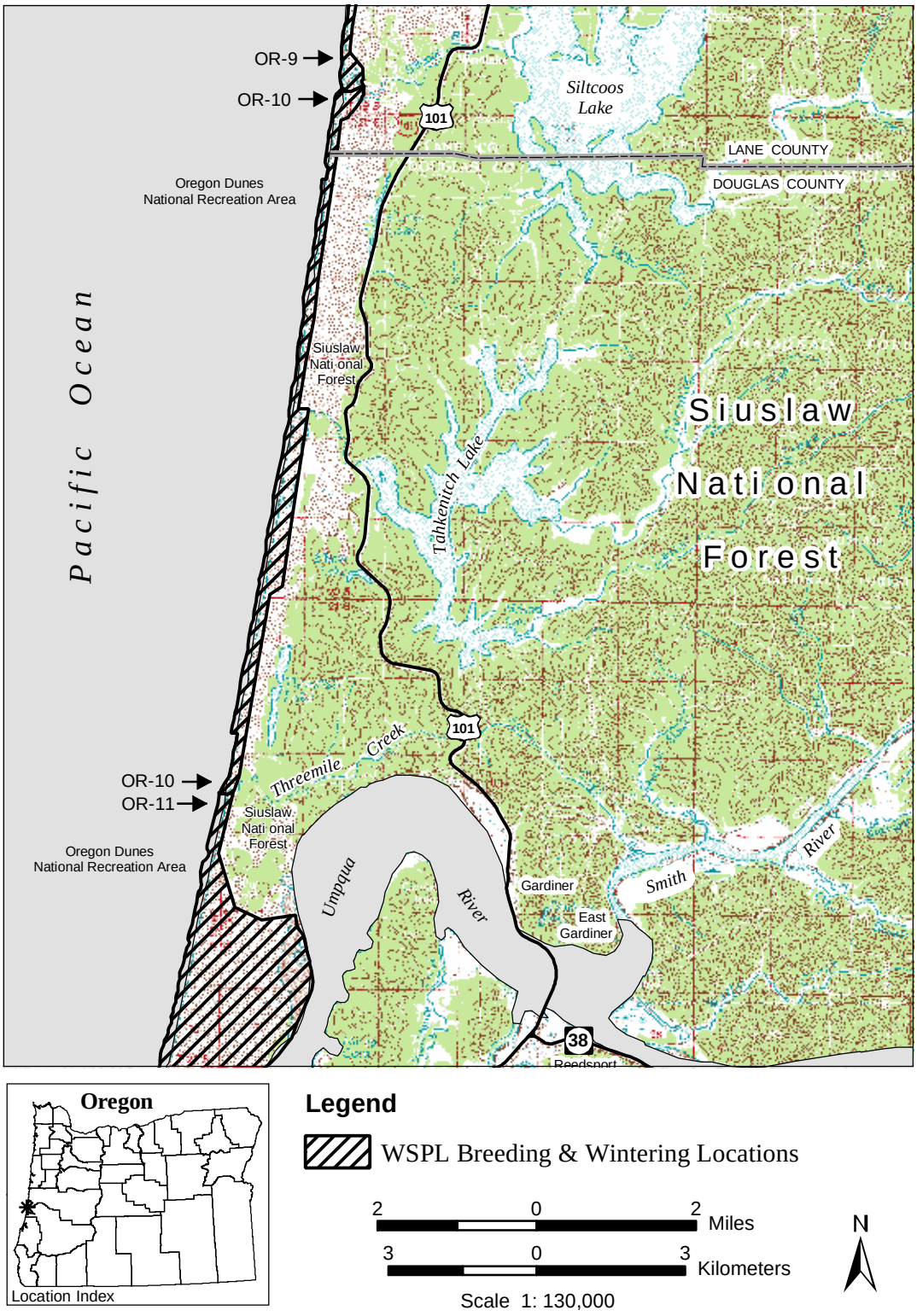


Figure L - 15. Threemile Creek to Umpqua River (OR-11), Douglas County, Oregon.

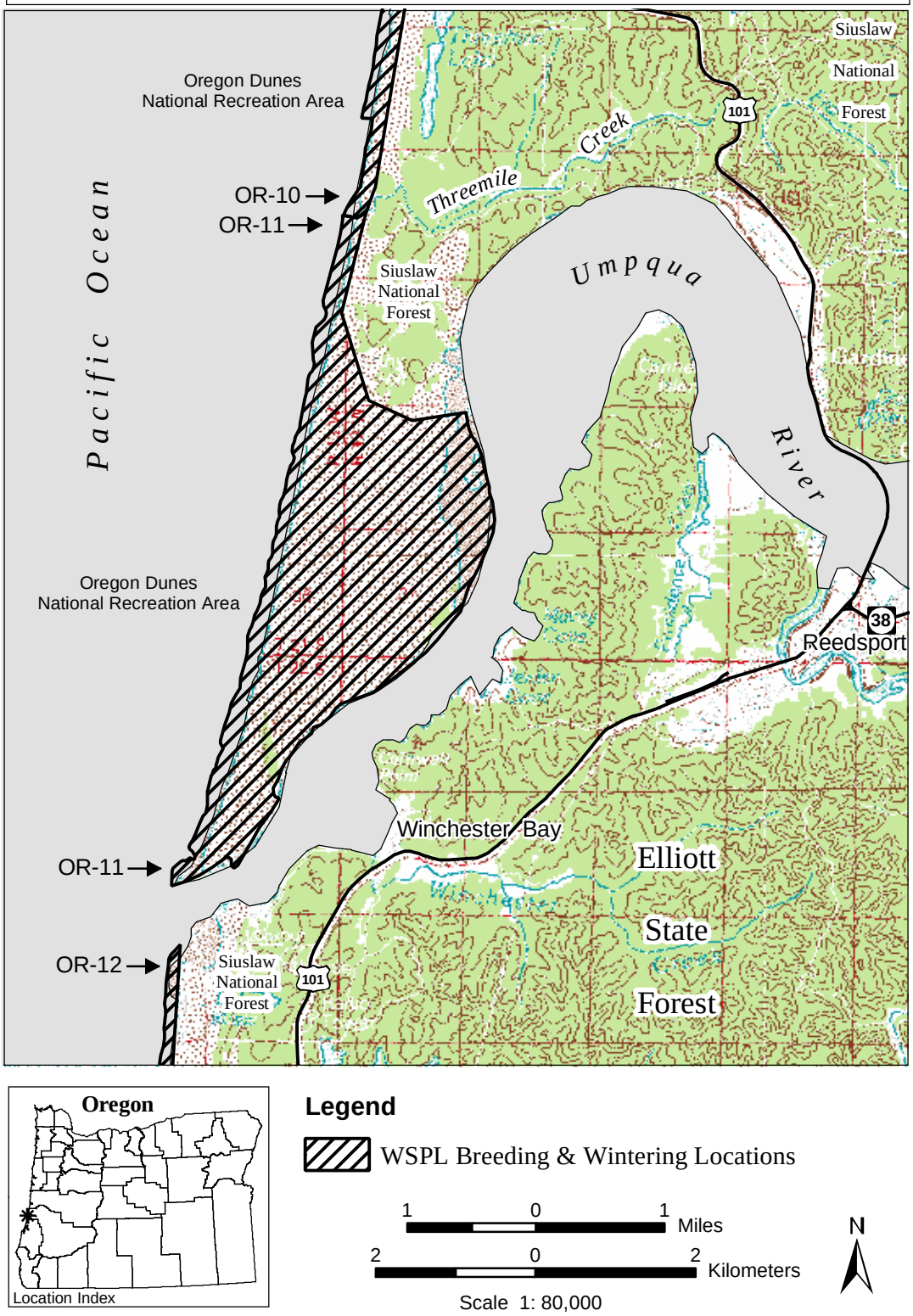
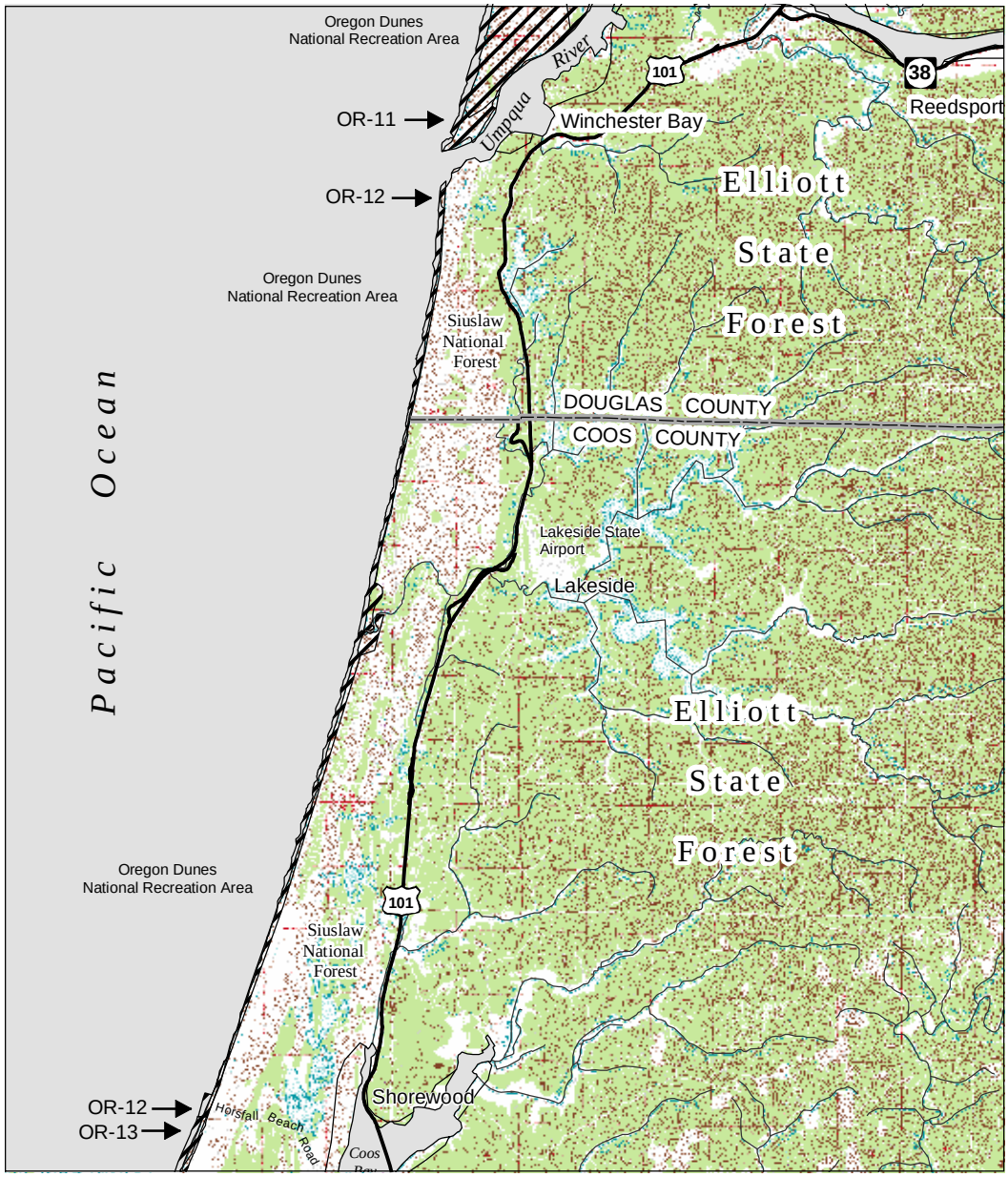
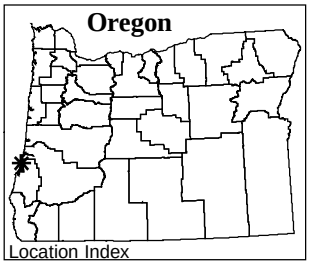


Figure L - 16. Umpqua River to Horsfall Beach (OR-12), Douglas and Coos County, Oregon.





Legend

WSPL Breeding & Wintering Locations

2 0 2 Miles

3 0 3 Kilometers

Scale 1: 180,000

N

Figure L - 17. Horsfall Beach to Coos Bay (OR-13), Coos County, Oregon.

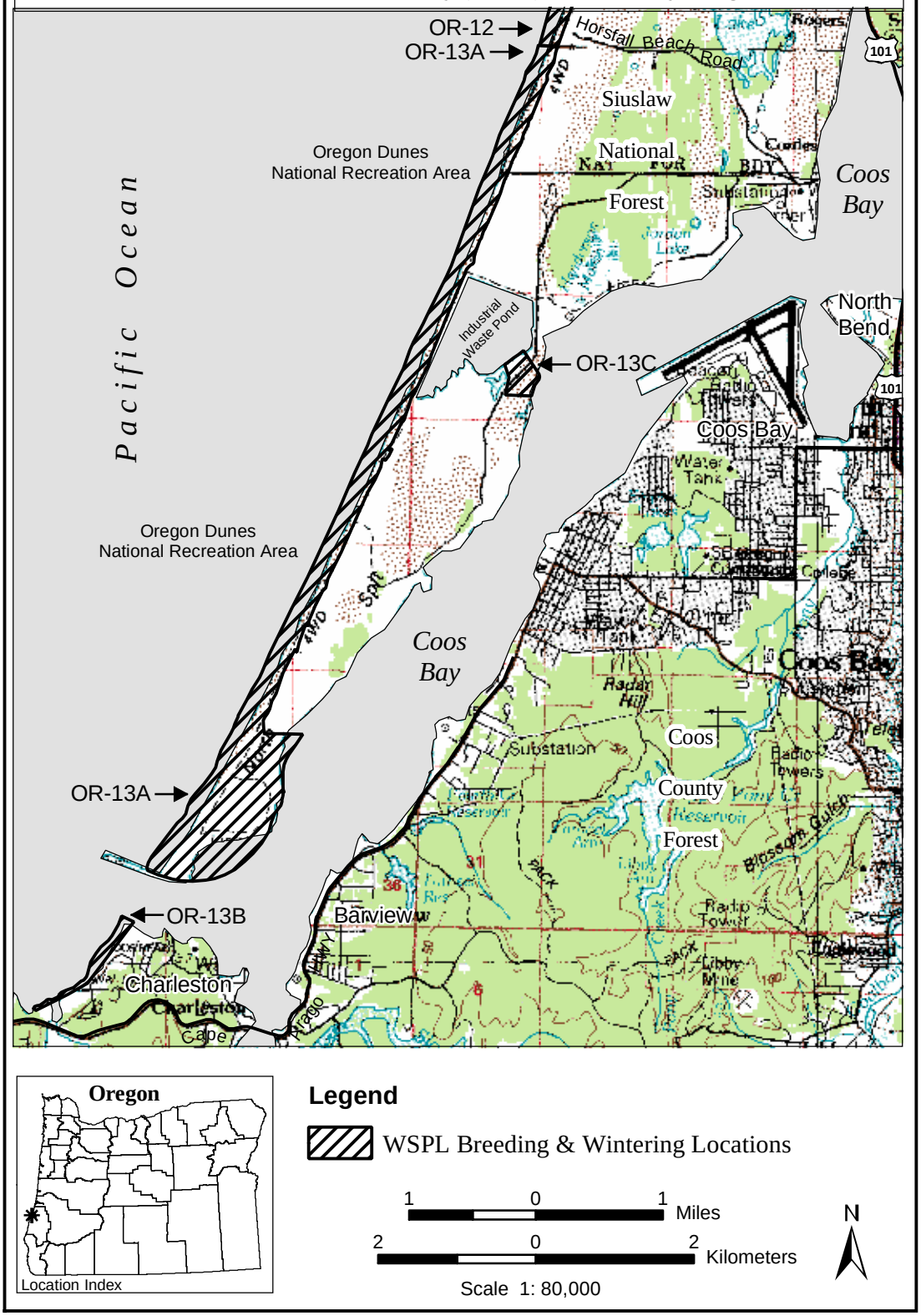
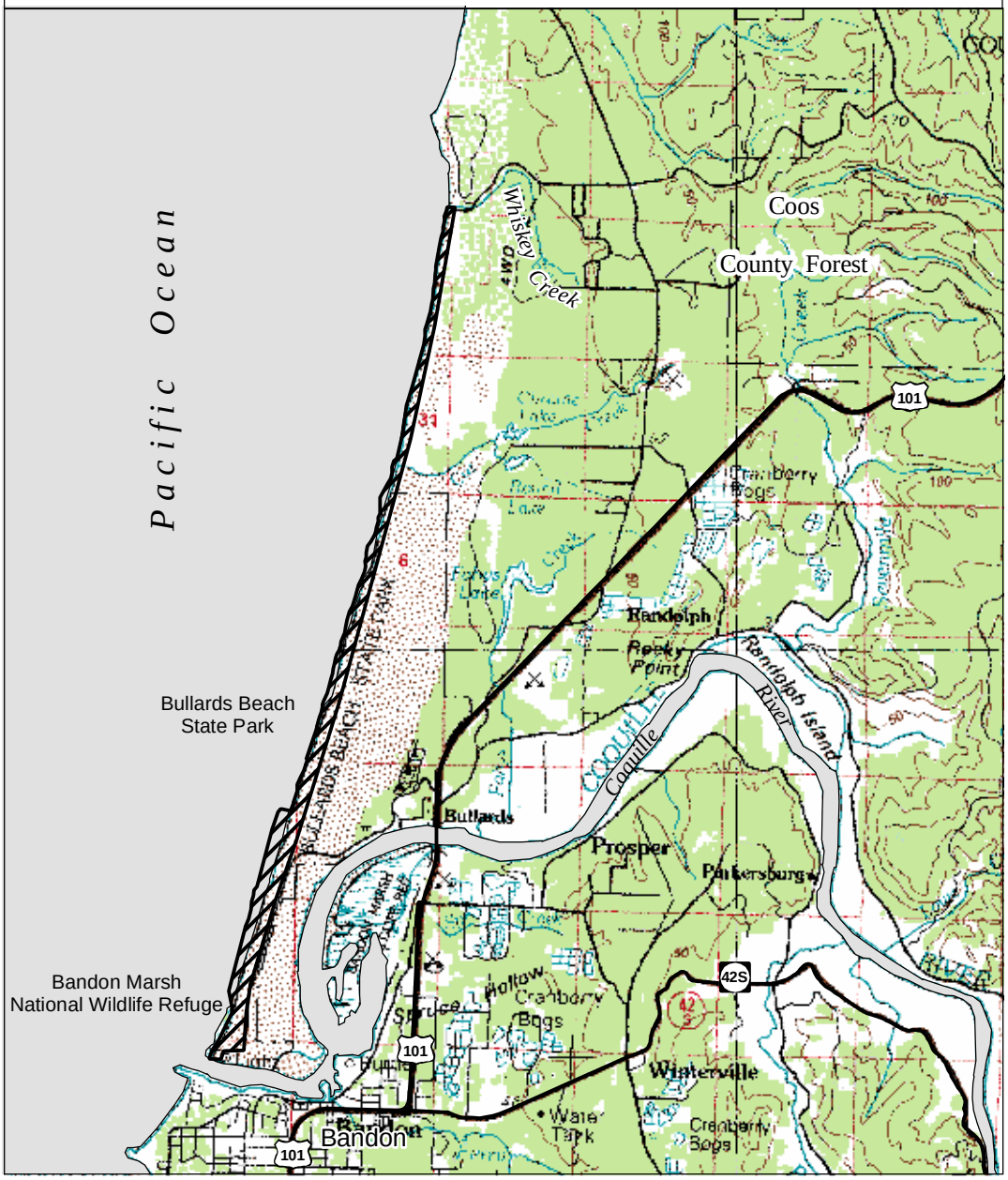
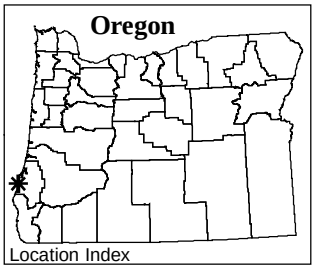


Figure L - 18. Whiskey Creek to Coquille River (OR-14), Coos County, Oregon.





Legend

WSPL Breeding & Wintering Locations

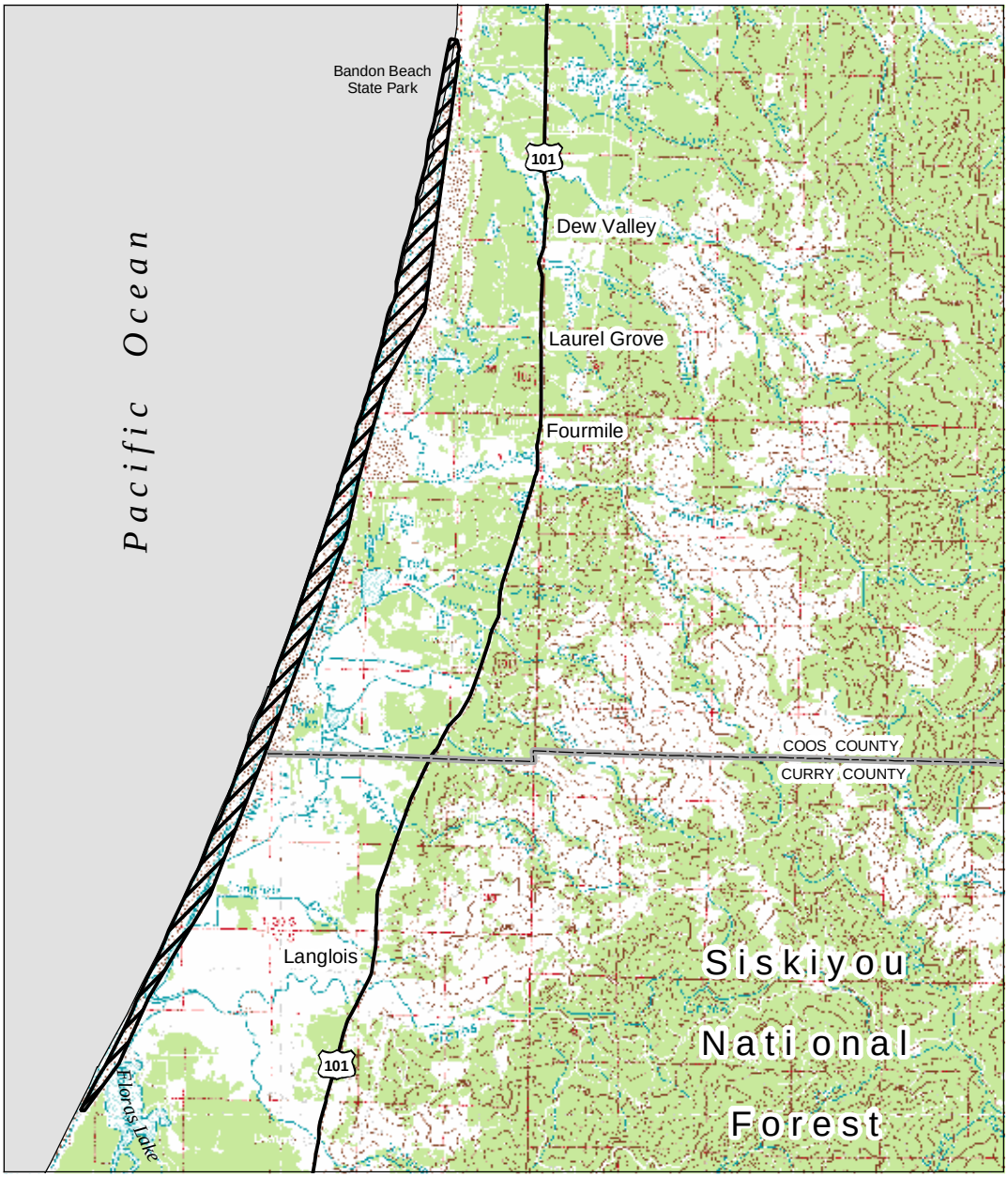
1 0 1 Miles

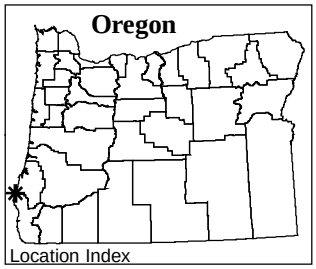
2 0 2 Kilometers

Scale 1: 80,000

N

Figure L - 19. Bandon State Park to Floras Lake (OR-15), Coos and Curry County, Oregon.





Legend

WSPL Breeding & Wintering Locations

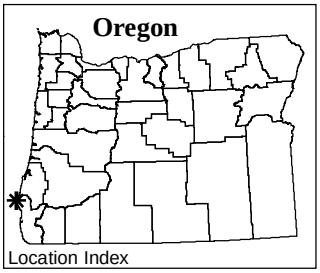
2 0 2 Miles

3 0 3 Kilometers

Scale 1: 130,000

N

Figure L - 20. Sixes River Mouth (OR-18), Curry County, Oregon.



Legend

WSPL Breeding & Wintering Locations

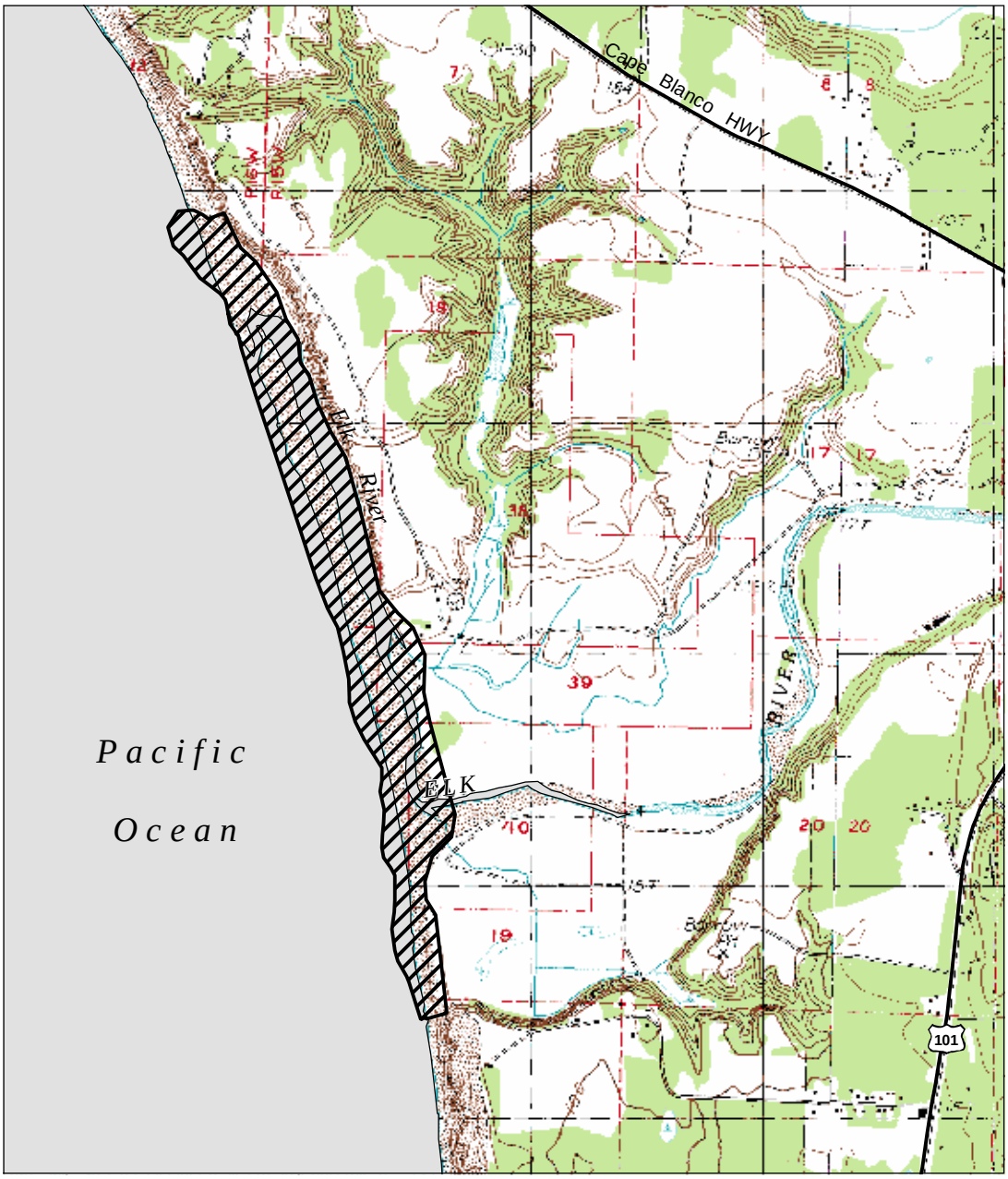
0.5 0 0.5 Miles

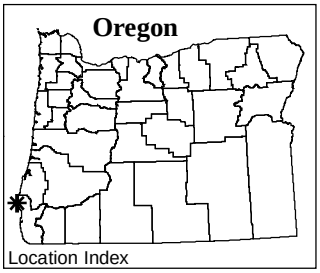
0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 21. Elk River Mouth (OR-19), Curry County, Oregon.





Legend

WSPL Breeding & Wintering Locations

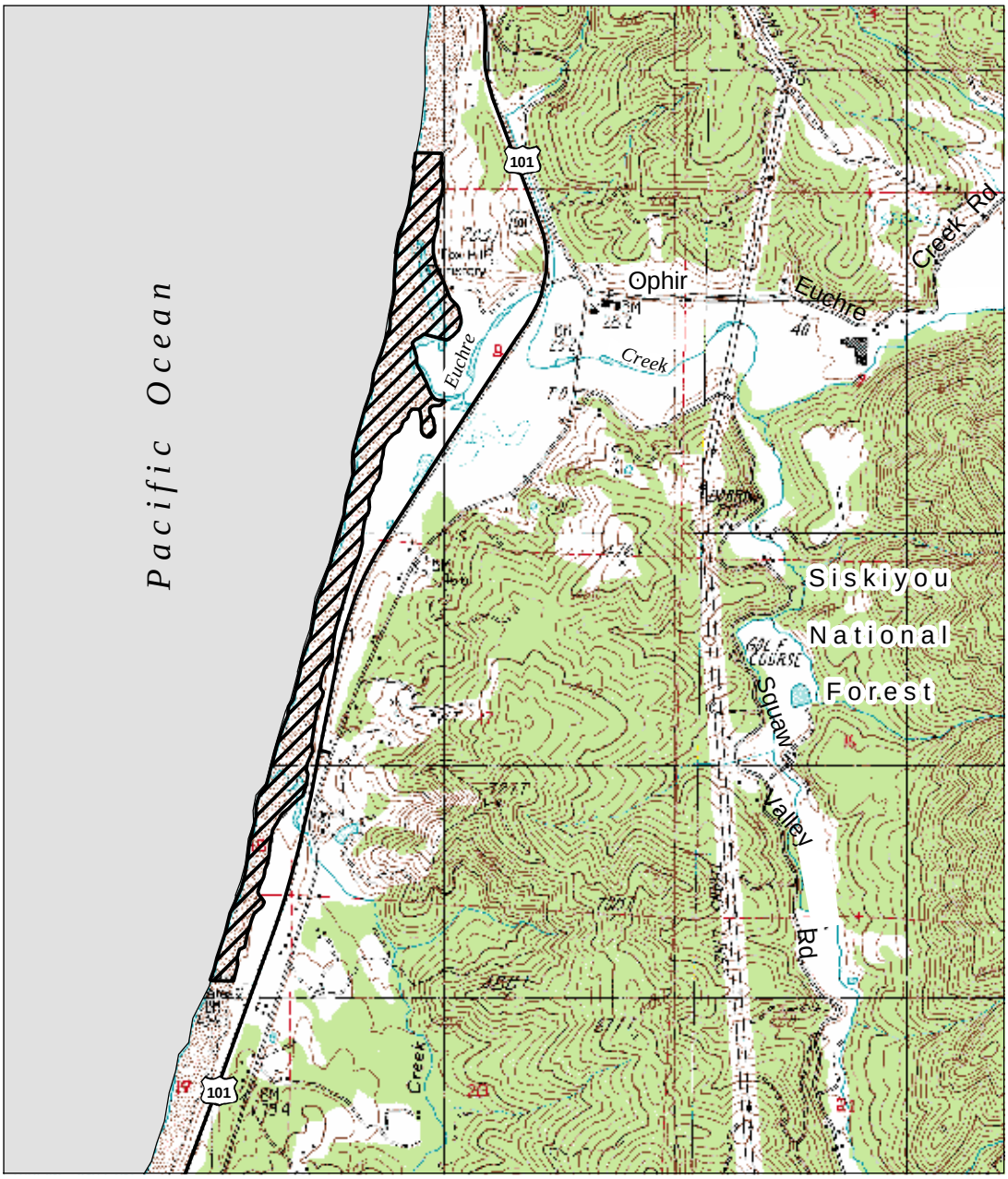
0.5 0 0.5 Miles

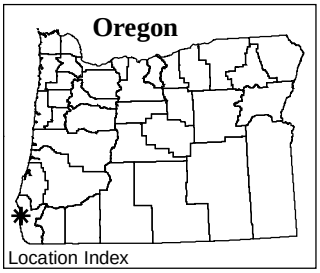
0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 22. Euchre Creek (OR-16), Curry County, Oregon.





Legend

WSPL Breeding & Wintering Locations

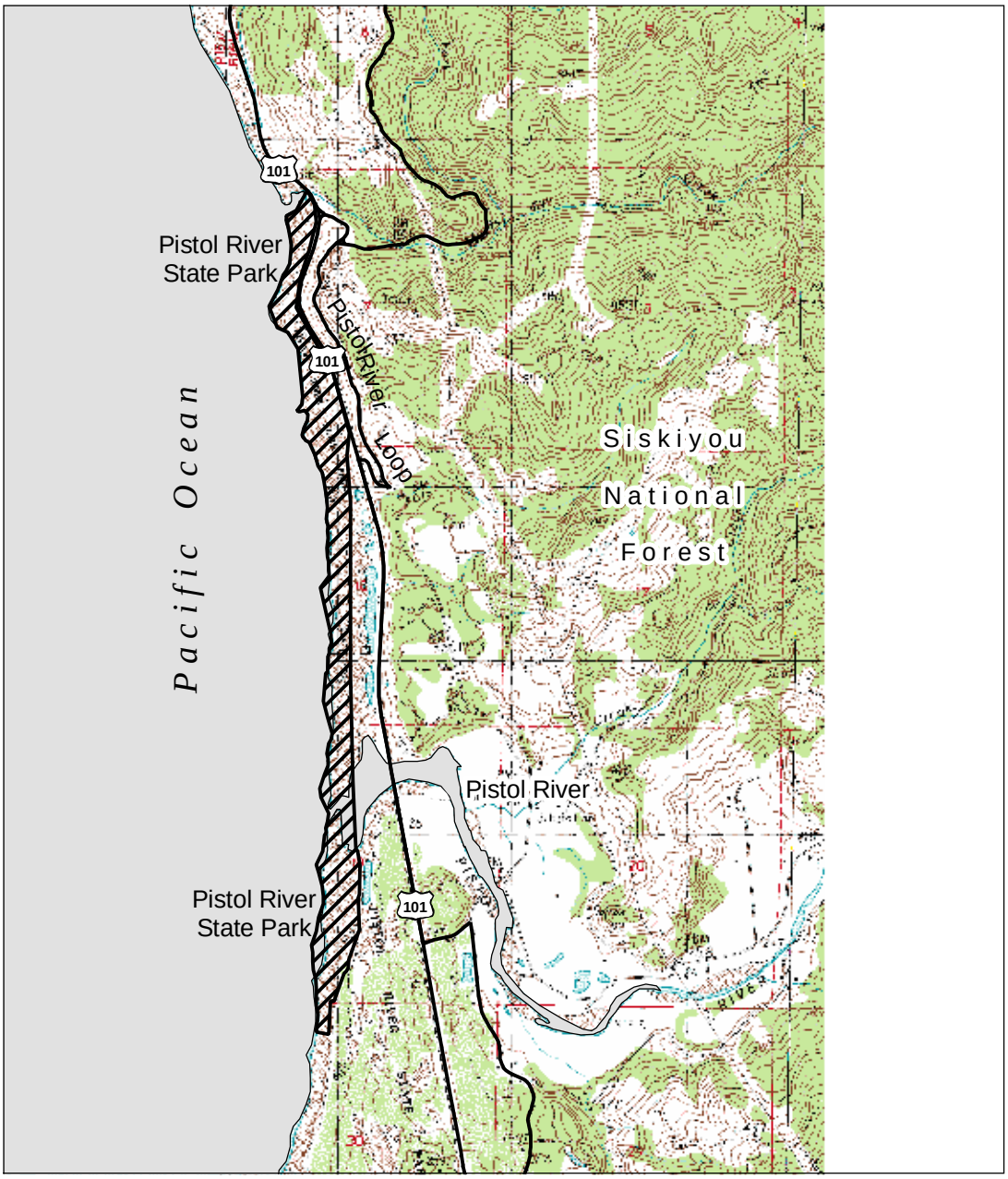
0.5 0 0.5 Miles

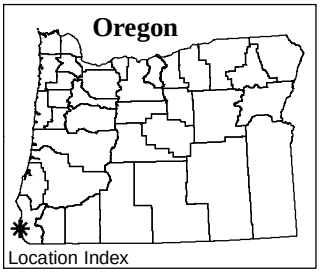
0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 23. Pistol River (OR-17), Curry County, Oregon.





Legend

WSPL Breeding & Wintering Locations

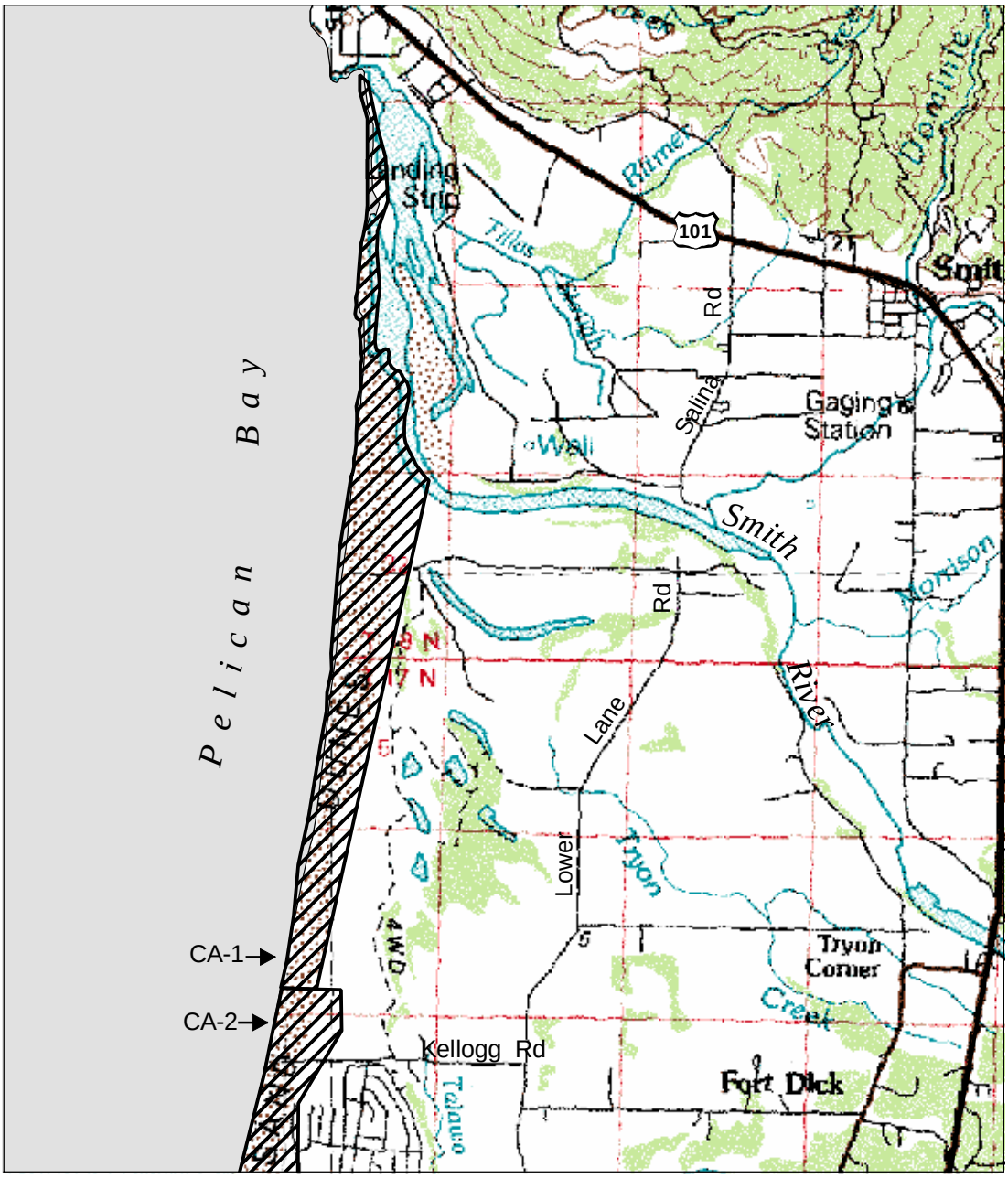
0.75 0 0.75 Miles

1 0 1 Kilometers

Scale 1: 30,000

N

Figure L - 24. Smith River Mouth (CA-1), Del Norte County, California.



Legend

WSPL Breeding & Wintering Locations

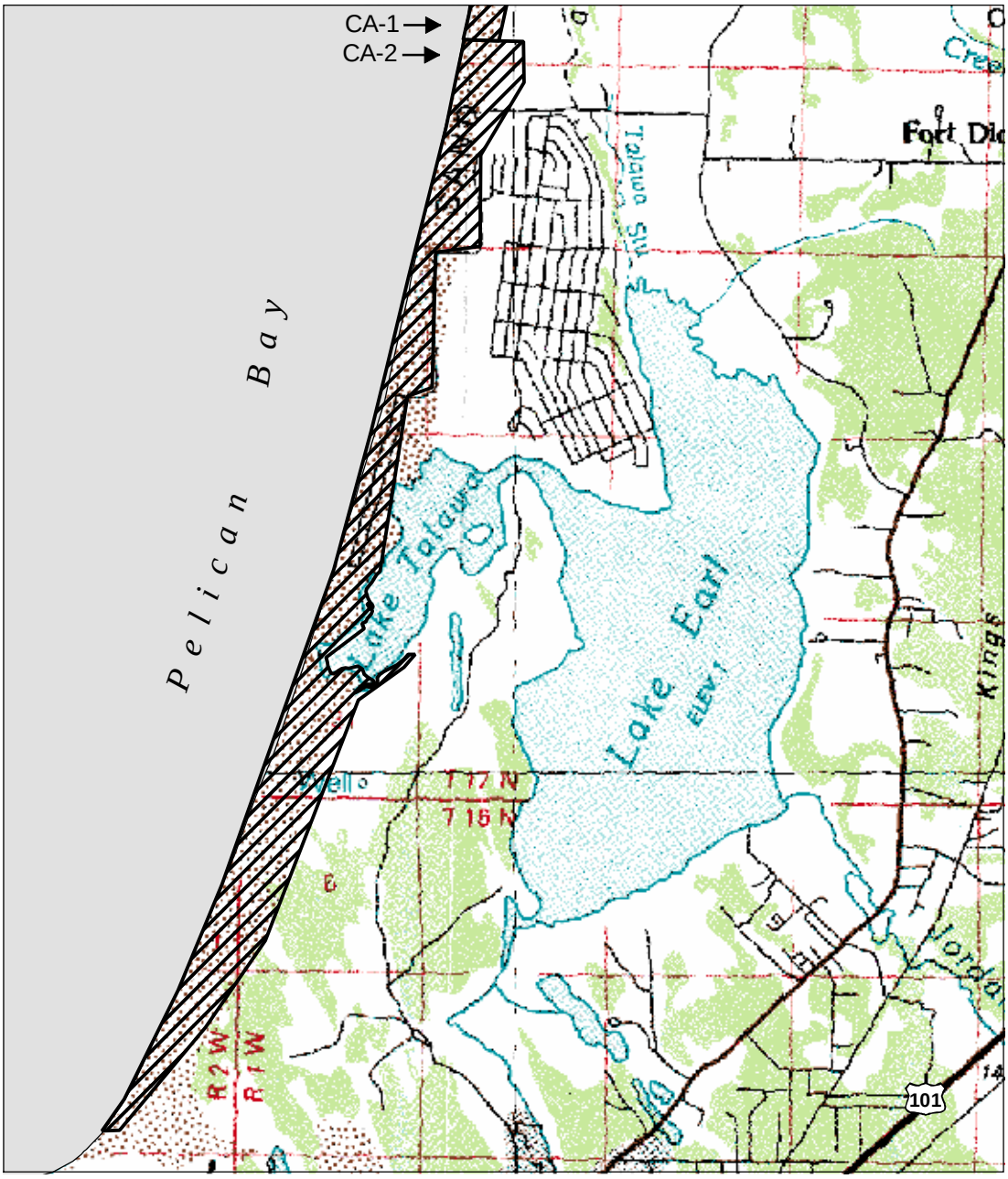
0.75 0 0.75 Miles

1 0 1 Kilometers

Scale 1: 50,000

N

Figure L - 25. Lake Earl (CA-2), Del Norte County, California.



Legend

WSPL Breeding & Wintering Locations

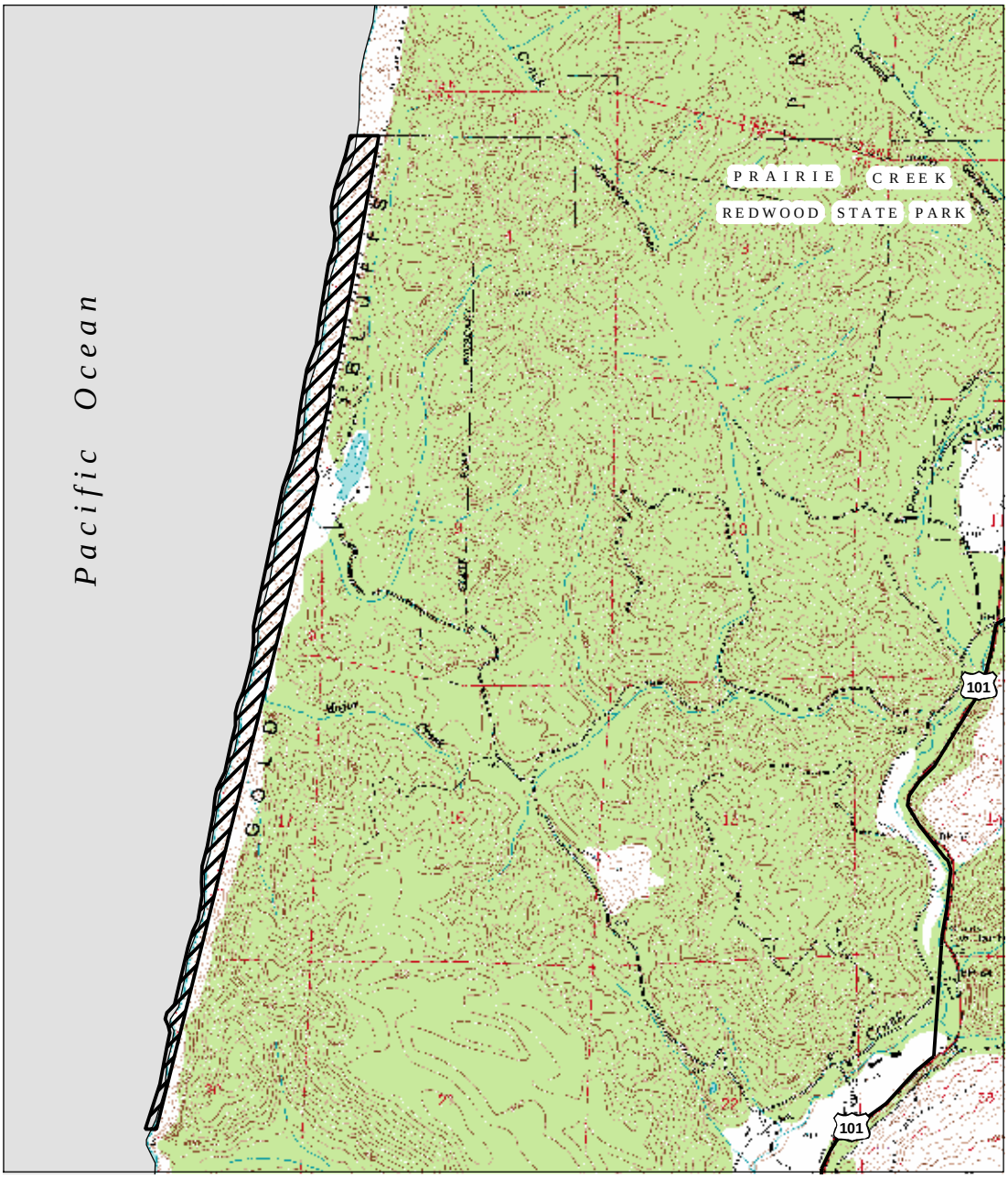
0.8 0 0.8 Miles

1 0 1 Kilometers

Scale 1: 60,000

N

Figure L - 26. Gold Bluffs Beach (CA-3), Humboldt County, California.



Legend

WSPL Breeding & Wintering Locations

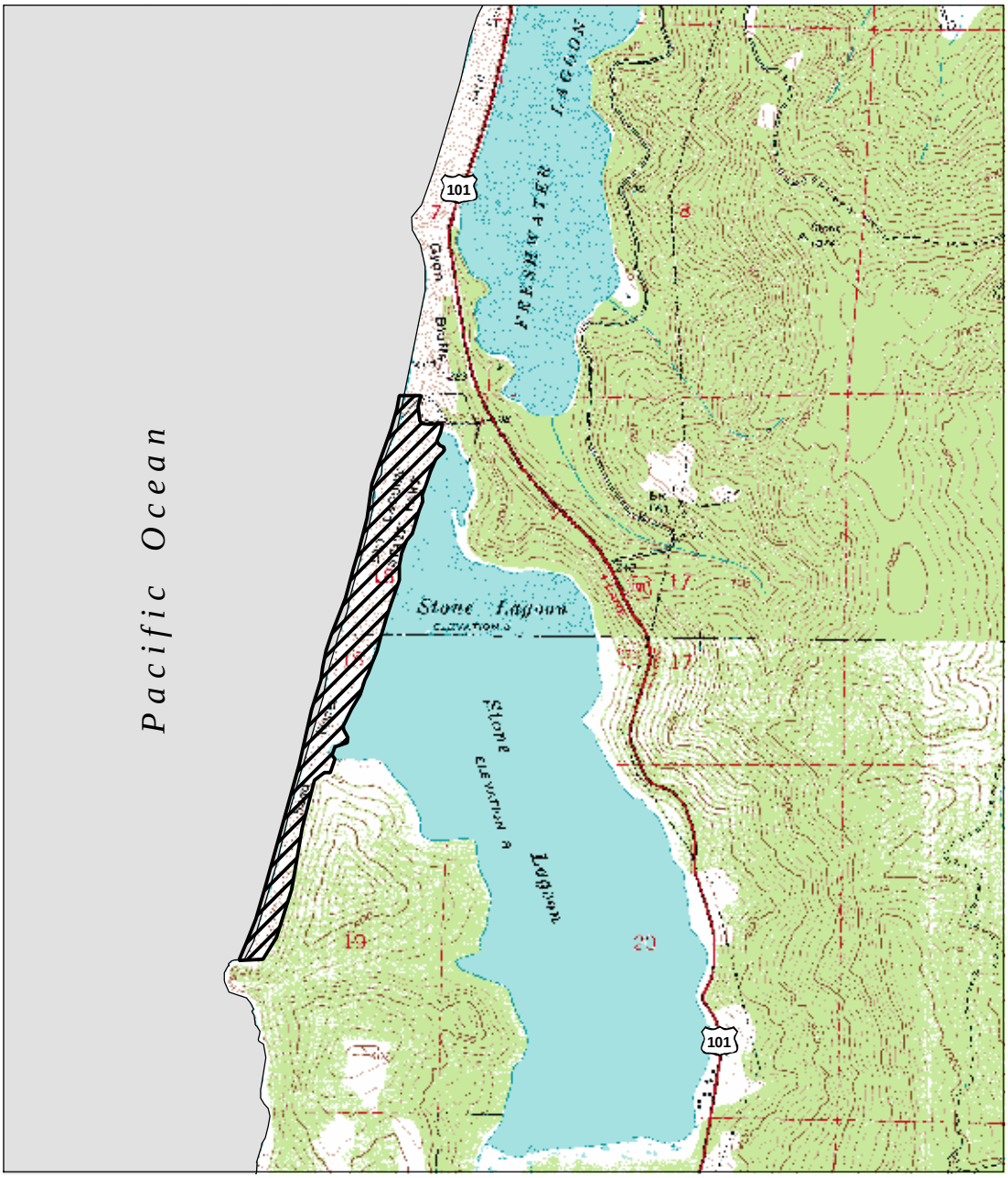
0.6 0 0.6 Miles

1 0 1 Kilometers

Scale 1: 40,000

N

Figure L - 27. Stone Lagoon (CA-4), Humboldt County, California.



Legend

WSPL Breeing & Wintering Locations

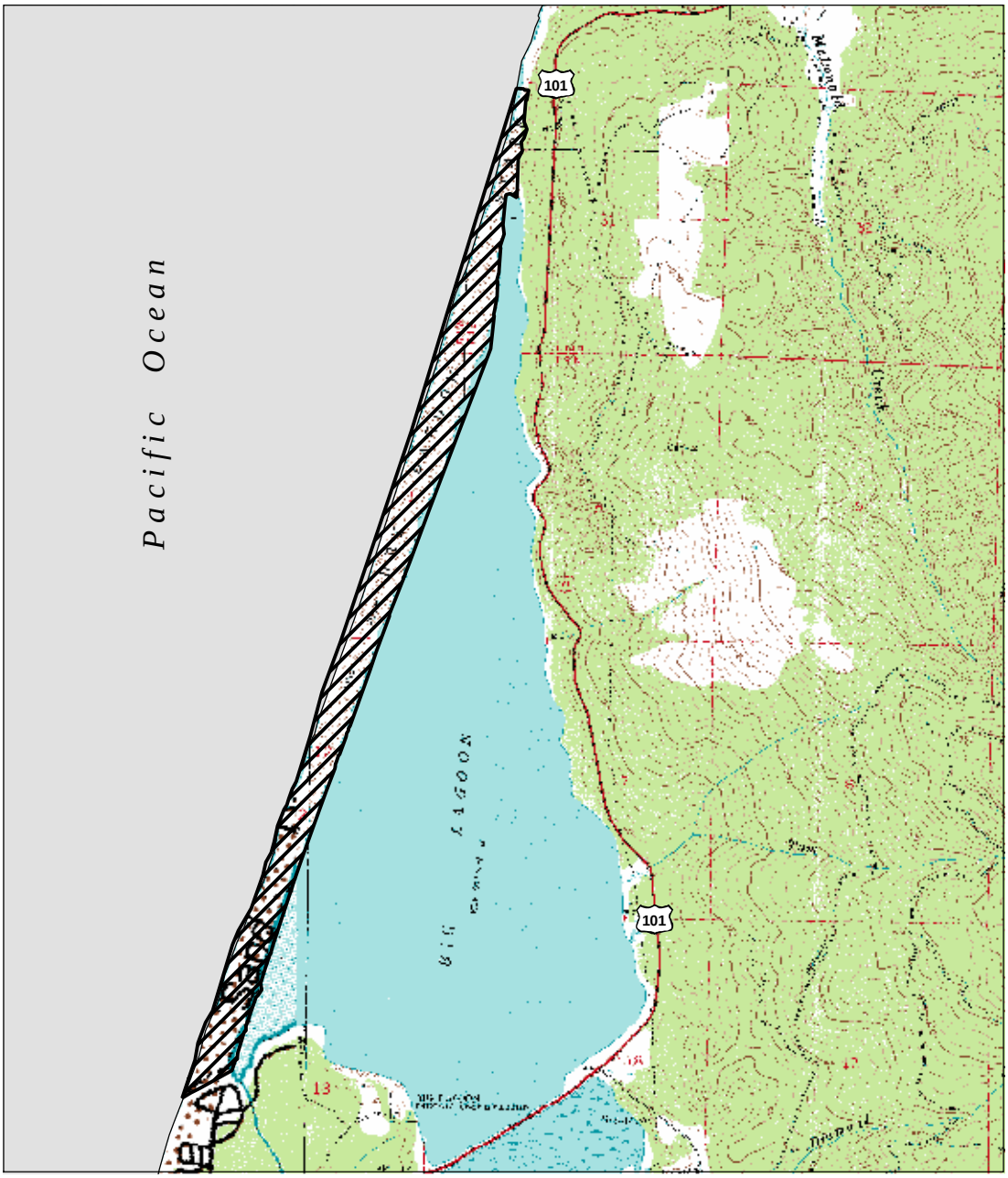
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 28. Big Lagoon (CA-5), Humboldt County, California.



Legend

WSPL Breeding & Wintering Locations

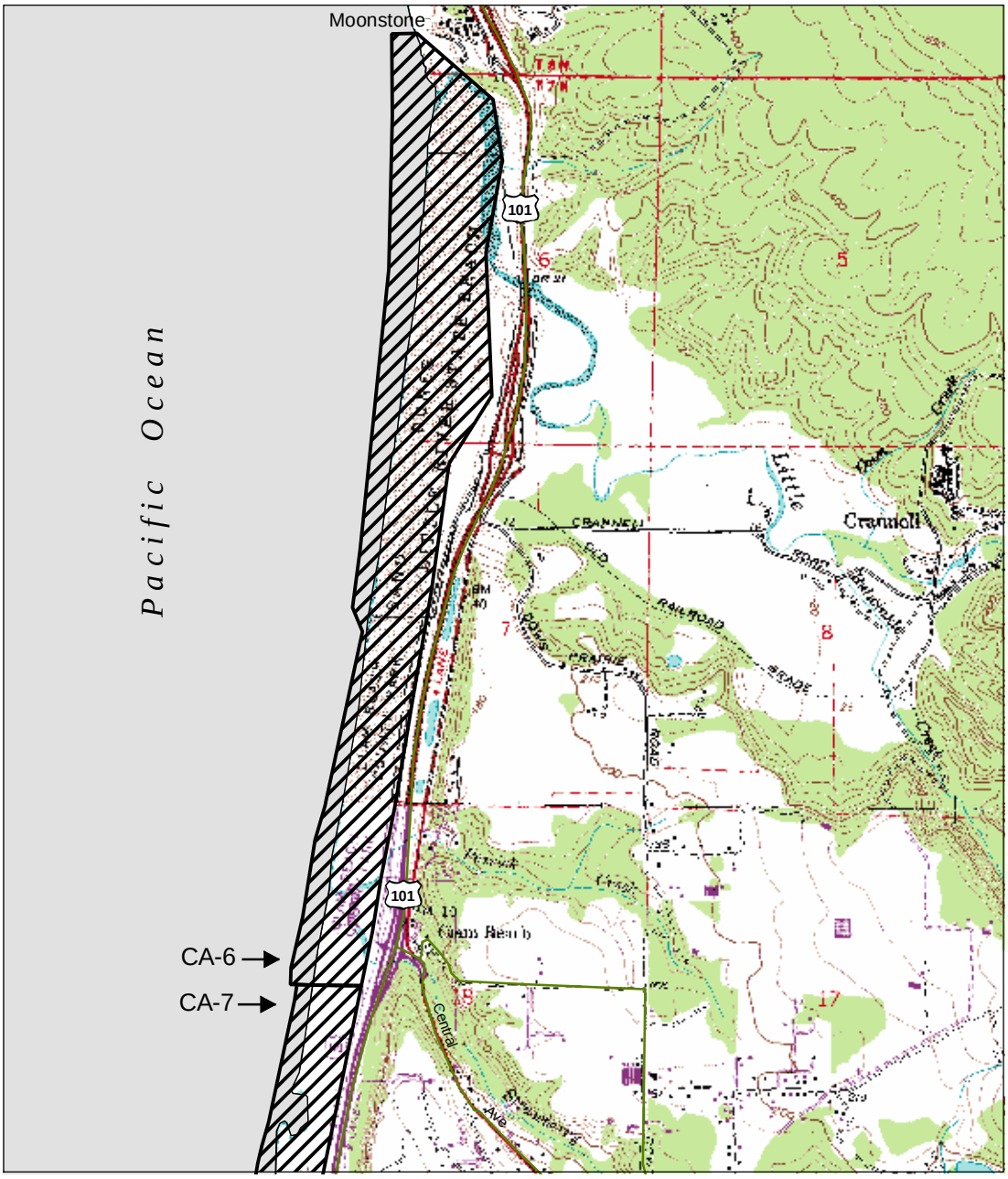
0.6 0 0.6 Miles

1 0 1 Kilometers

Scale 1: 40,000

N

Figure L - 29. Clam Beach/Little River (CA-6), Humboldt County, California.



Legend

WSPL Breeding & Wintering Locations

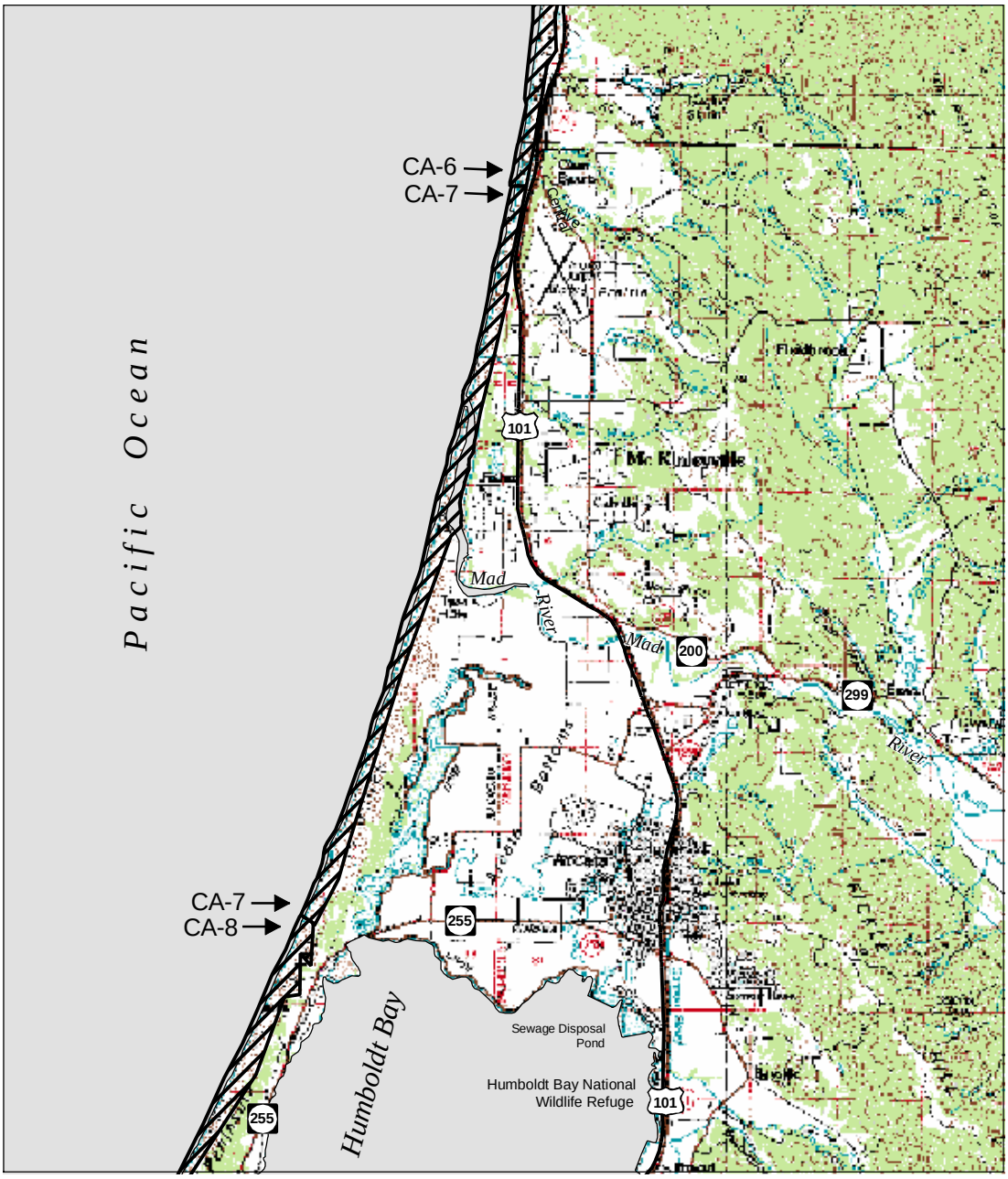
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

N

Scale 1: 30,000

Figure L - 30. Mad River Mouth and Beach (CA-7), Humboldt County, California.



Legend

WSPL Breeding & Wintering Locations

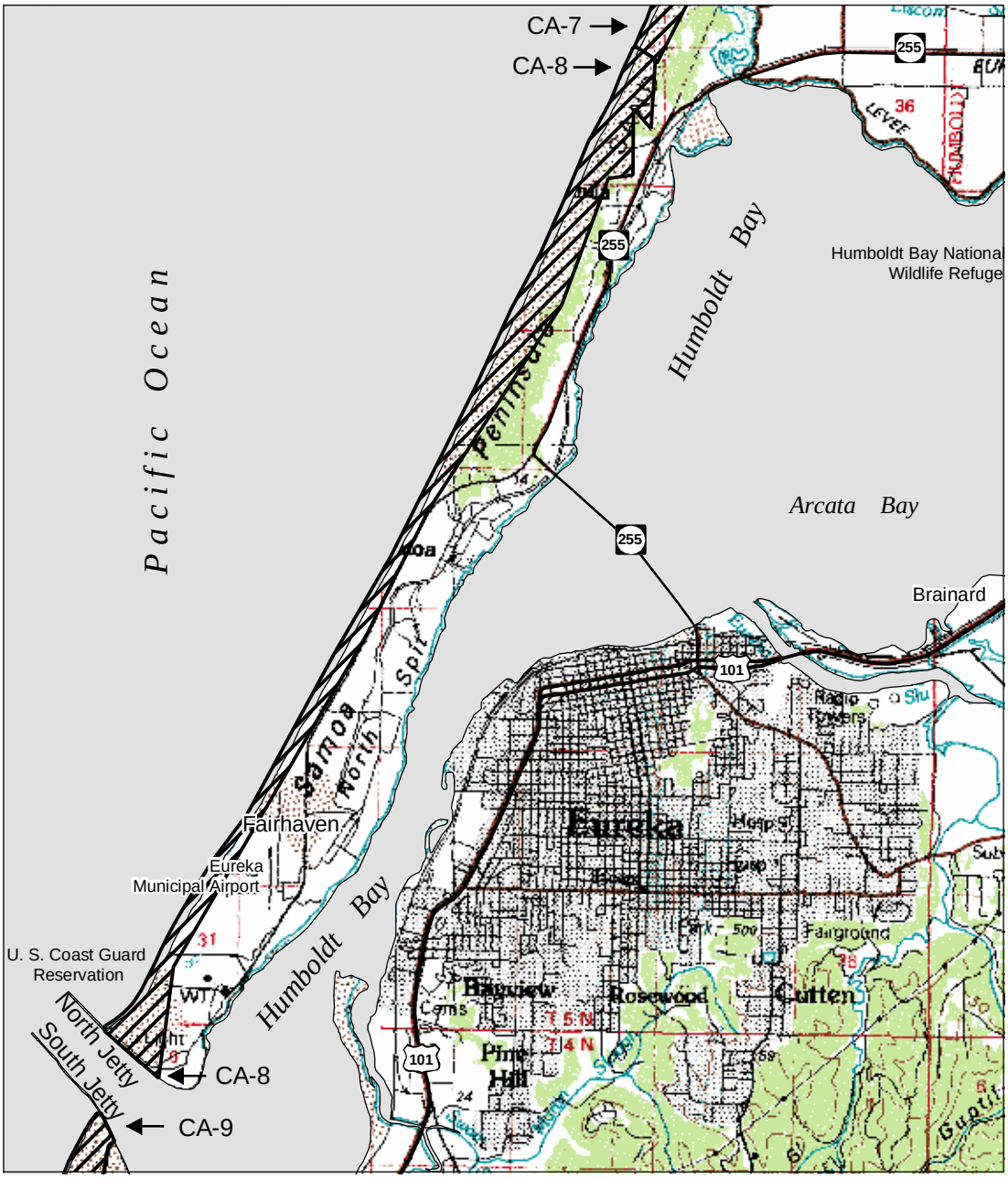
2 0 2 Miles

3 0 3 Kilometers

Scale 1: 130,000

N

Figure L - 31. Humboldt Bay; North Spit (CA-8), Humboldt County, California.



Legend

WSPL Breeding & Wintering Locations

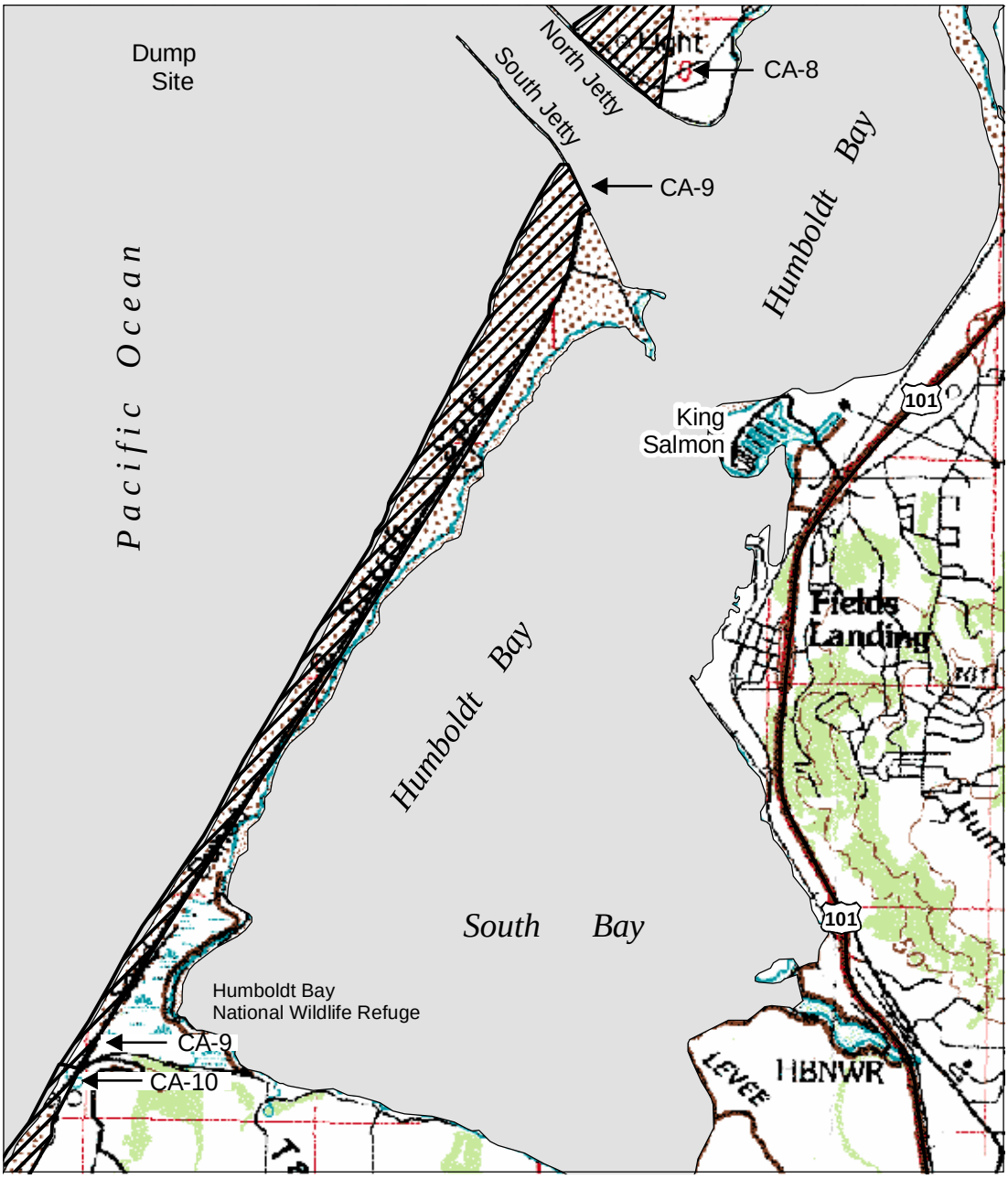
1 0 1 Miles

2 0 2 Kilometers

Scale 1: 80,000

N

Figure L - 32. Humboldt Bay; South Spit (CA-9), Humboldt County, California.



Legend

WSPL Breeding & Wintering Locations

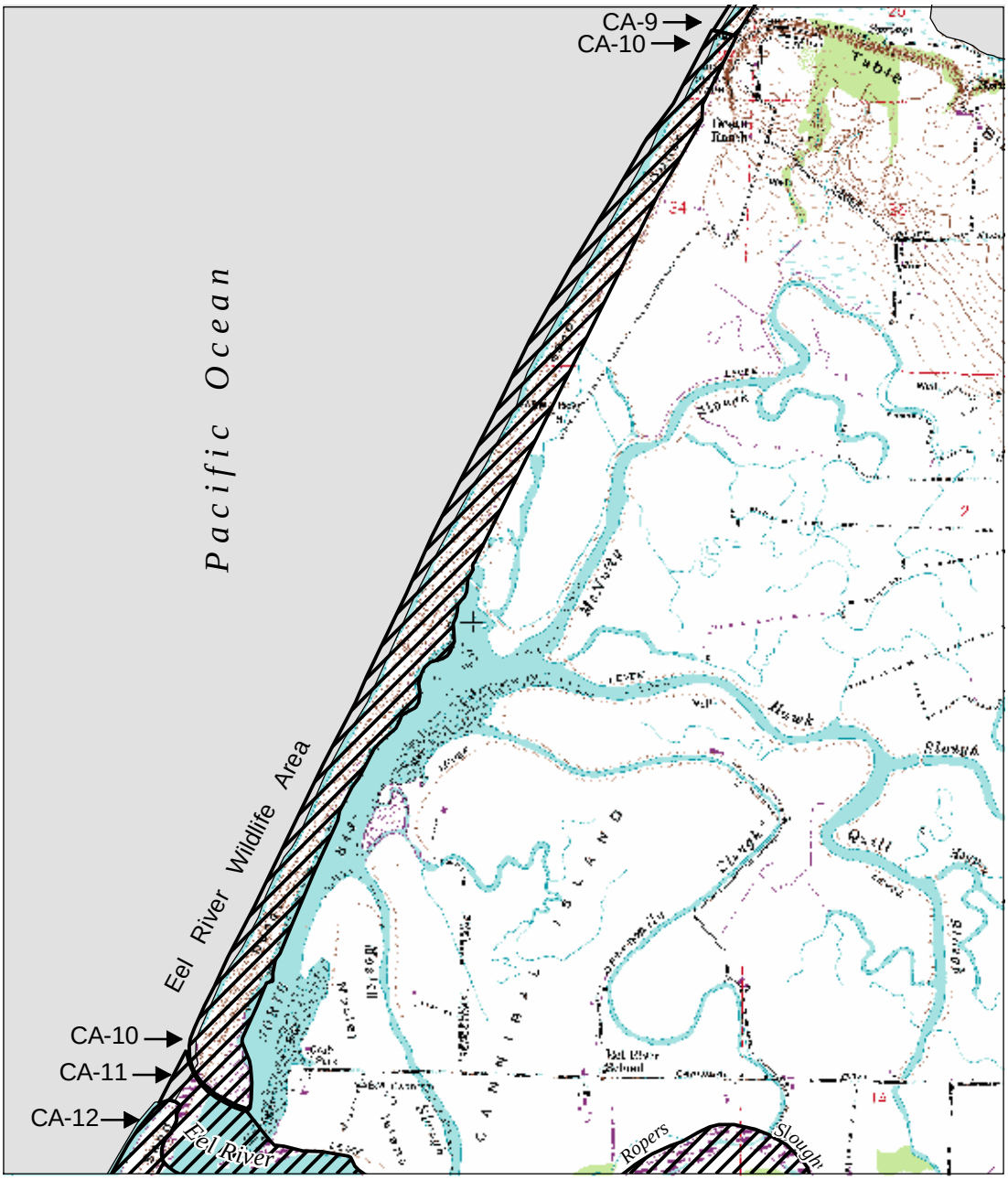
0.6 0 0.6 Miles

1 0 1 Kilometers

Scale 1: 50,000

N

Figure L - 33. Eel River; North Spit and Beach (CA-10), Humboldt County, California.



Legend

WSPL Breeding & Wintering Locations

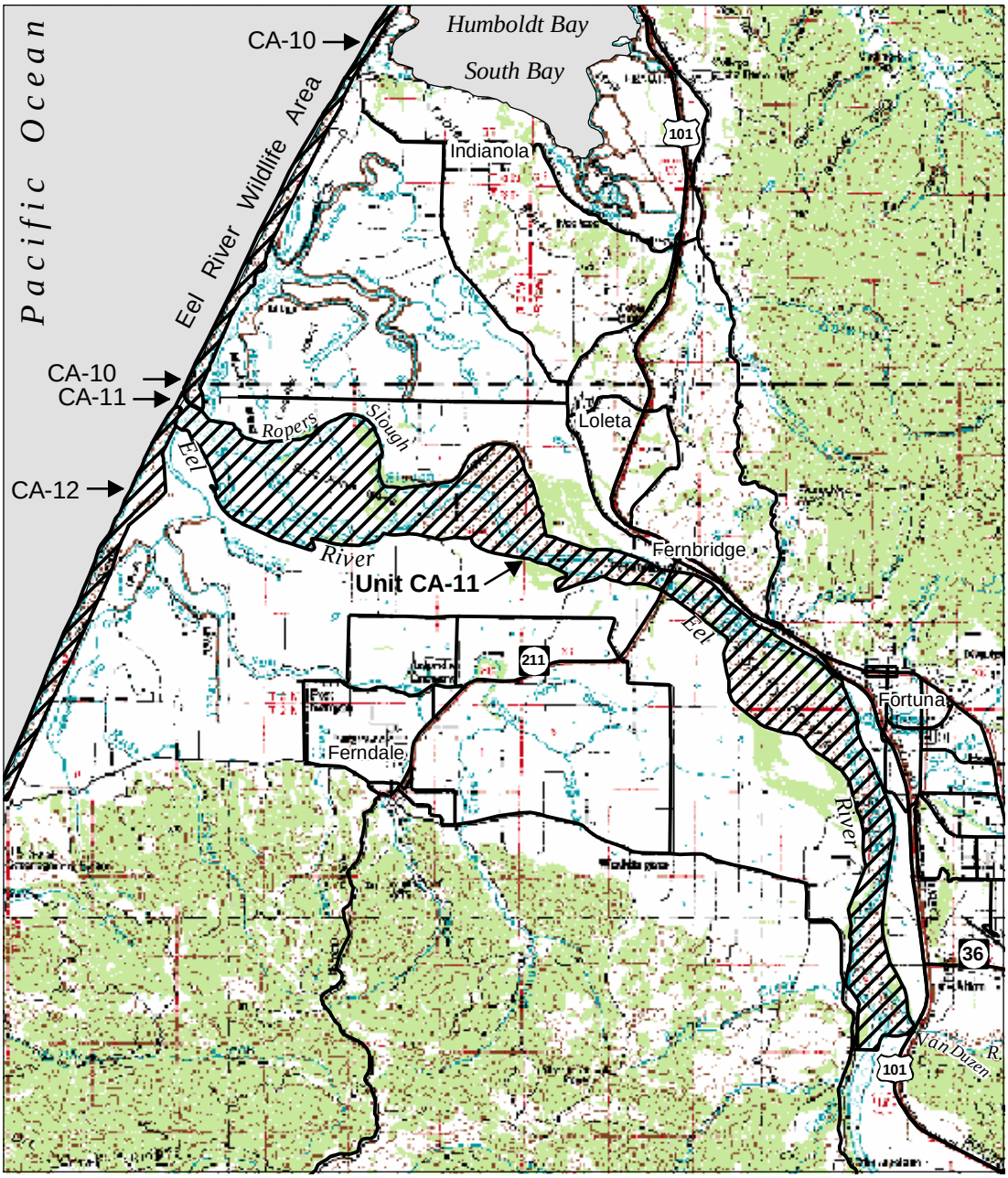
0.6 0 0.6 Miles

1 0 1 Kilometers

Scale 1: 40,000

N

Figure L - 34. Eel River Mouth to Van Duzen River (CA-11), Humboldt County, California.



Legend

WSPL Breeding & Wintering Locations

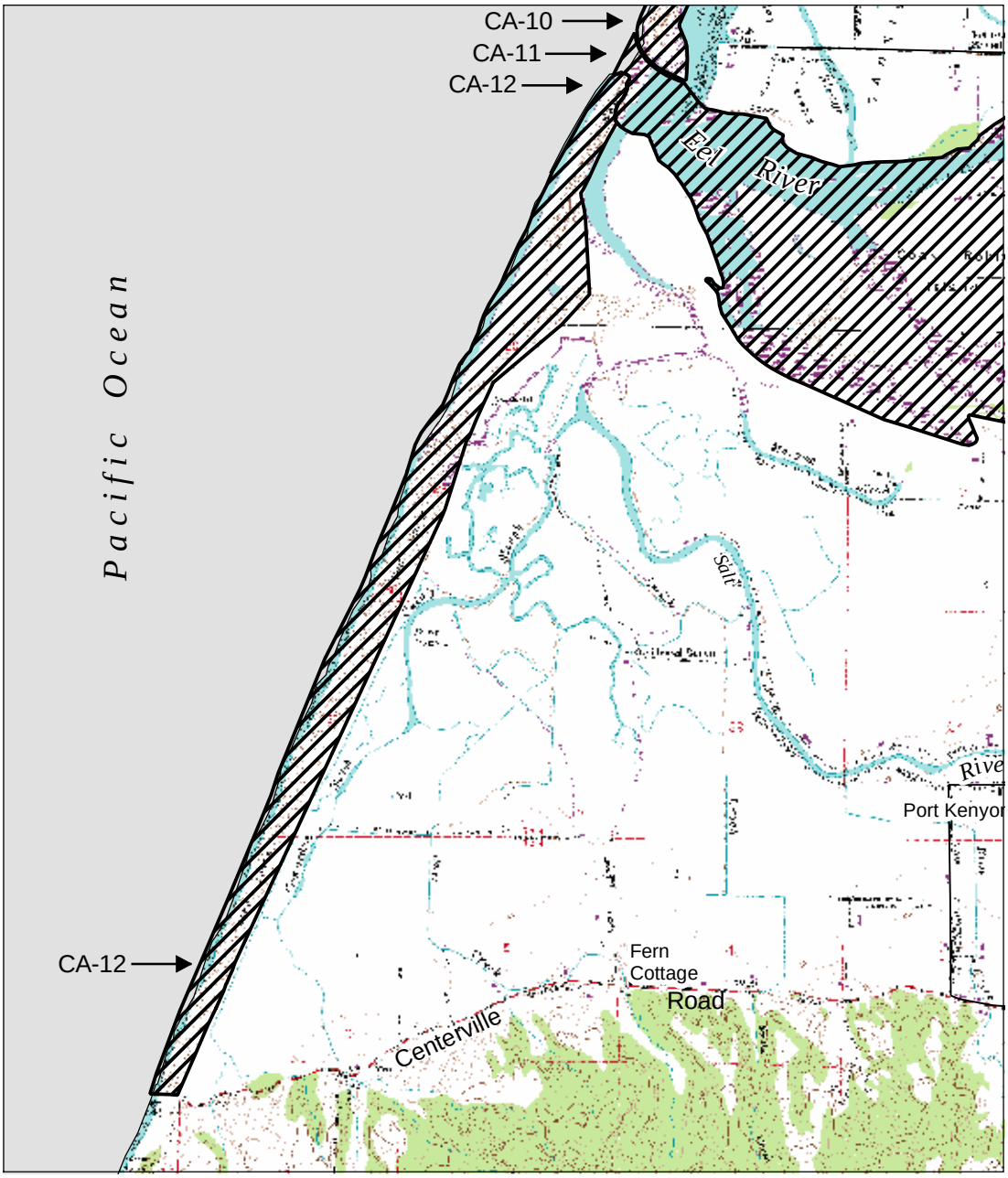
2 0 2 Miles

3 0 3 Kilometers

Scale 1: 130,000

N

Figure L - 35. Eel River; South Spit and Beach (CA-12), Humboldt County, California.



Legend

WSPL Breeding & Wintering Locations

0.6 0 0.6 Miles

1 0 1 Kilometers

Scale 1: 50,000

N

Figure L - 36. McNutt Gulch (CA-13), Humboldt County, California.

Legend

WSPL Breeding & Wintering Locations

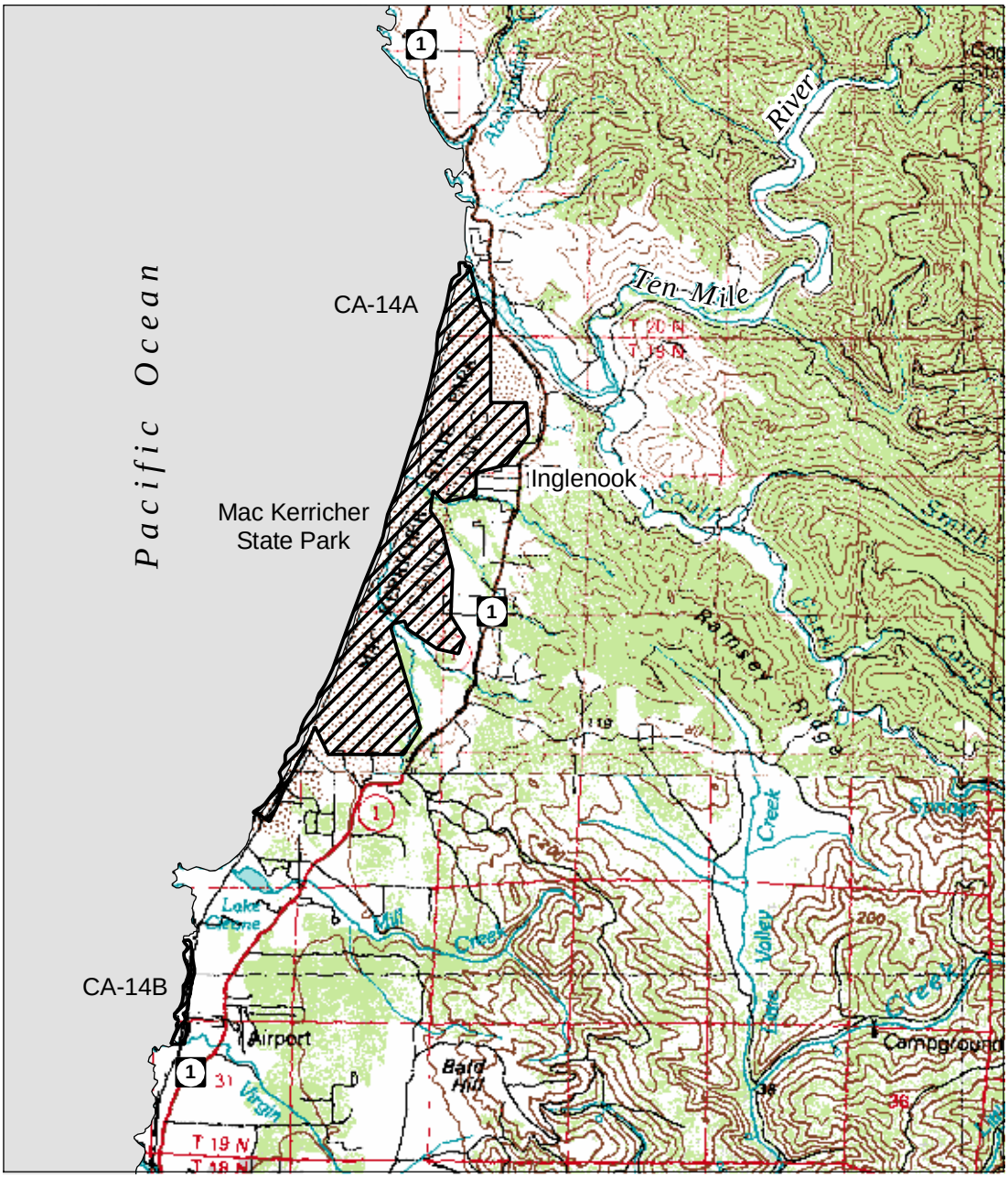
1 0 1 Miles

2 0 2 Kilometers

Scale 1: 80,000

N

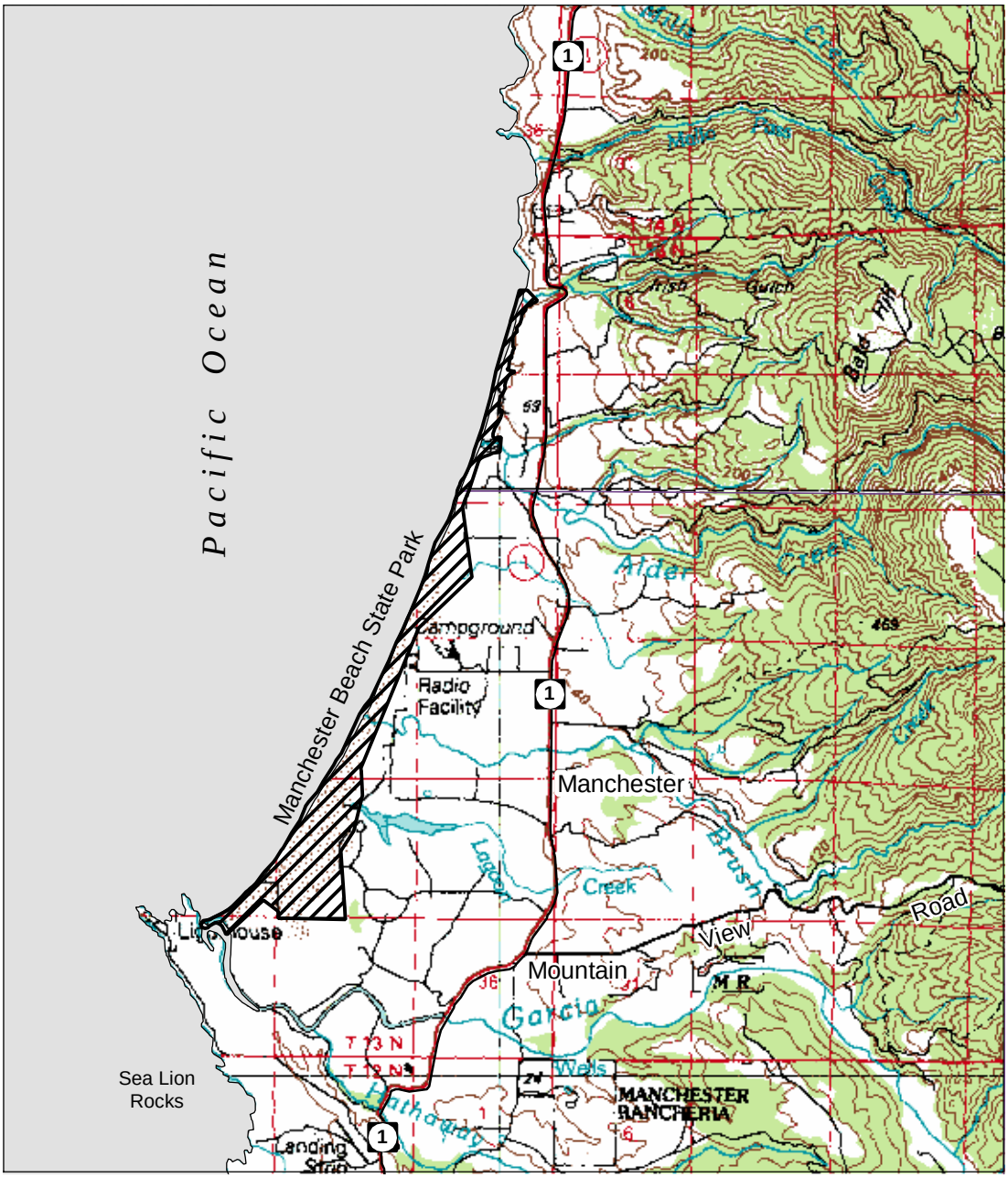
Figure L - 37. MacKerricher Beach (CA-14), Mendocino County, California.



Legend

WSPL Breeding & Wintering Locations

Figure L - 38. Manchester Beach (CA-15), Mendocino County, California.



Legend

WSPL Breeding & Wintering Locations

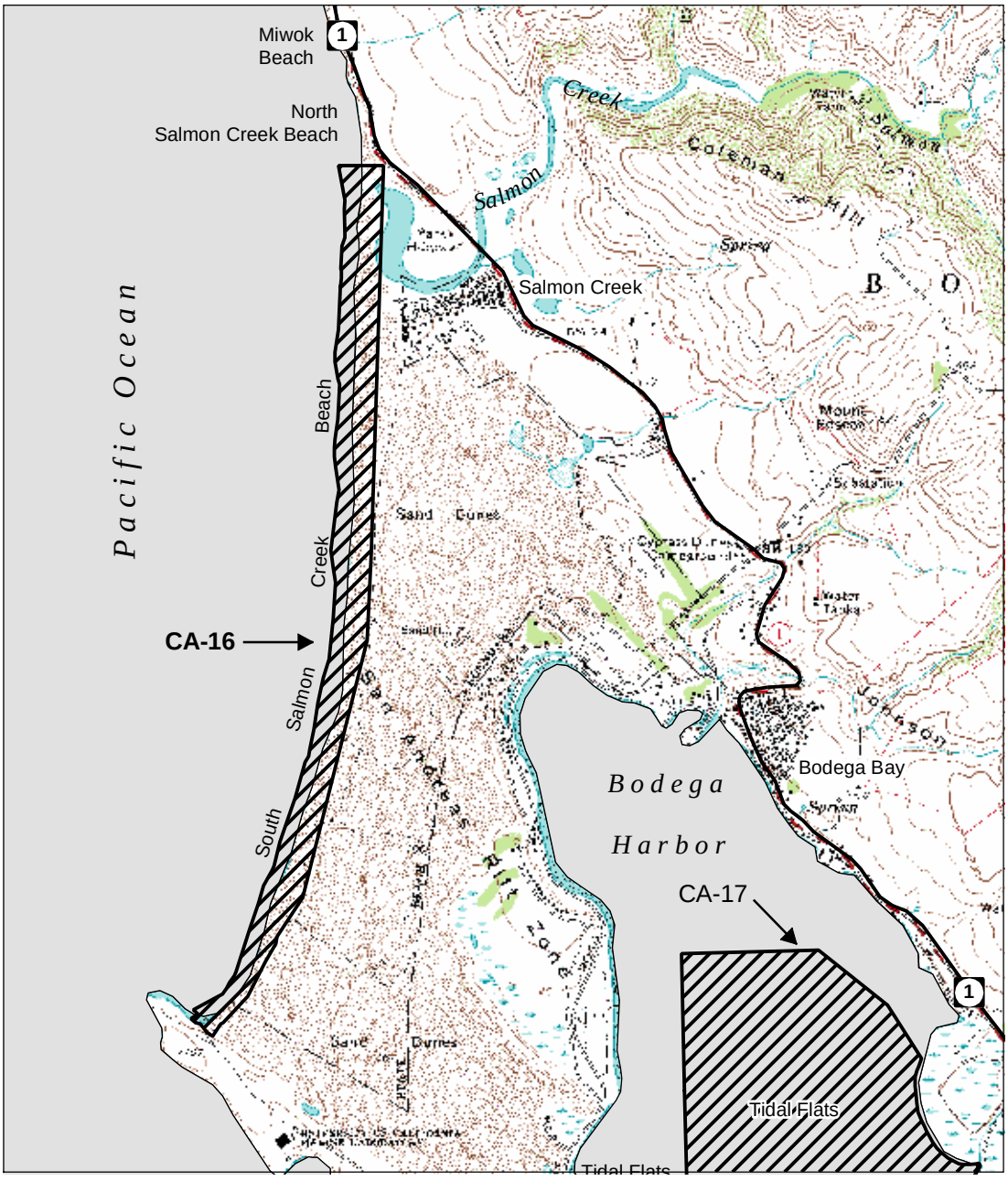
1 0 1 Miles

2 0 2 Kilometers

Scale 1: 80,000

N

Figure L - 39. Salmon Creek (CA-16), Sonoma County, California.



Legend

WSPL Breeding & Wintering Locations

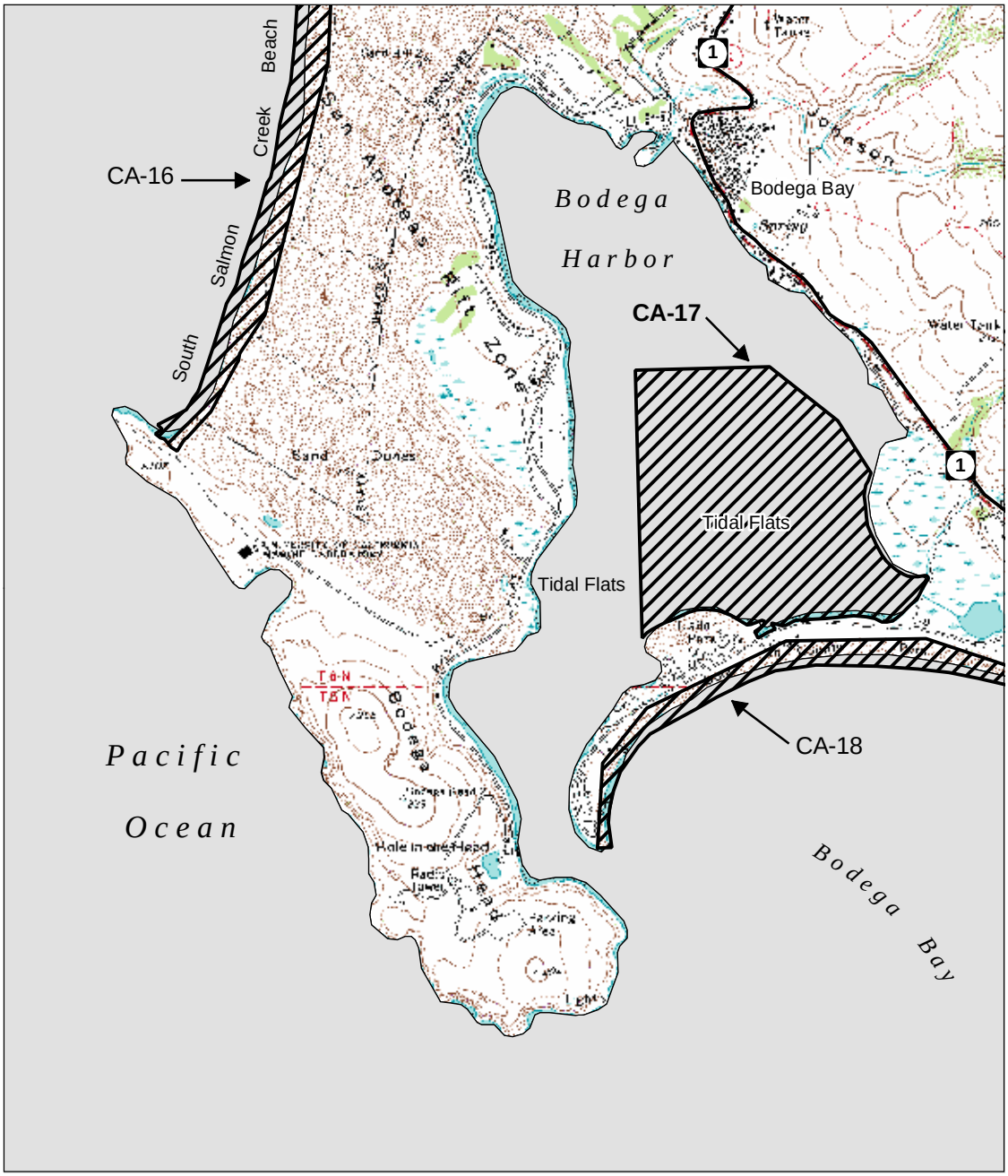
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 40. Bodega Harbor (CA-17), Sonoma County, California.



Legend

WSPL Breeding & Wintering Locations

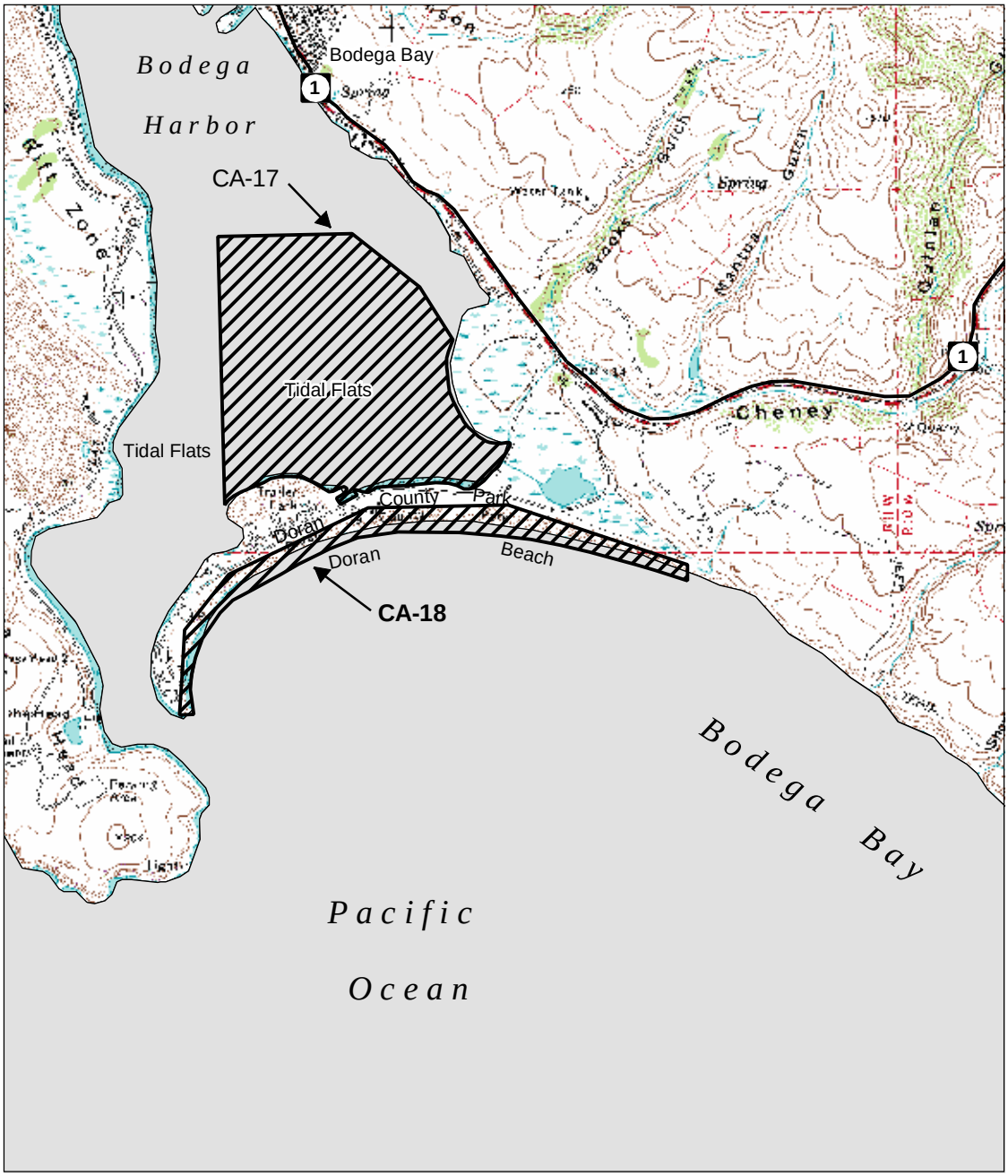
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 41. Doran Spit (CA-18), Sonoma County, California.



Legend

WSPL Breeding & Wintering Locations

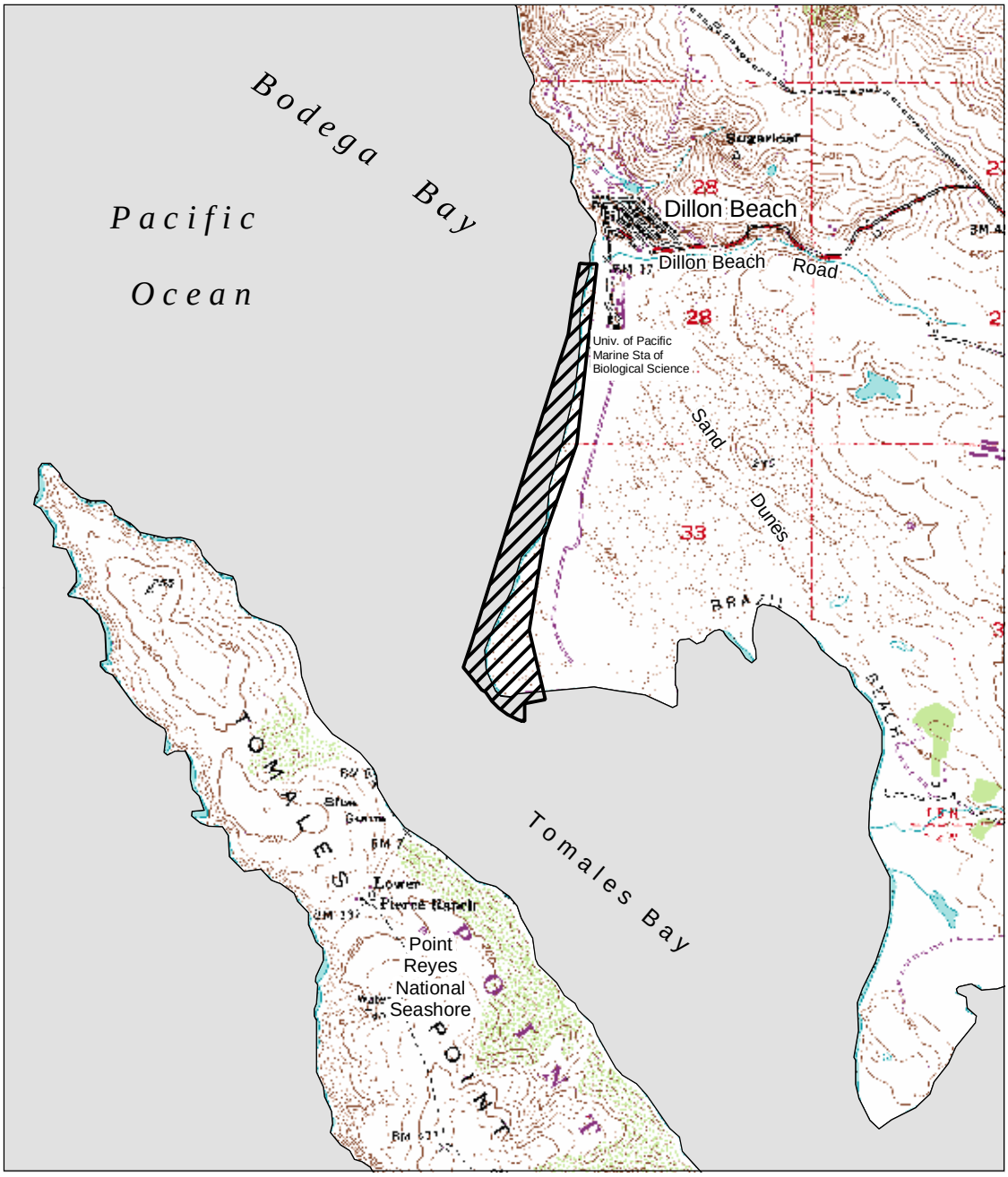
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 42. Dillon Beach (CA-19), Marin County, California.



Legend

WSPL Breeding & Wintering Locations

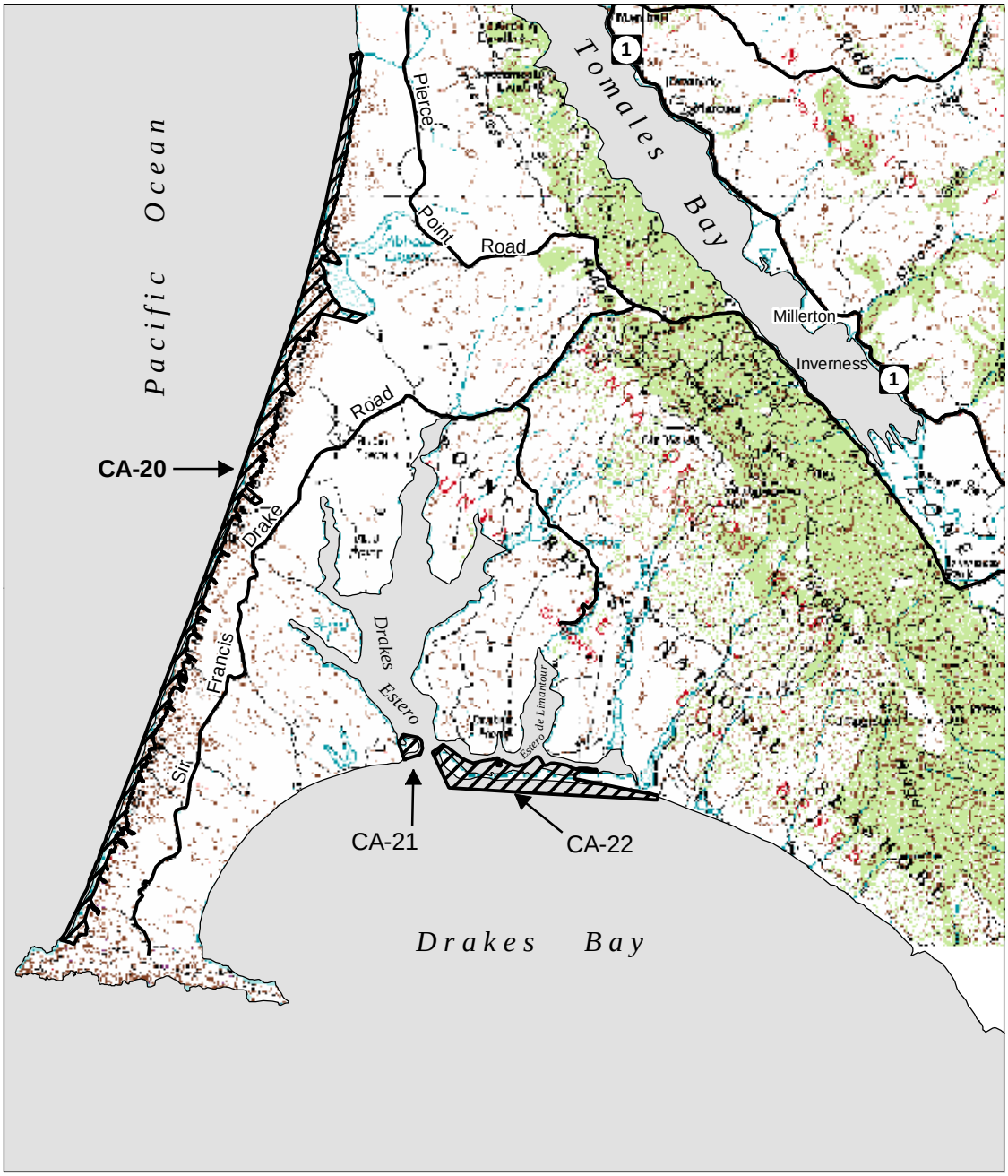
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 43. Point Reyes Beach (CA-20), Marin County, California.



Legend

WSPL Breeding & Wintering Locations

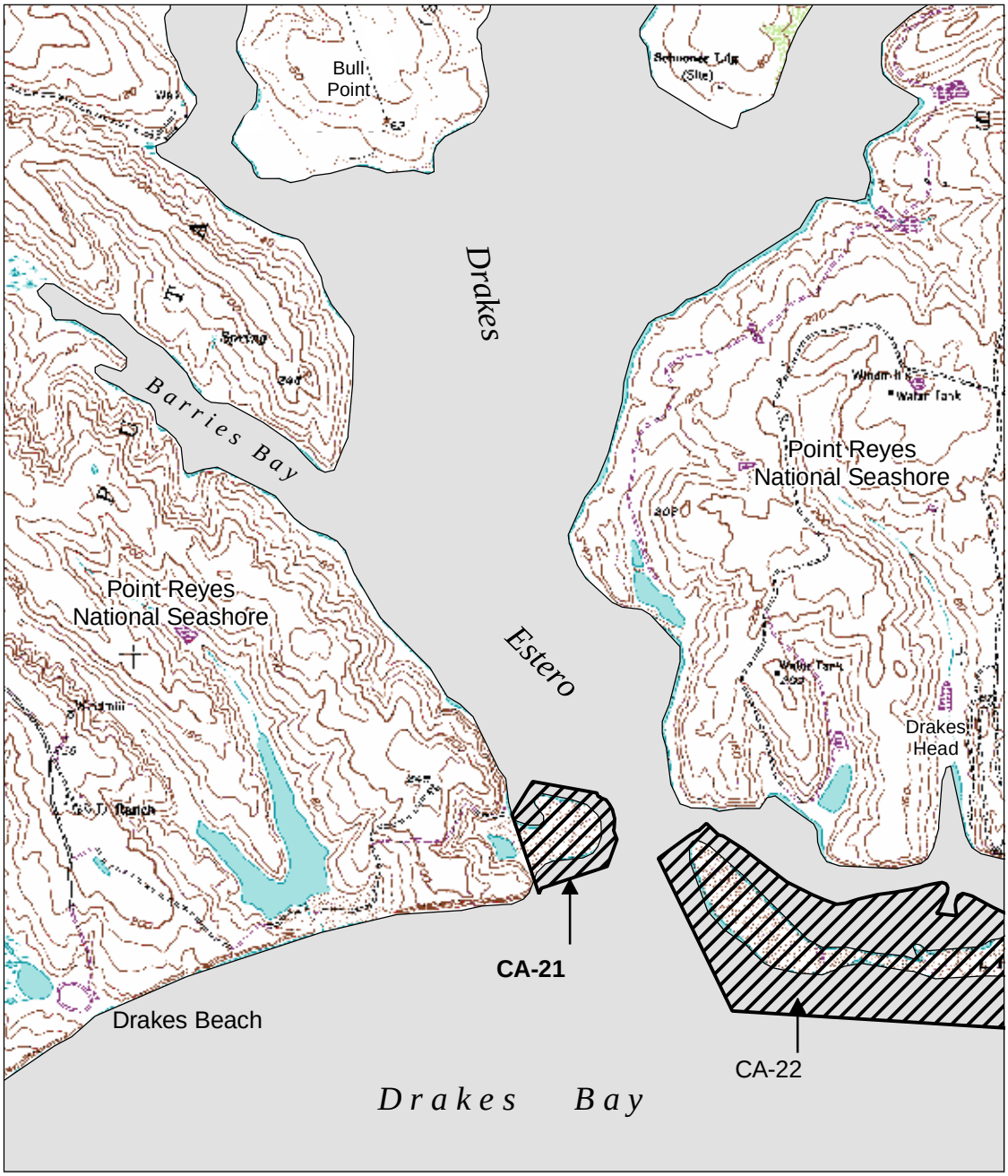
2 0 2 Miles

3 0 3 Kilometers

Scale 1: 130,000

N

Figure L - 44. Drakes Spit (CA-21), Marin County, California.



Legend

WSPL Breeding & Wintering Locations

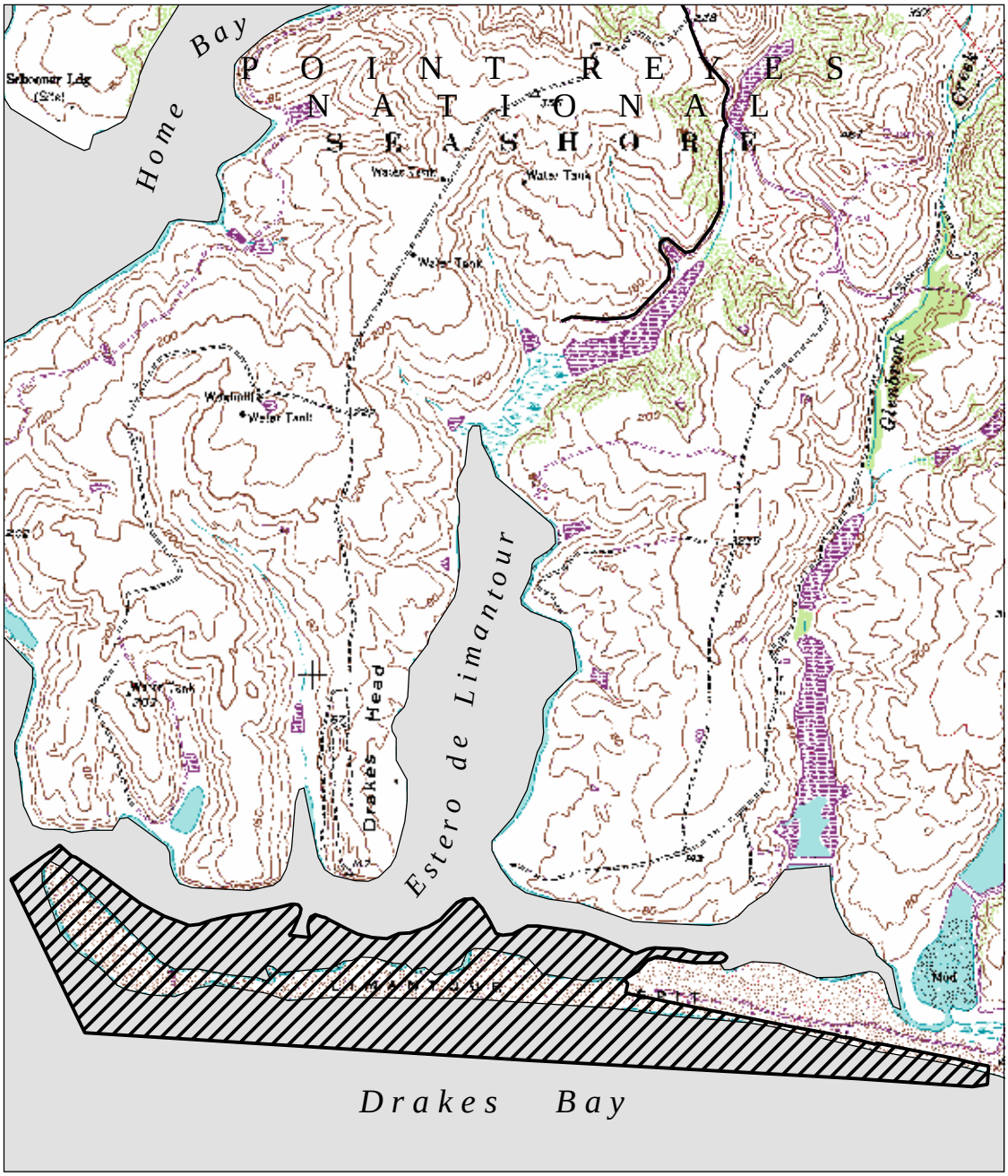
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 45. Limantour Spit (CA-22), Marin County, California.



Legend

WSPL Breeding & Wintering Locations

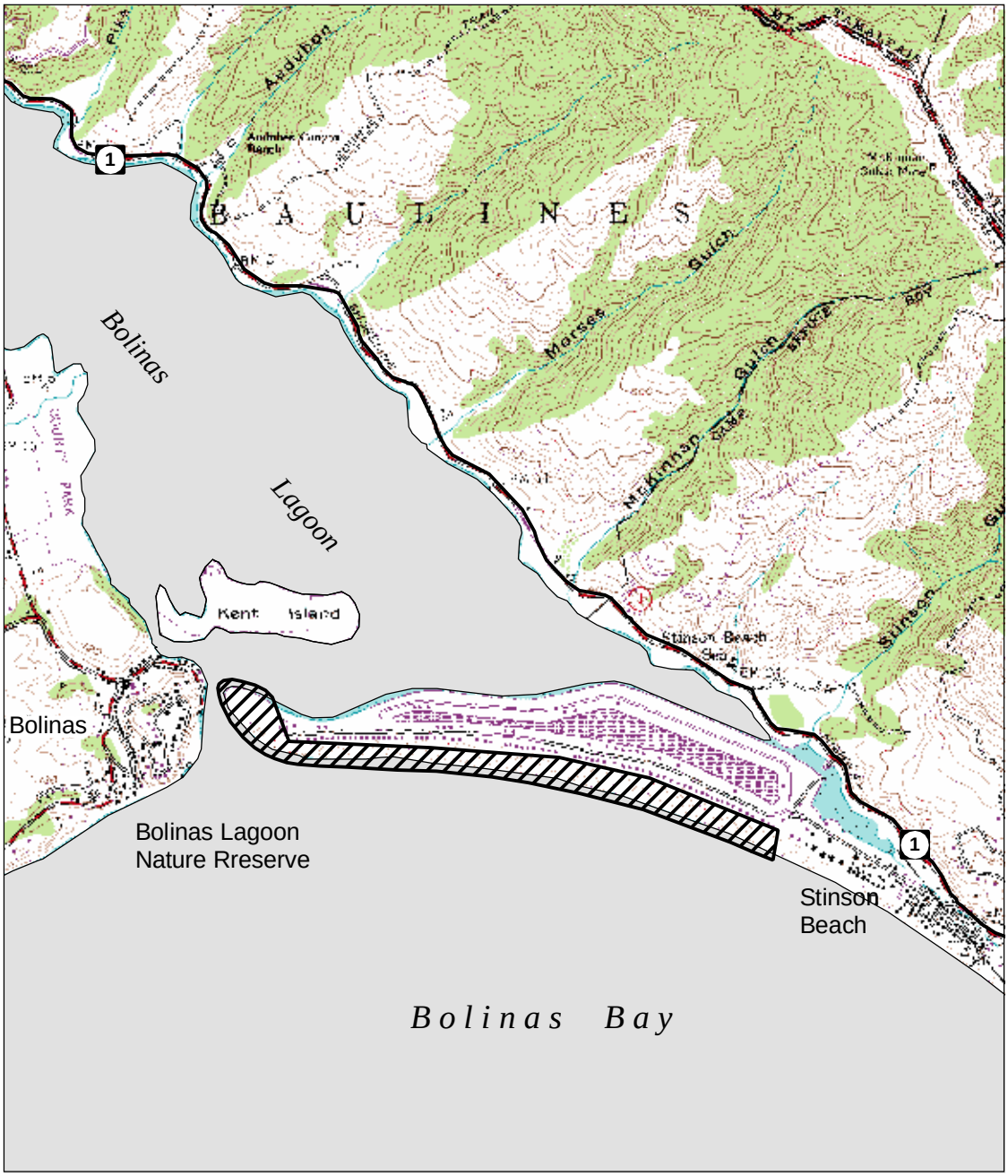
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 46. Bolinas Spit/Stinson Beach (CA-23), Marin County, California.



Legend

WSPL Breeding & Wintering Locations

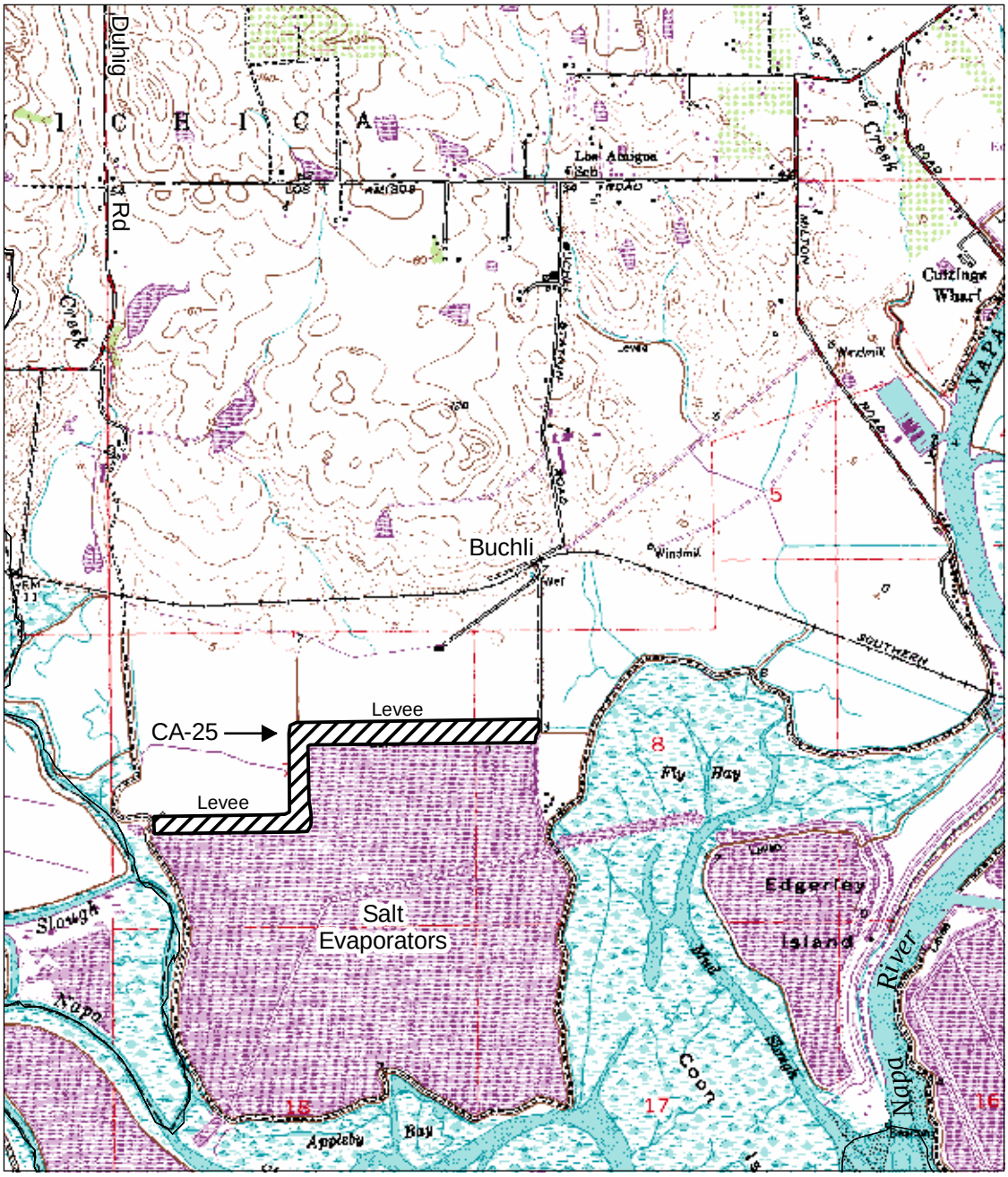
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 47. Salt Ponds 7A Levee (CA-25), Napa County, California.



Legend

WSPL Breeding & Wintering Locations
(Areas surrounding levee are not part of CA-25)

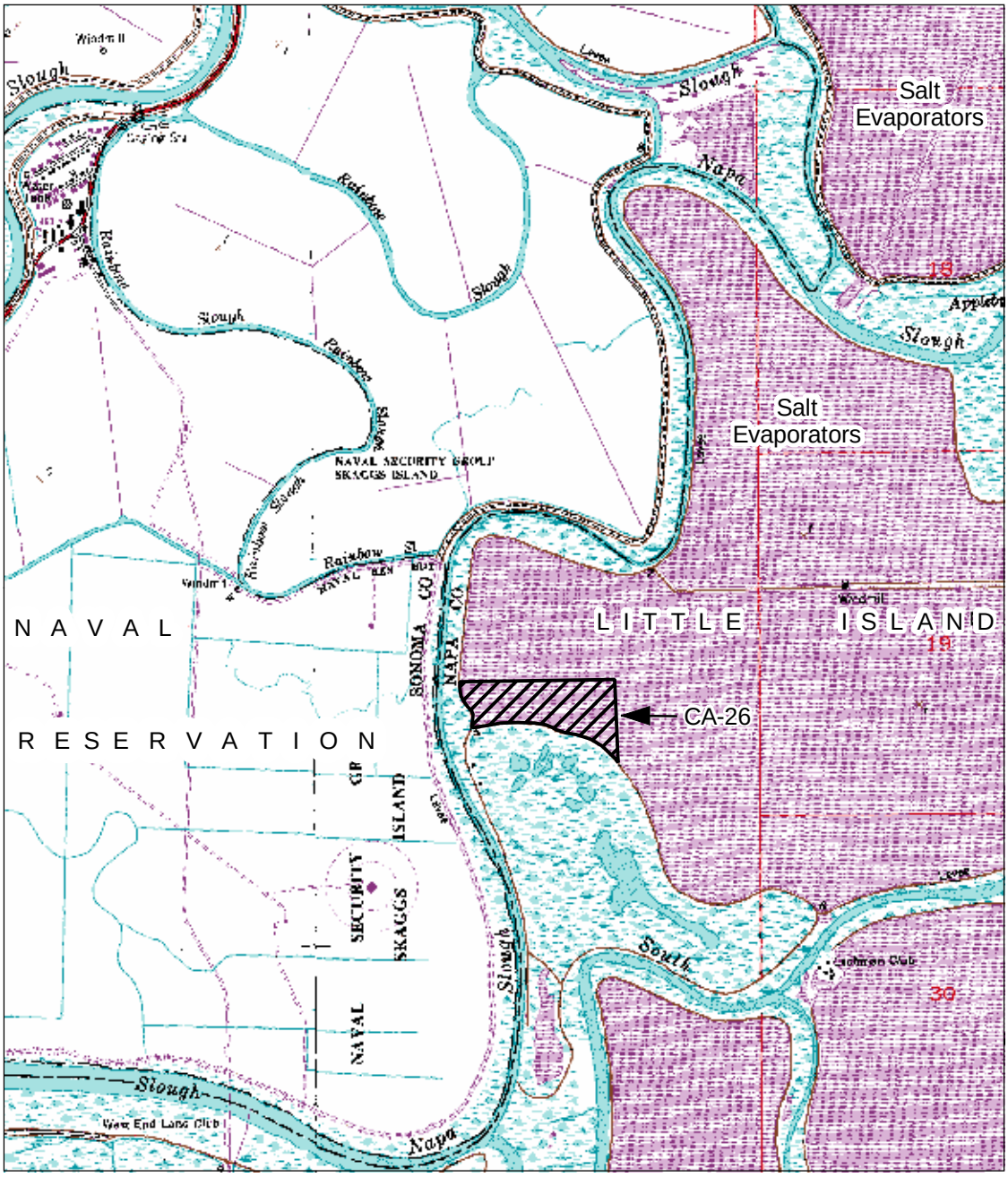
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 48. Little Island (CA-26), Napa County, California.



Legend

WSPL Breeding & Wintering Locations

0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 49. Alameda Naval Air Station (CA-27), Alameda County, California.

Legend

WSPL Breeding & Wintering Locations

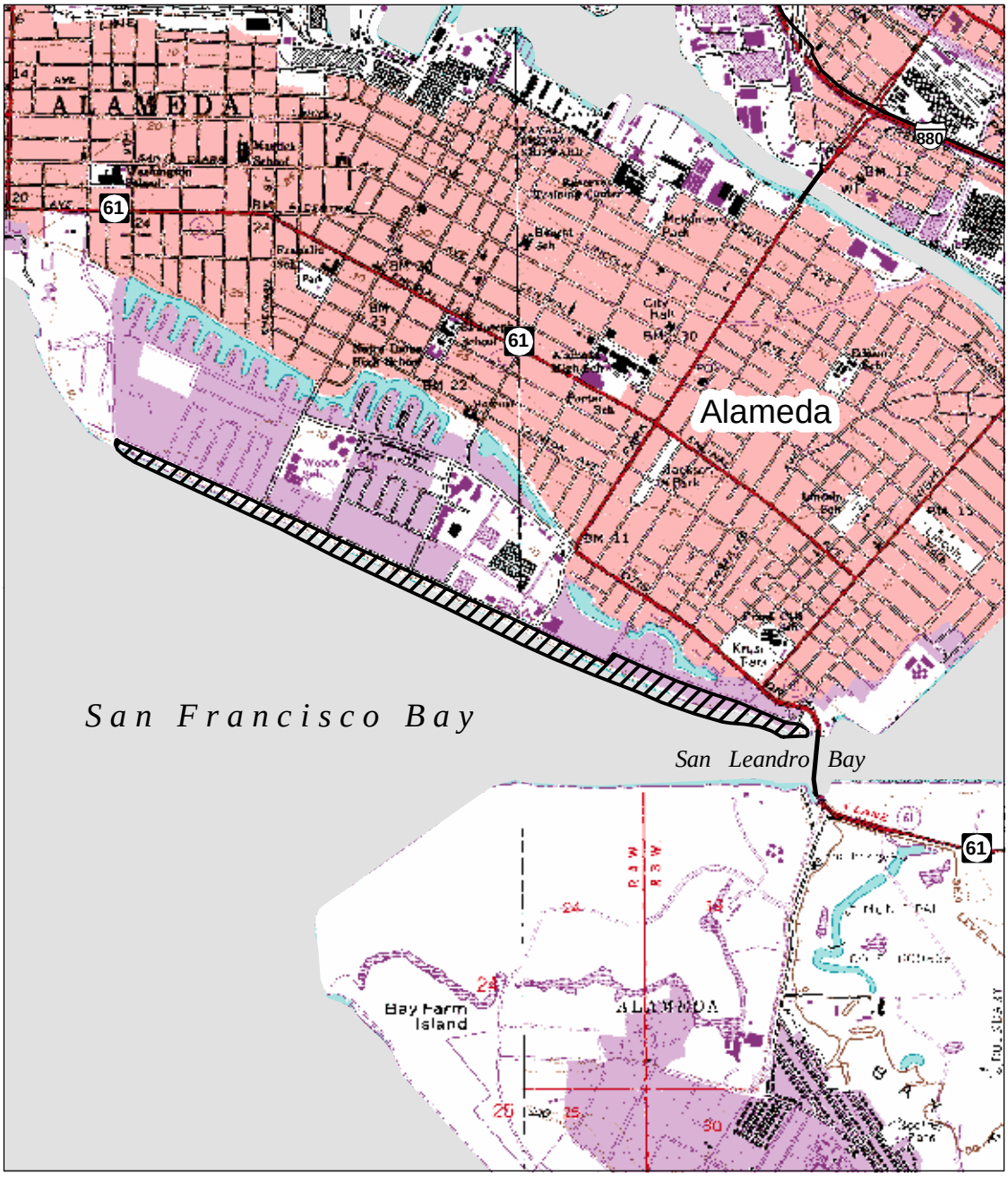
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 50. Alameda South Shore (CA-28), Alameda County, California.



Legend

WSPL Breeding & Wintering Locations

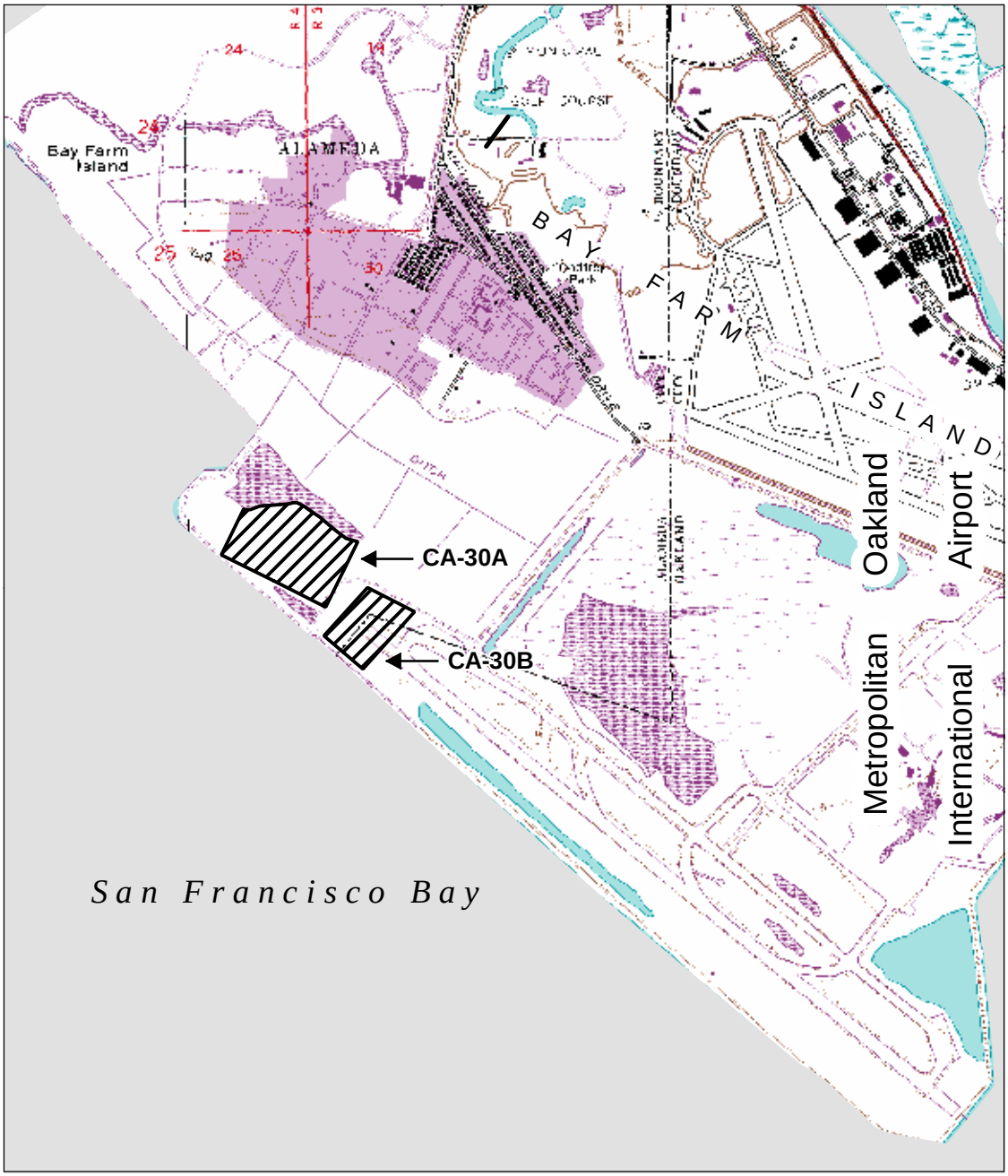
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 51. Oakland Airport (CA-30), Alameda County, California.



Legend

WSPL Breeding & Wintering Locations

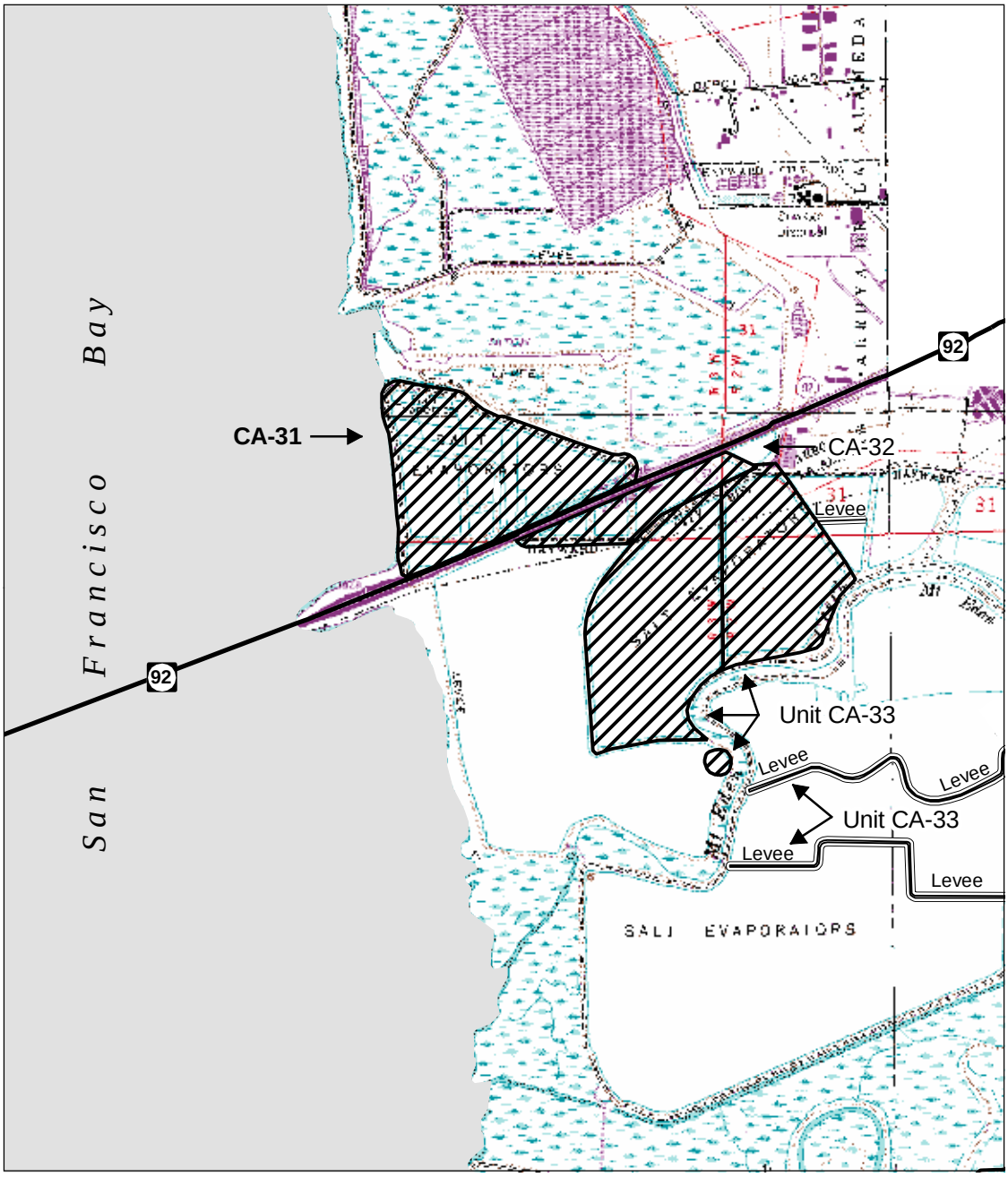
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 52. Oliver Salt Ponds; North of Hwy. 92 (CA-31), Alameda County, California.



Legend

WSPL Breeding & Wintering Locations

Western Snowy Plover Recovery Area on Levees

(Areas surrounding levees are not part of CA-31, CA-32 or CA-33)

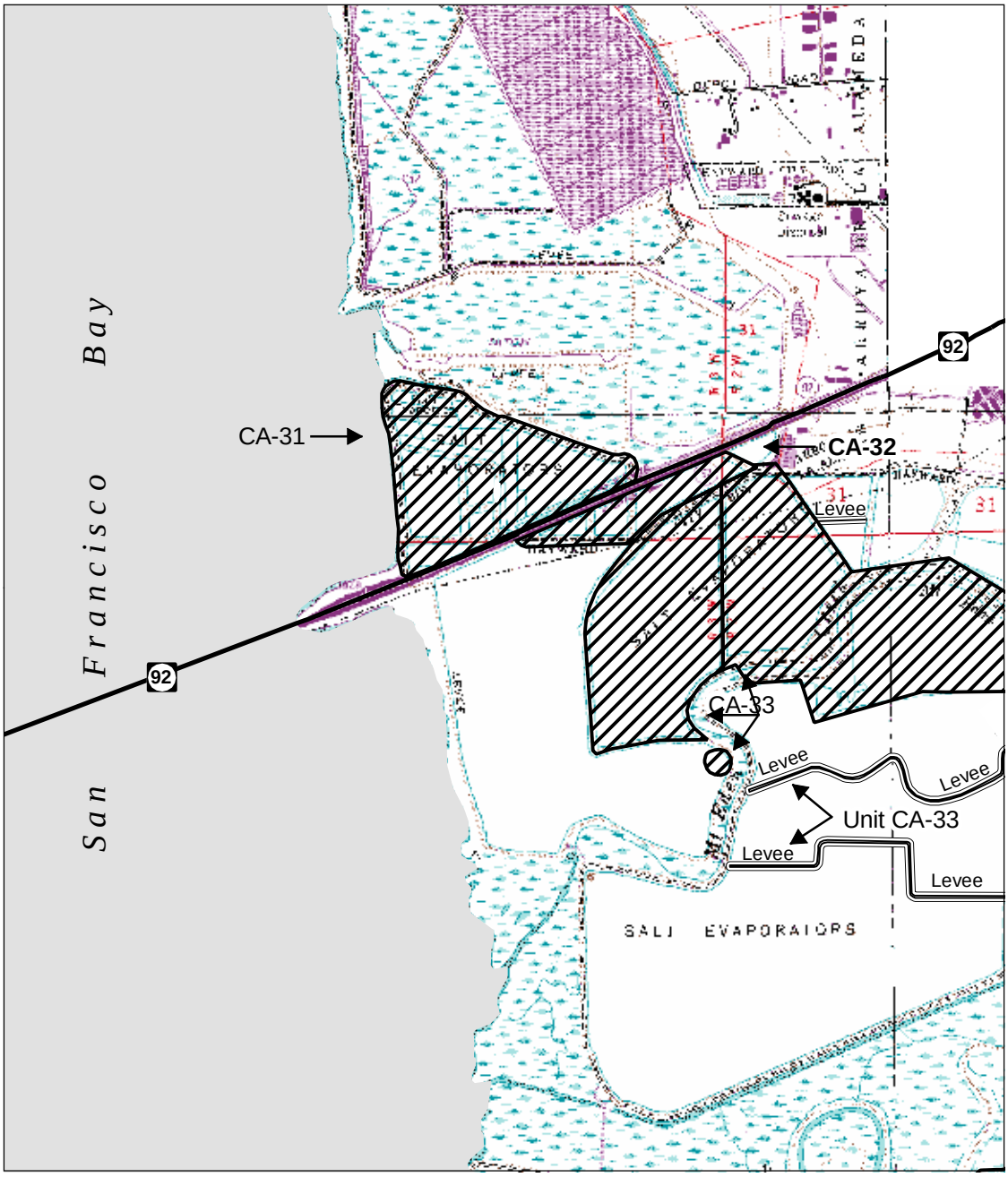
0.6 0 0.6 Miles

1 0 1 Kilometers

Scale 1: 30,000

N

Figure L - 53. Oliver Salt Ponds; South of Hwy. 92 (CA-32), Alameda County, California.



Legend

WSPL Breeding & Wintering Locations

Western Snowy Plover Recovery Area on Levees

(Areas surrounding levees are not part of CA-31, CA-32 or CA-33)

0.6 0 0.6 Miles

1 0 1 Kilometers

Scale 1: 30,000

N

Figure L - 54. Baumberg Salt Ponds (CA-33), Alameda County, California.

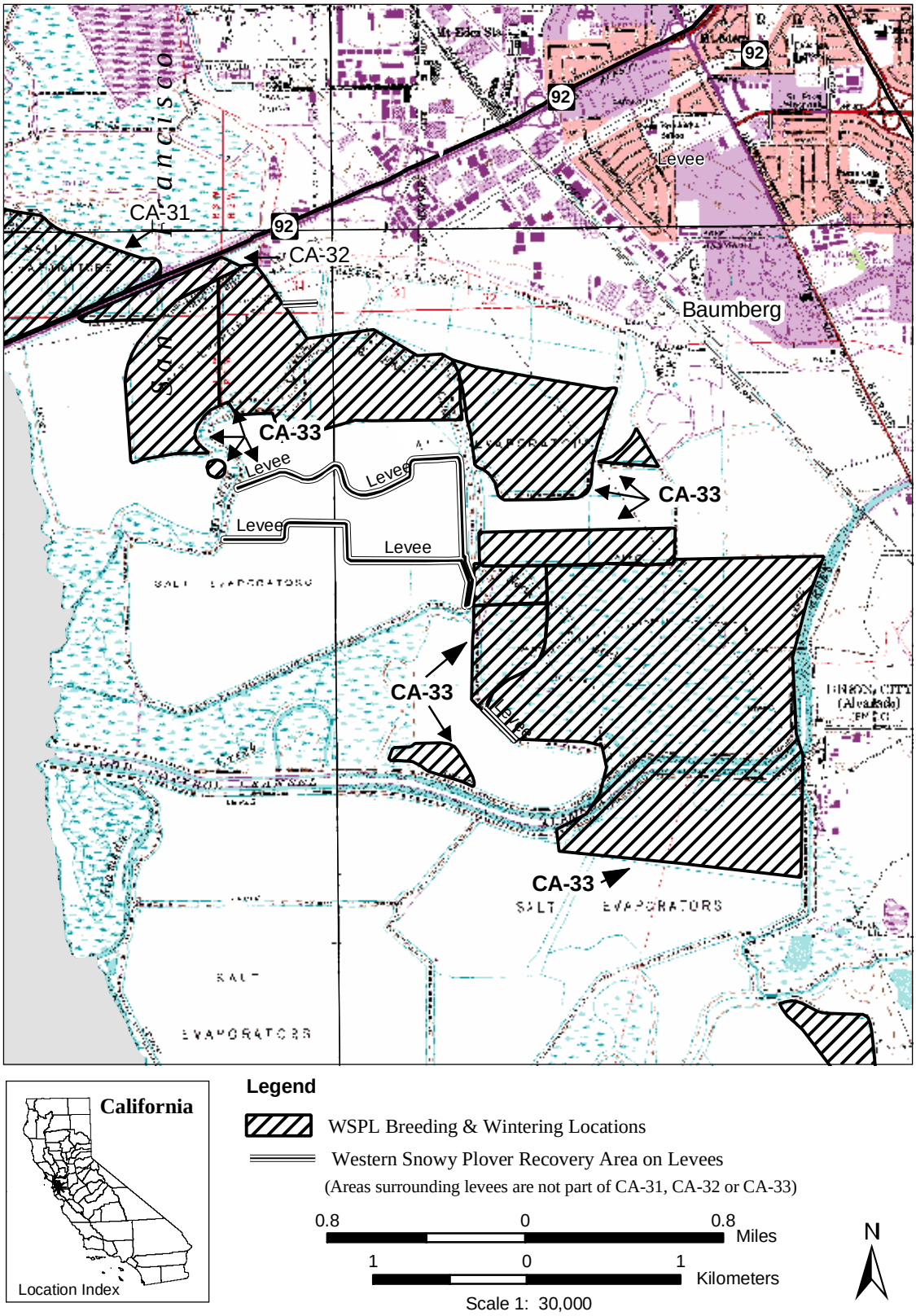


Figure L - 55. Turk Island Salt Ponds (CA-34), Alameda County, California.

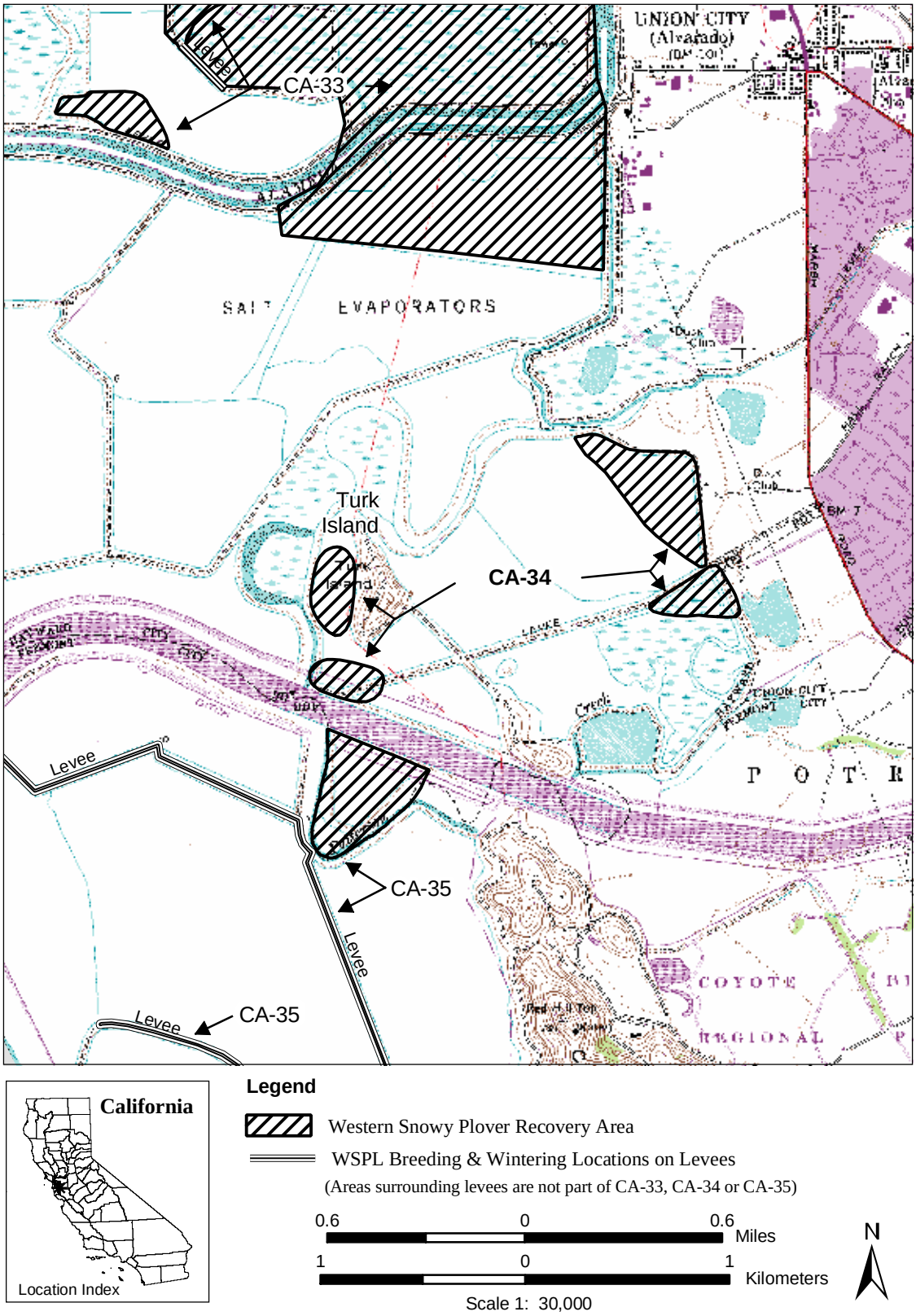


Figure L - 56. Coyote Hills Salt Ponds (CA-35), Alameda County, California.

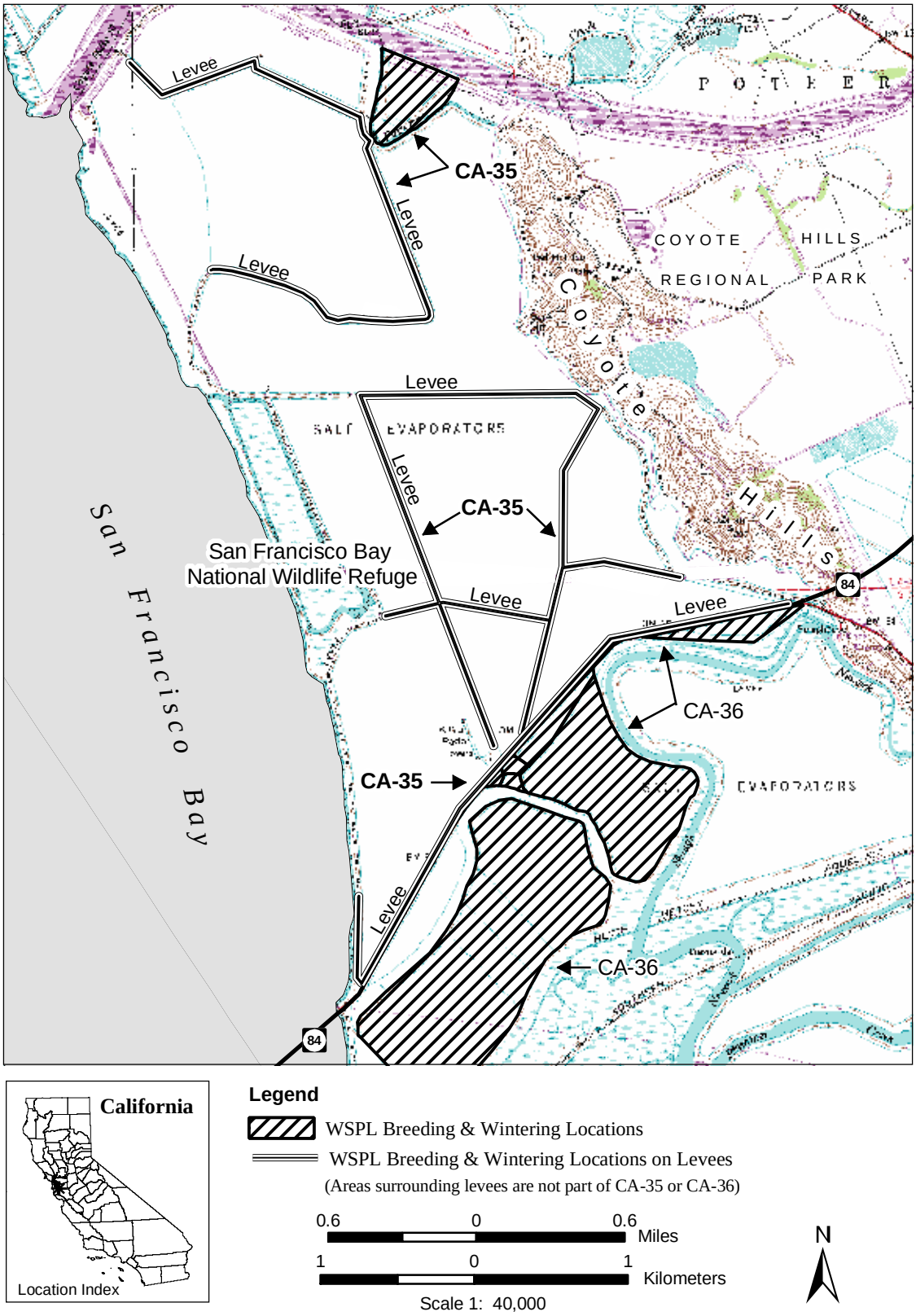
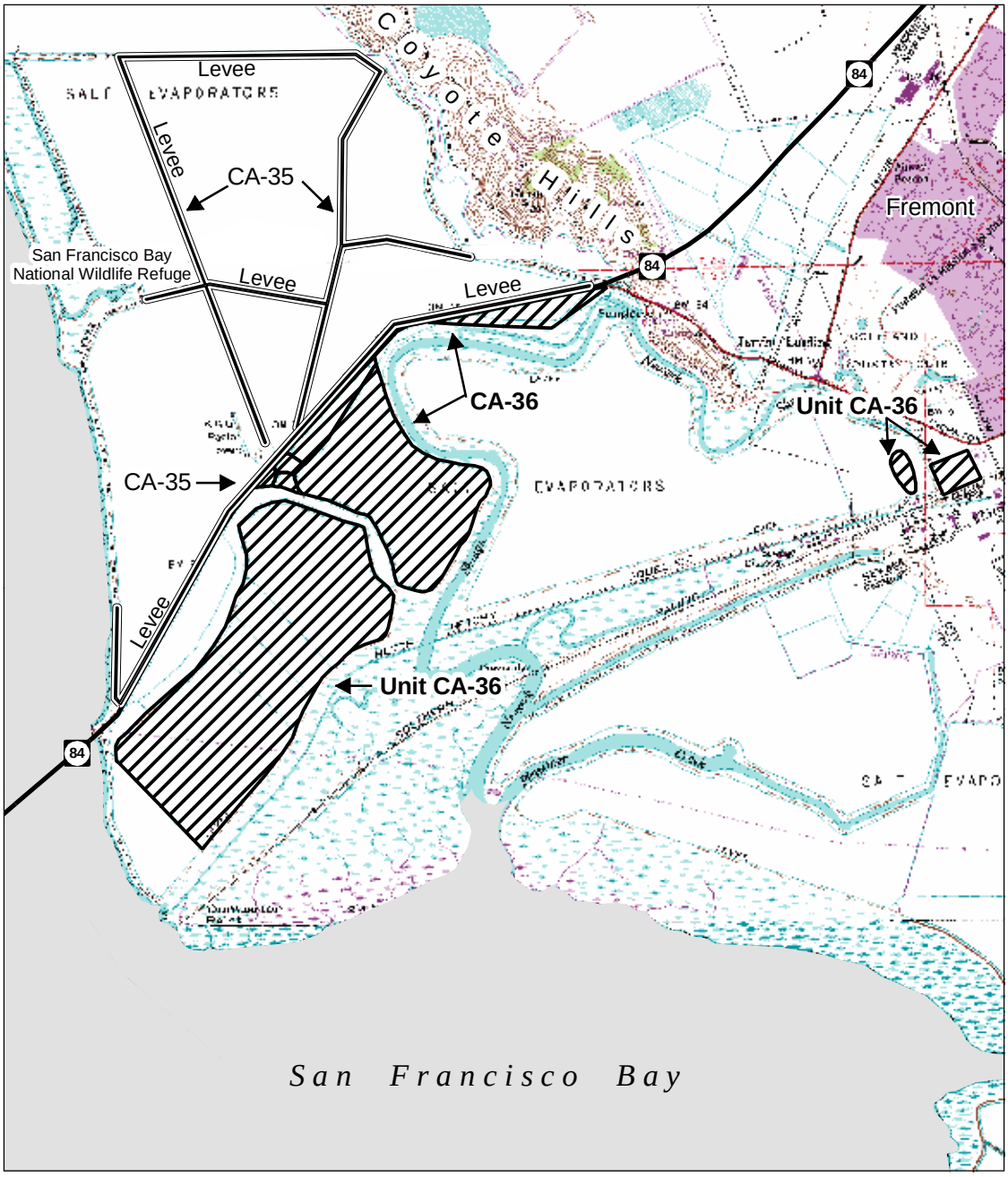


Figure L - 57. Dumbarton Salt Ponds (CA-36), Alameda County, California.



Legend

WSPL Breeding & Wintering Locations

WSPL Breeding & Wintering Locations on Levees

(Areas surrounding levees are not part of CA-35 or CA-36)

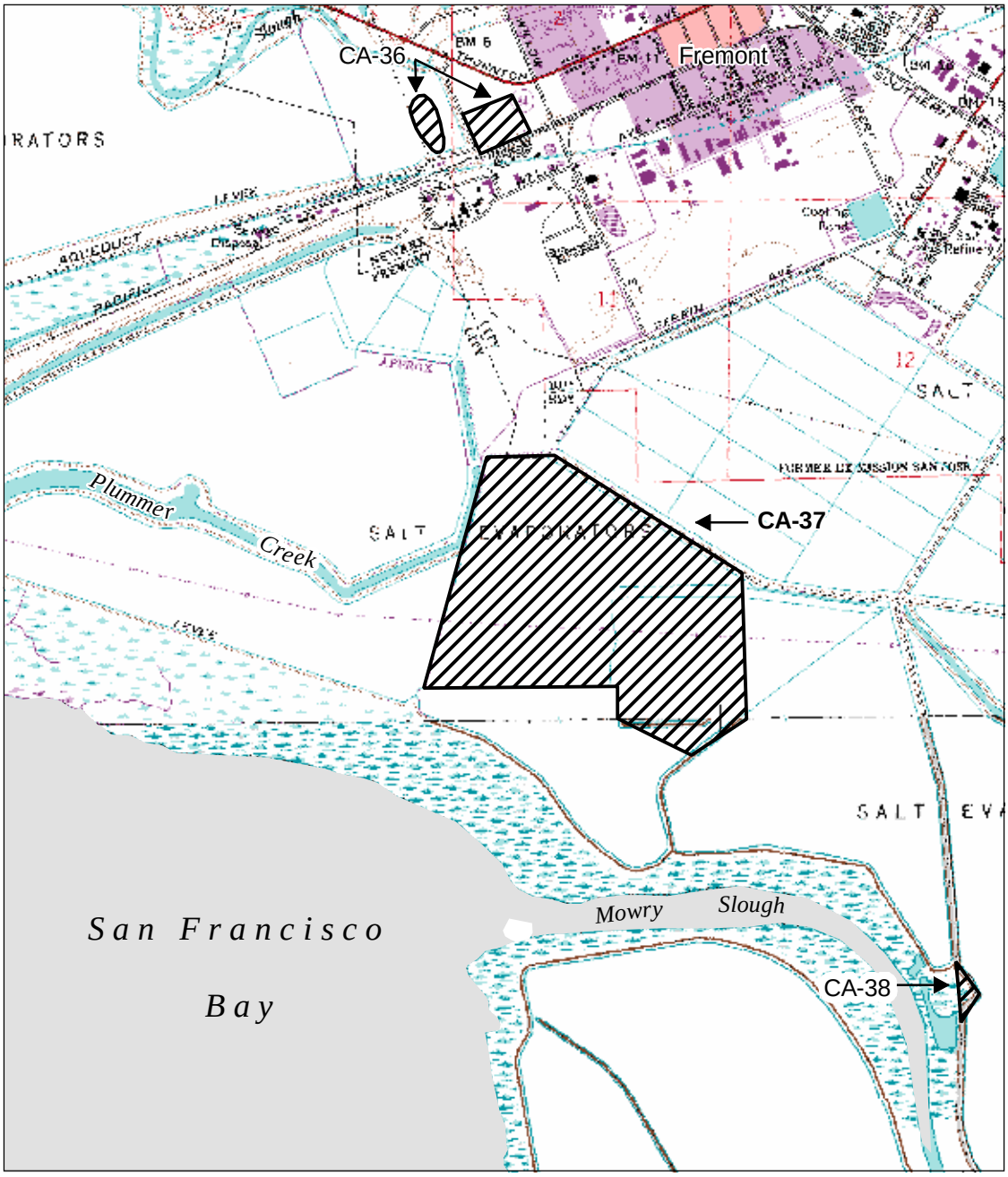
0.6 0 0.6 Miles

1 0 1 Kilometers

Scale 1: 40,000

N

Figure L - 58. Plummer Creek Salt Pond (CA-37), Alameda County, California.



Legend

WSPL Breeding & Wintering Area

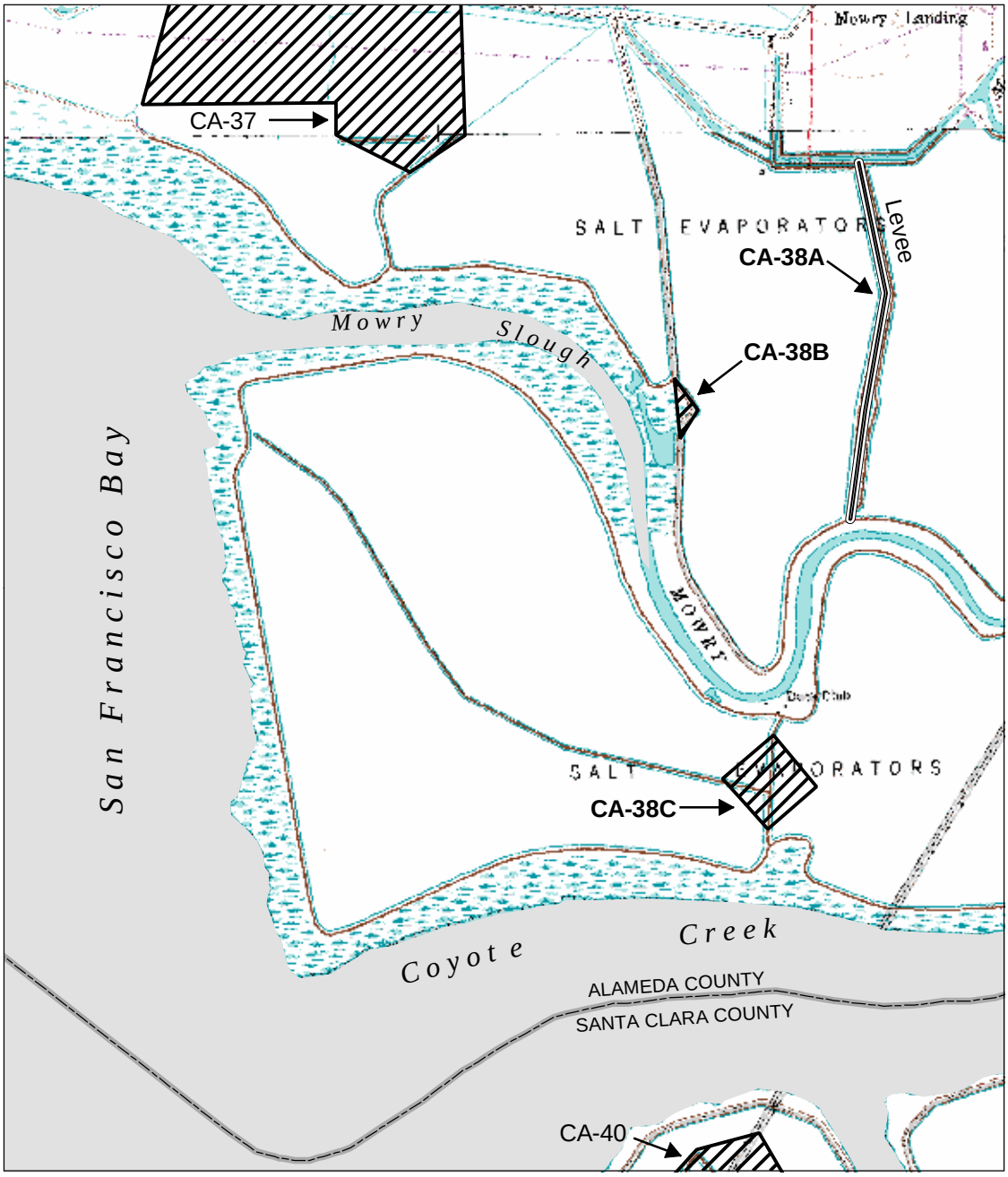
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 59. Mowry Salt Ponds (CA-38), Alameda County, California.



Legend

Western Snowy Plover Recovery Area

WSPL Breeding & Wintering Locations on Levees

(Areas surrounding levees are not part of CA-38)

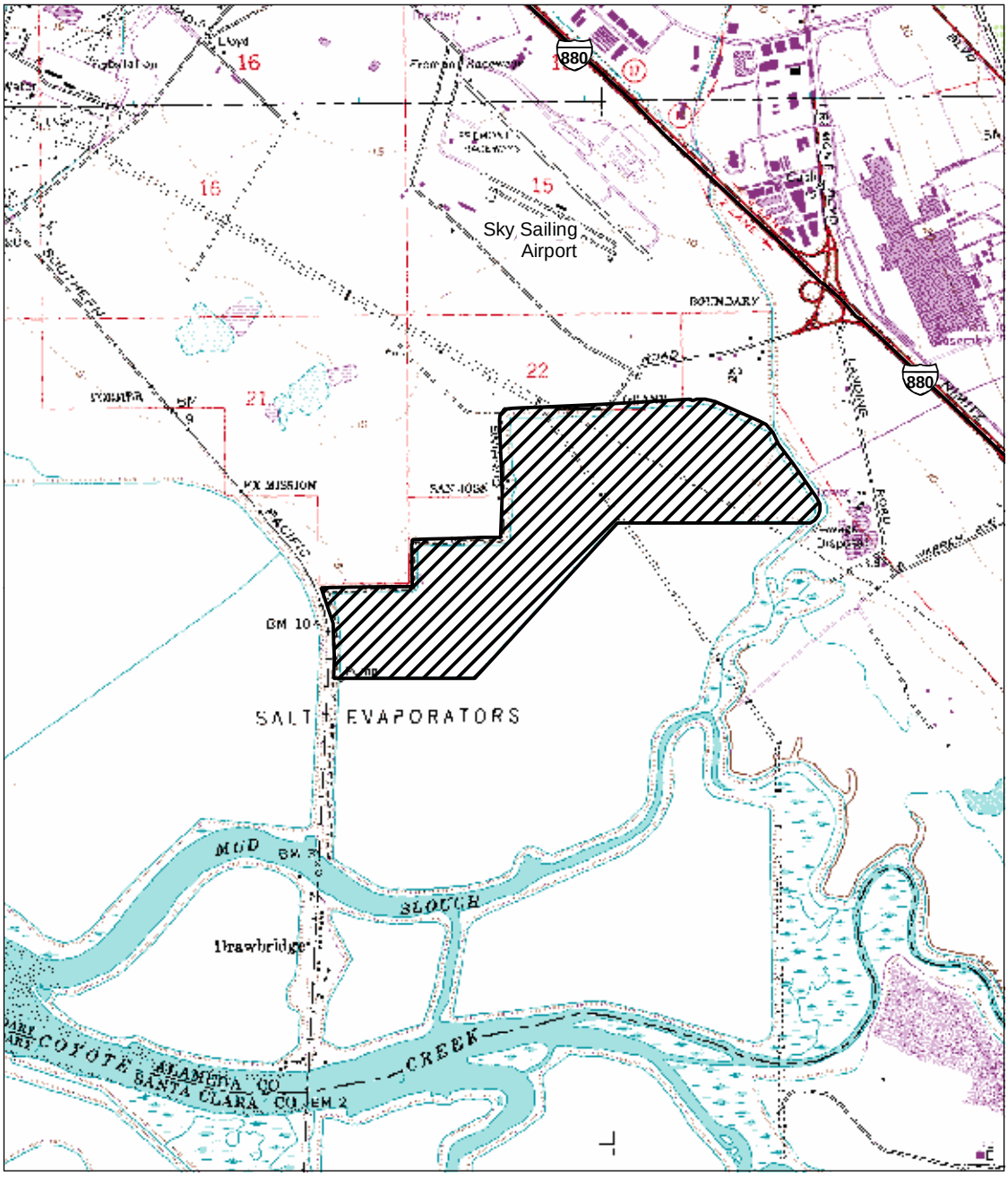
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 60. Warm Springs Salt Pond (CA-39), Alameda County, California.



Legend

WSPL Breeding & Wintering Locations

0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 61. Knapp Salt Pond (CA-40), Santa Clara County, California.

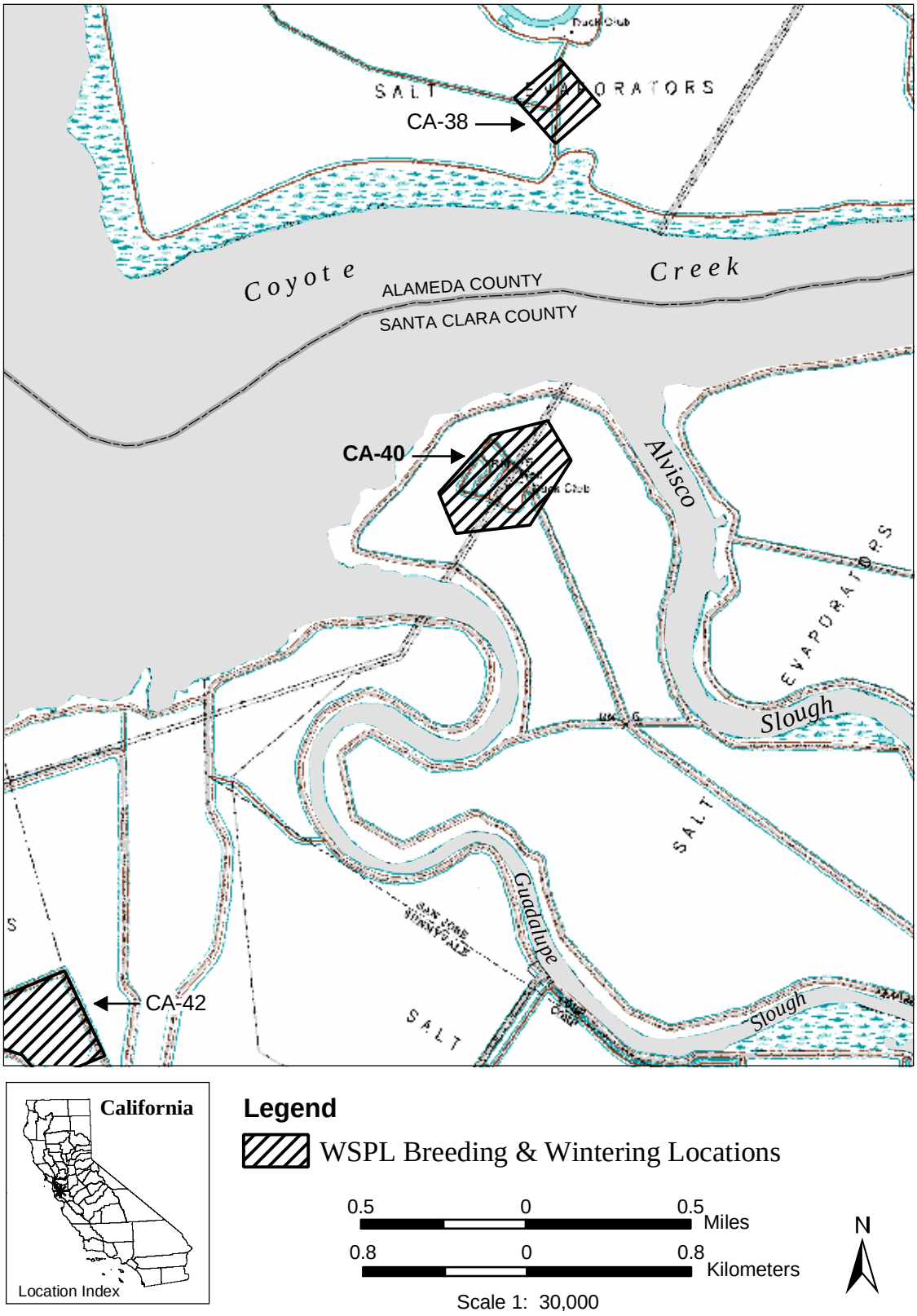
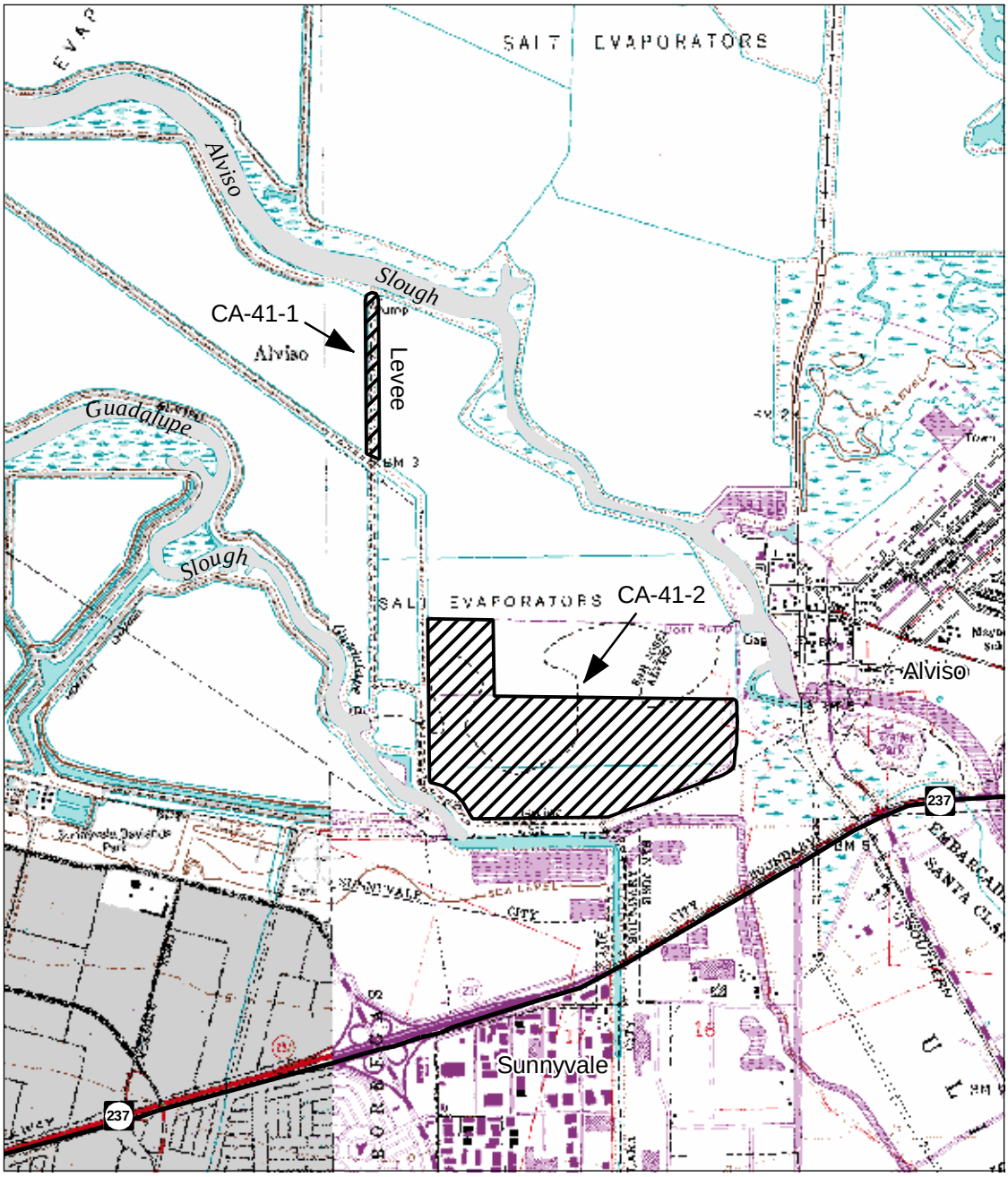


Figure L - 62. Alviso Salt Ponds (CA-41), Santa Clara County, California.



Legend

WSPL Breeding & Wintering Locations

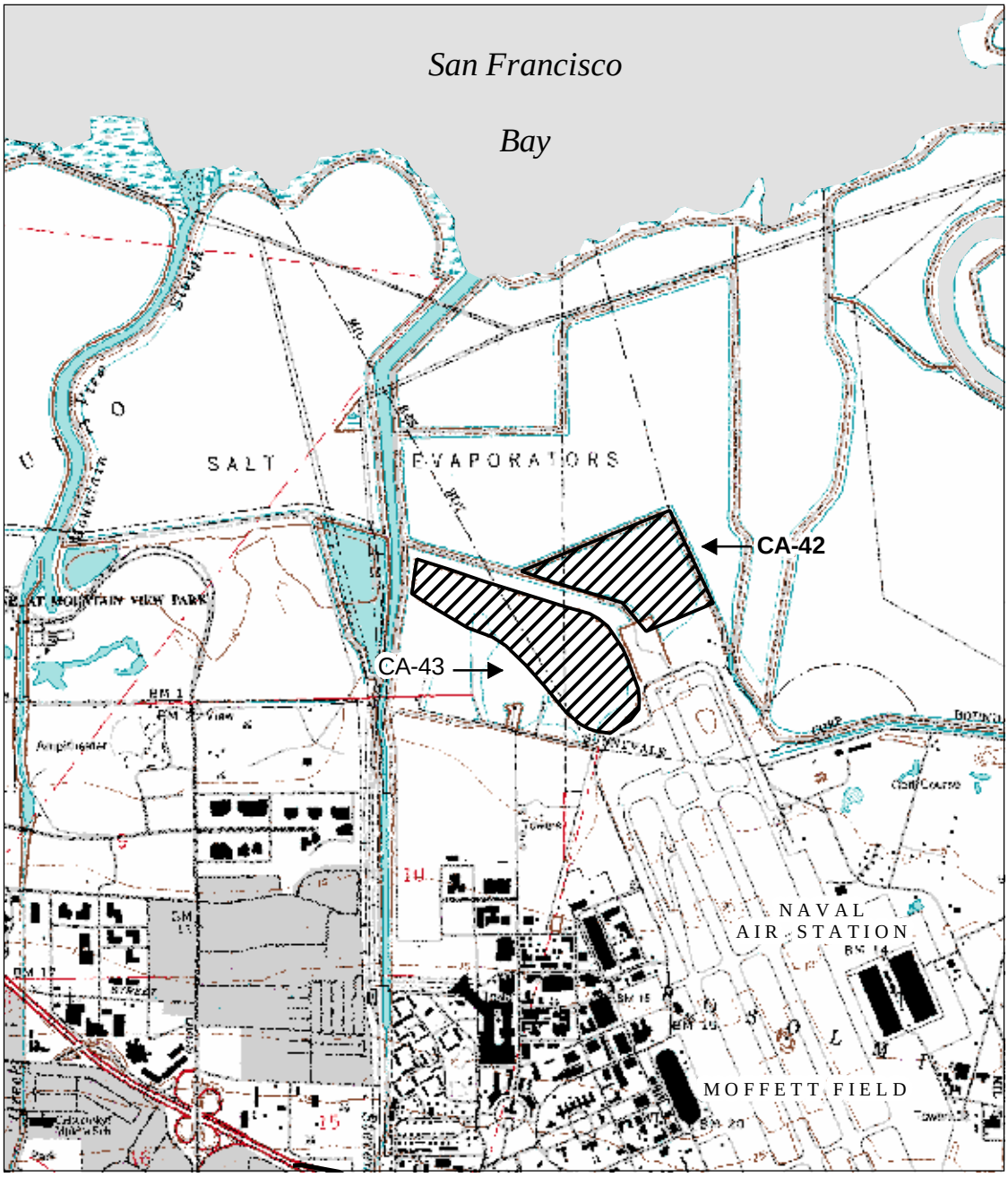
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 63. Moffett Field (CA-42), Santa Clara County, California.



Legend

Western Snowy Plover Recovery Area

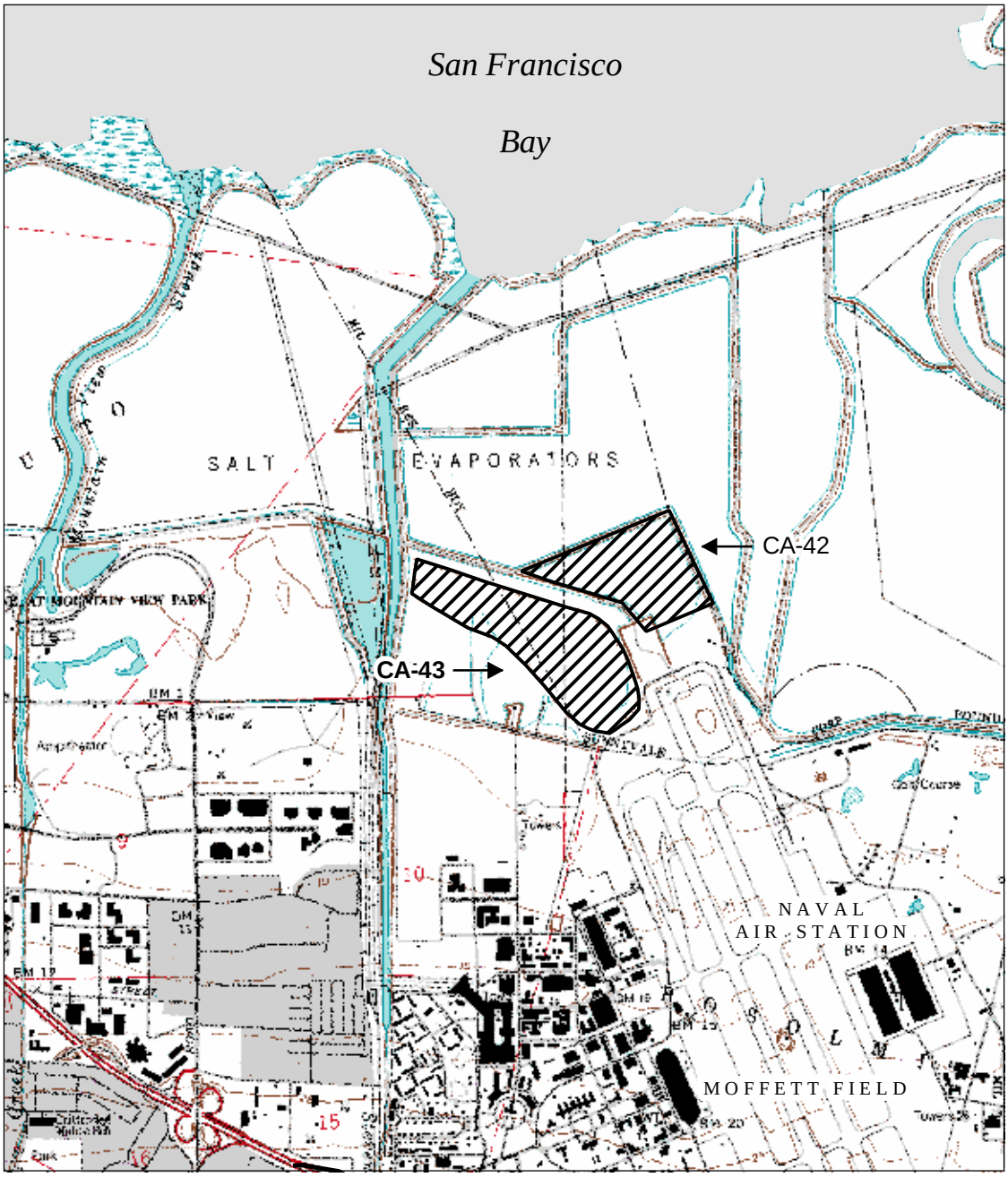
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 64. Crittenden Marsh (CA-43), Santa Clara County, California.



Legend

Western Snowy Plover Recovery Area

0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 65. Ravenswood Salt Pond and Levee (CA-44), San Mateo County, California.

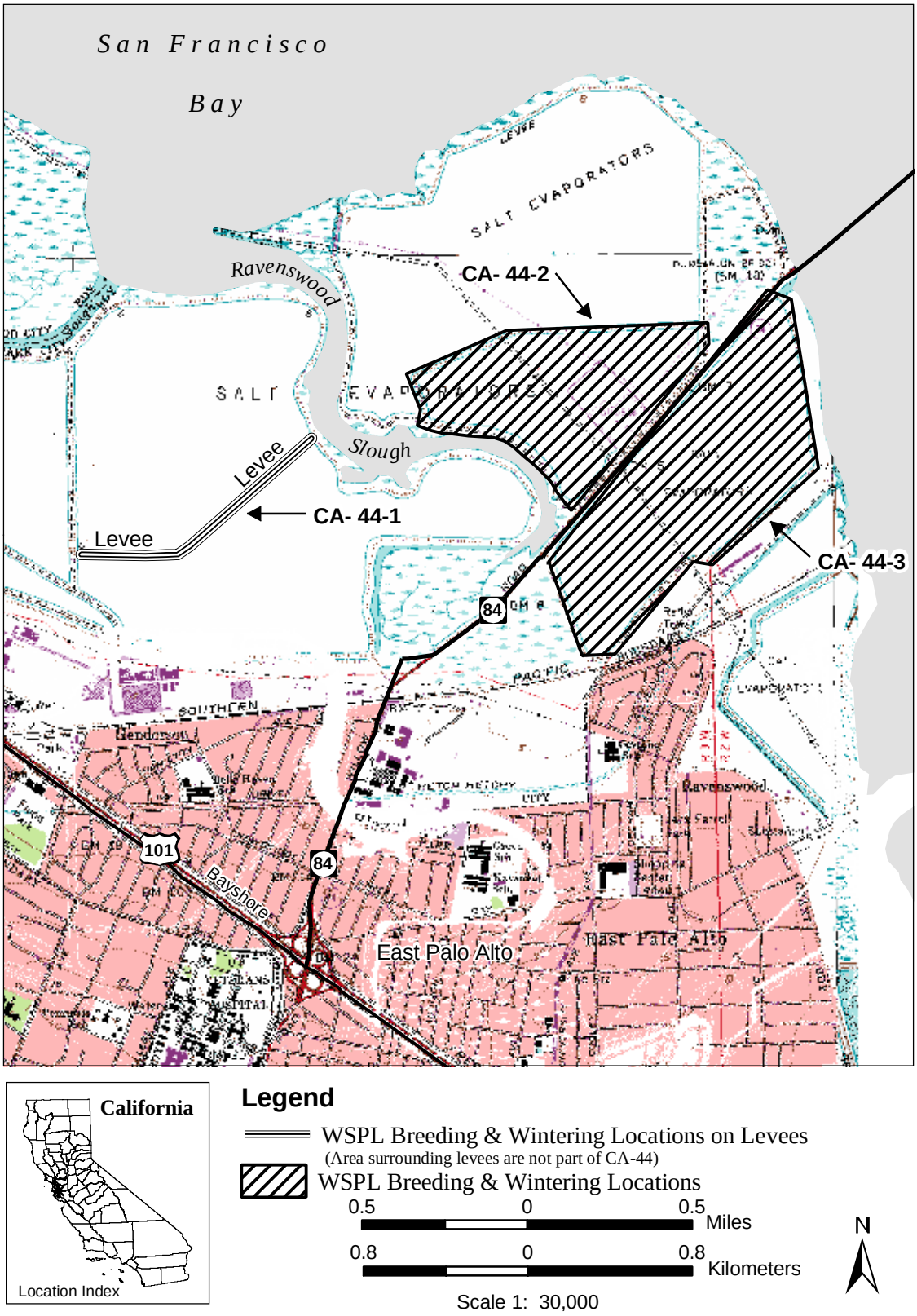
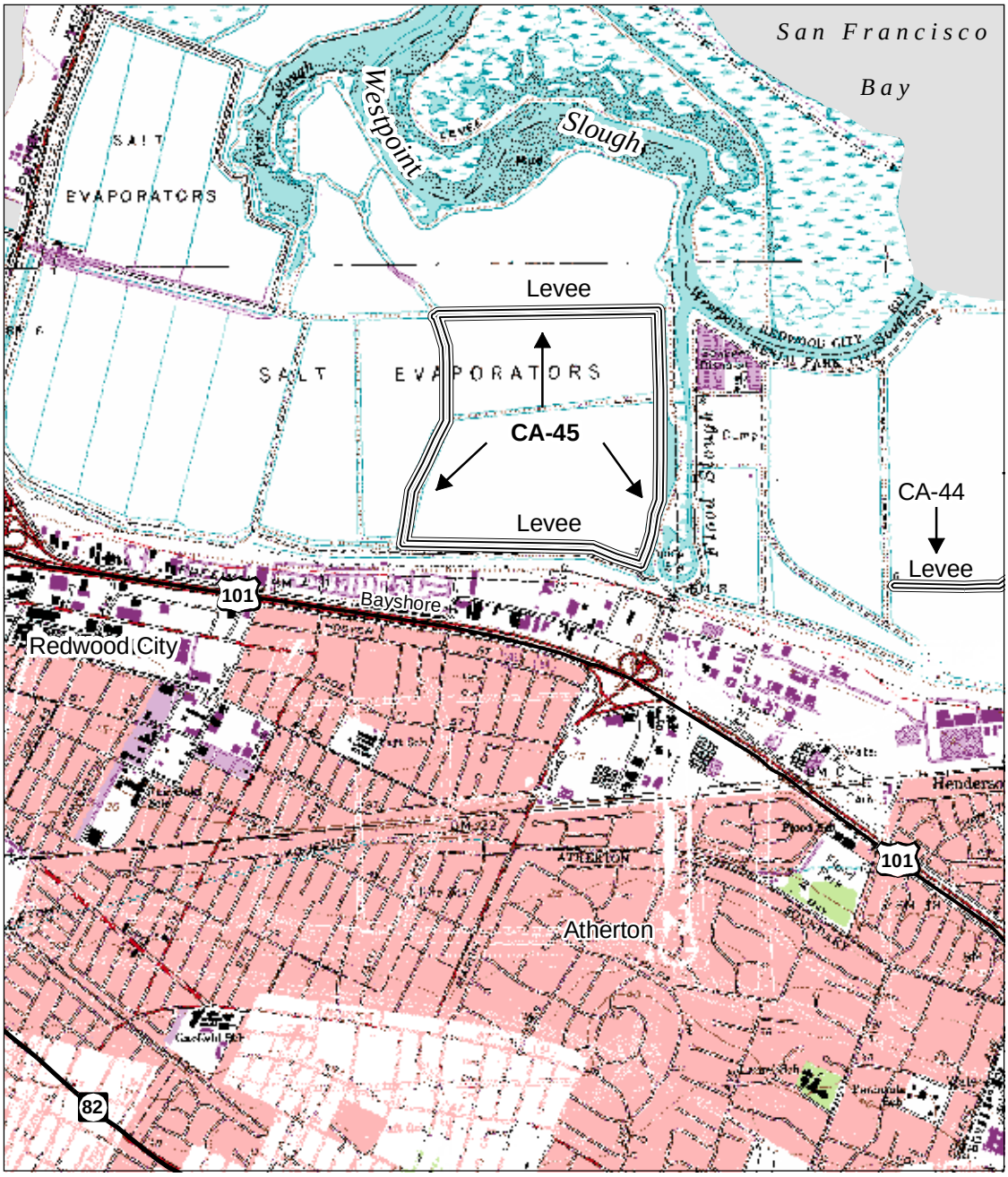


Figure L - 66. Redwood City Salt Pond (CA-45), San Mateo County, California.



Legend

WSPL Breeding & Wintering Locations on Levees
(Area surrounding levees are not part of CA-44 or CA-45)

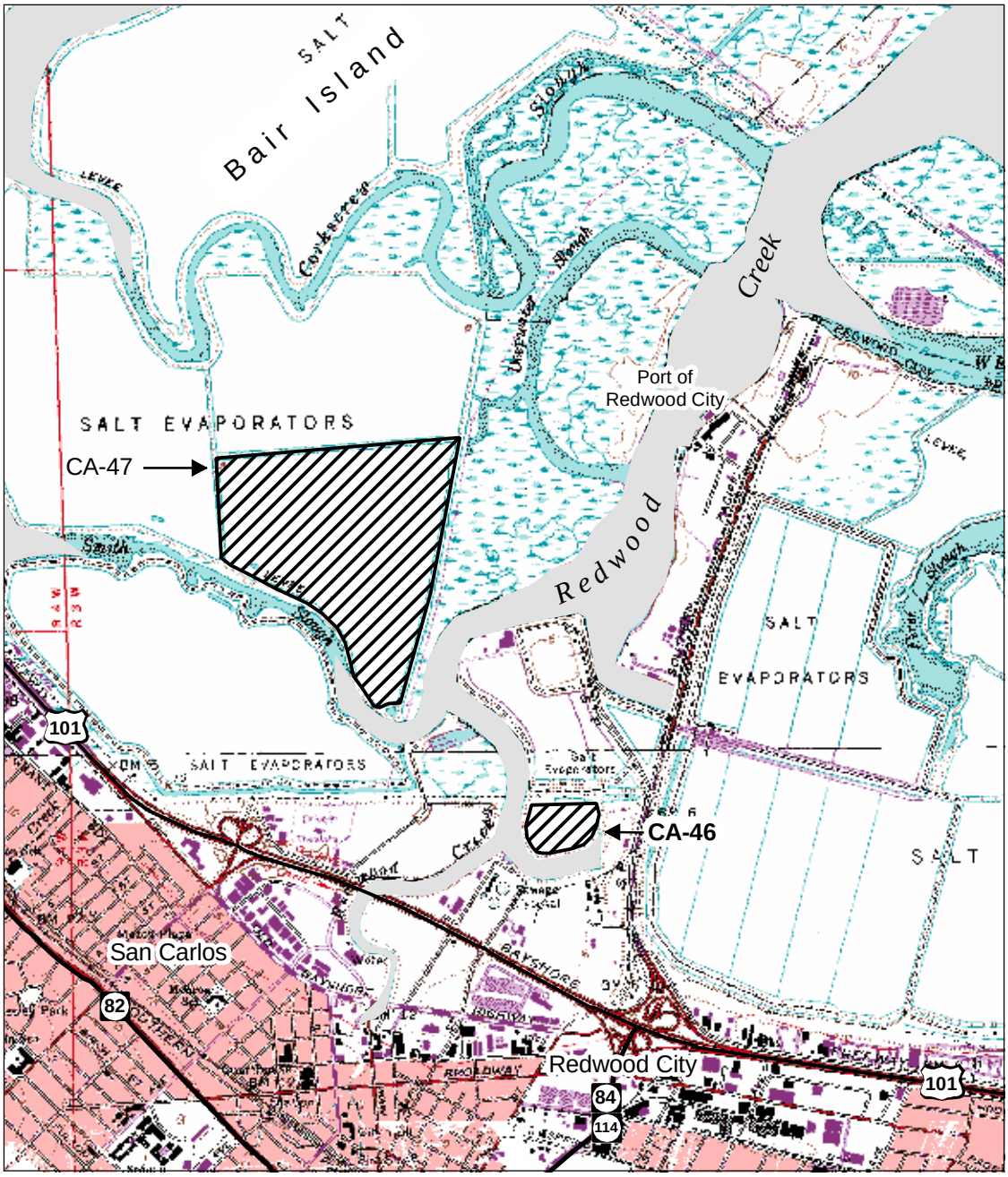
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 67. Redwood Creek (CA-46), San Mateo County, California.



Legend

Western Snowy Plover Recovery Area

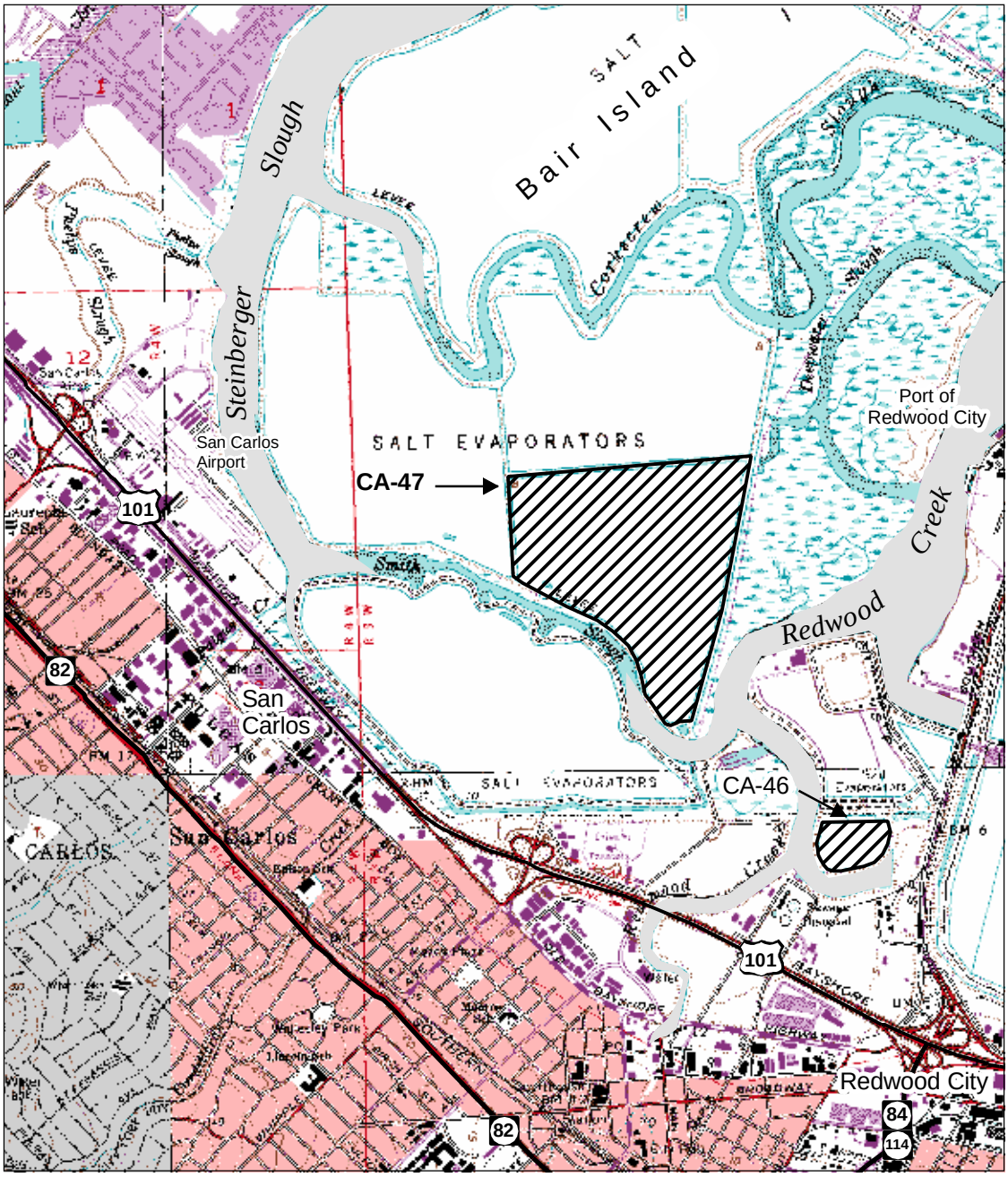
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 68. Middle Bair Island (CA-47), San Mateo County, California.



Legend

WSPL Breeding & Wintering Locations

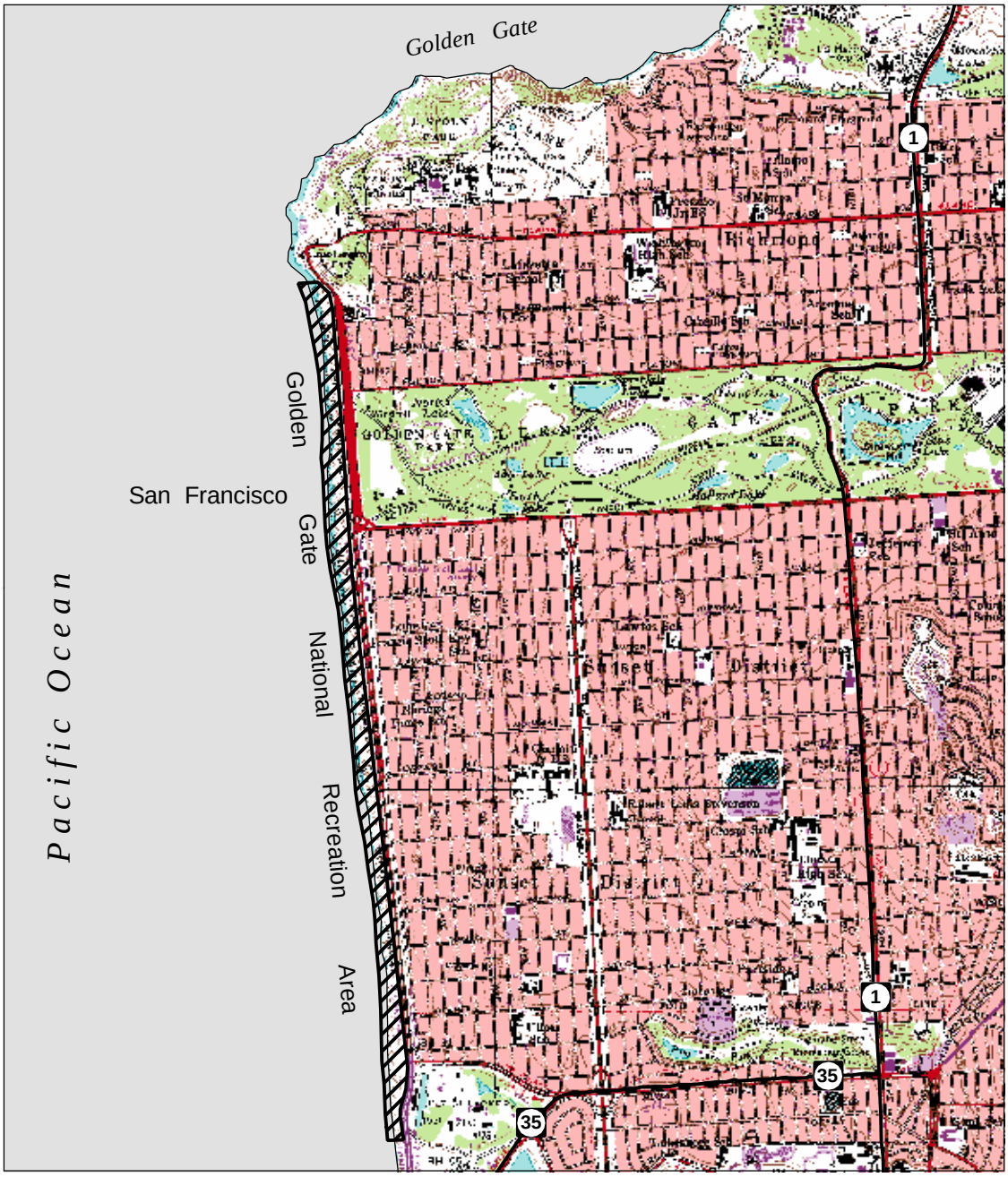
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 69. Ocean Beach (CA-24), San Francisco County, California.



Legend

WSPL Breeding & Wintering Locations

0.6 0 0.6 Miles

1 0 1 Kilometers

Scale 1: 40,000

N

Figure L - 70. Pacifica Beach (CA-48), San Mateo County, California.

Legend

WSPL Breeding & Wintering Locations

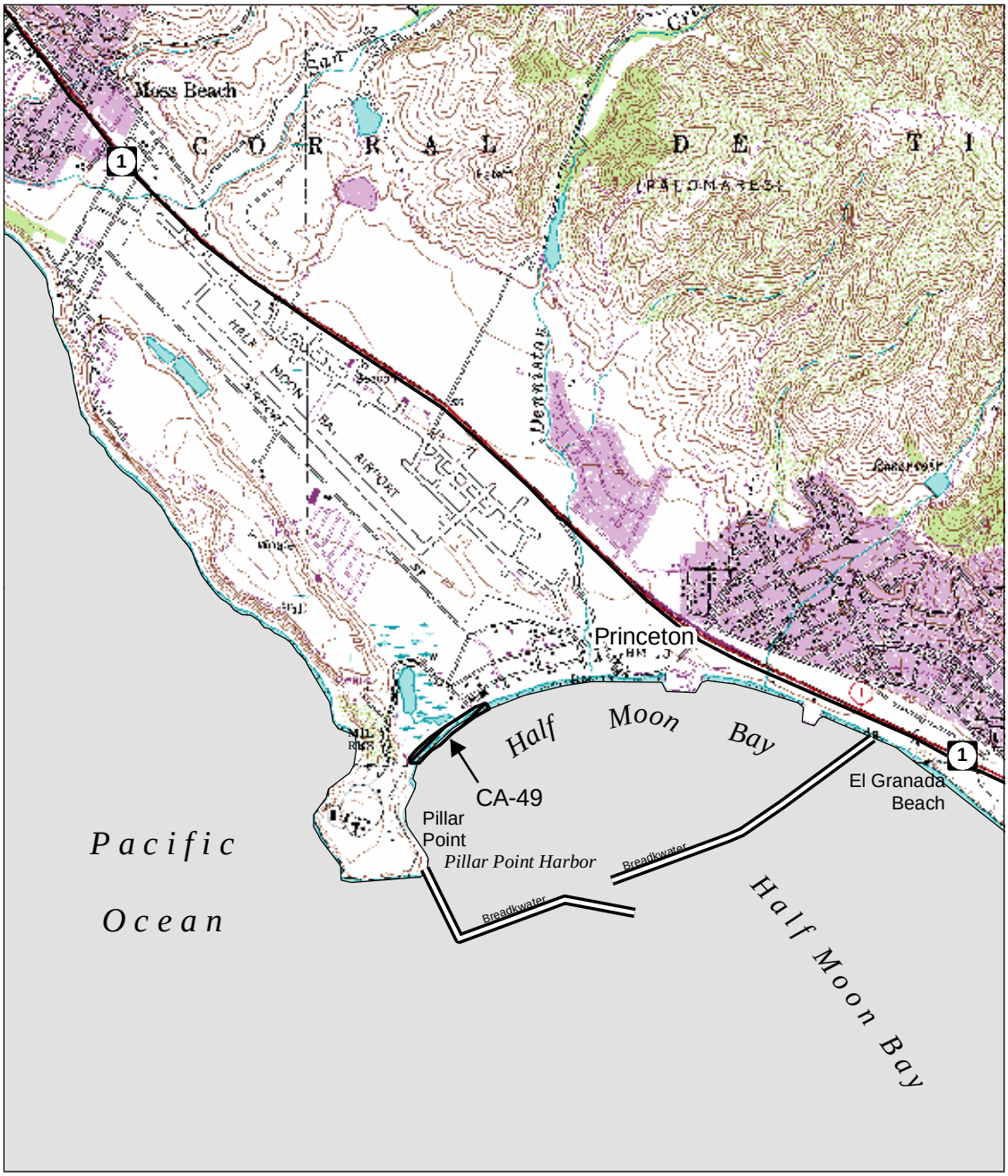
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 71. Pillar Point (CA-49), San Mateo County, California.



Legend

WSPL Breeding & Wintering Locations

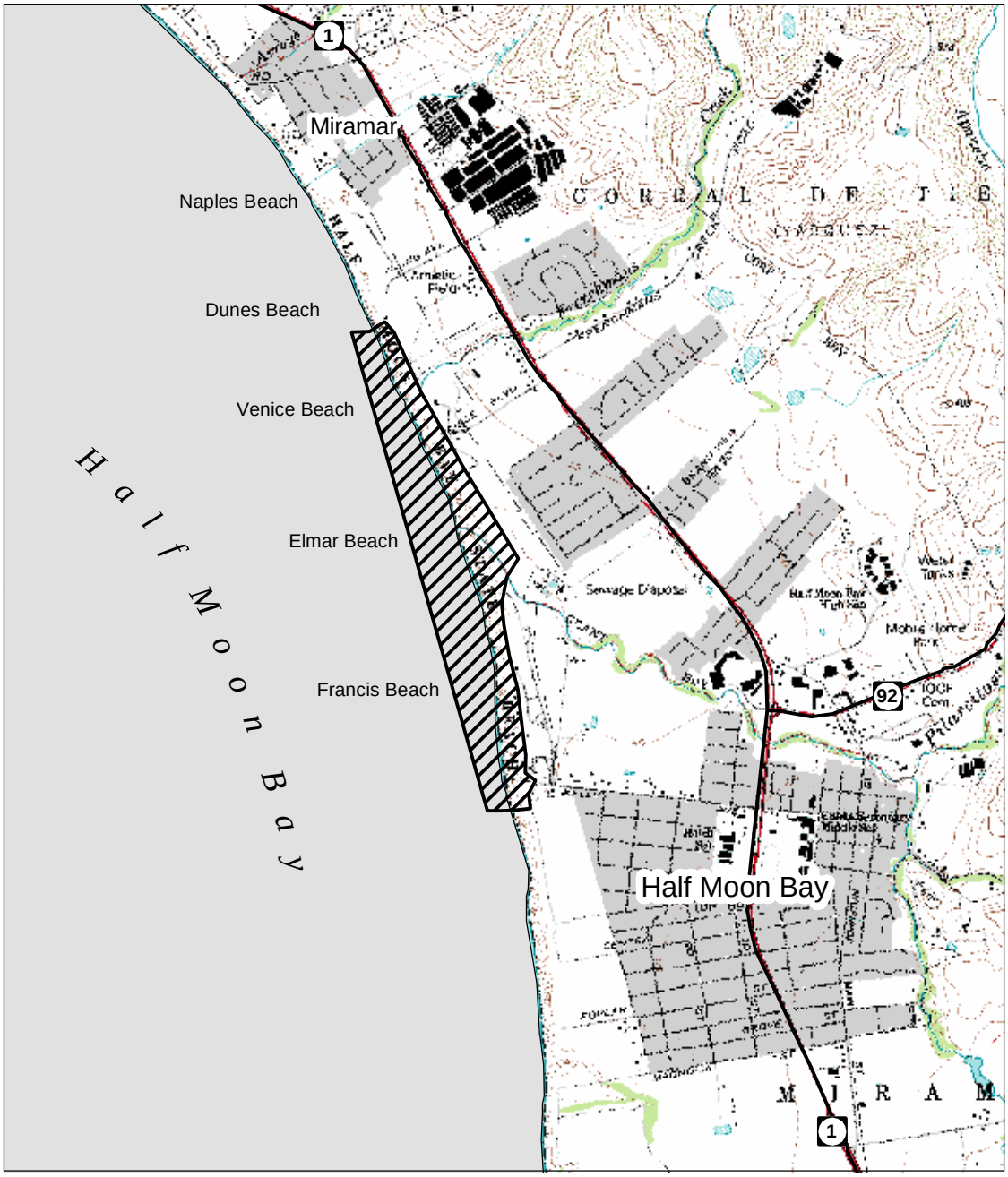
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 72. Half Moon Bay Beaches (CA-50), San Mateo County, California.



Legend

WSPL Breeding & Wintering Locations

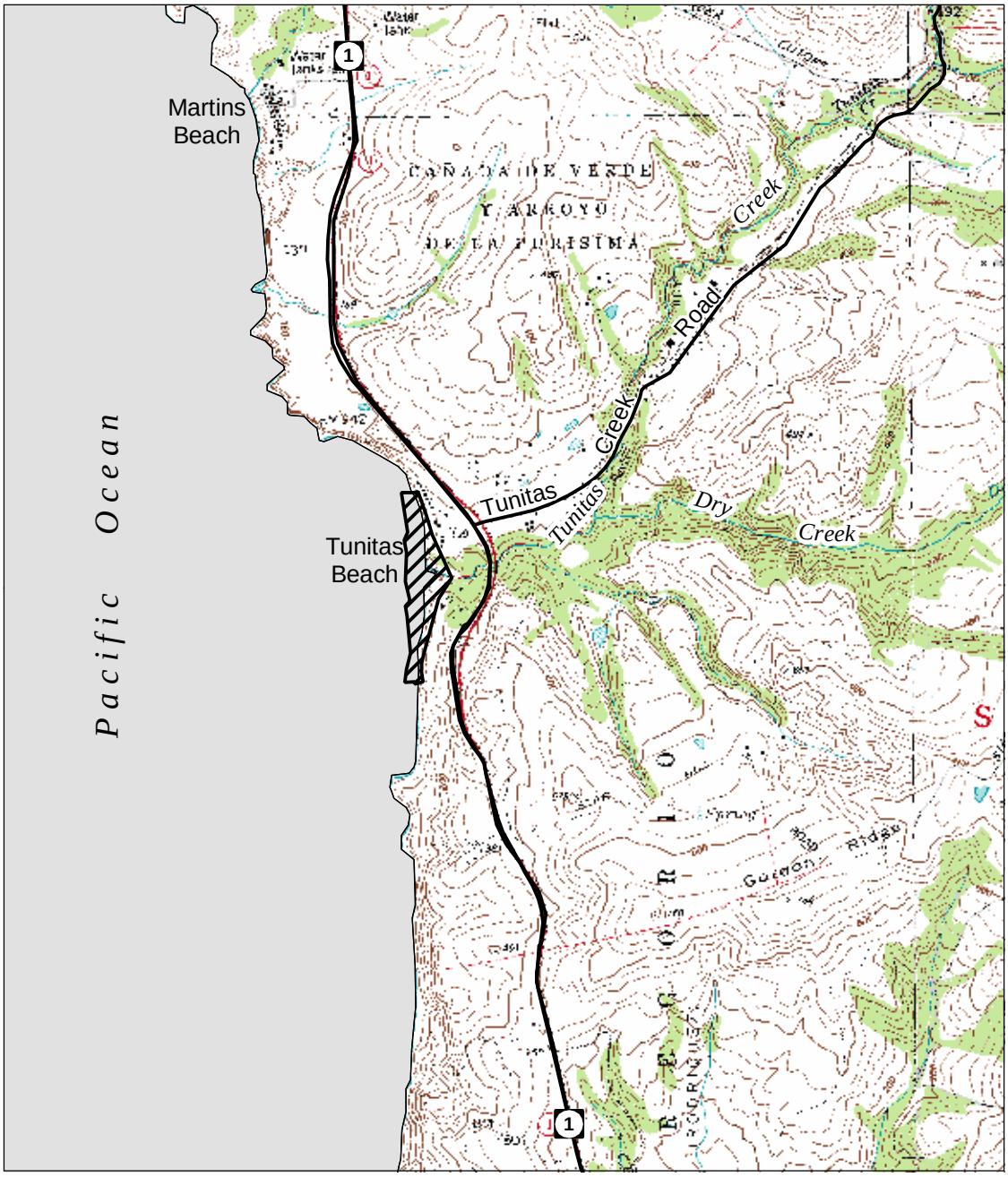
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 73. Tunitas Beach (CA-51), San Mateo County, California.



Legend

WSPL Breeding & Wintering Locations

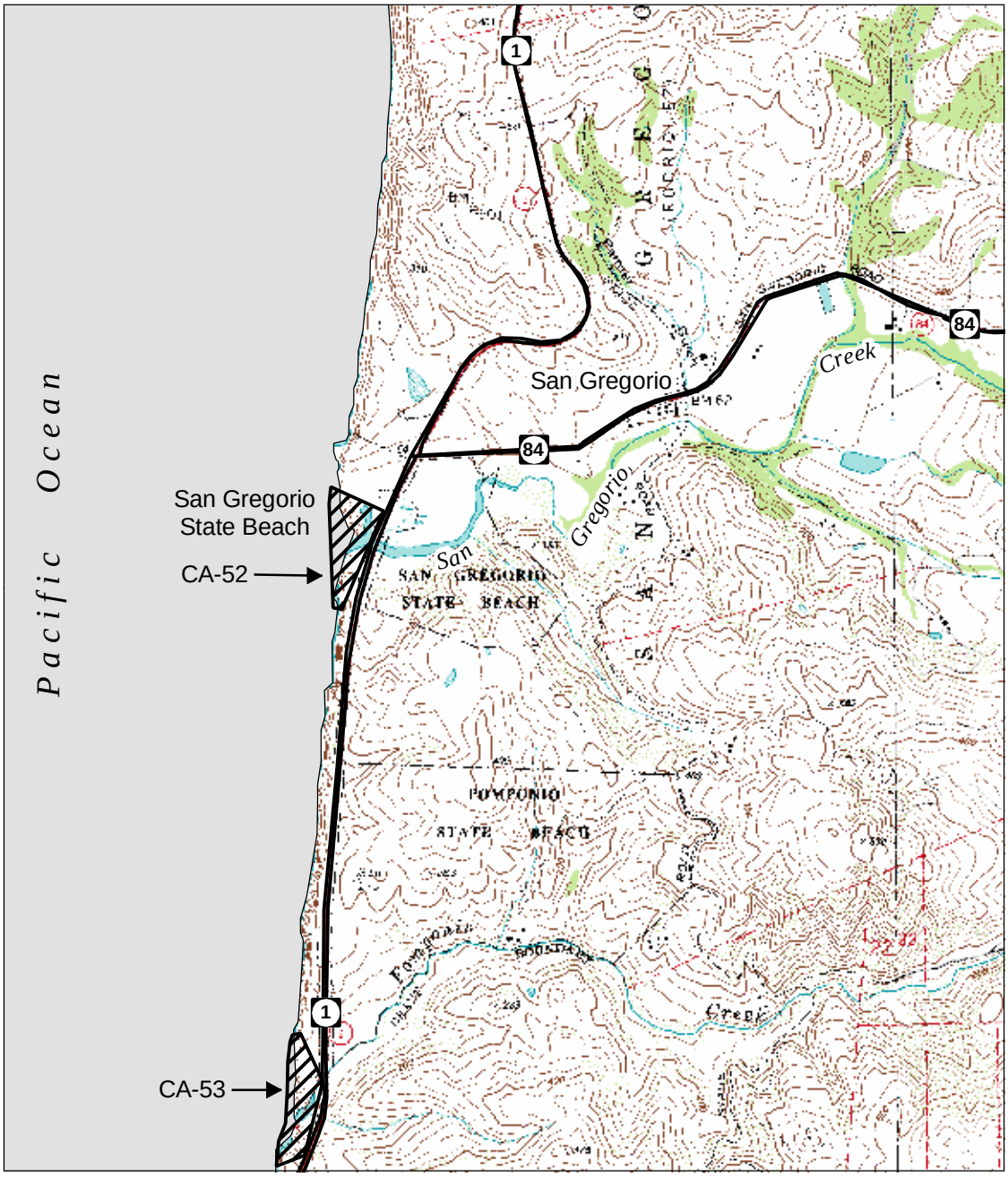
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 74. San Gregorio Beach (CA-52), San Mateo County, California.



Legend

WSPL Breeding & Wintering Locations

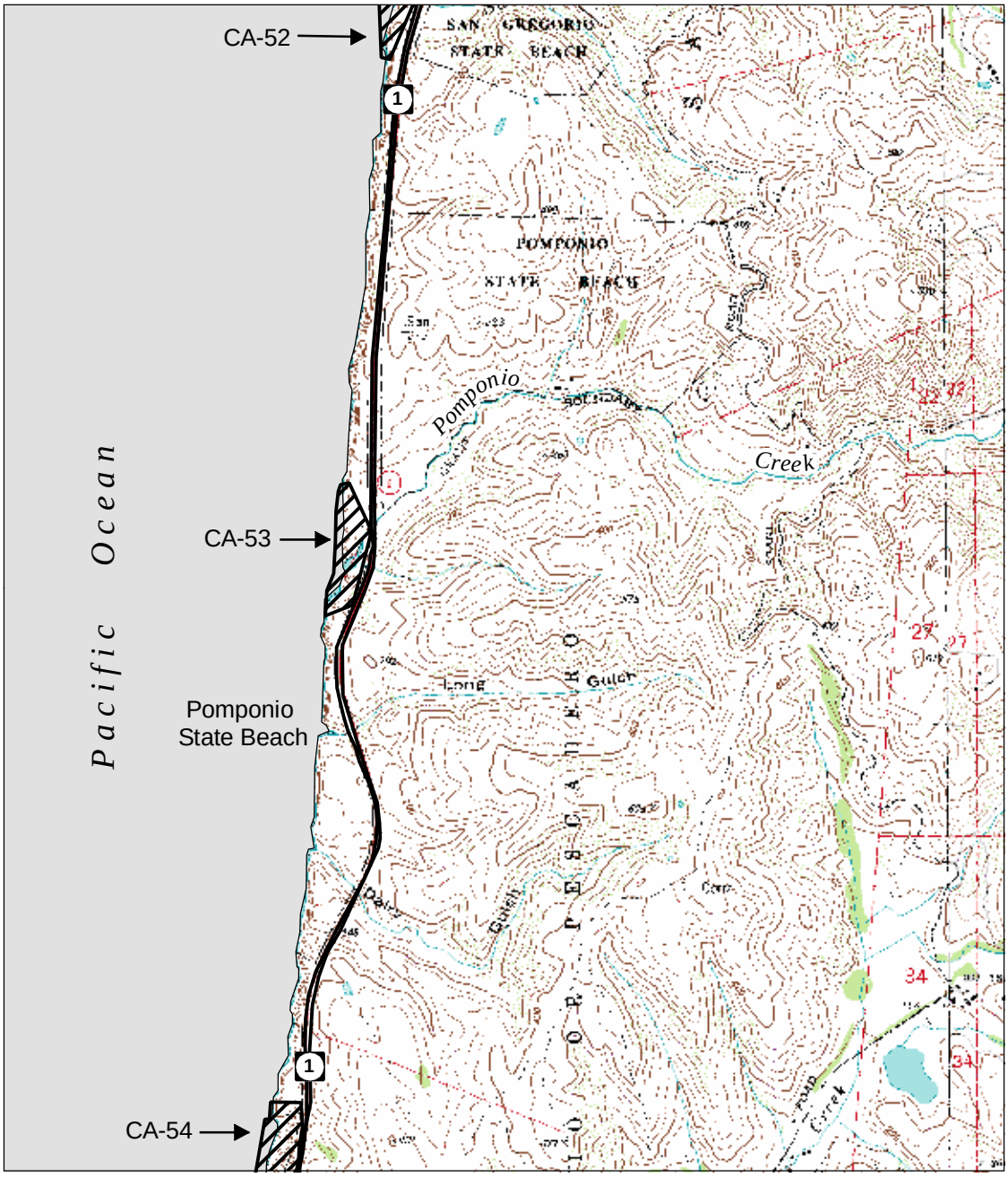
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 75. Pomponio Beach (CA-53), San Mateo County, California.



Legend

WSPL Breeding & Wintering Locations

0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 76. Pescadero Beach (CA-54), San Mateo County, California.

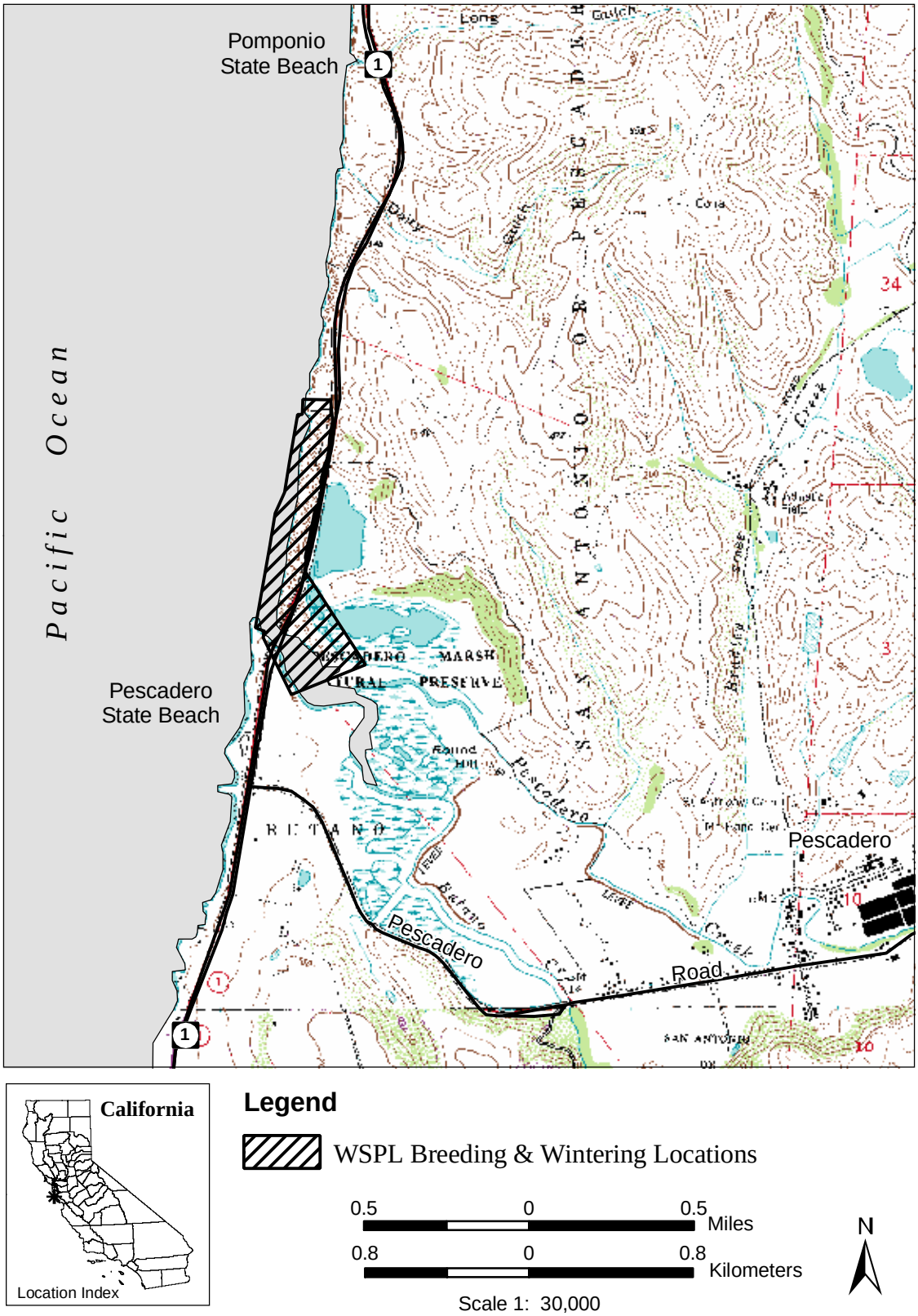
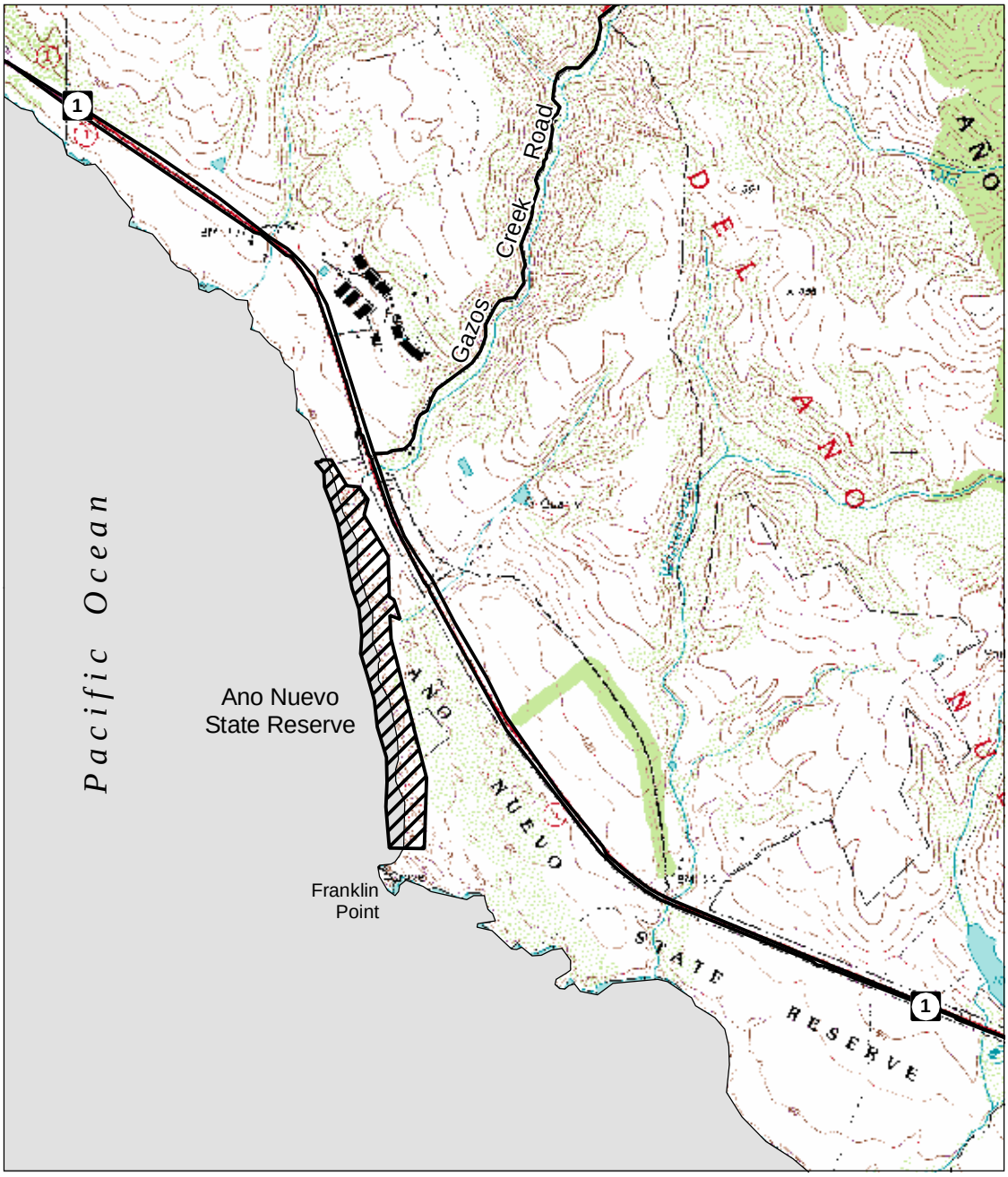


Figure L - 77. Gazos Creek (CA-55), San Mateo County, California.



Legend

WSPL Breeding & Wintering Locations

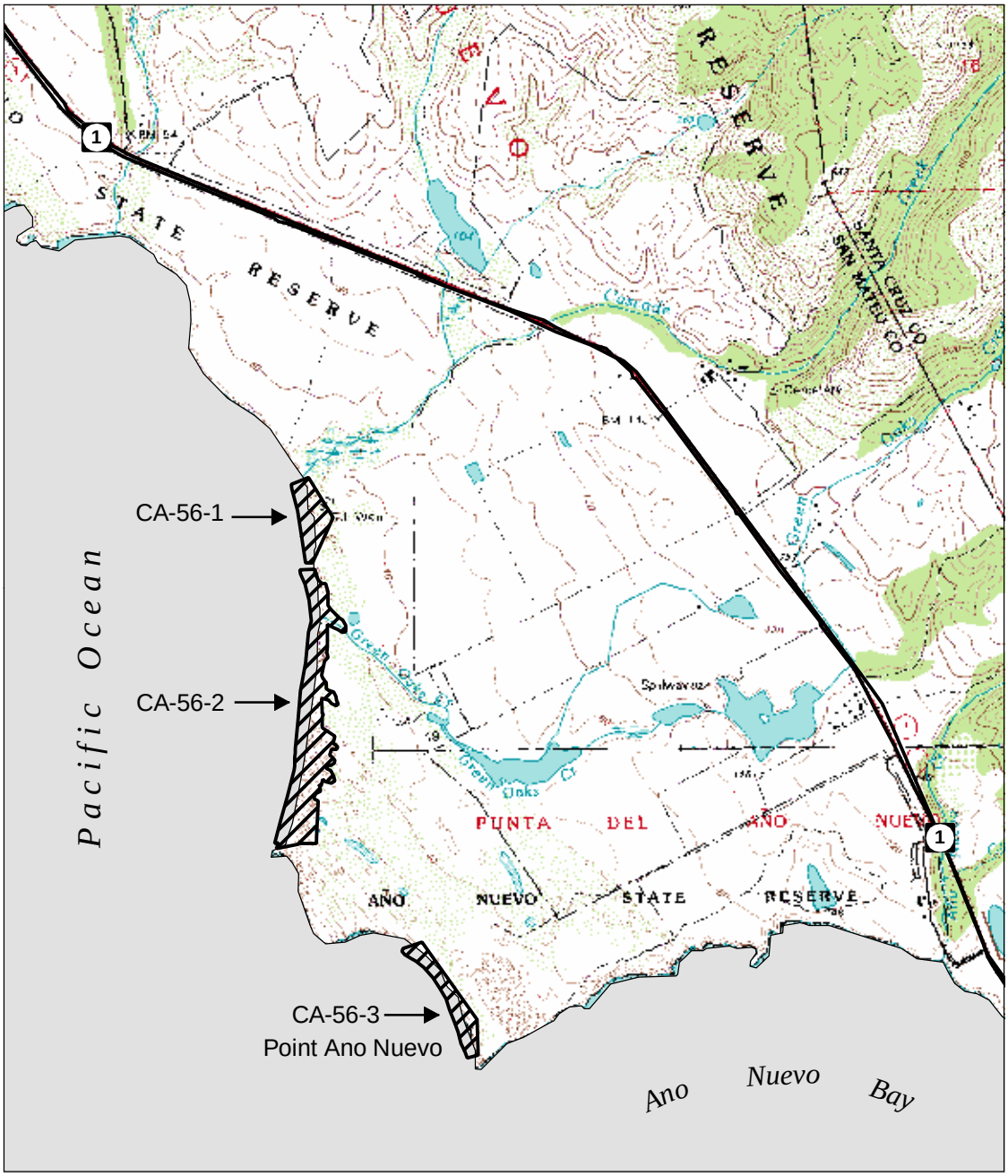
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 78. Ano Nuevo (CA-56), San Mateo County, California.



Legend

WSPL Breeding & Wintering Locations

0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 79. Waddell Creek (CA-57), Santa Cruz County, California.

Legend

WSPL Breeding & Wintering Locations

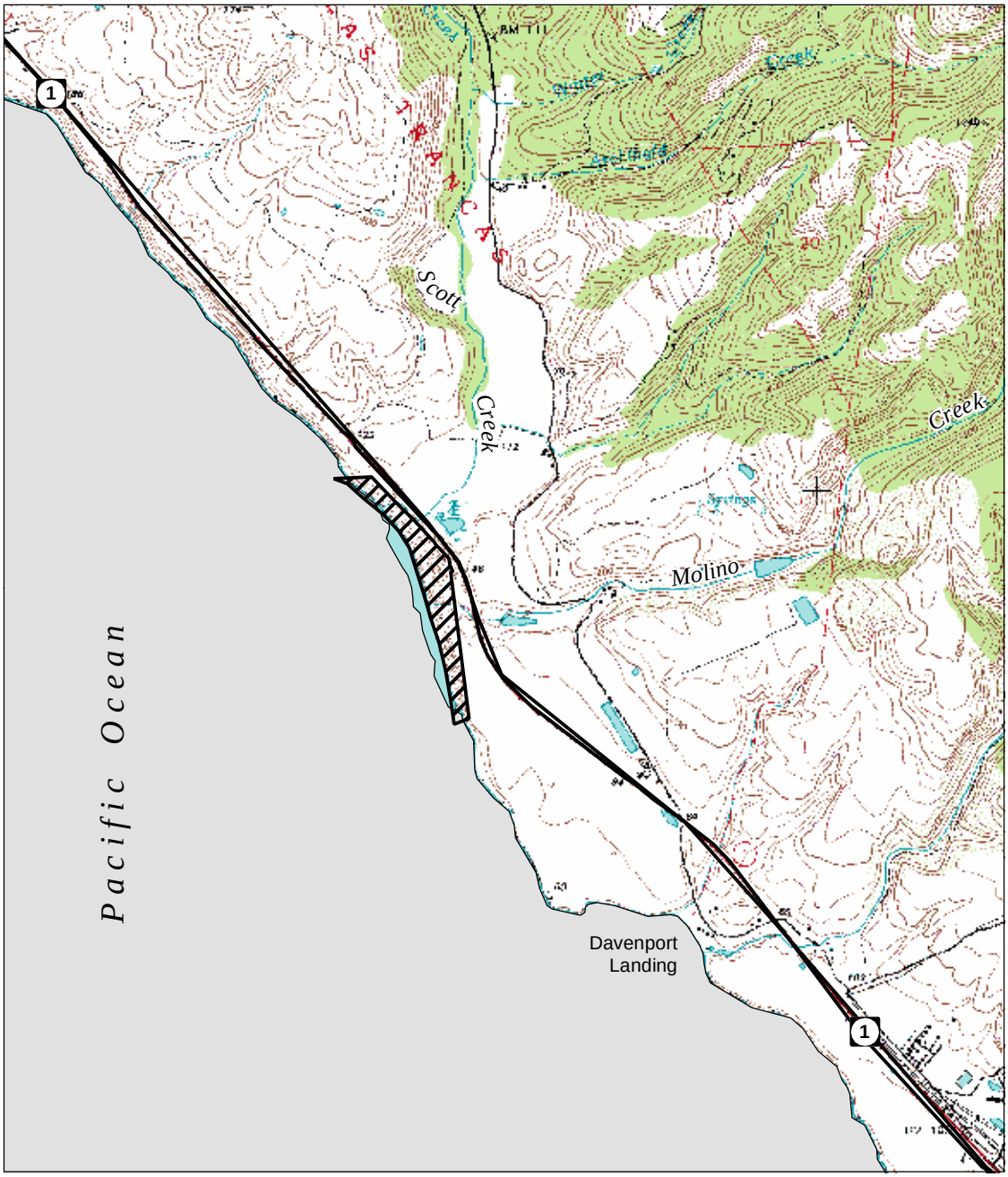
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 80. Scott Creek Beach (CA-58), Santa Cruz County, California.



Legend

WSPL Breeding & Wintering Locations

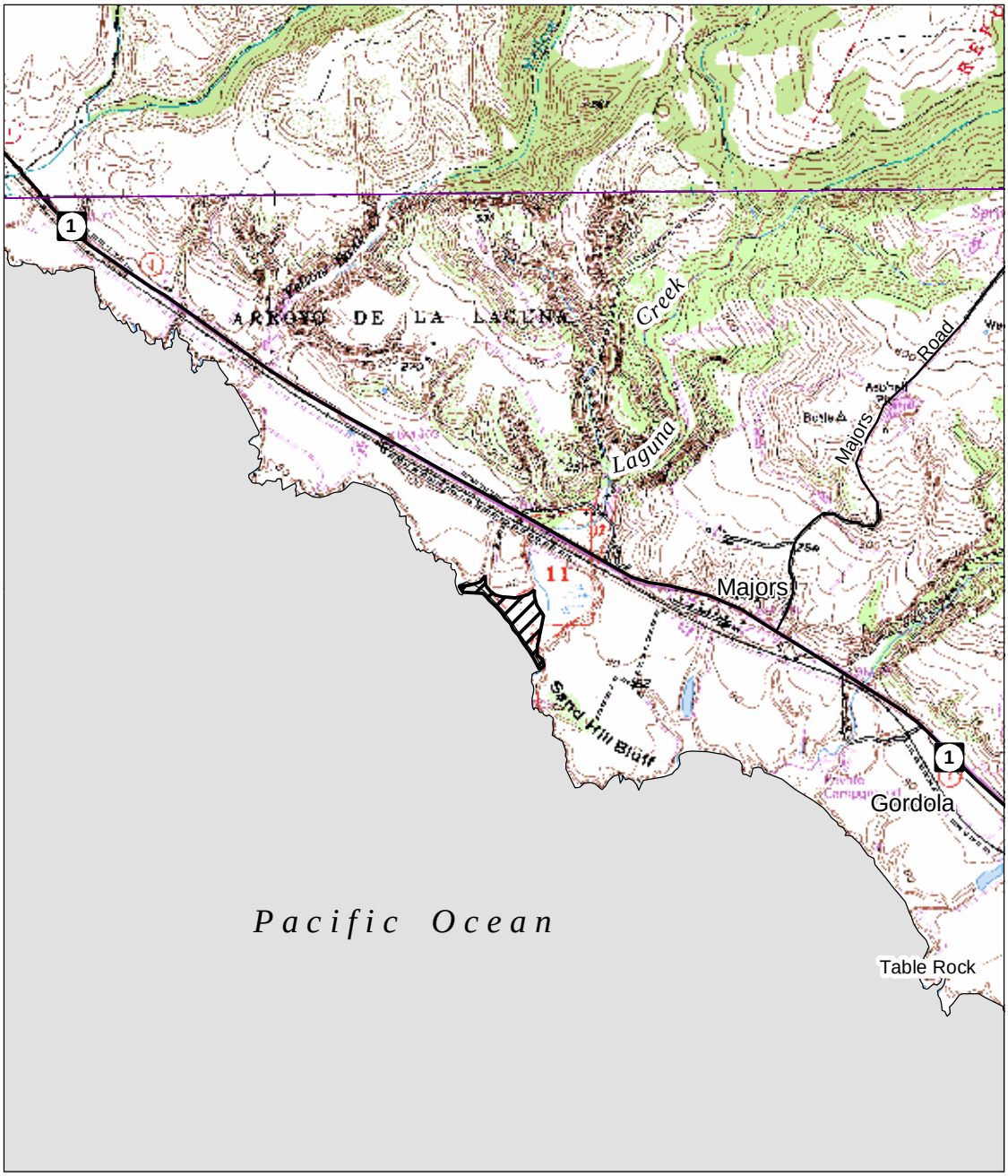
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 81. Laguna Creek Beach (CA-59), Santa Cruz County, California.



Legend

WSPL Breeding & Wintering Locations

0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 82. Baldwin Creek Beach (CA-60), Santa Cruz County, California.

Legend

WSPL Breeding & Wintering Locations

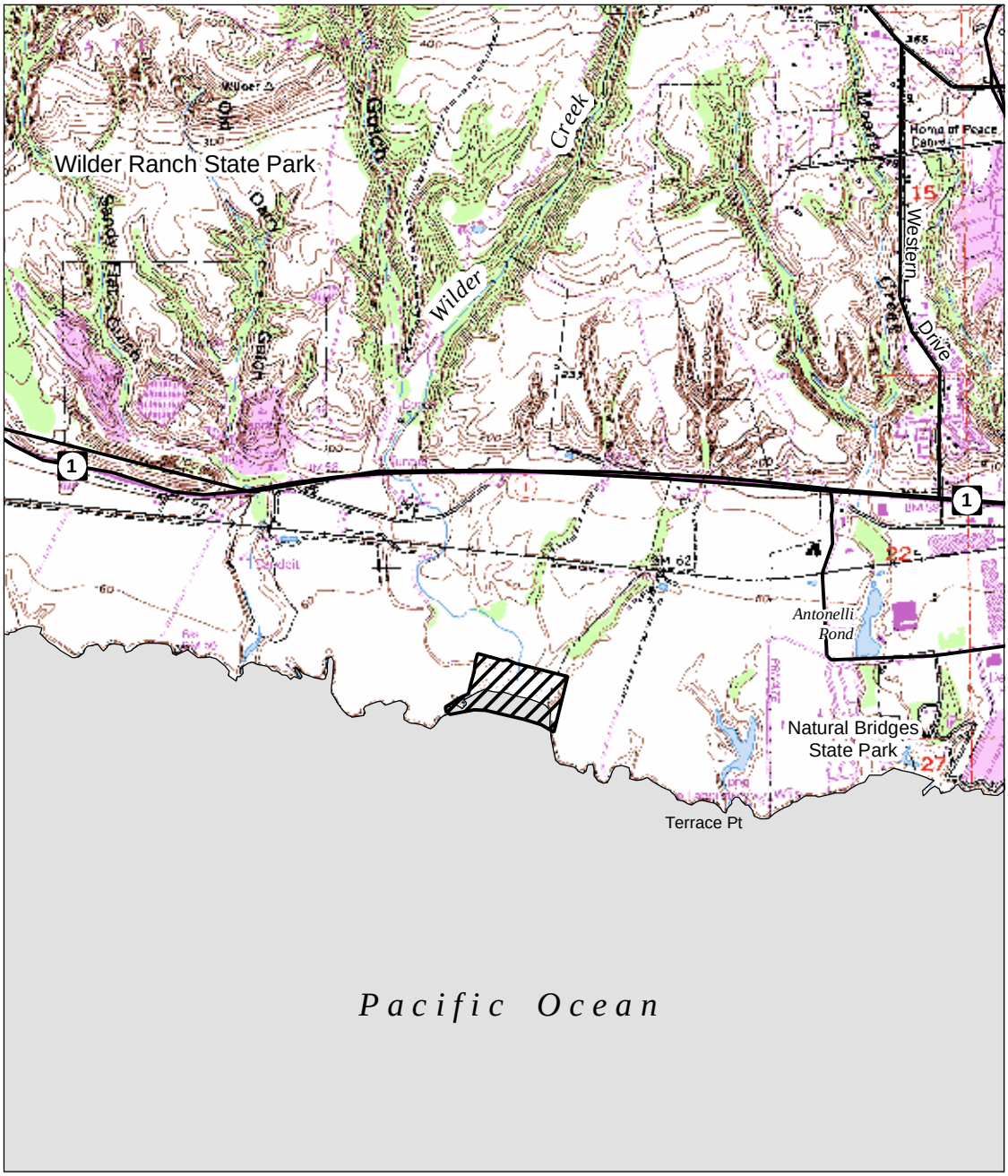
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 83. Wilder Ranch Beach (CA-61), Santa Cruz County, California.



Legend

WSPL Breeding & Wintering Locations

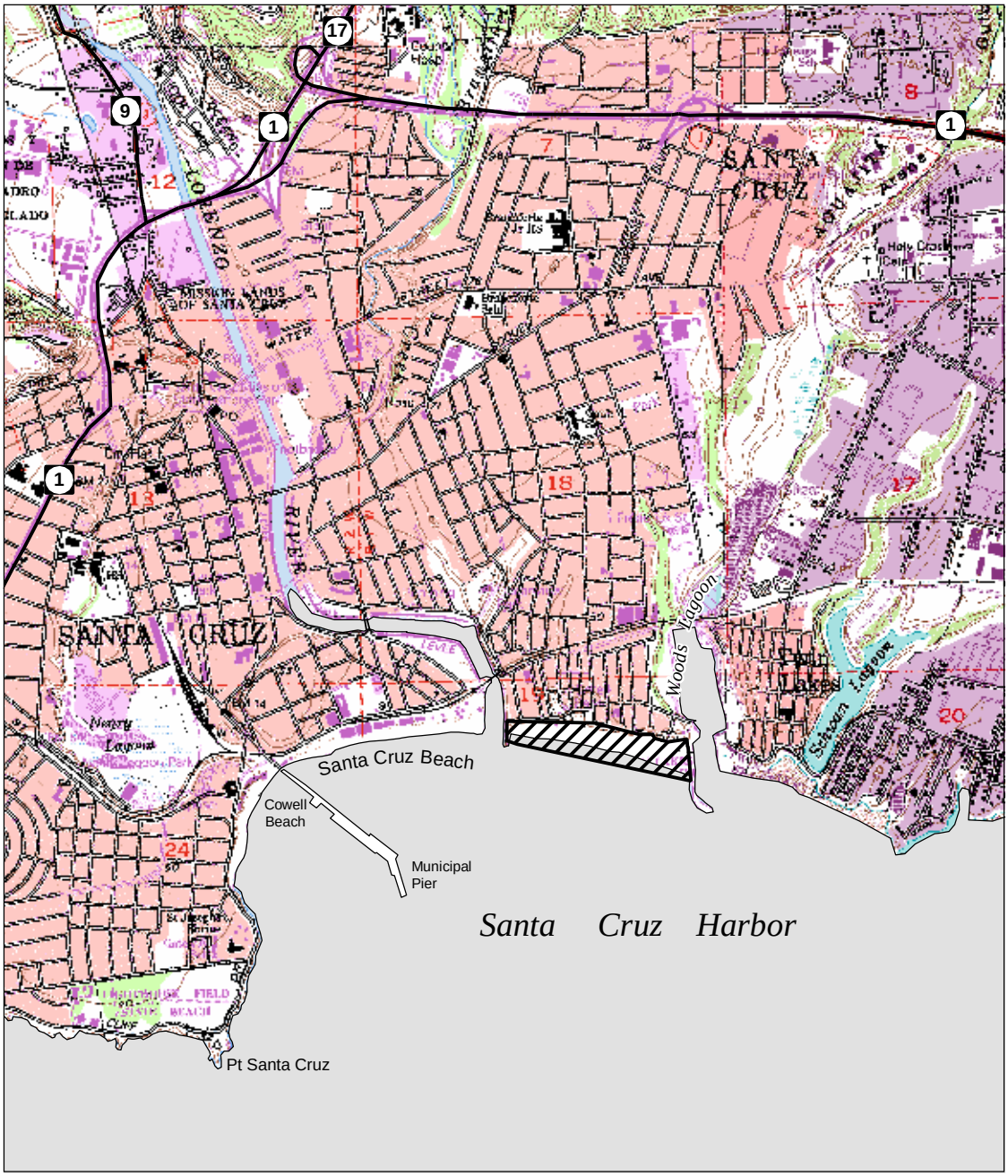
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 84. Seabright Beach (CA-62), Santa Cruz County, California.



Legend

WSPL Breeding & Wintering Locations

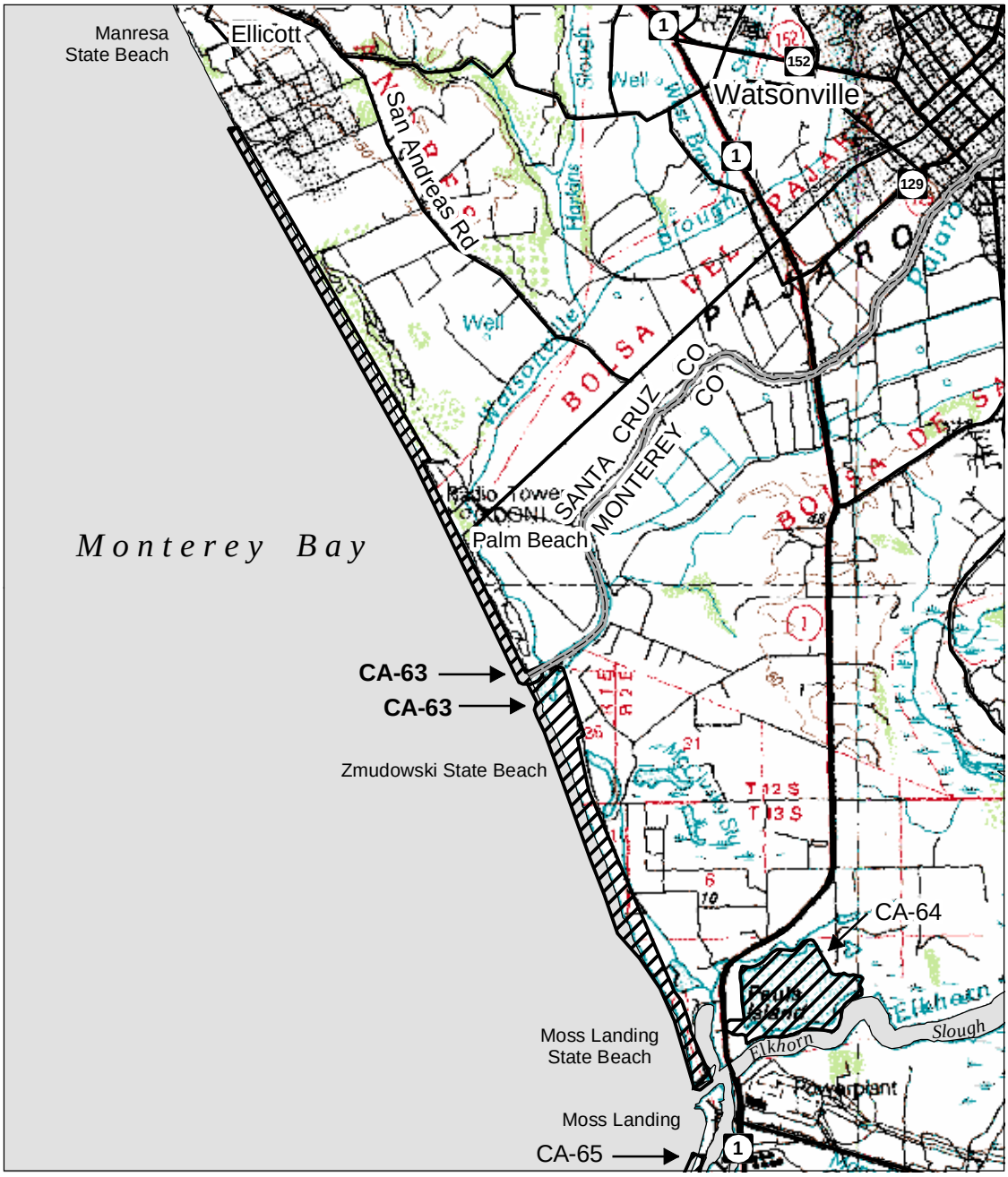
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 85. Jetty Road to Aptos (CA-63), Santa Cruz and Monterey County, California.



Legend

WSPL Breeding & Wintering Locations

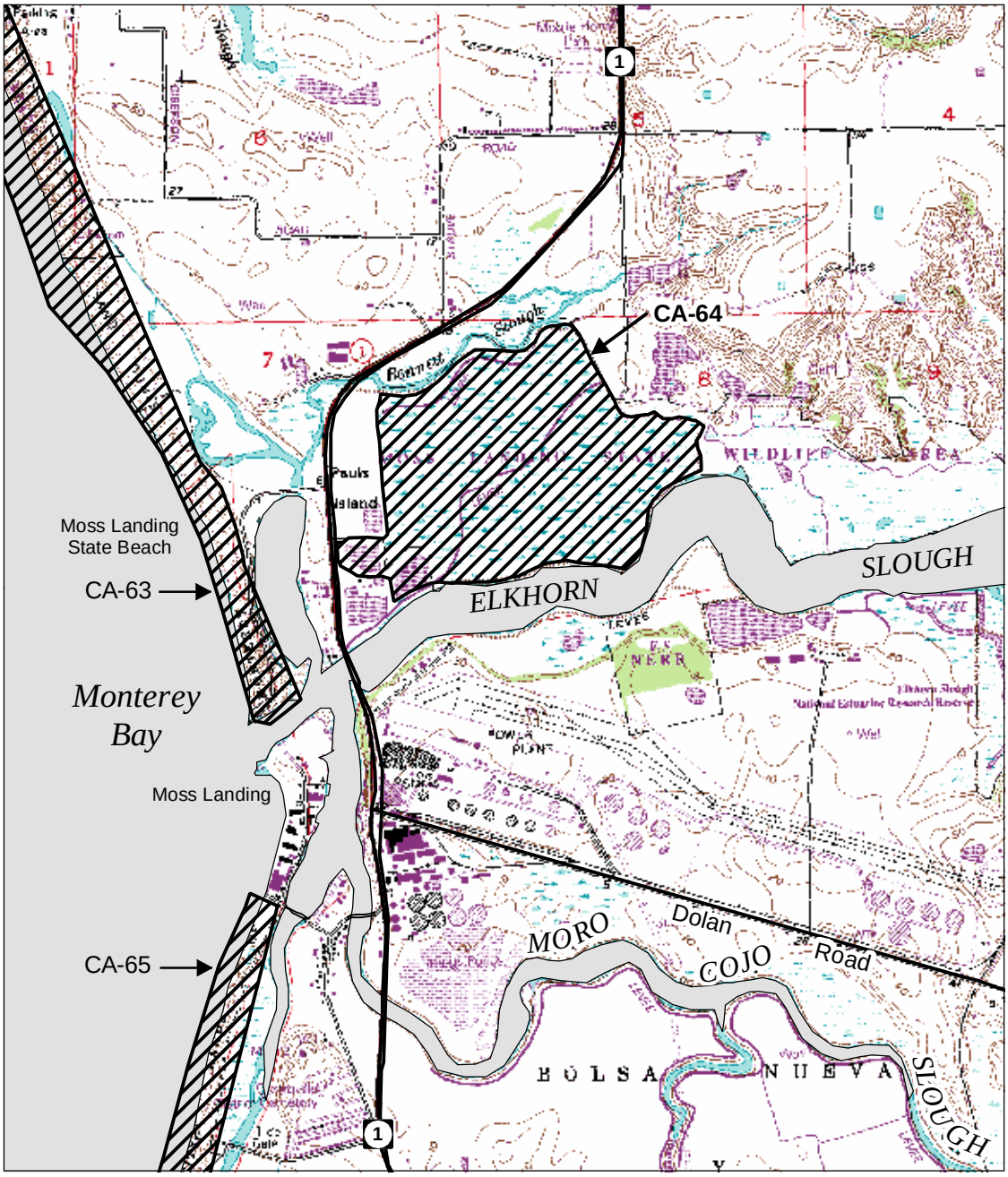
1 0 1 Miles

2 0 2 Kilometers

Scale 1: 80,000

N

Figure L - 86. Elkhorn Slough Mudflat/Salt Pond (CA-64), Monterey County, California.



Legend

WSPL Breeding & Wintering Locations

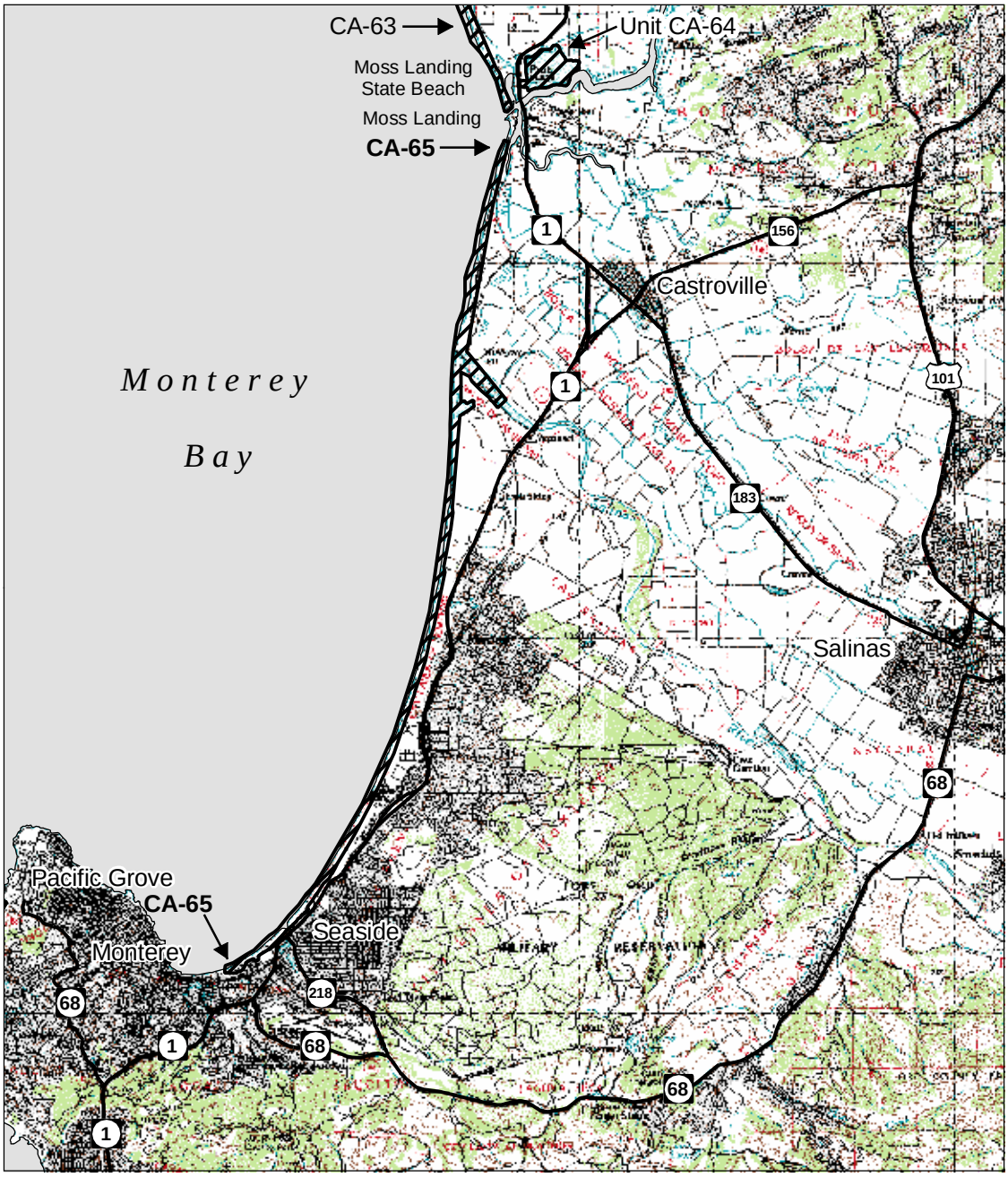
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 87. Moss Landing to Monterey (CA-65), Monterey County, California.



Legend

WSPL Breeding & Wintering Locations

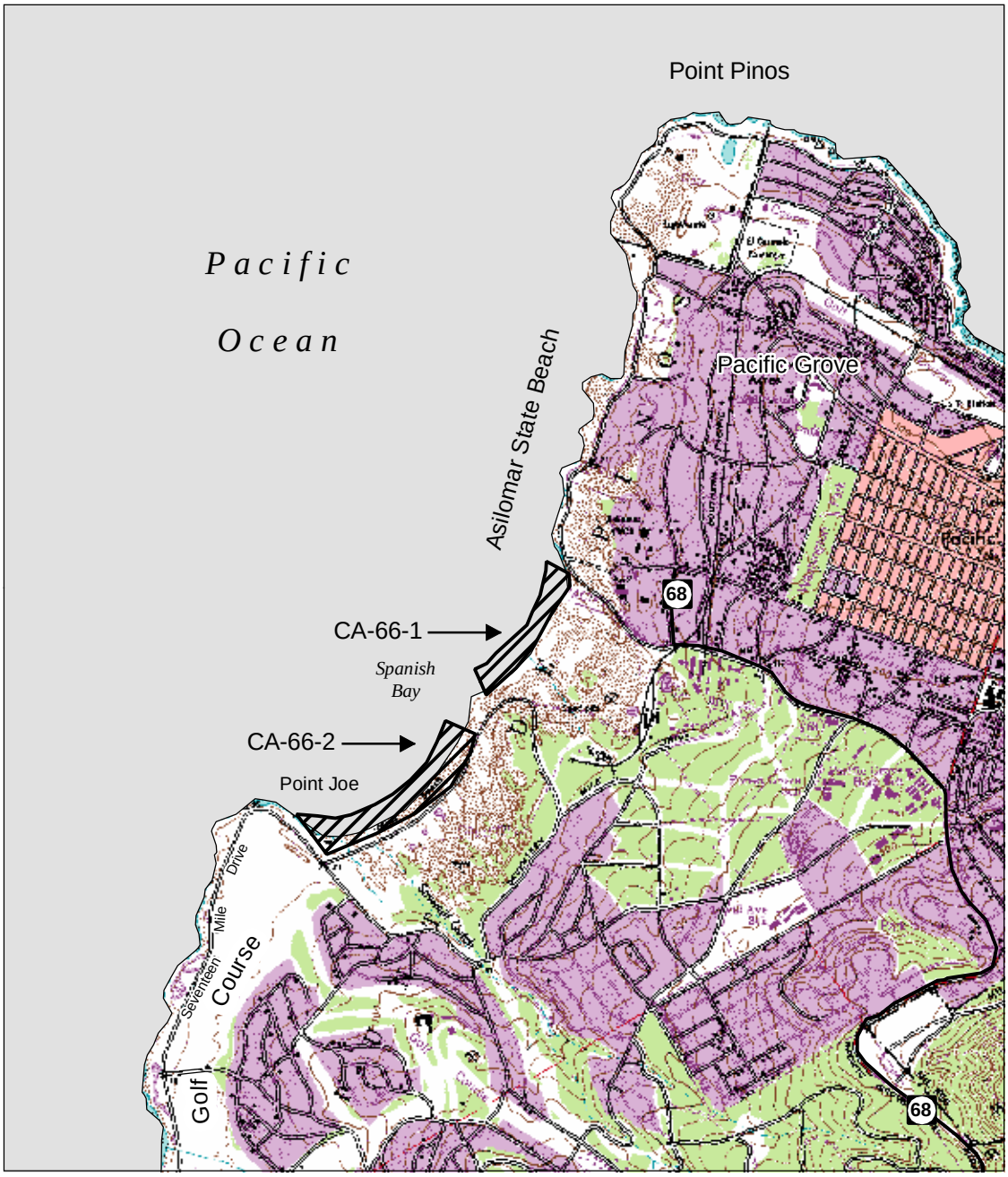
2 0 2 Miles

3 0 3 Kilometers

Scale 1: 180,000

N

Figure L - 88. Asilomar Beach (CA-66), Monterey County, California.



Legend

WSPL Breeding & Wintering Locations

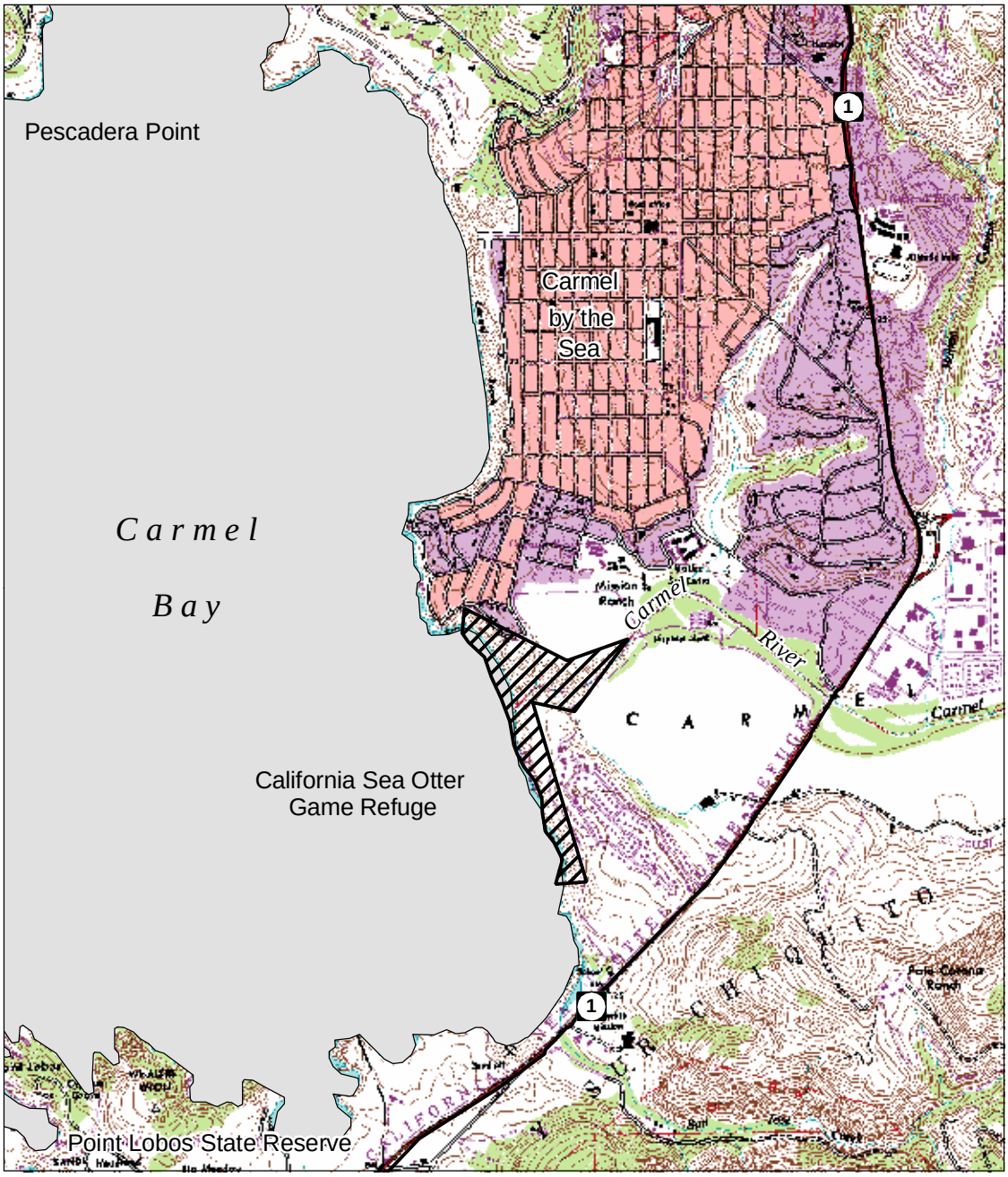
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 89. Carmel River Mouth (CA-67), Monterey County, California.



Legend

WSPL Breeding & Wintering Locations

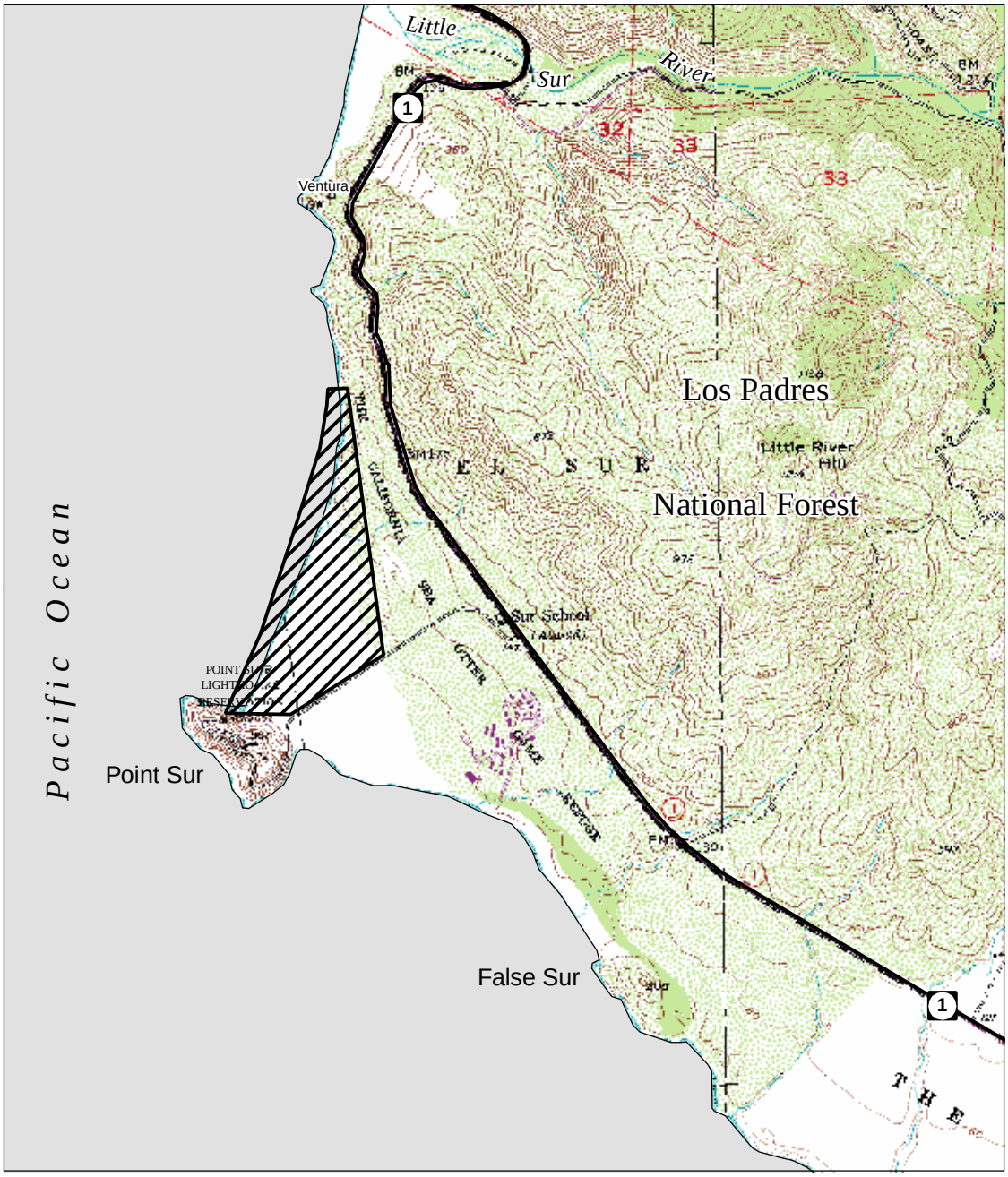
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 90. Point Sur (CA-68), Monterey County, California.



Legend

WSPL Breeding & Wintering Locations

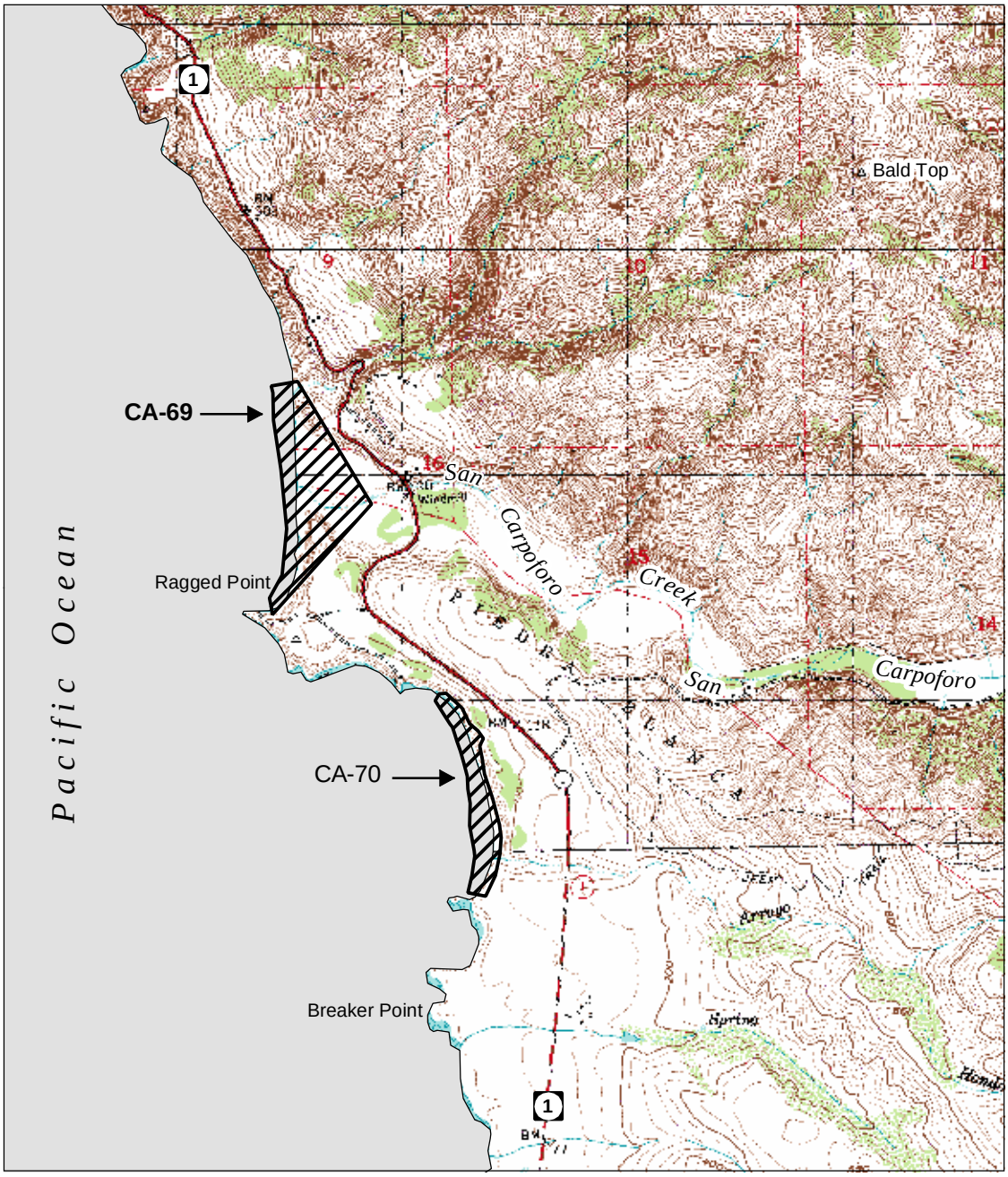
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 91. San Carpoforo Creek (CA-69) and Arroyo Hondo Creek (CA-70), San Luis Obispo County, California.



Legend

WSPL Breeding & Wintering Locations

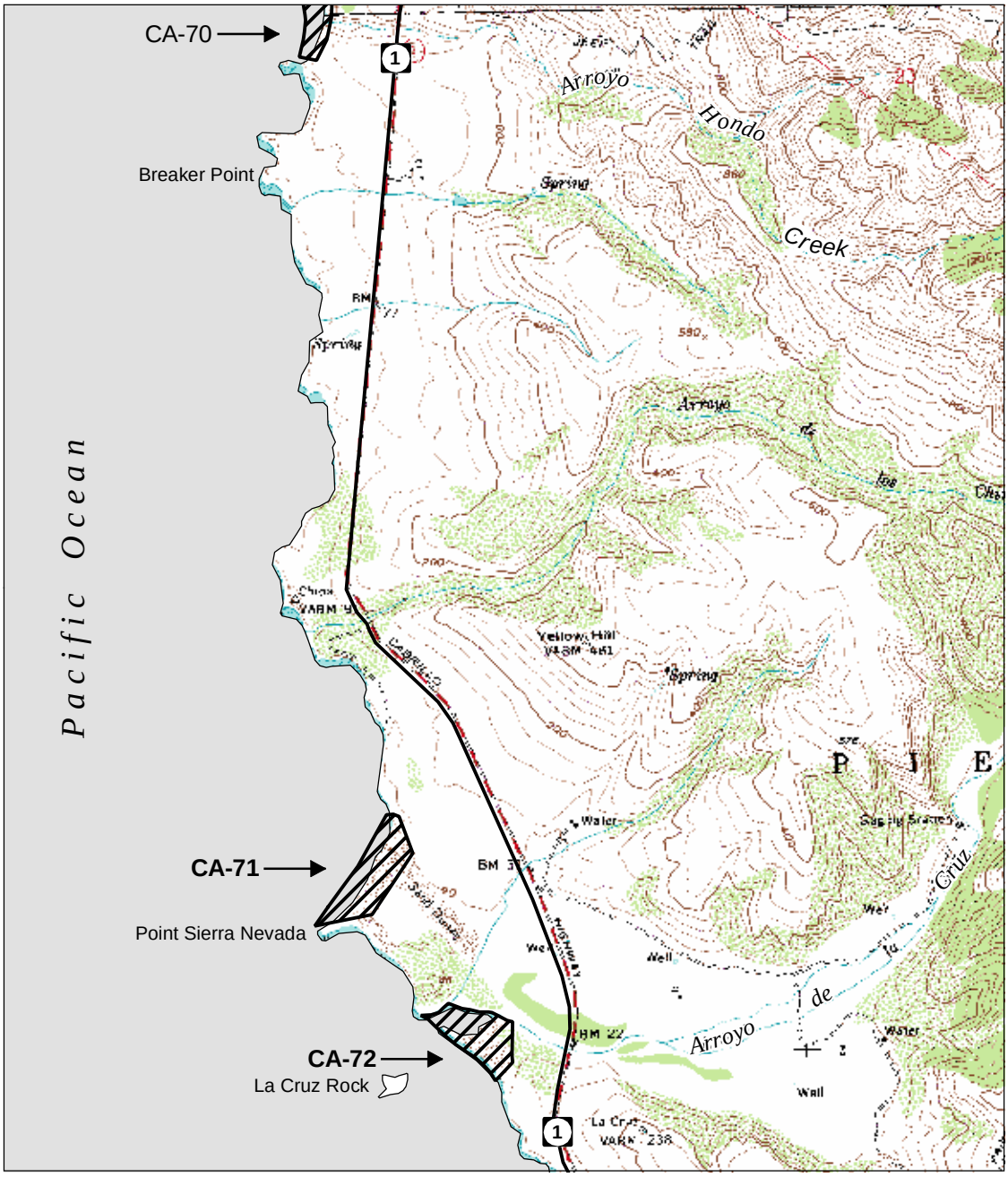
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 92. Point Sierra Nevada (CA-71) and Arroyo de la Cruz (CA-72), San Luis Obispo County, California.



Legend

WSPL Breeding & Wintering Locations

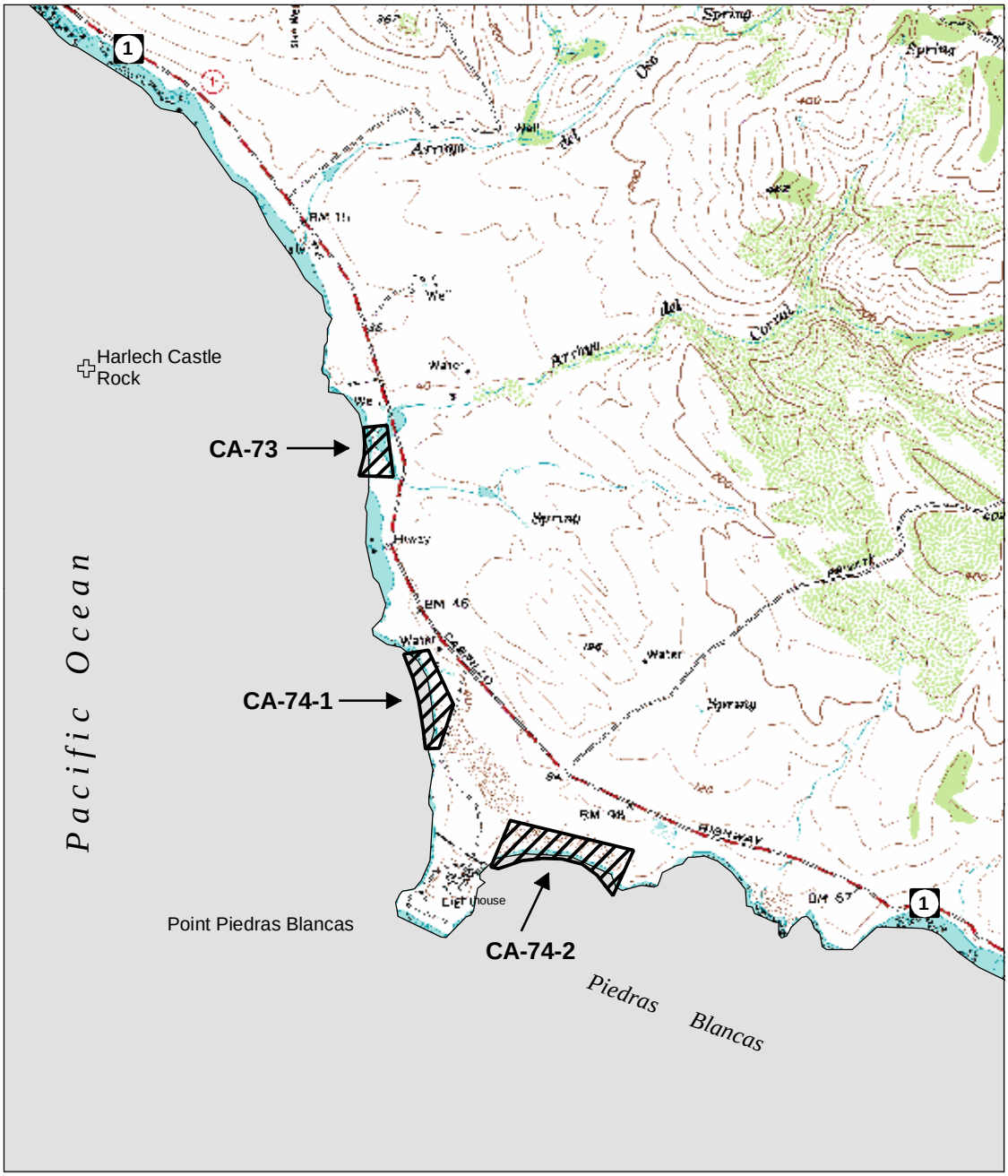
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 93. Sidney's Lagoon (CA-73) and Piedras Blancas (CA-74), San Luis Obispo County, California.



Legend

WSPL Breeding & Wintering Locations

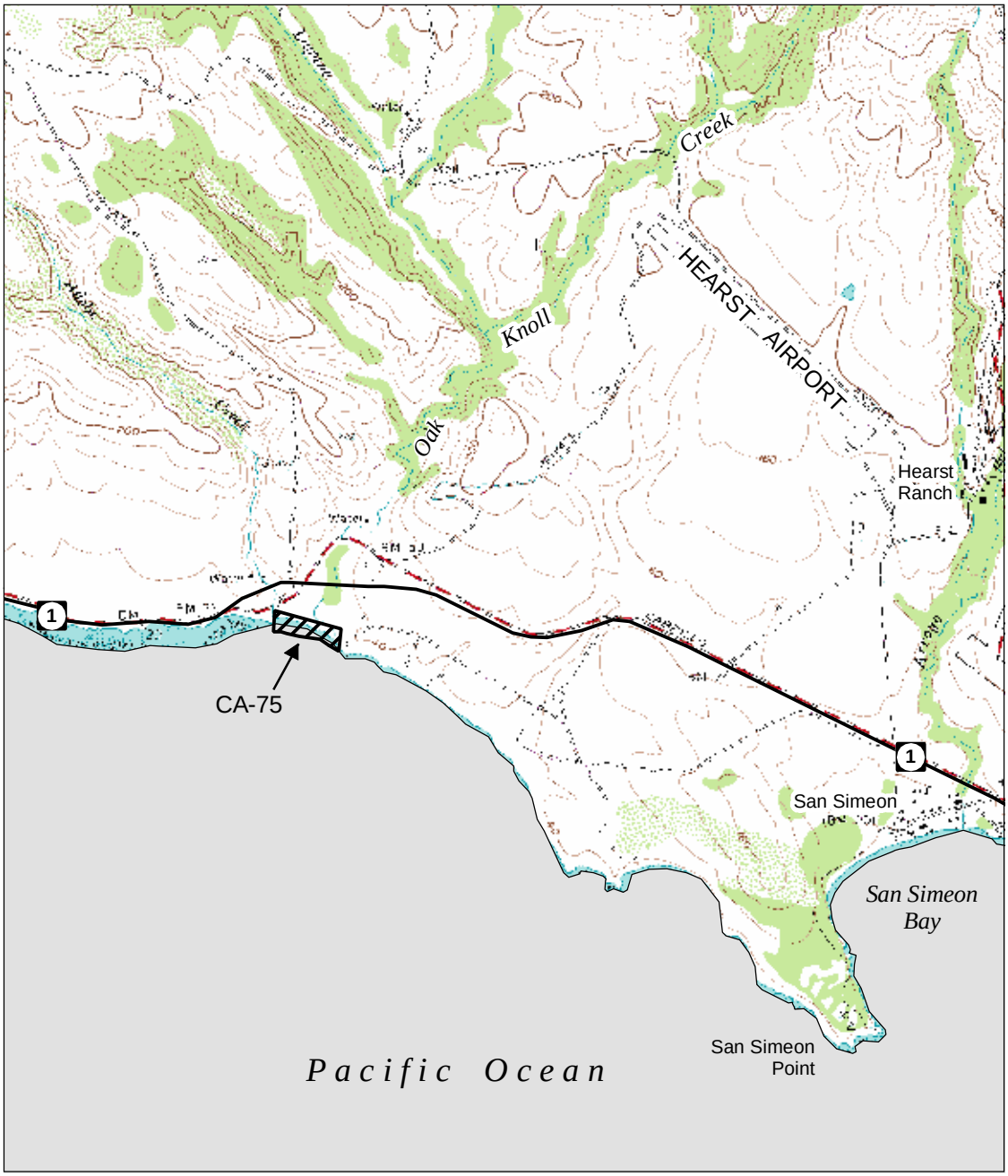
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 94. Arroyo Laguna Creek (CA-75), San Luis Obispo County, California.



Legend

WSPL Breeding & Wintering Locations

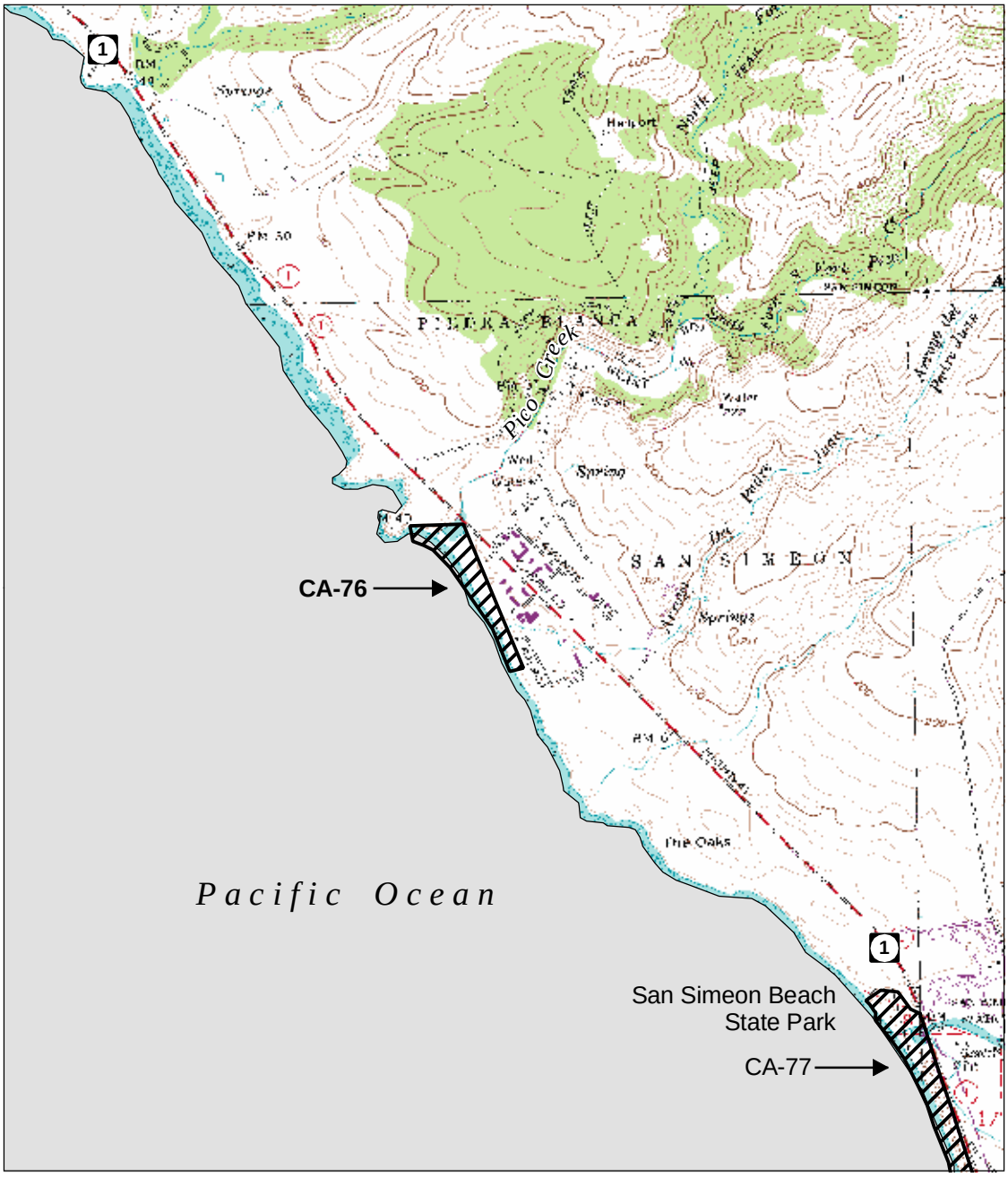
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 95. Pico Creek (CA-76), San Luis Obispo County, California.



Legend

WSPL Breeding & Wintering Locations

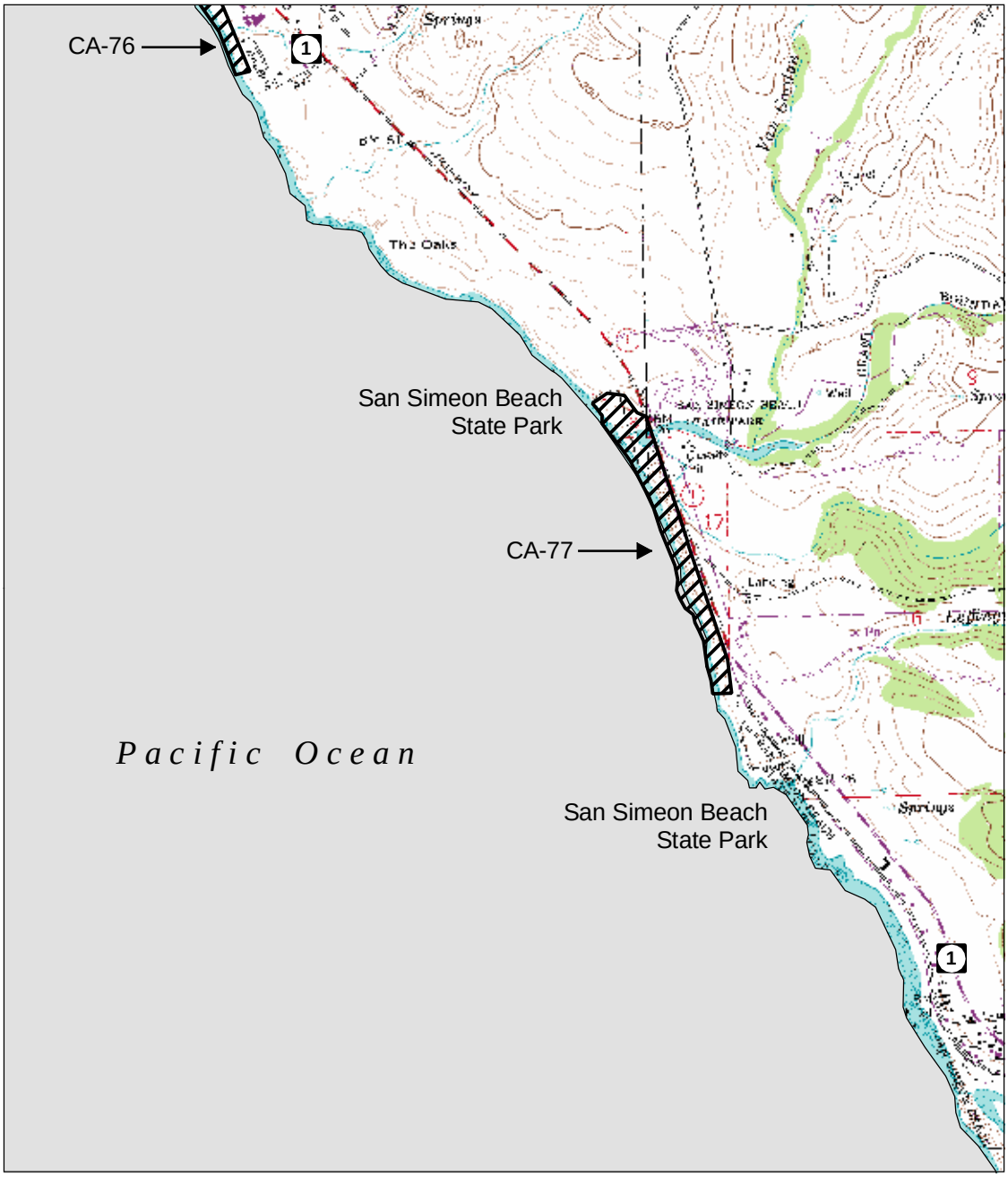
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 96. San Simeon Beach (CA-77), San Luis Obispo County, California.



Legend

WSPL Breeding & Wintering Locations

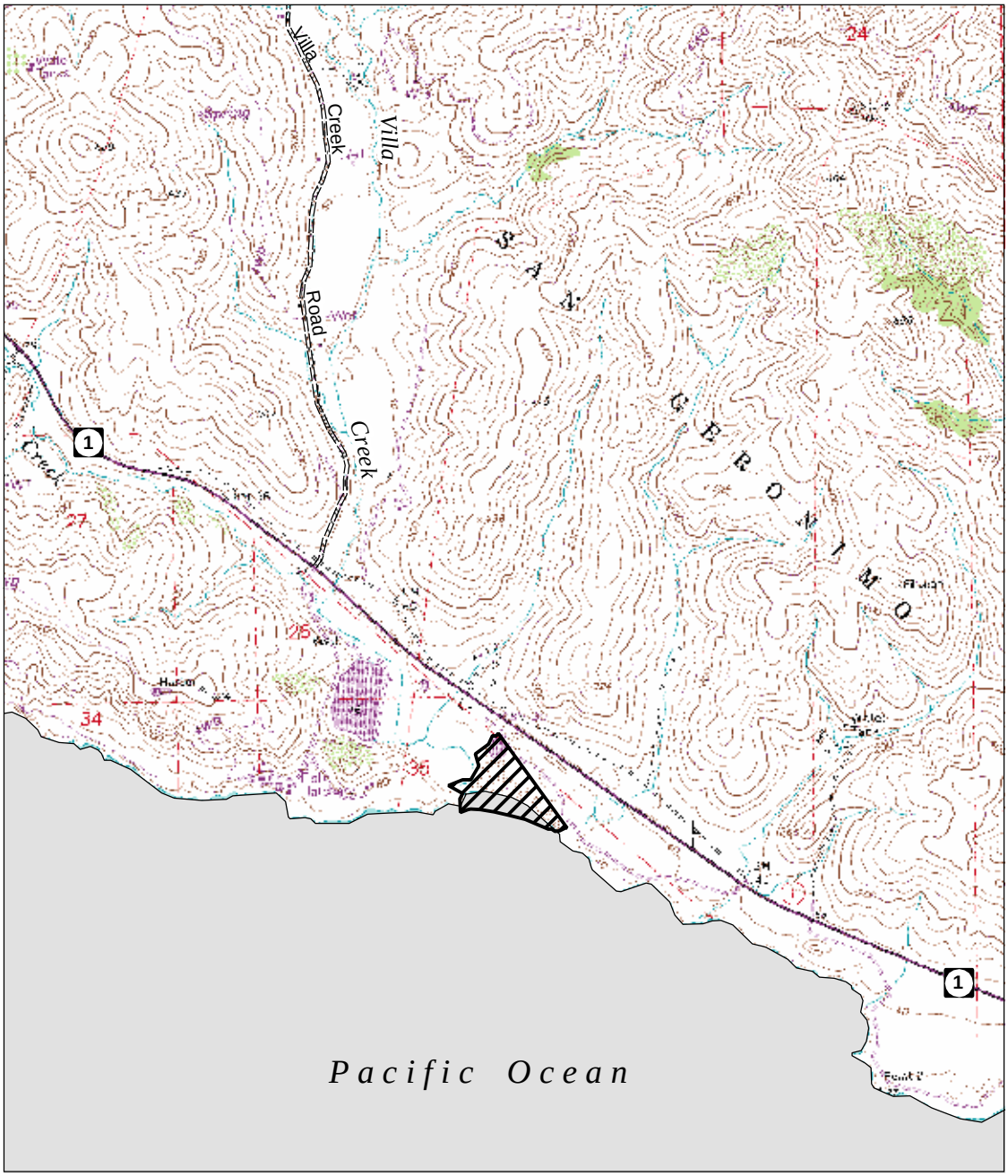
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 97. Villa Creek (CA-78), San Luis Obispo County, California.



Legend

WSPL Breeding & Wintering Locations

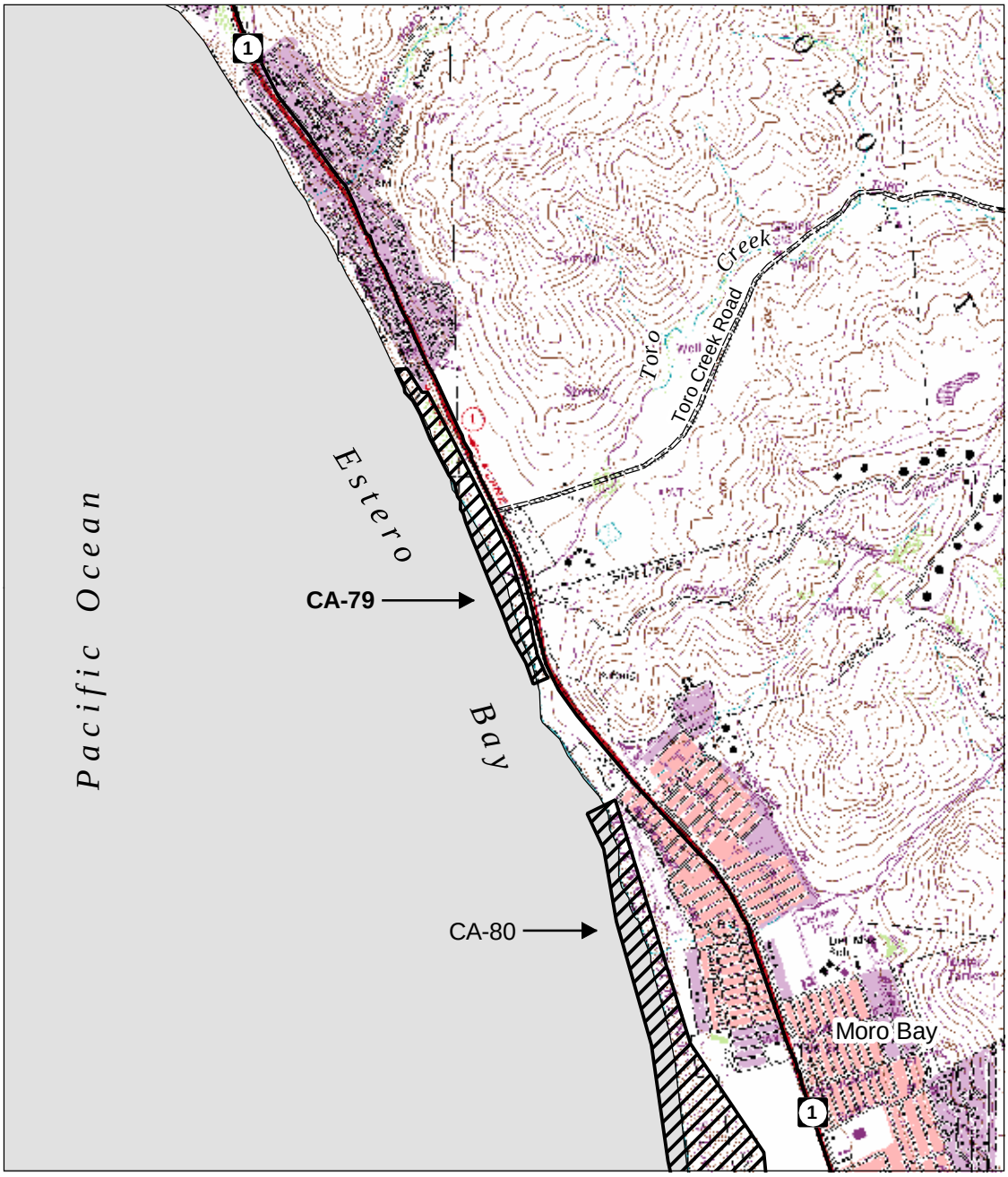
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 98. Toro Creek (CA-79), San Luis Obispo County, California.



Legend

WSPL Breeding & Wintering Locations

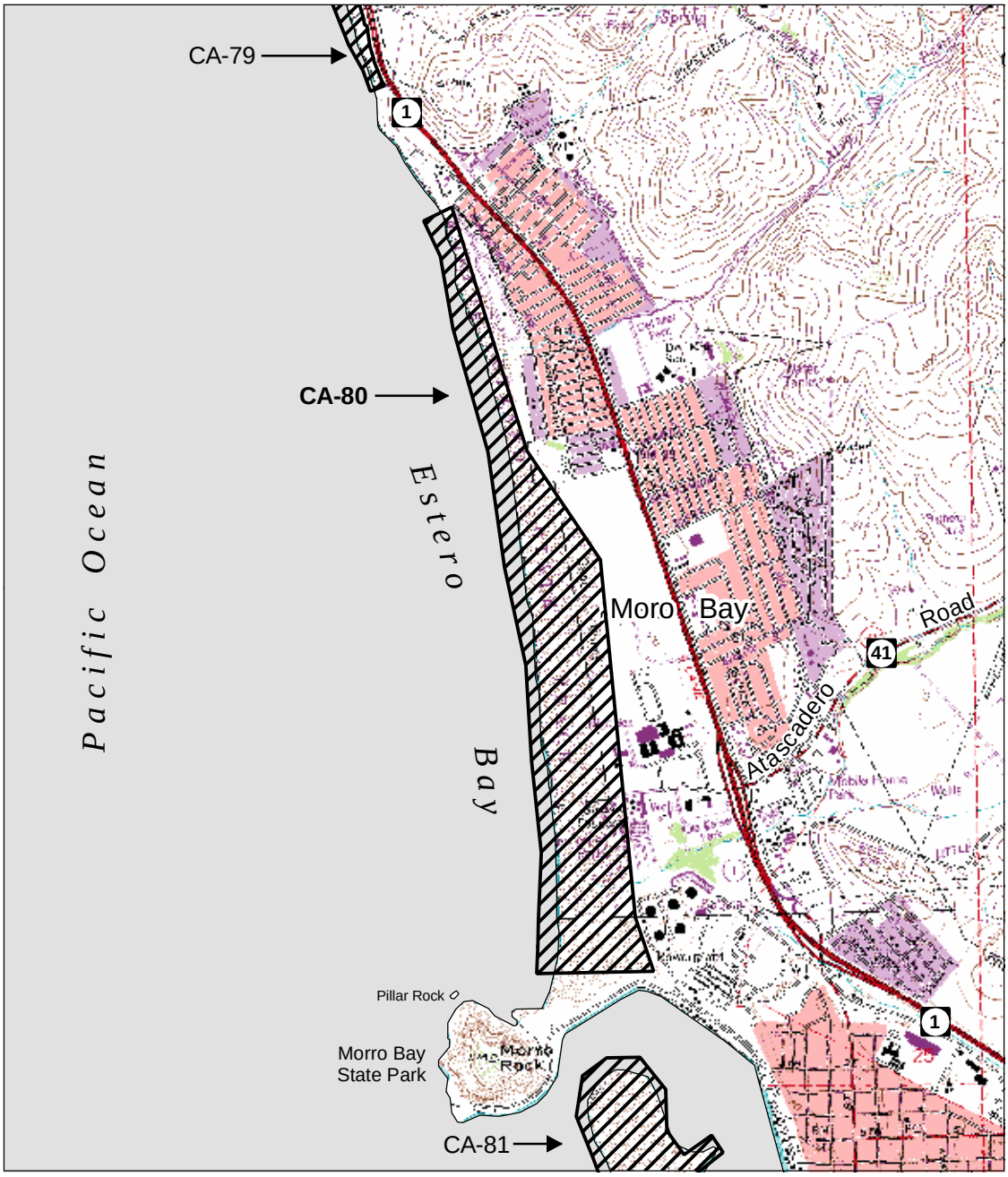
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 99. Atascadero Beach (CA-80), San Luis Obispo County, California.



Legend

WSPL Breeding & Wintering Locations

0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 100. Morro Bay (CA-81), San Luis Obispo County, California.

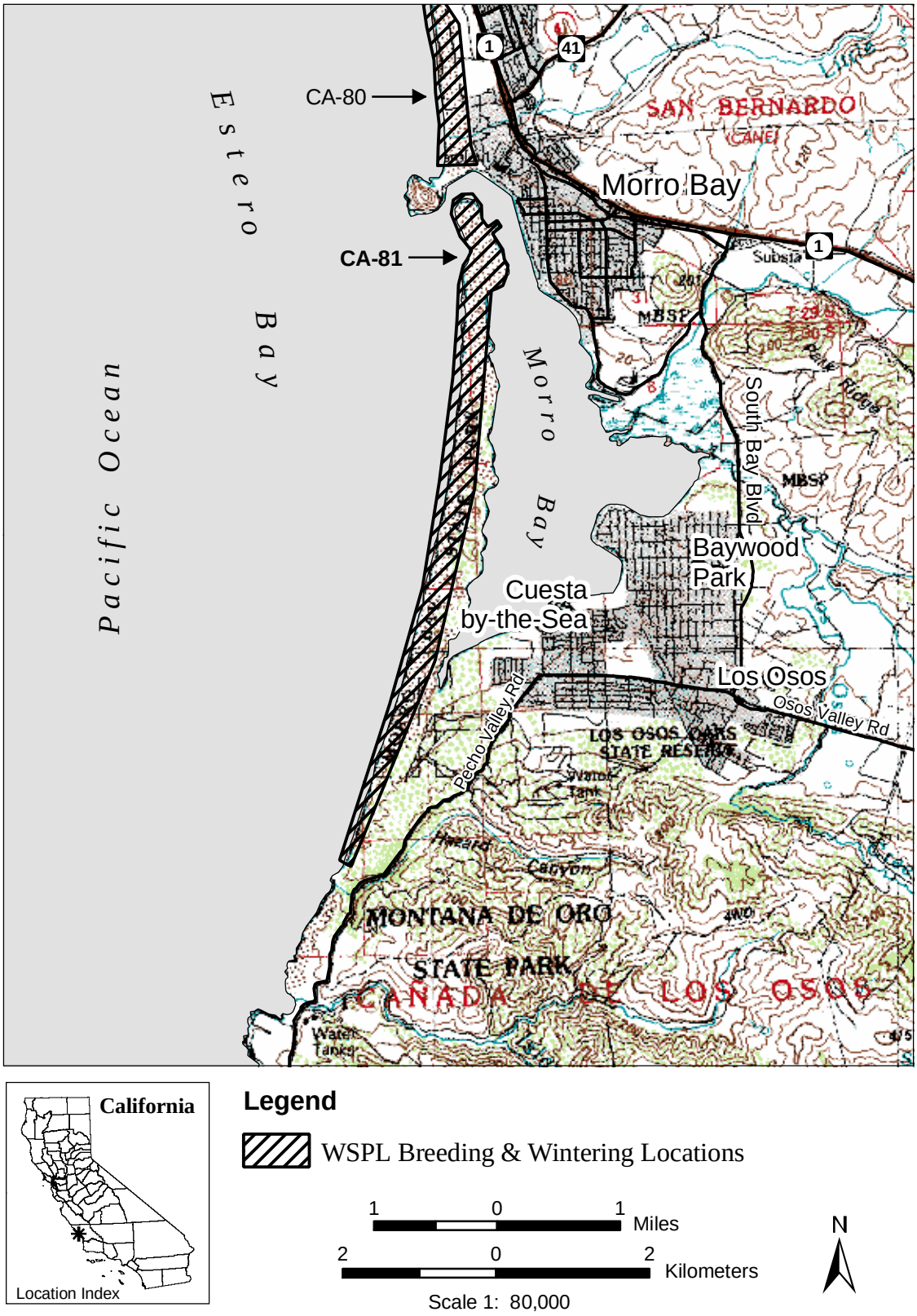


Figure L - 101. Avila Beach (CA-82), San Luis Obispo County, California.

Legend

WSPL Breeding & Wintering Locations

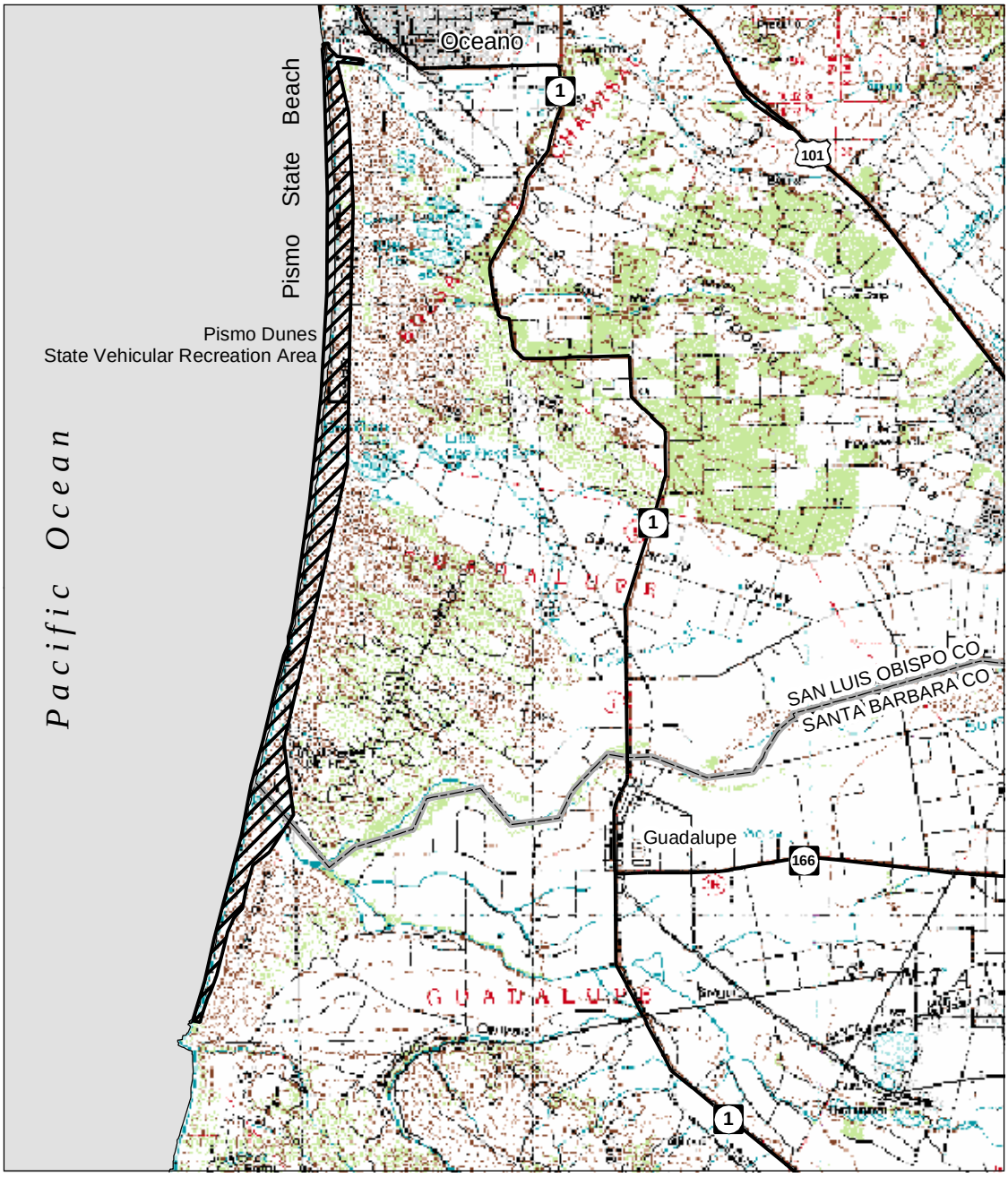
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 102. Pismo Beach/Nipomo Dunes (CA-83), San Luis Obispo and Santa Barbara County, California.



Legend

WSPL Breeding & Wintering Locations

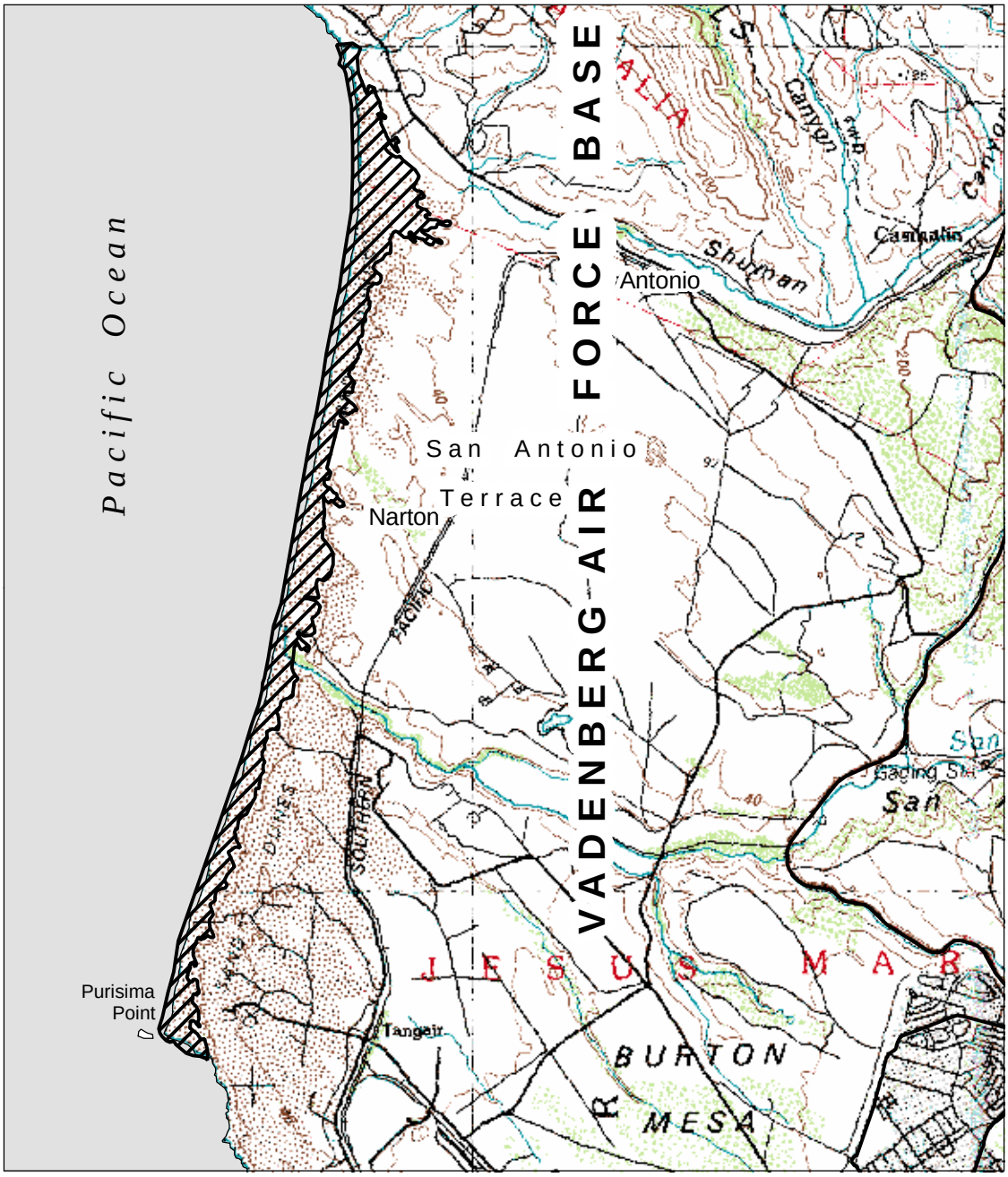
2 0 2 Miles

3 0 3 Kilometers

Scale 1: 130,000

N

Figure L - 103. Vandenberg Air Force Base (CA-84), Santa Barbara County, California.



Legend

WSPL Breeding & Wintering Locations

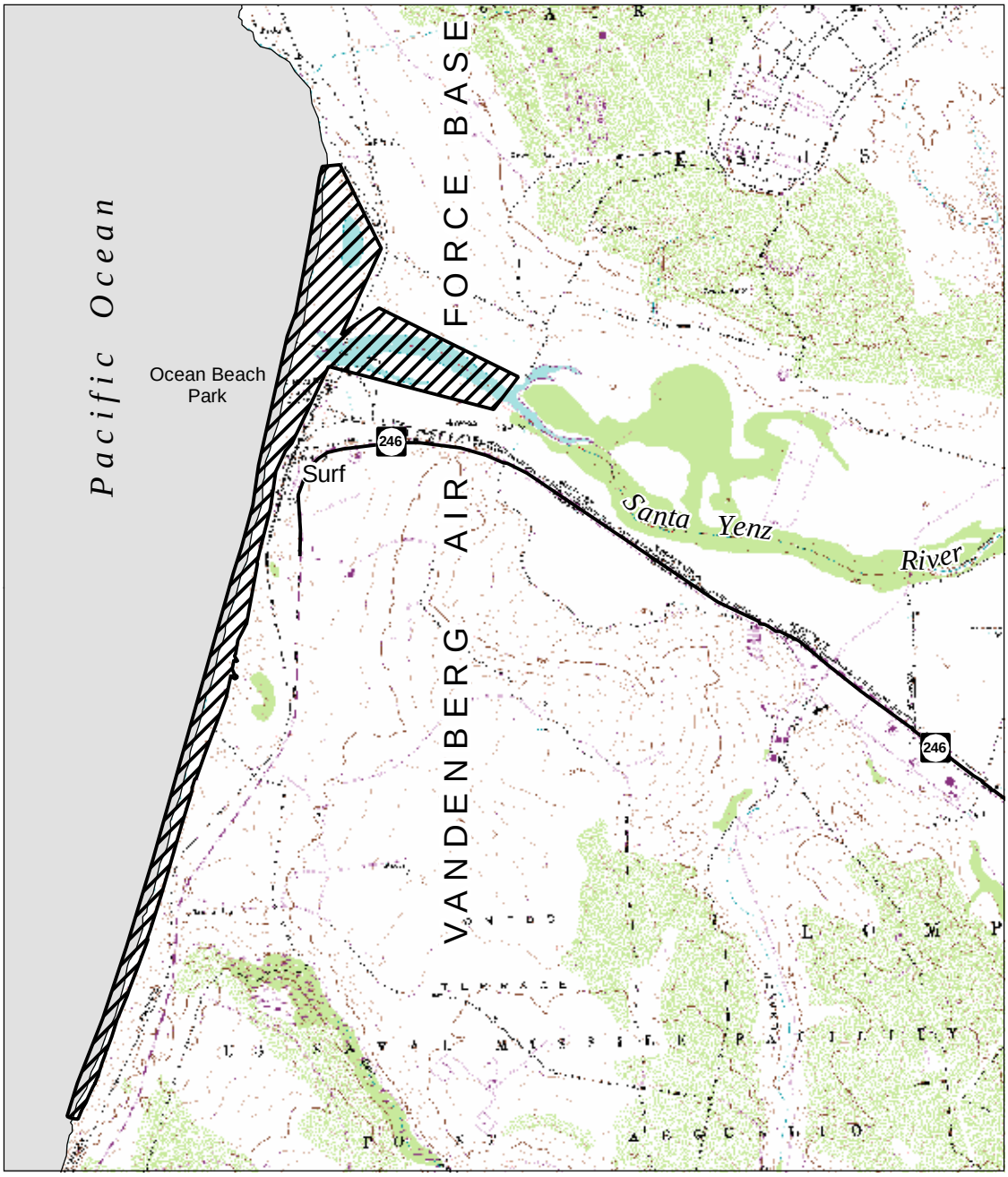
1 0 1 Miles

2 0 2 Kilometers

Scale 1: 80,000

N

Figure L - 104. Santa Ynez River Mouth/Ocean Beach (CA-85), Santa Barbara County, California.



Legend

WSPL Breeding & Wintering Locations

0.6 0 0.6 Miles

1 0 1 Kilometers

Scale 1: 50,000

N

Figure L - 105. Jalama Beach (CA-86), Santa Barbara County, California.

Legend

WSPL Breeding & Wintering Locations

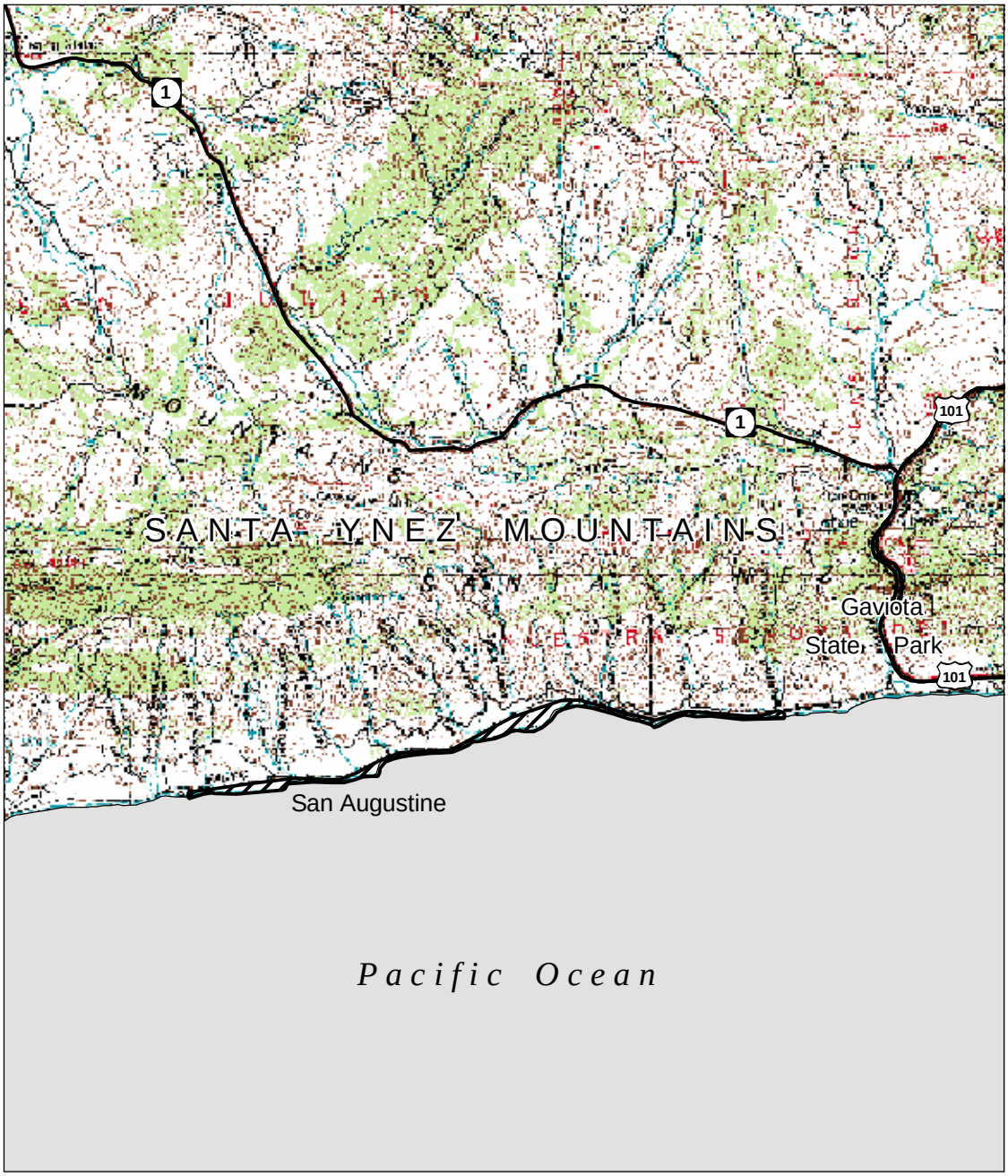
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 106. Hollister Ranch (CA-87), Santa Barbara County, California.



Legend

WSPL Breeding & Wintering Locations

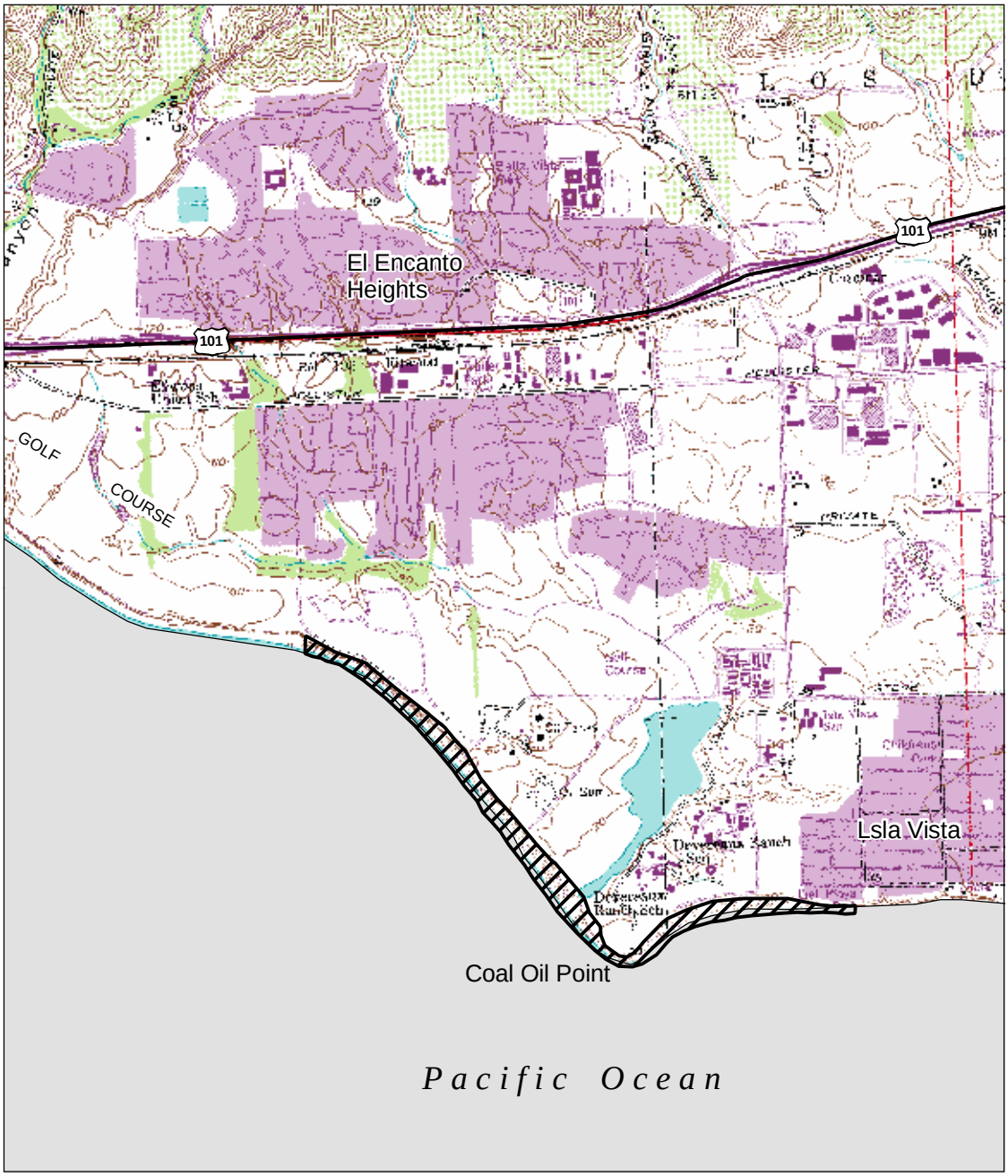
2 0 2 Miles

3 0 3 Kilometers

Scale 1: 130,000

N

Figure L - 107. Devereaux/Sands/Ellwood (CA-88), Santa Barbara County, California.



Legend

WSPL Breeding & Wintering Locations

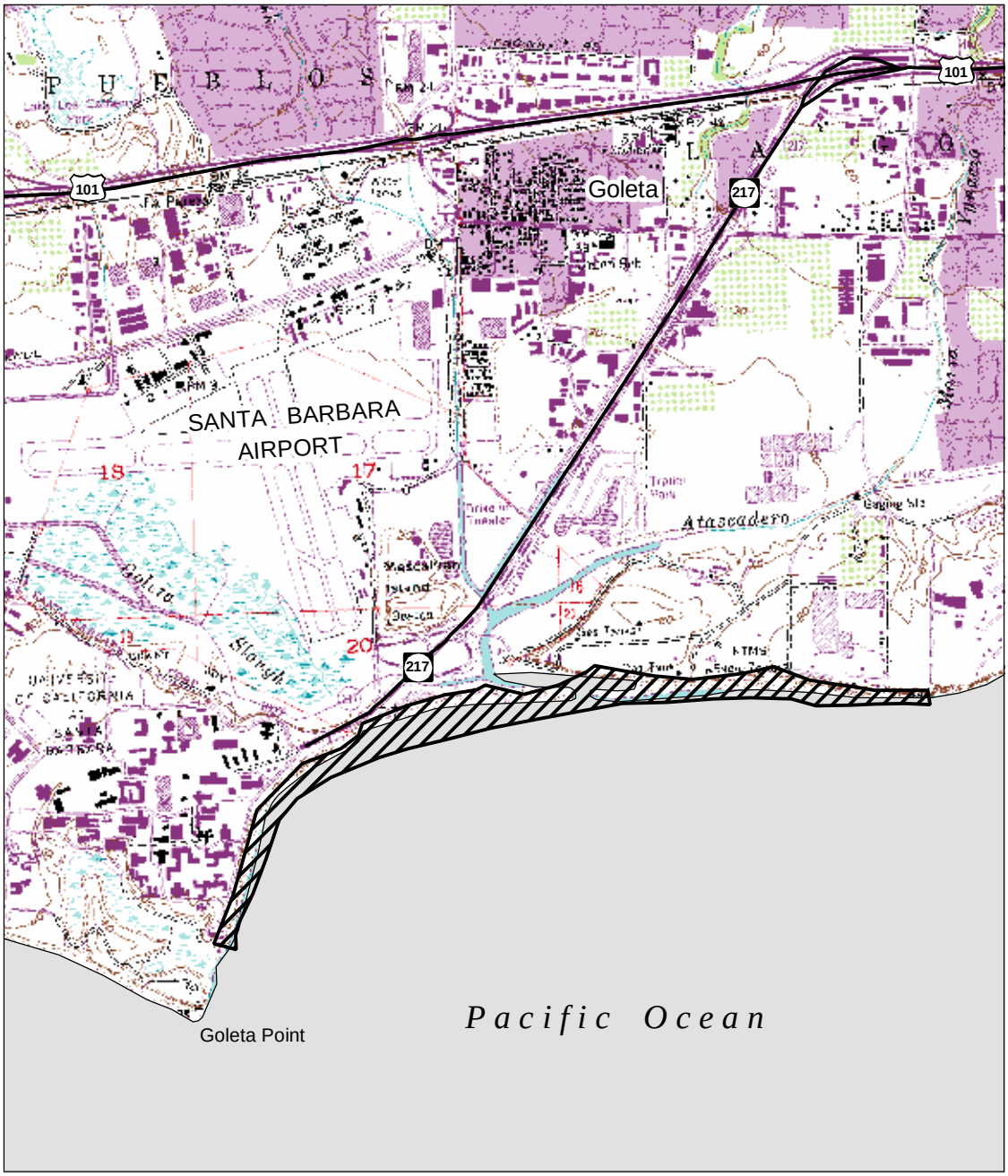
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 108. Goleta Beach (CA-89), Santa Barbara County, California.



Legend

WSPL Breeding & Wintering Locations

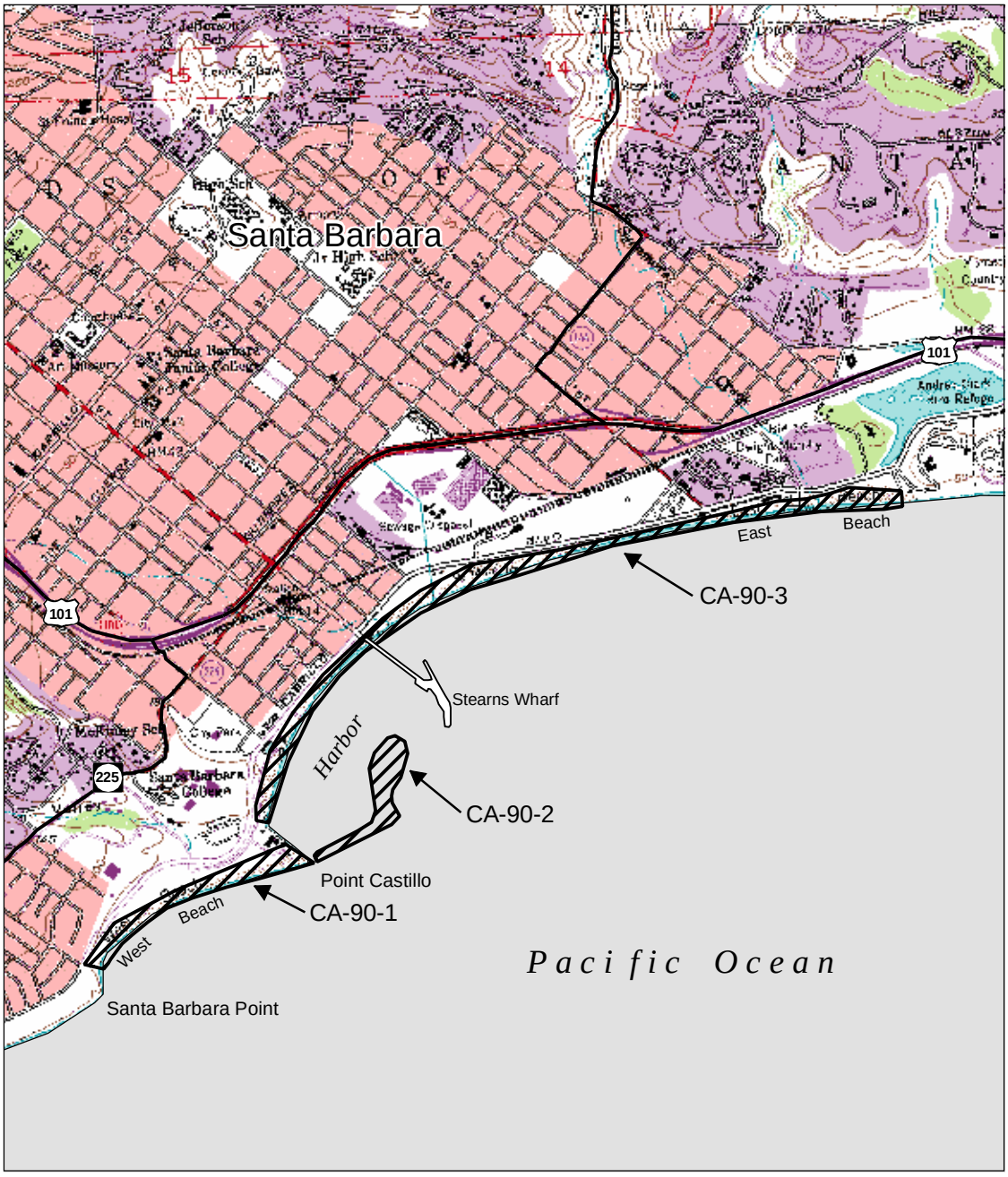
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 109. Point Castillo/Santa Barbara Harbor (CA-90), Santa Barbara County, California.



Legend

WSPL Breeding & Wintering Locations

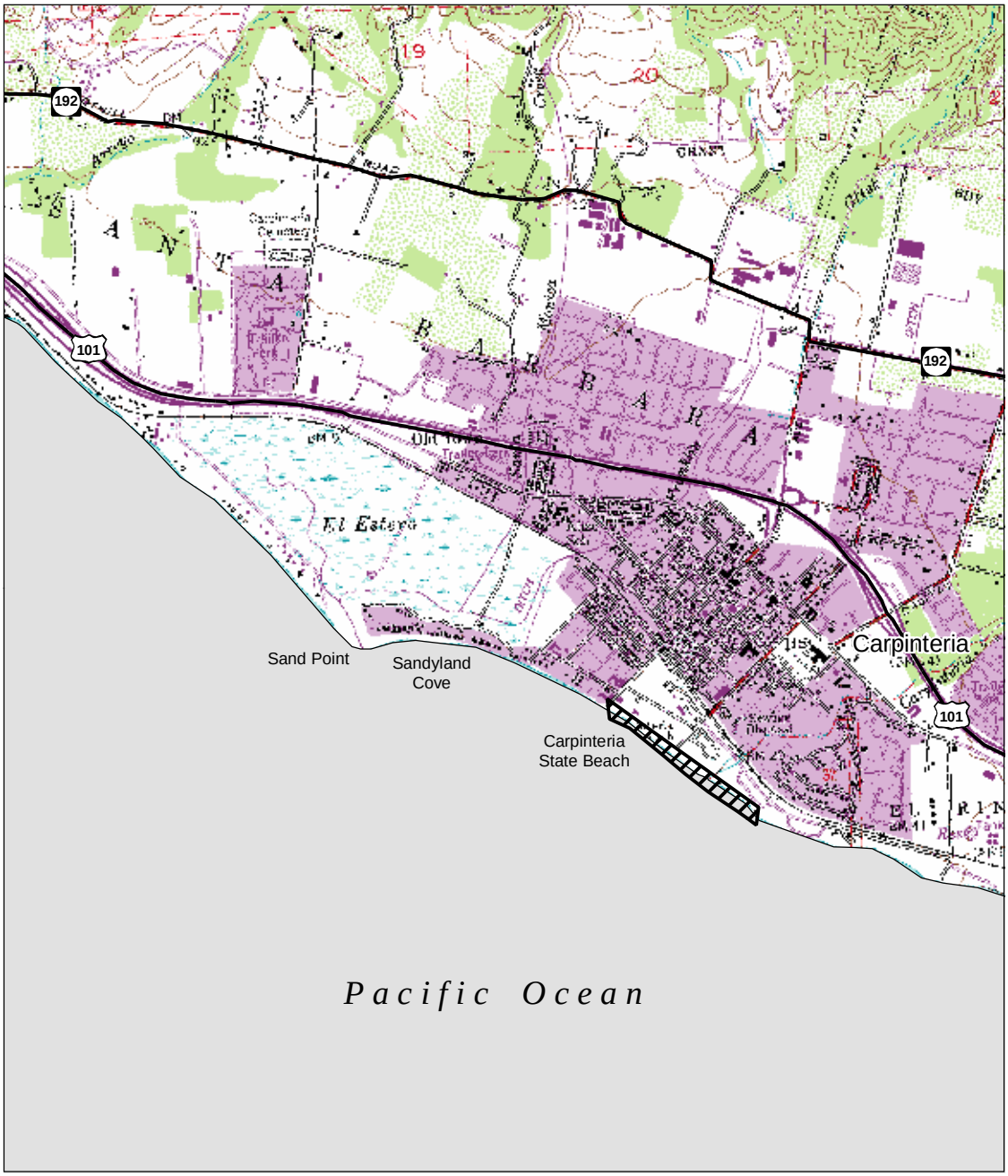
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 110. Carpinteria Beach (CA-91), Santa Barbara County, California.



Legend

WSPL Breeding & Wintering Locations

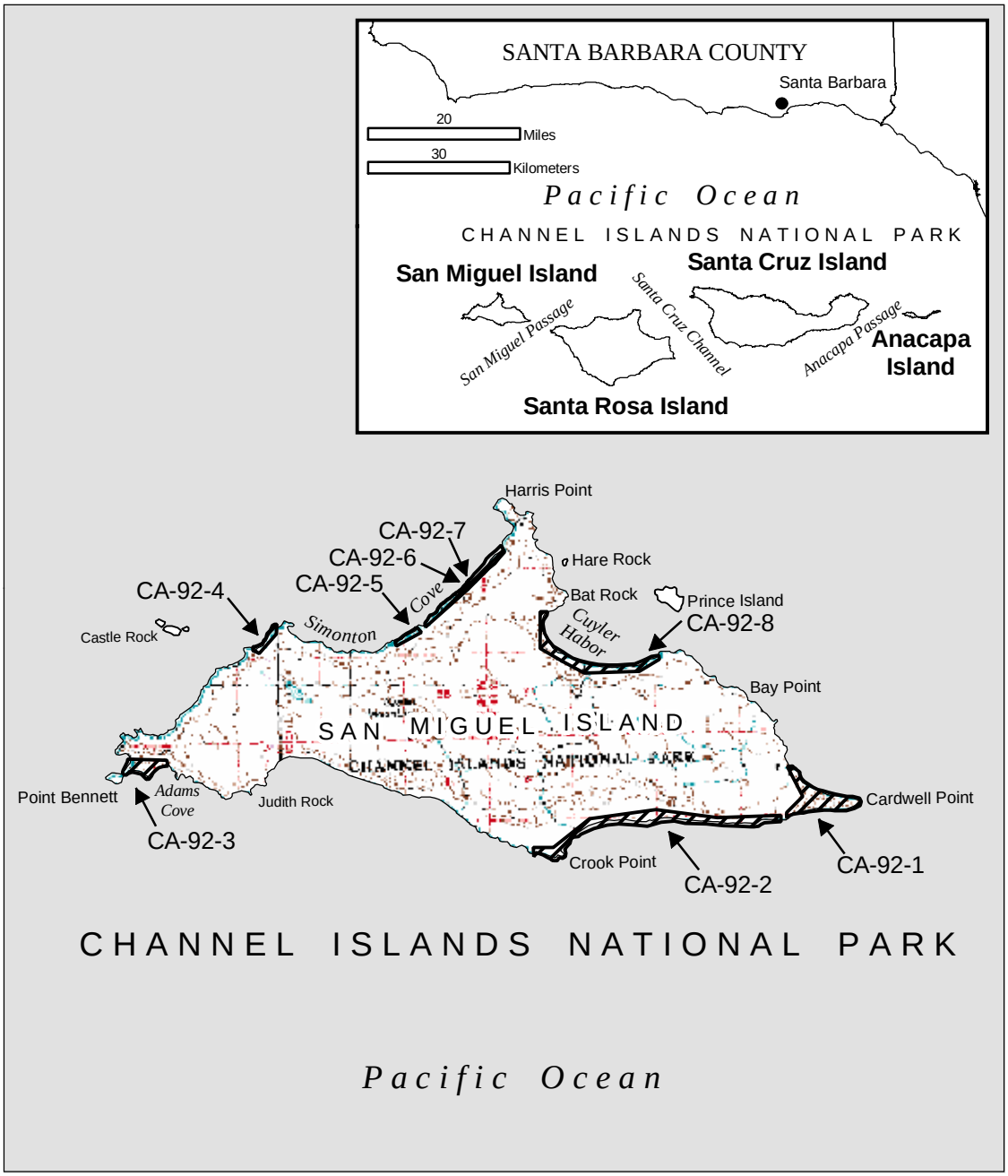
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 111. San Miguel Island (CA-92), Santa Barbara County, California.



Legend

WSPL Breeding & Wintering Locations

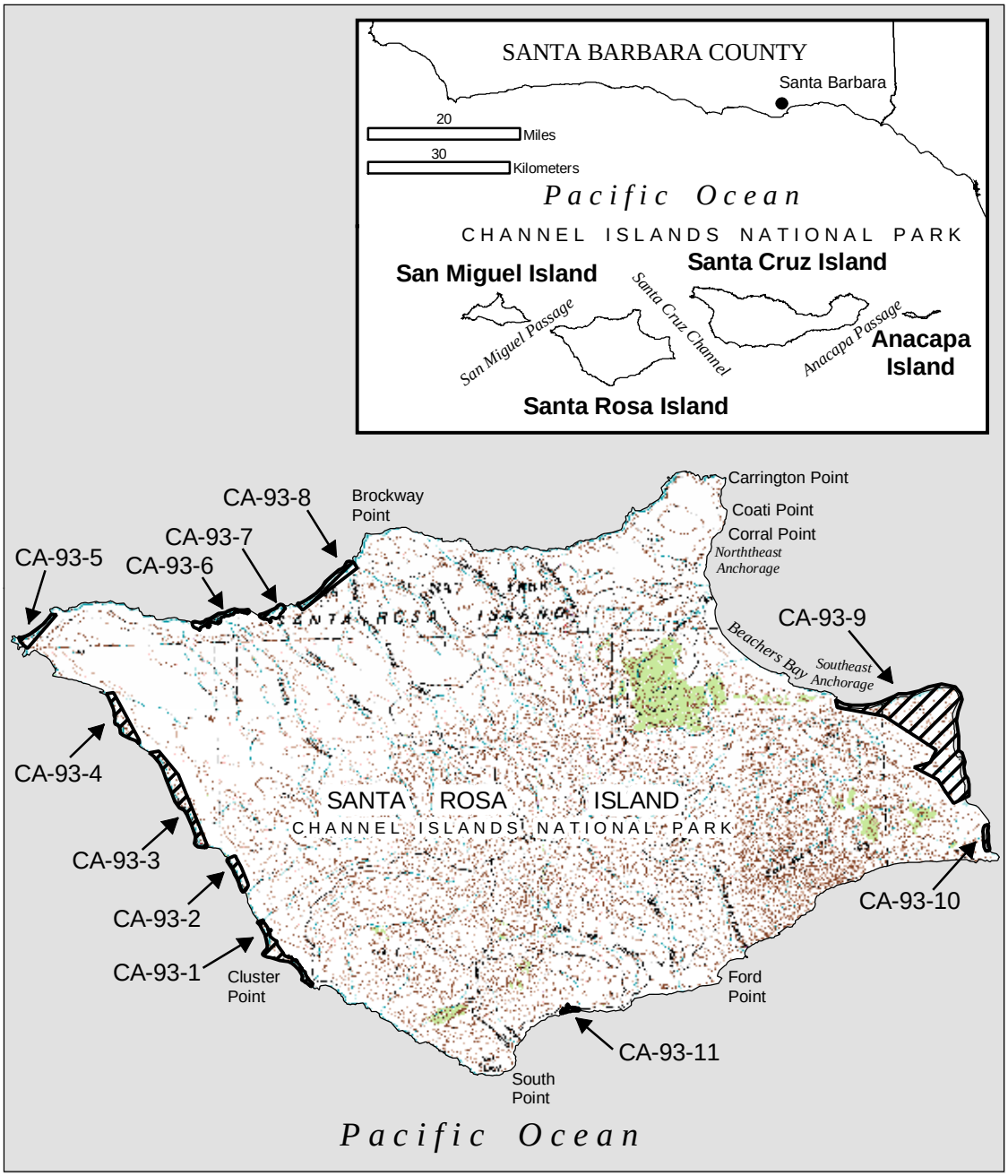
2 0 2 Miles

3 0 3 Kilometers

Scale 1: 130,000

N

Figure L - 112. Santa Rosa Island (CA-93), Santa Barbara County, California.



Legend

WSPL Breeding & Wintering Locations

2 0 2 Miles

3 0 3 Kilometers

Scale 1: 180,000

N

Figure L - 113. Santa Cruz Island (CA-94), Santa Barbara County, California.

Legend

WSPL Breeding & Wintering Locations

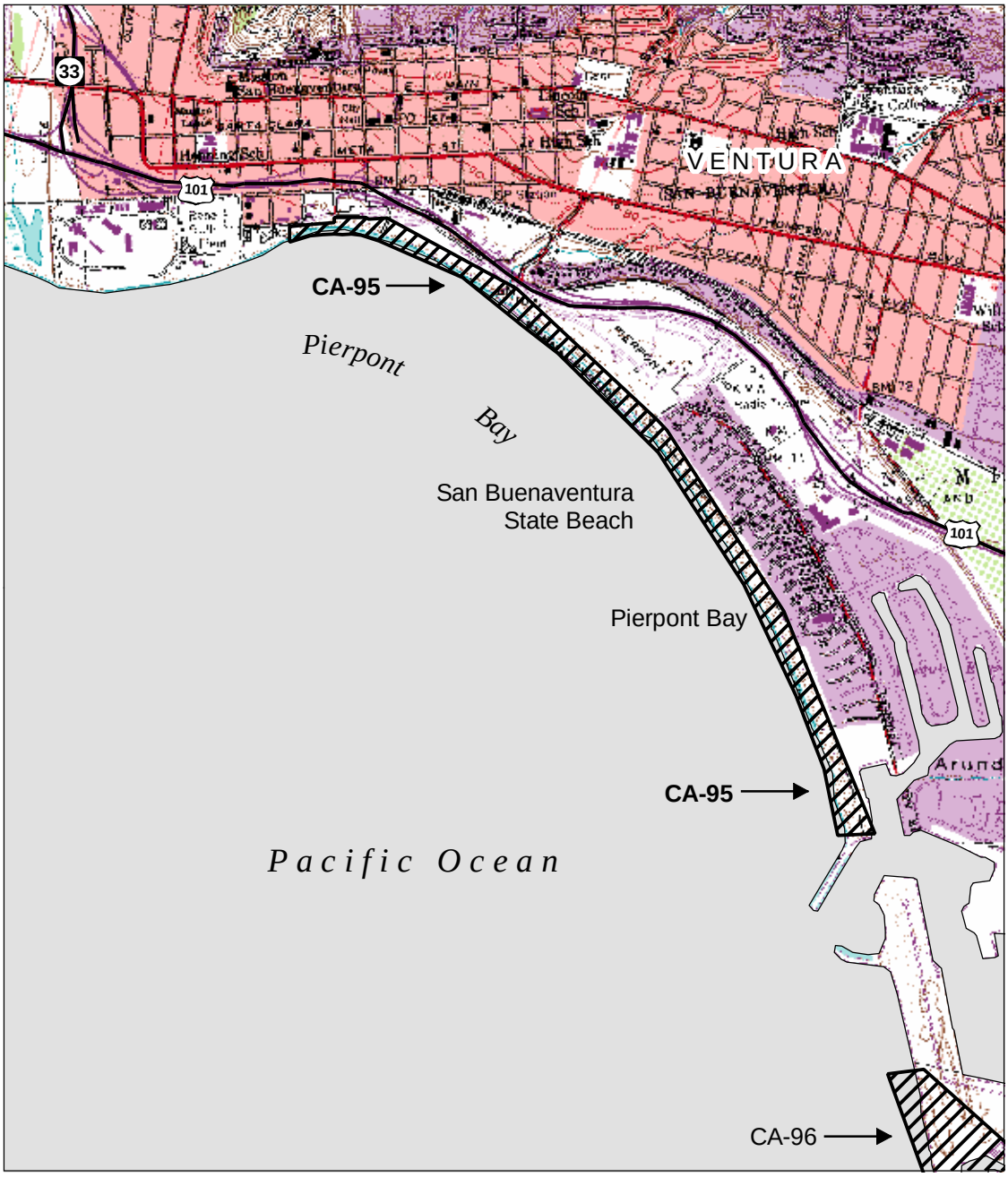
2 0 2 Miles

3 0 3 Kilometers

Scale 1: 130,000

N

Figure L - 114. San Buenaventura Beach (CA-95), Ventura County, California.



Legend

WSPL Breeding & Wintering Locations

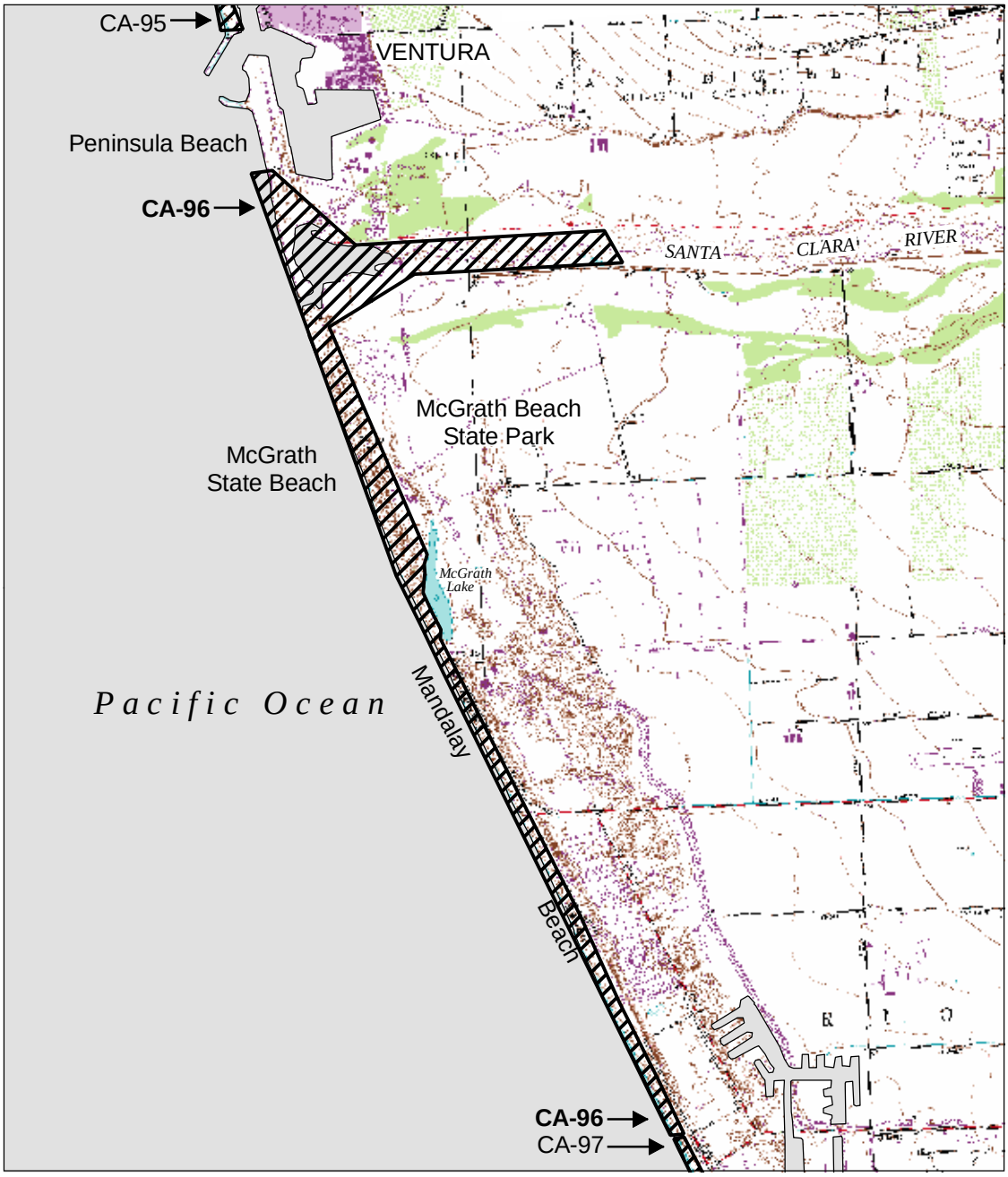
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 115. Santa Clara River Mouth/Mandalay State Beach (CA-96), Ventura County, California.



Legend

WSPL Breeding & Wintering Locations

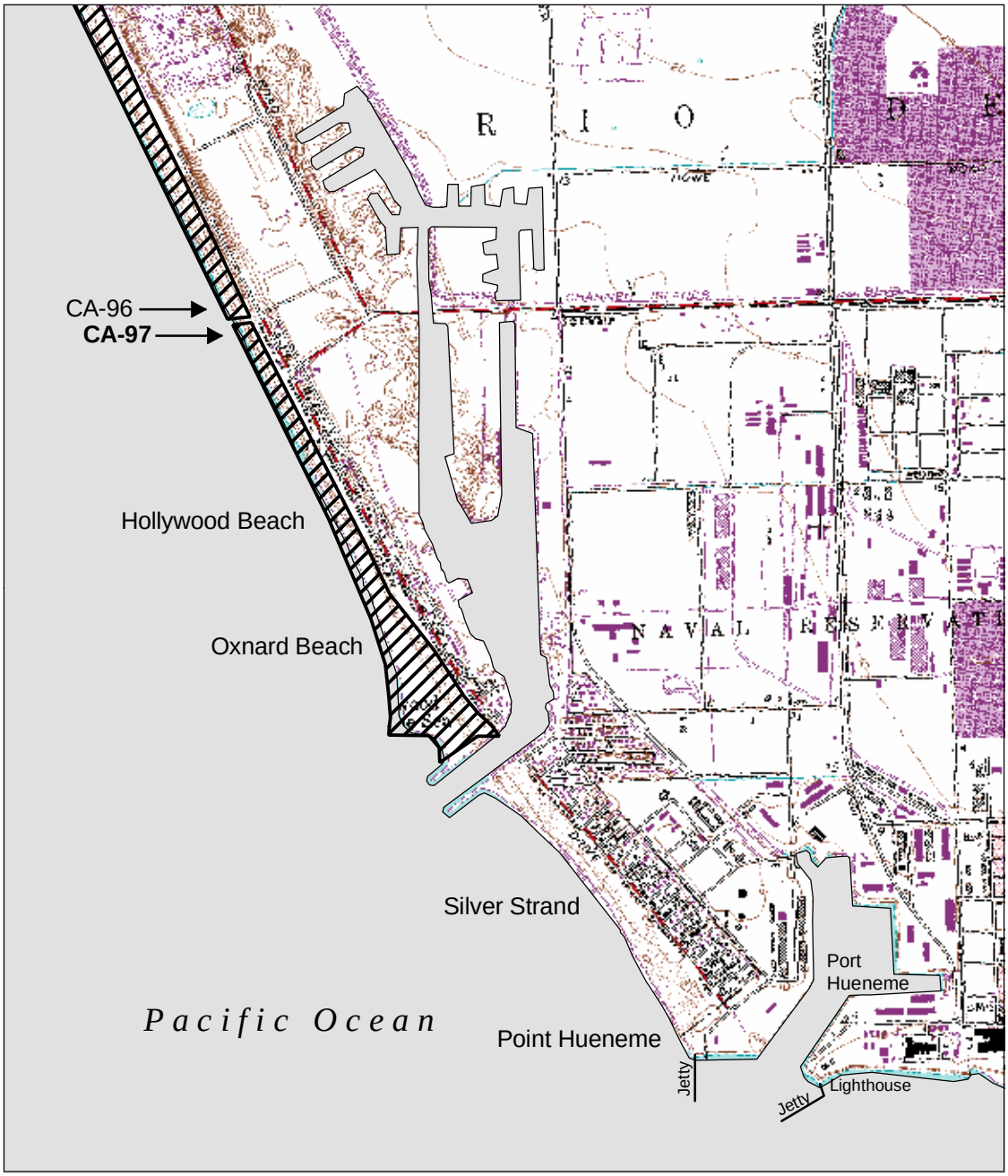
0.6 0 0.6 Miles

1 0 1 Kilometers

Scale 1: 50,000

N

Figure L - 116. Hollywood Beach (CA-97), Ventura County, California.



Legend

WSPL Breeding & Wintering Locations

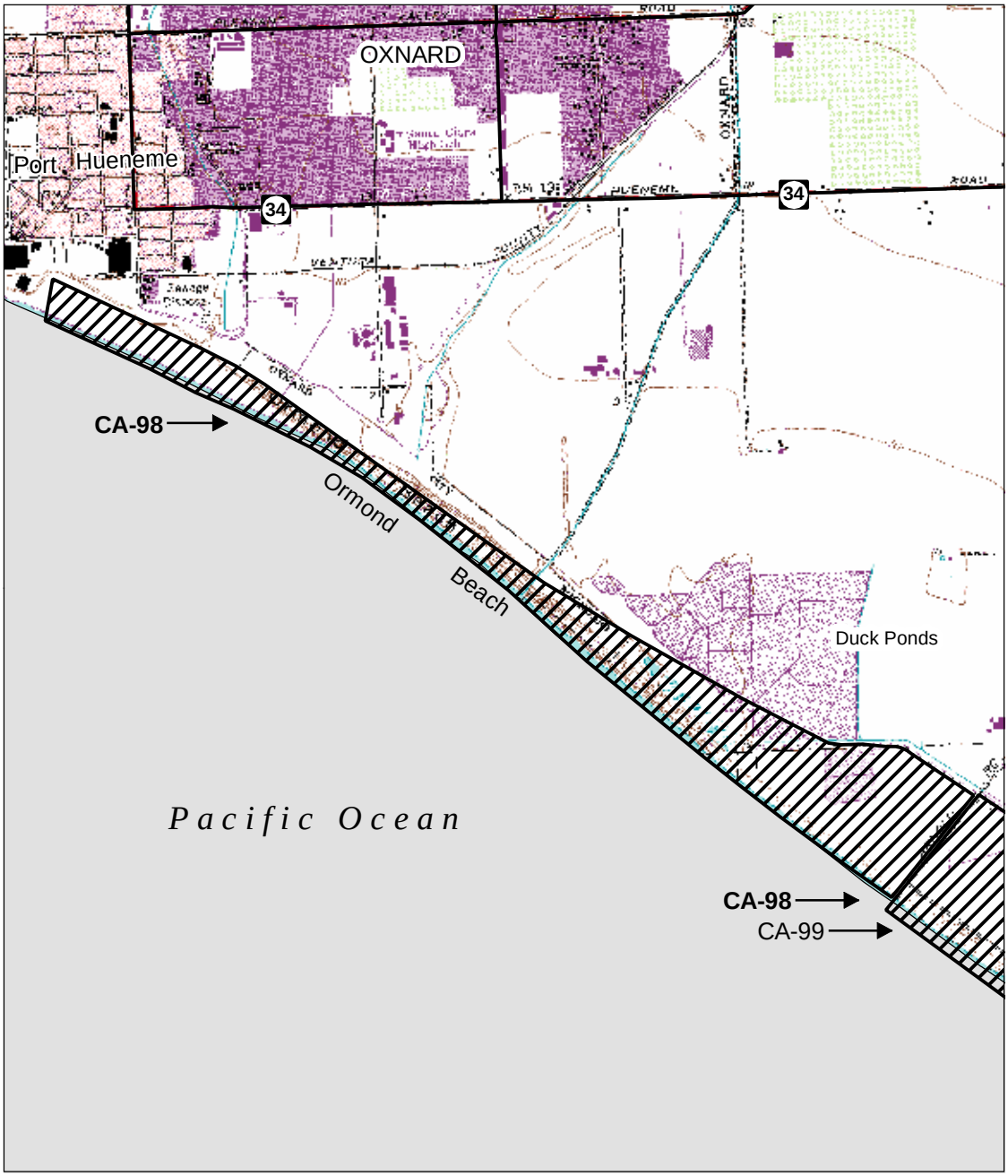
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 117. Ormond Beach (CA-98), Ventura County, California.



Legend

WSPL Breeding & Wintering Locations

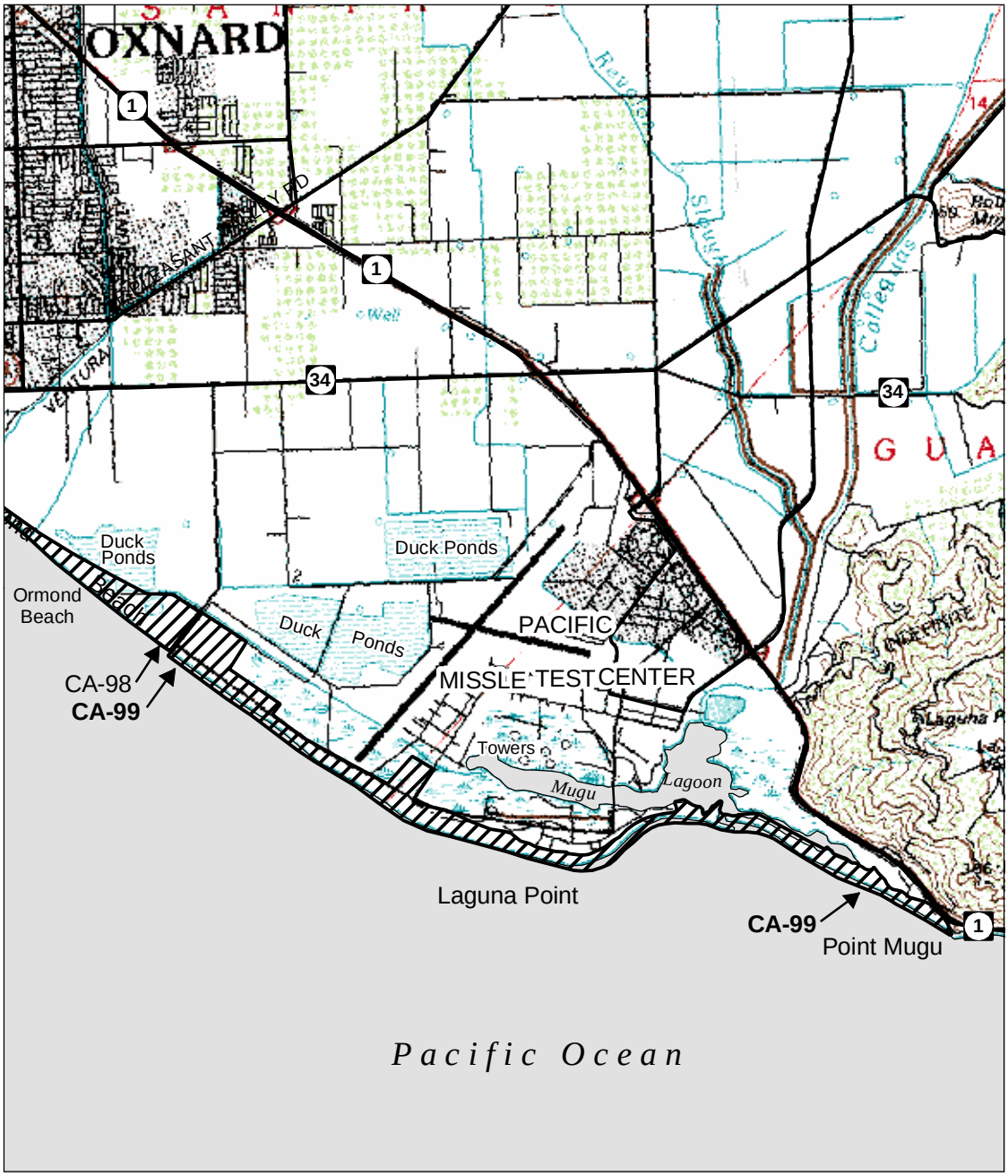
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 118. Mugu Lagoon Beach (CA-99), Ventura County, California.



Legend

WSPL Breeding & Wintering Locations

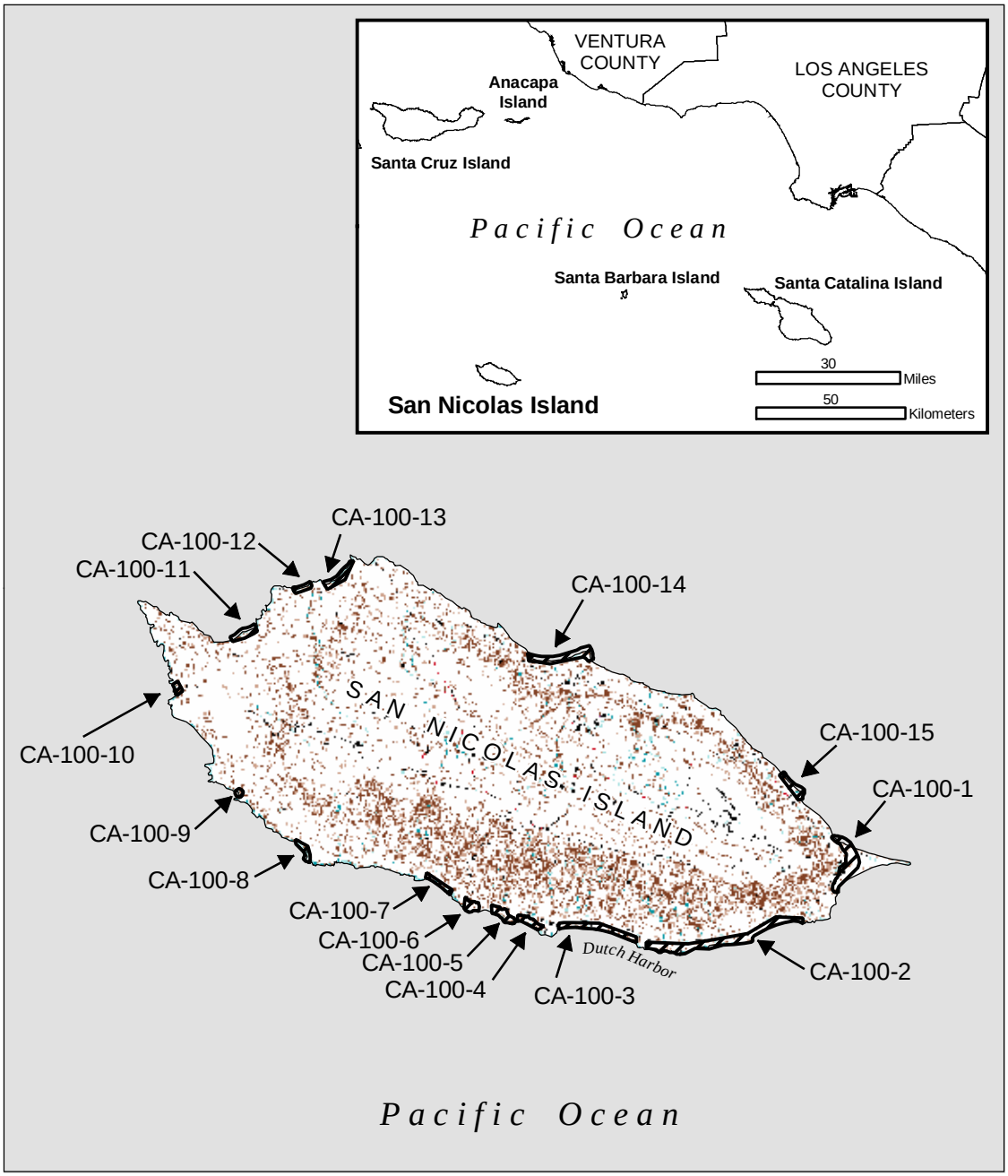
1 0 1 Miles

2 0 2 Kilometers

Scale 1: 80,000

N

Figure L - 119. San Nicolas Island (CA-100), Ventura County, California.



Legend

WSPL Breeding & Wintering Locations

2 0 2 Miles

3 0 3 Kilometers

Scale 1: 130,000

N

Figure L - 120. Zuma Beach (CA-101), Los Angeles County, California.

Legend

WSPL Breeding & Wintering Locations

0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 121. Corral Beach (CA-102), Los Angeles County, California.

Legend

WSPL Breeding & Wintering Locations

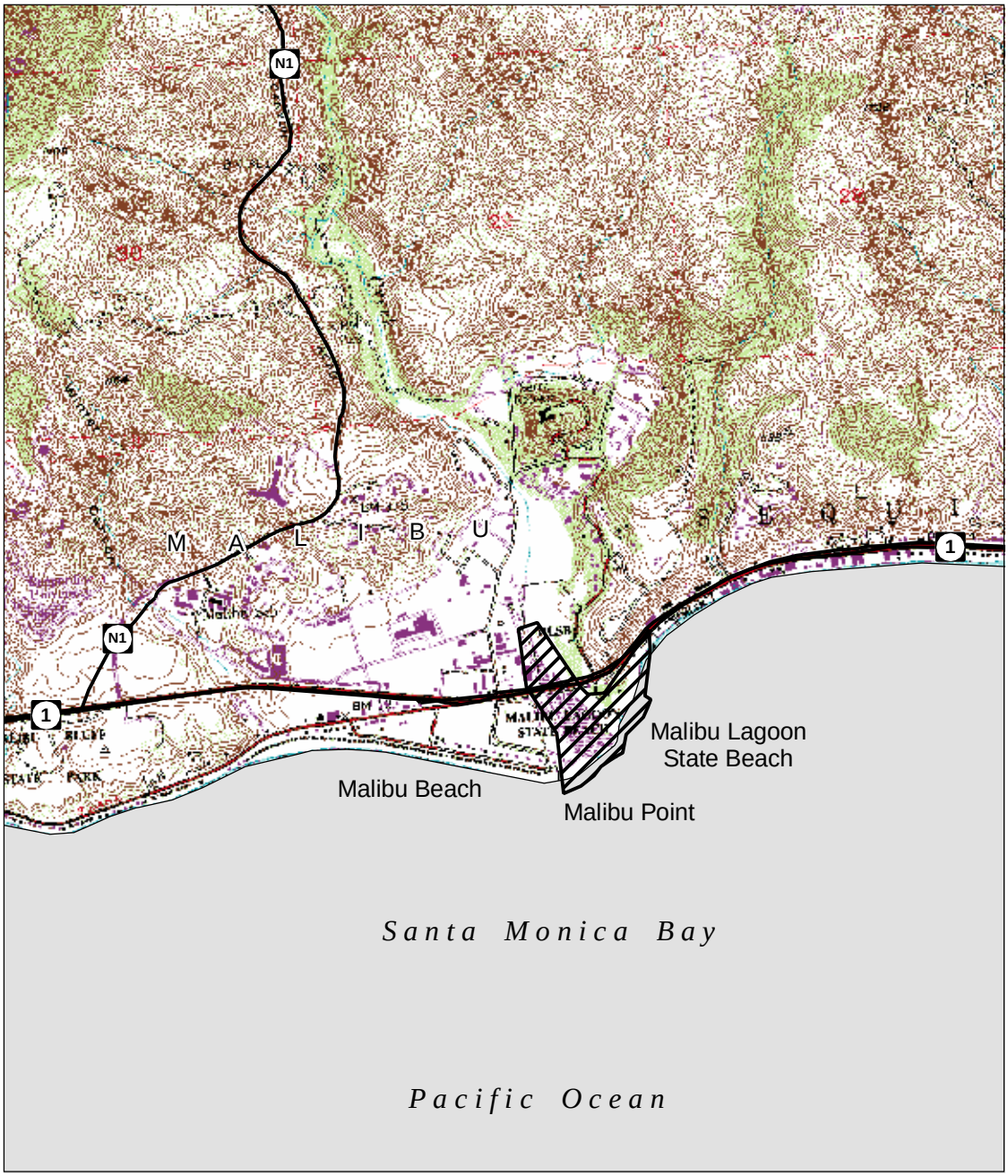
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 122. Malibu Lagoon/Beach (CA-103), Los Angeles County, California.



Legend

WSPL Breeding & Wintering Locations

0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 123. Santa Monica Beach (CA-104), Los Angeles County, California.

Legend

WSPL Breeding & Wintering Locations

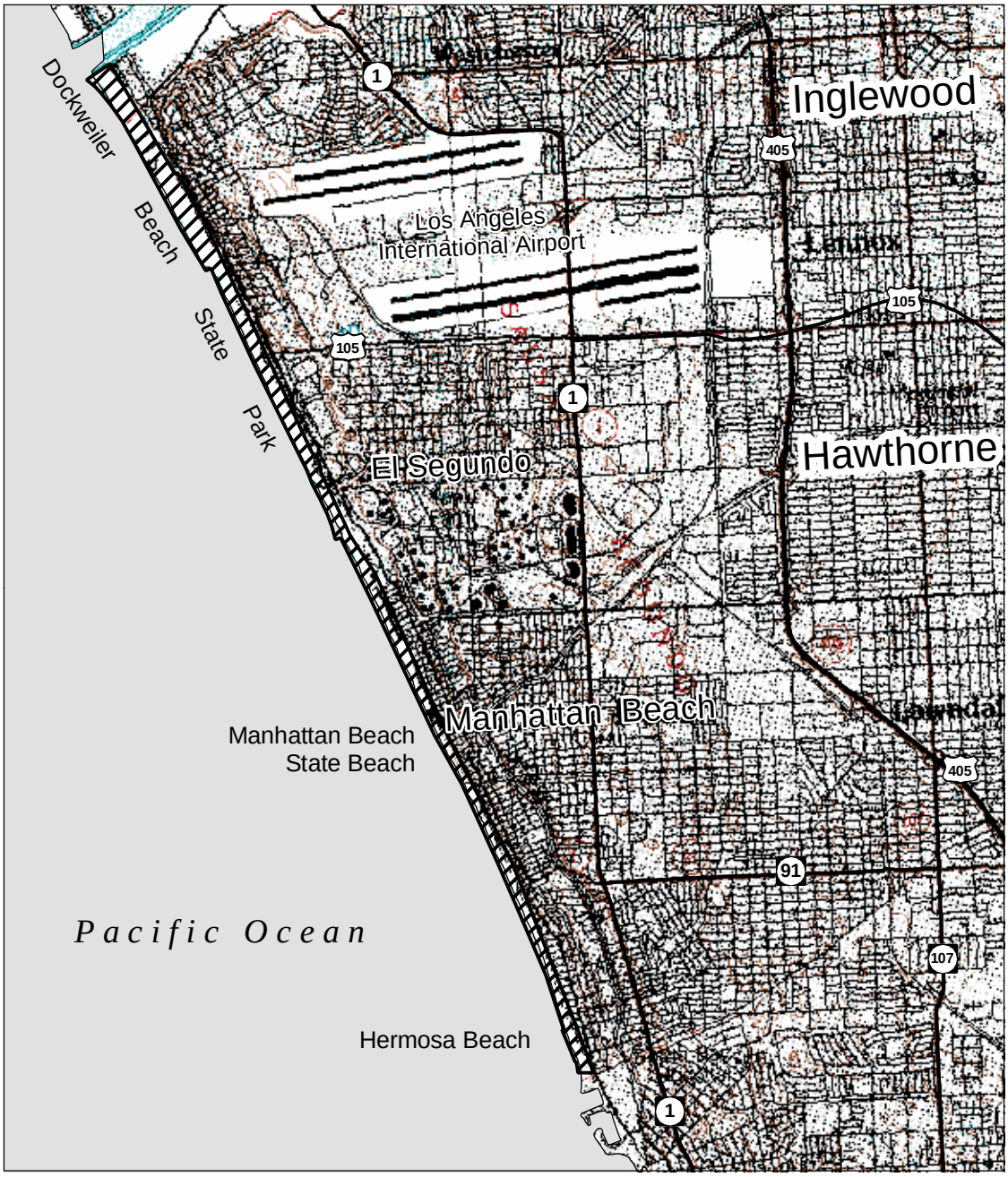
1 0 1 Miles

2 0 2 Kilometers

Scale 1: 80,000

N

Figure L - 124. Dockweiler to Hermosa Beach (CA-105), Los Angeles County, California.



Legend

WSPL Breeding & Wintering Locations

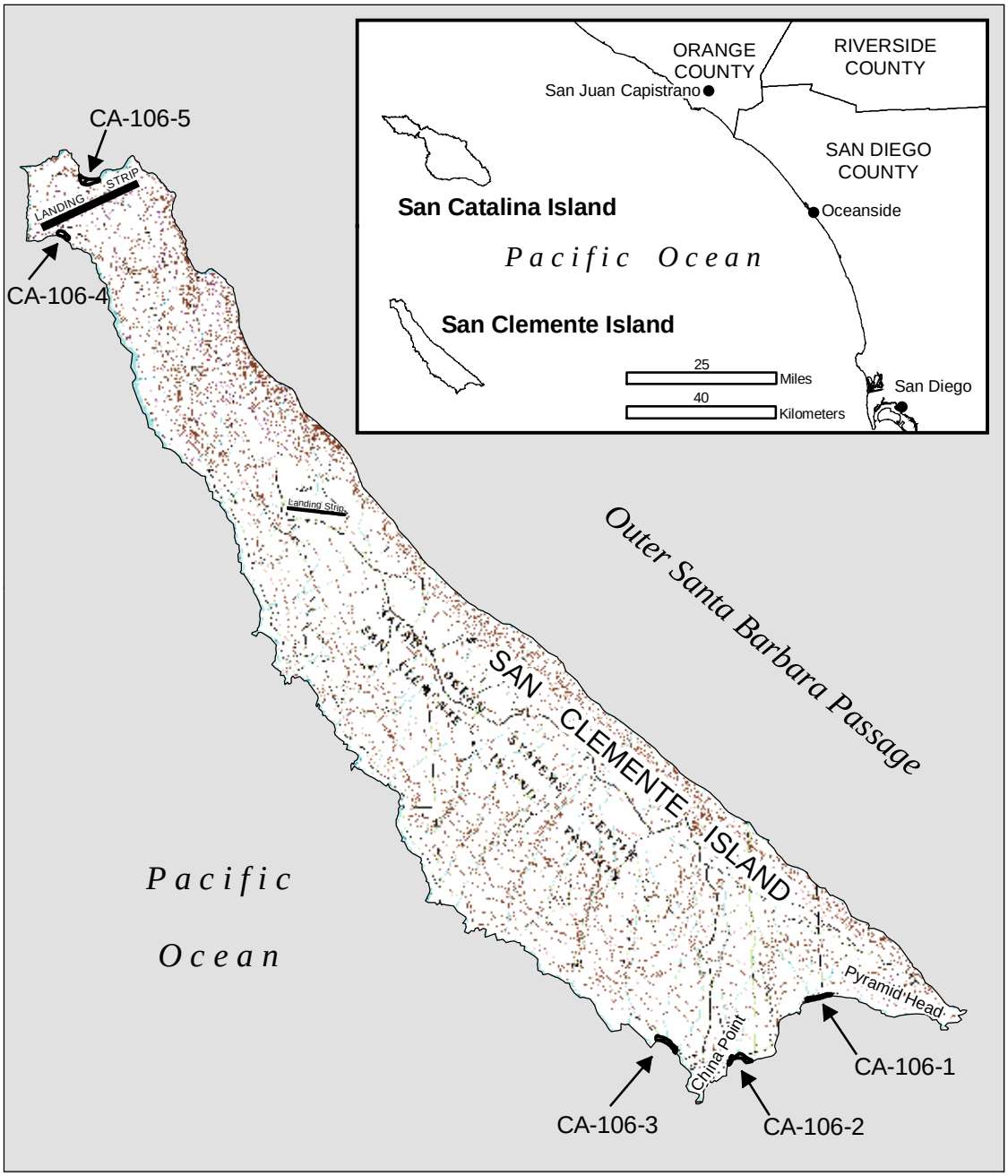
1 0 1 Miles

2 0 2 Kilometers

Scale 1: 80,000

N

Figure L - 125. San Clemente Island (CA-106), Los Angles County, California.



Legend

WSPL Breeding & Wintering Locations

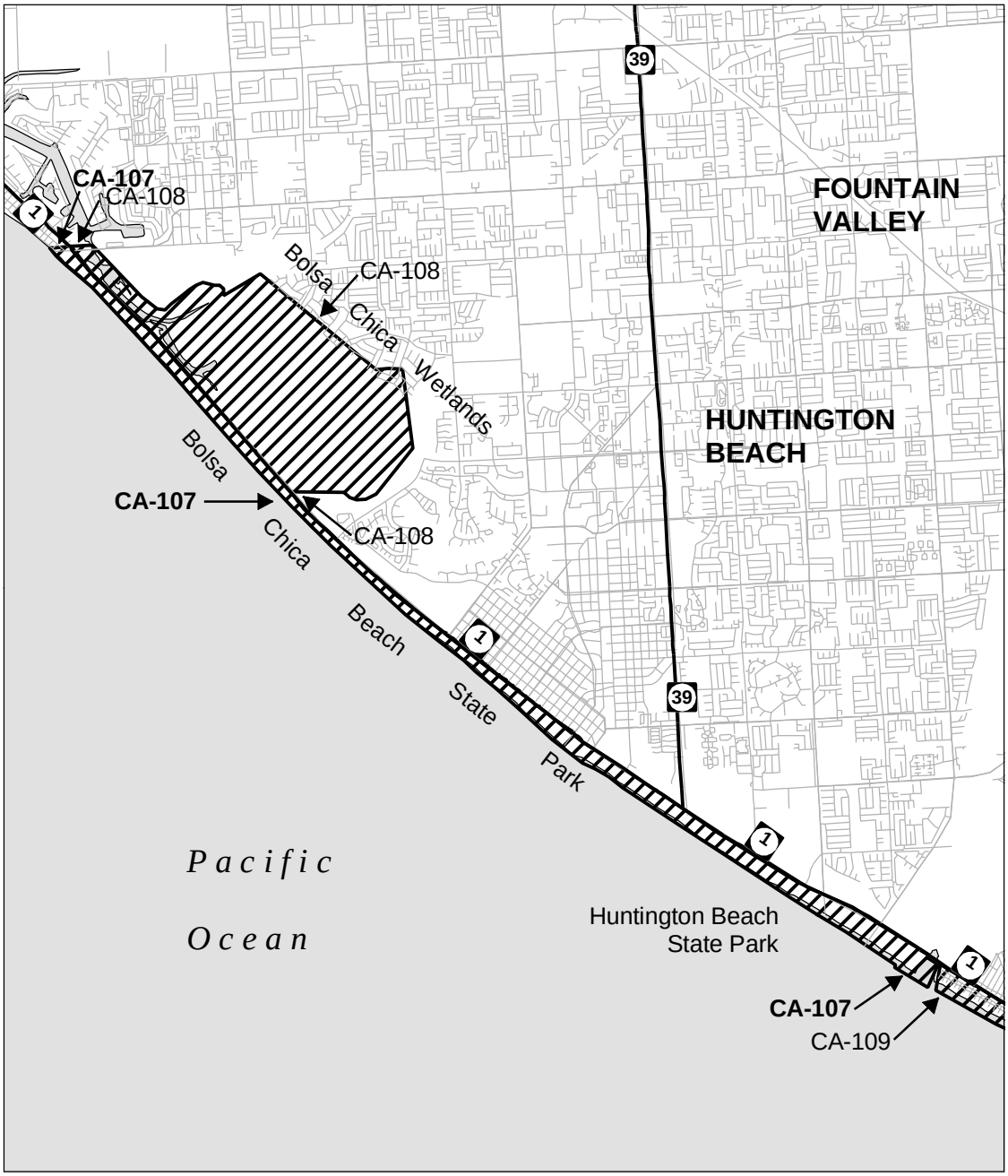
2 0 2 Miles

3 0 3 Kilometers

Scale 1: 180,000

N

Figure L - 126. Huntington Beach (CA-107), Orange County, California.



Legend

WSPL Breeding & Wintering Locations

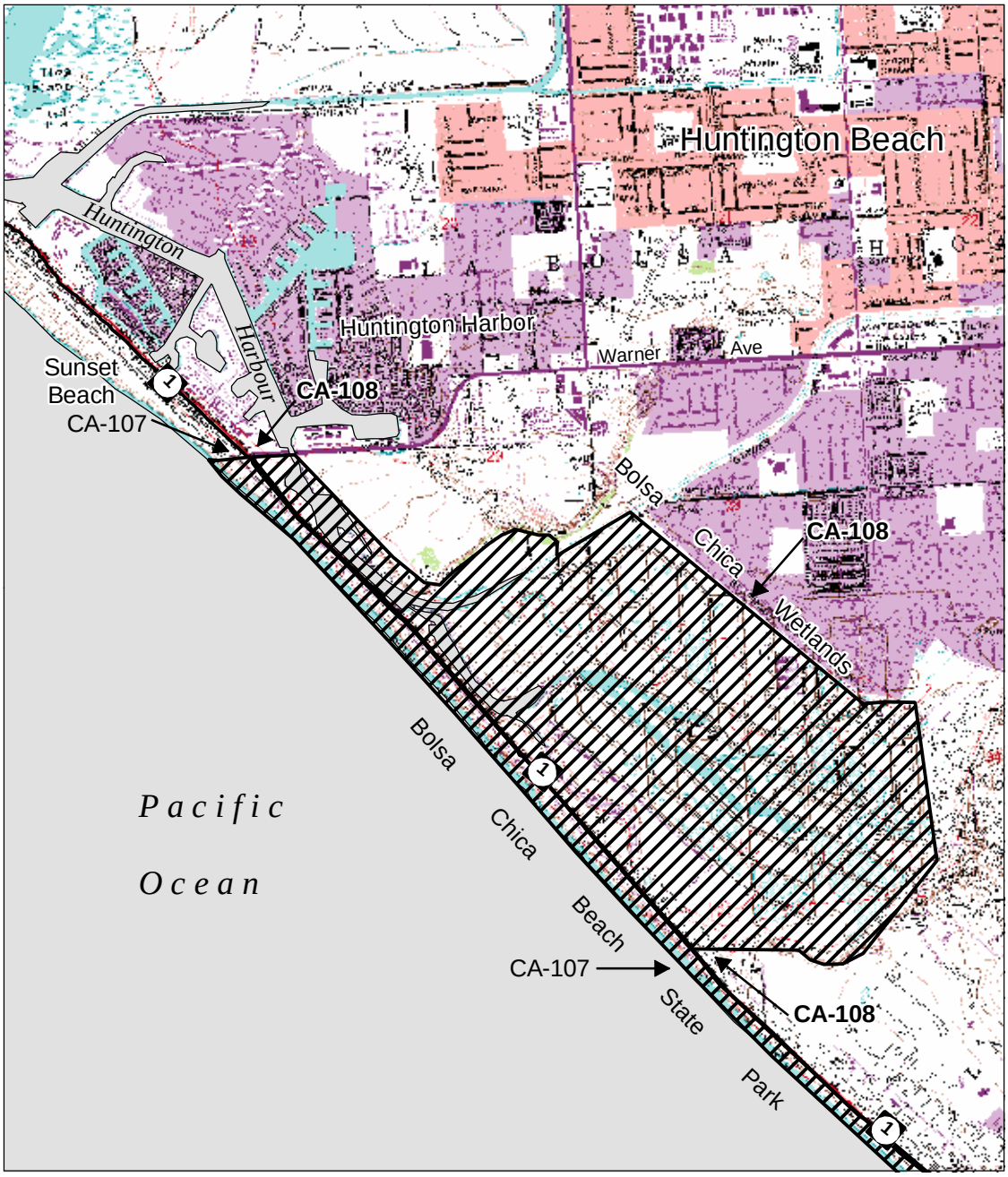
1 0 1 Miles

2 0 2 Kilometers

Scale 1: 80,000

N

Figure L - 127. Bolsa Chica Wetlands (CA-108), Orange County, California.



Legend

WSPL Breeding & Wintering Locations

0.6 0 0.6 Miles

1 0 1 Kilometers

Scale 1: 40,000

N

Figure L - 128. Newport Beach (CA-109), Orange County, California.

Legend

WSPL Breeding & Wintering Locations

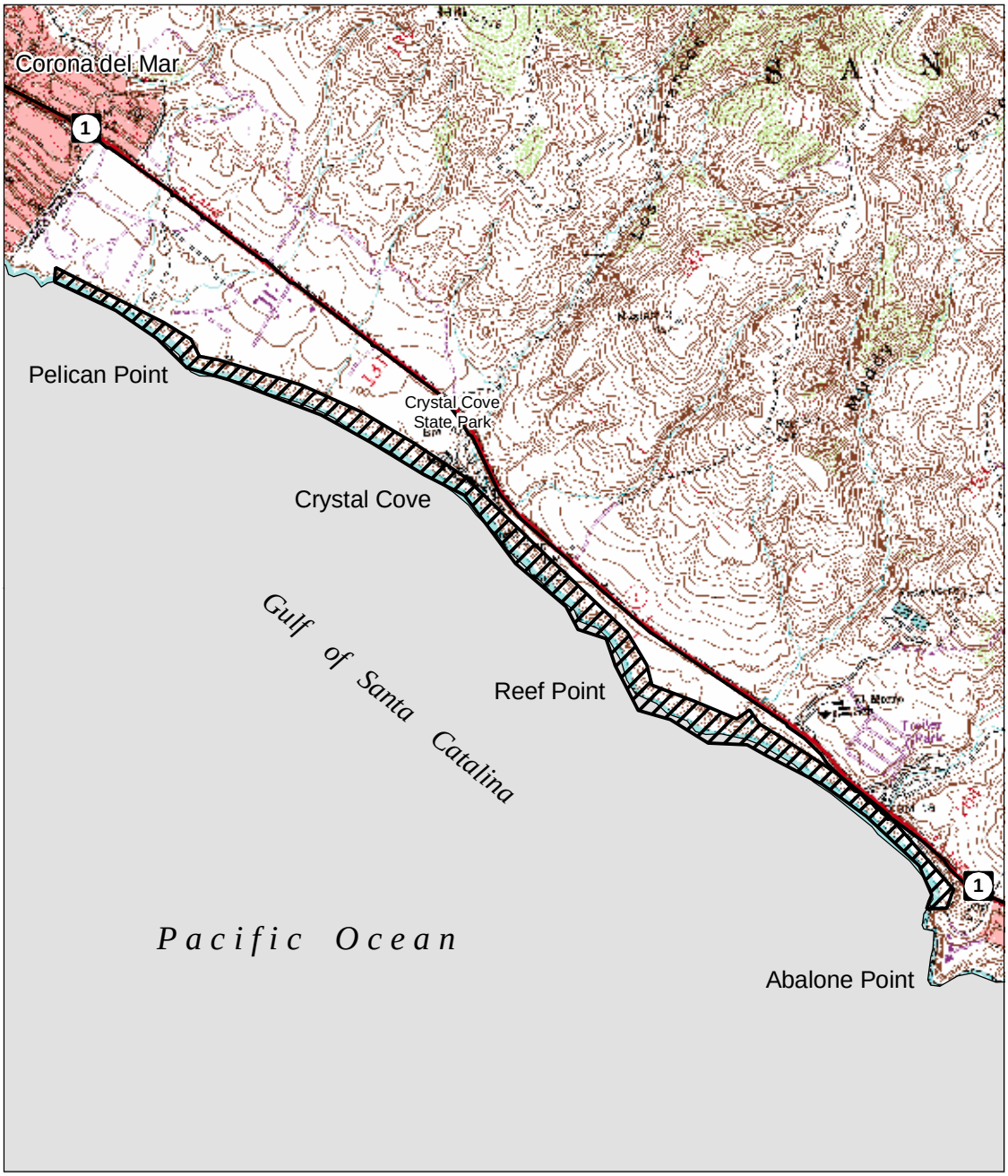
1 0 1 Miles

2 0 2 Kilometers

Scale 1: 80,000

N

Figure L - 129. Crystal Cove (CA-110), Orange County, California.



Legend

WSPL Breeding & Wintering Locations

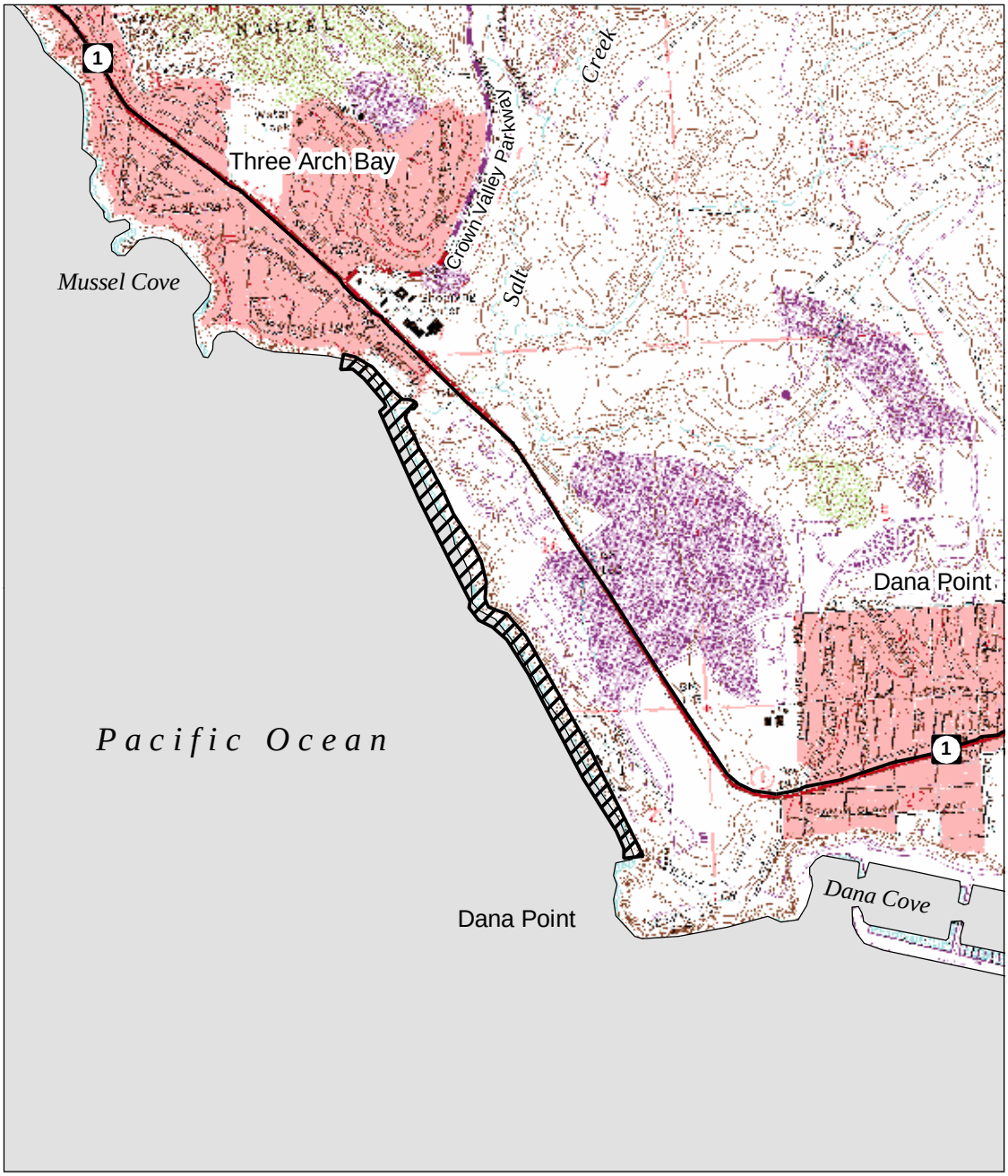
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 130. Salt Creek Beach (CA-111), Orange County, California.



Legend

WSPL Breeding & Wintering Locations

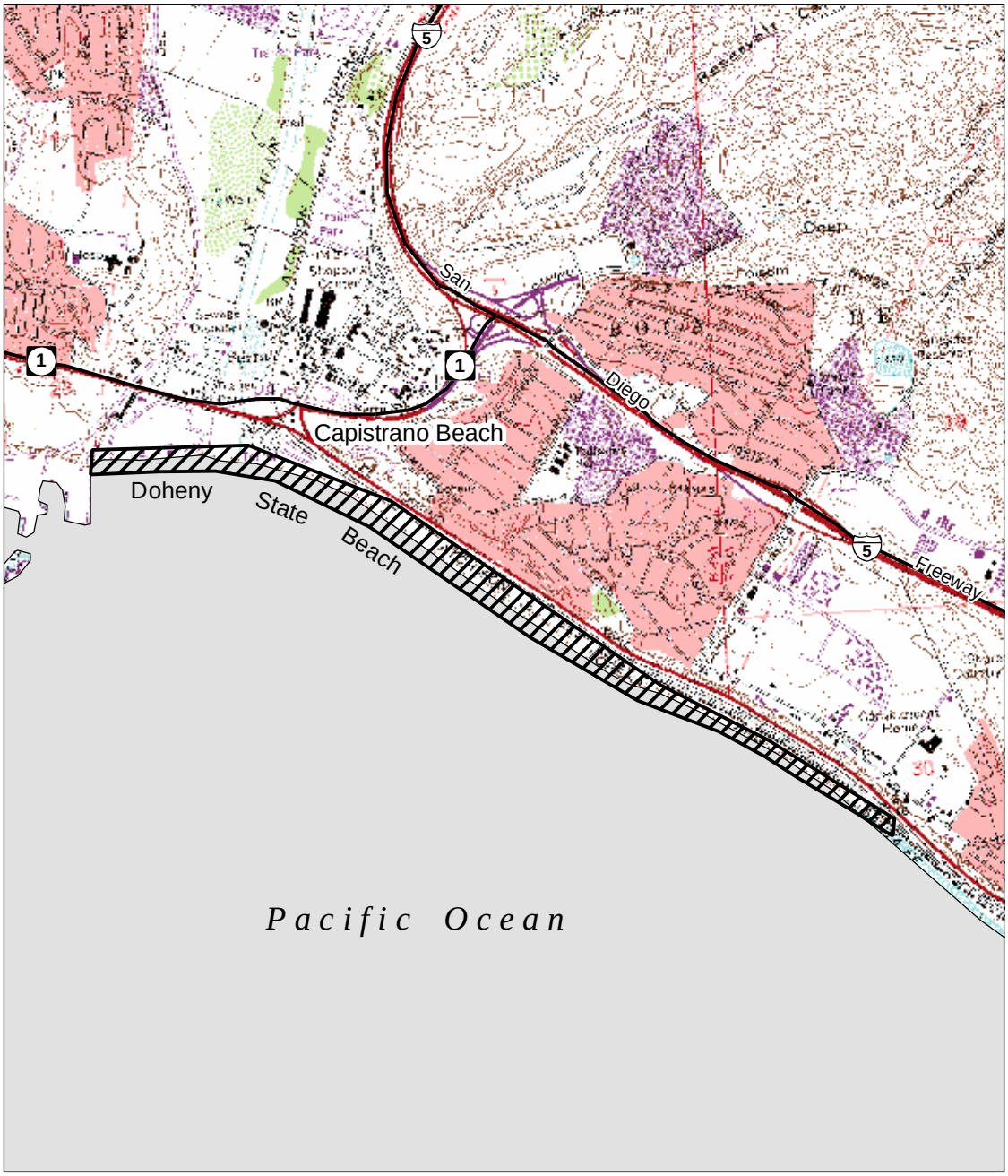
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 131. Doheny Beach (CA-112), Orange County, California.



Legend

WSPL Breeding & Wintering Locations

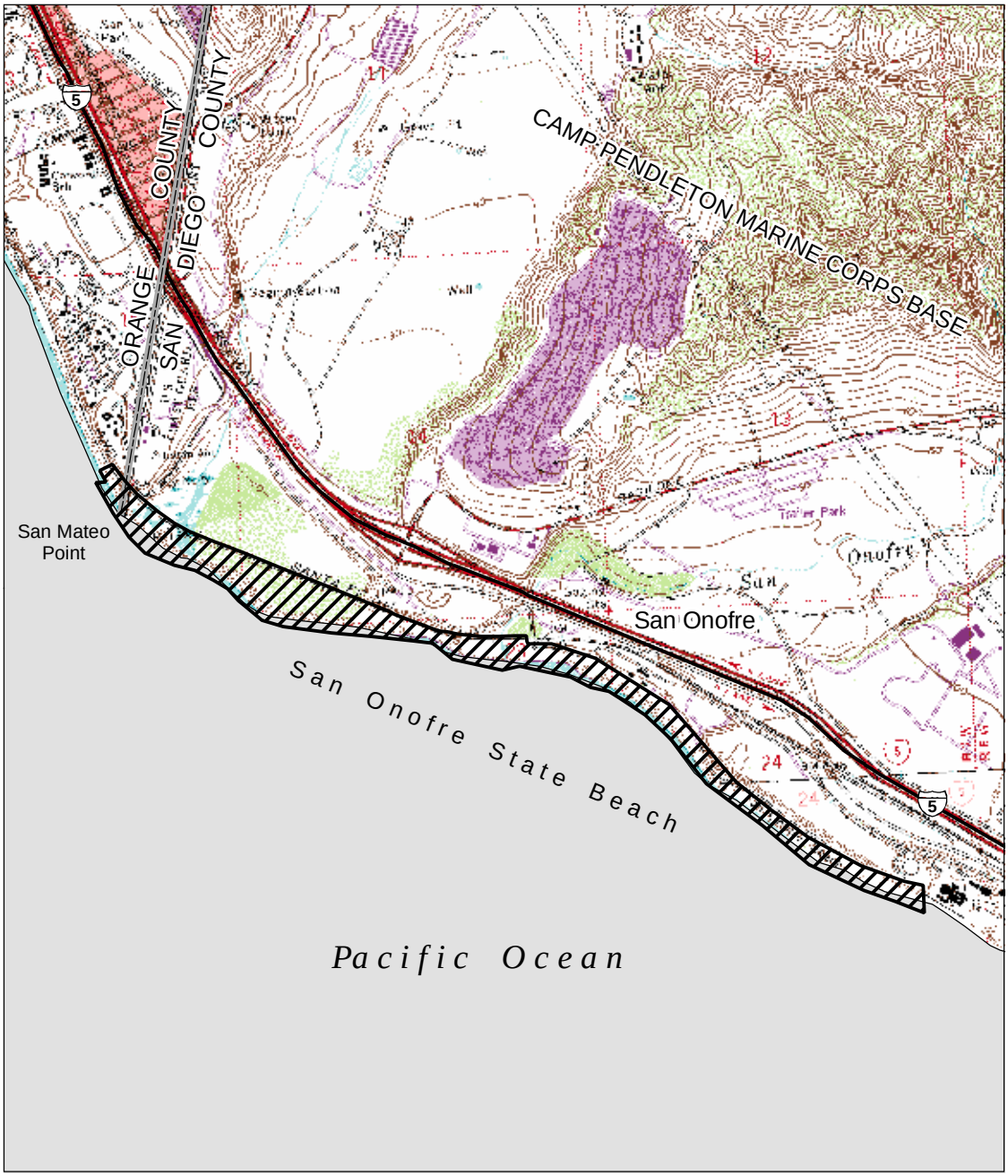
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 132. San Onofre Beach (CA-113), Orange and San Diego County, California.



Legend

WSPL Breeding & Wintering Locations

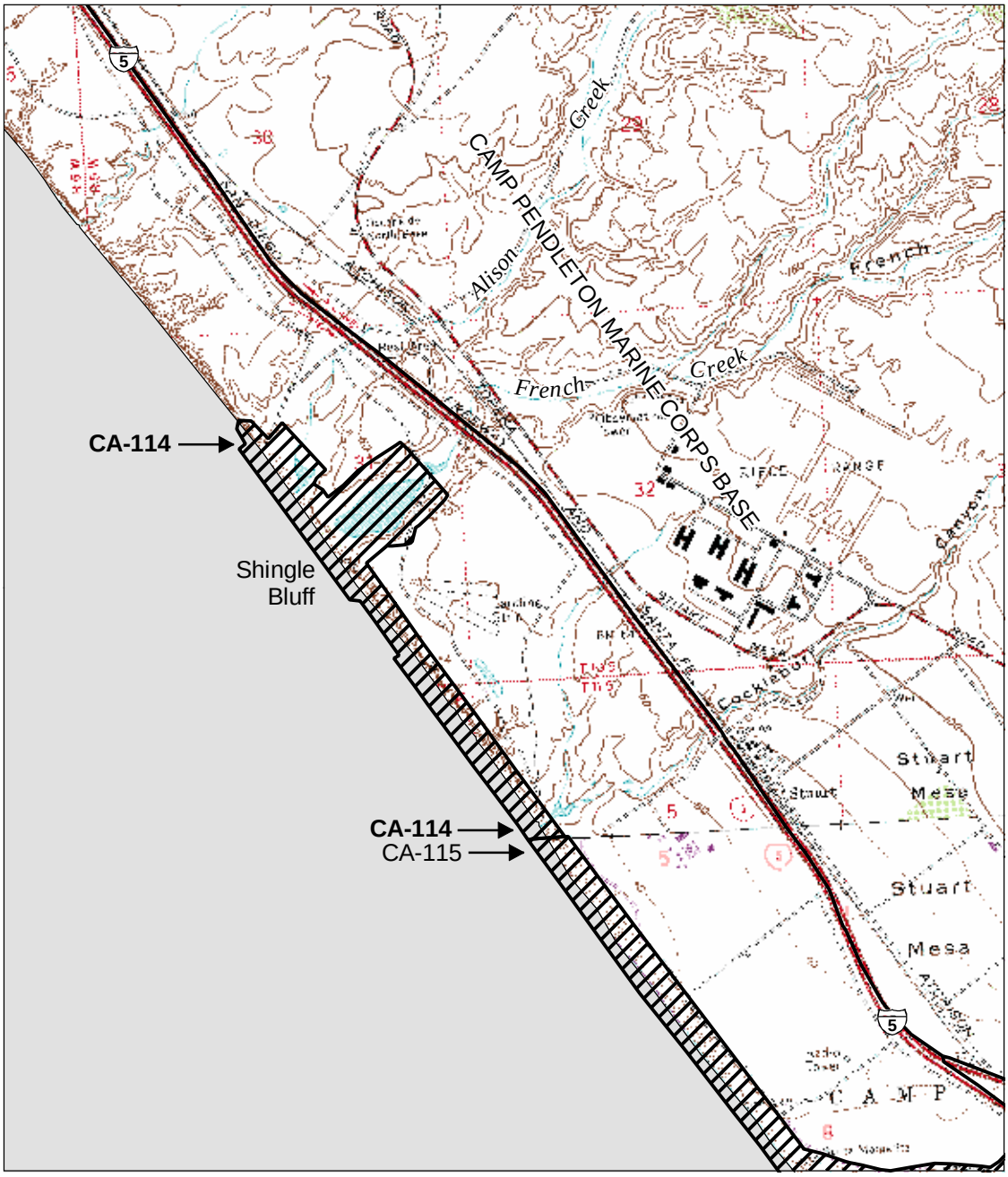
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 133. Aliso/French Creek Mouth (CA-114), San Diego County, California.



Legend

WSPL Breeding & Wintering Locations

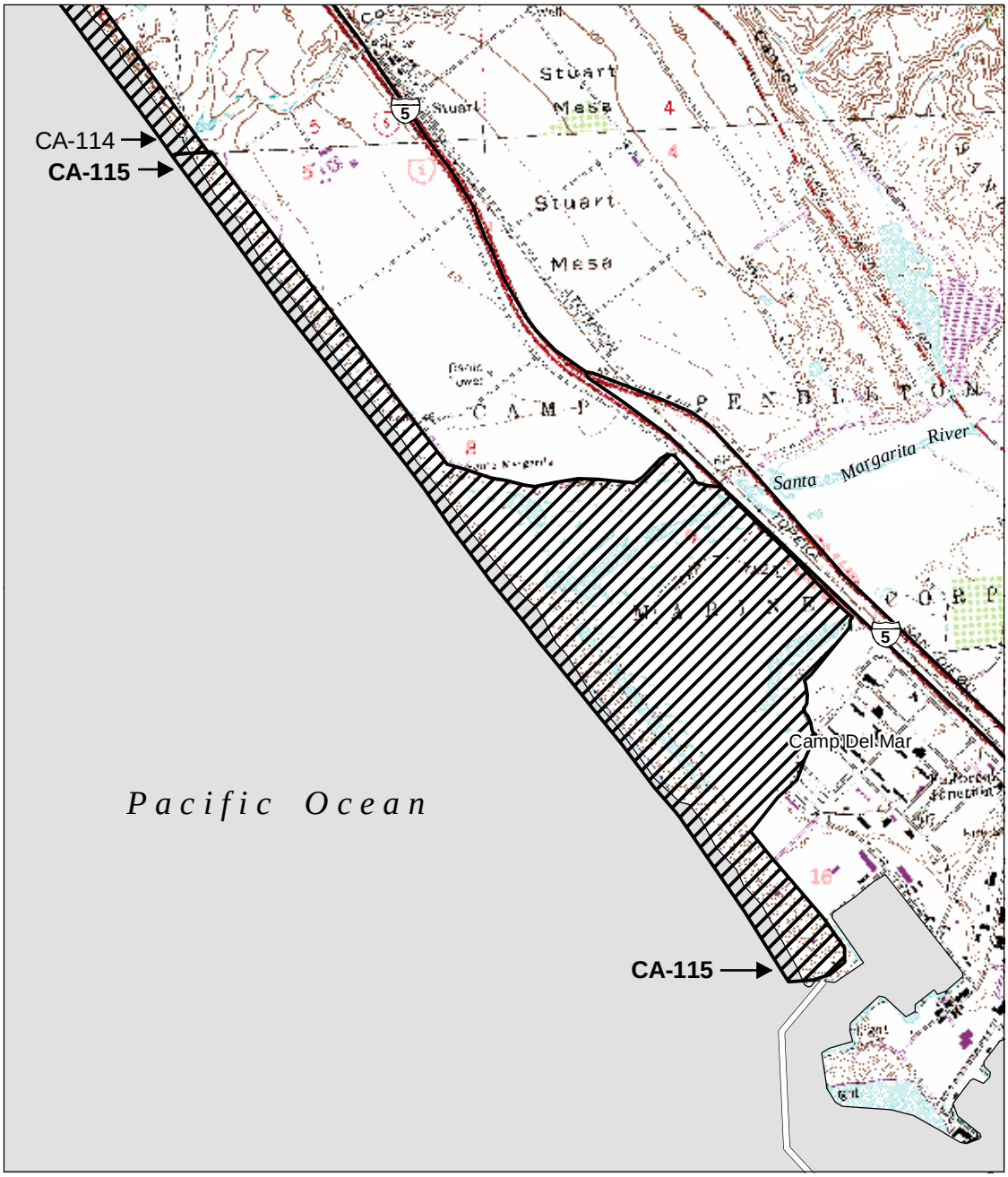
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 134. Santa Margarita River (CA-115), San Diego County, California.



Legend

WSPL Breeding & Wintering Locations

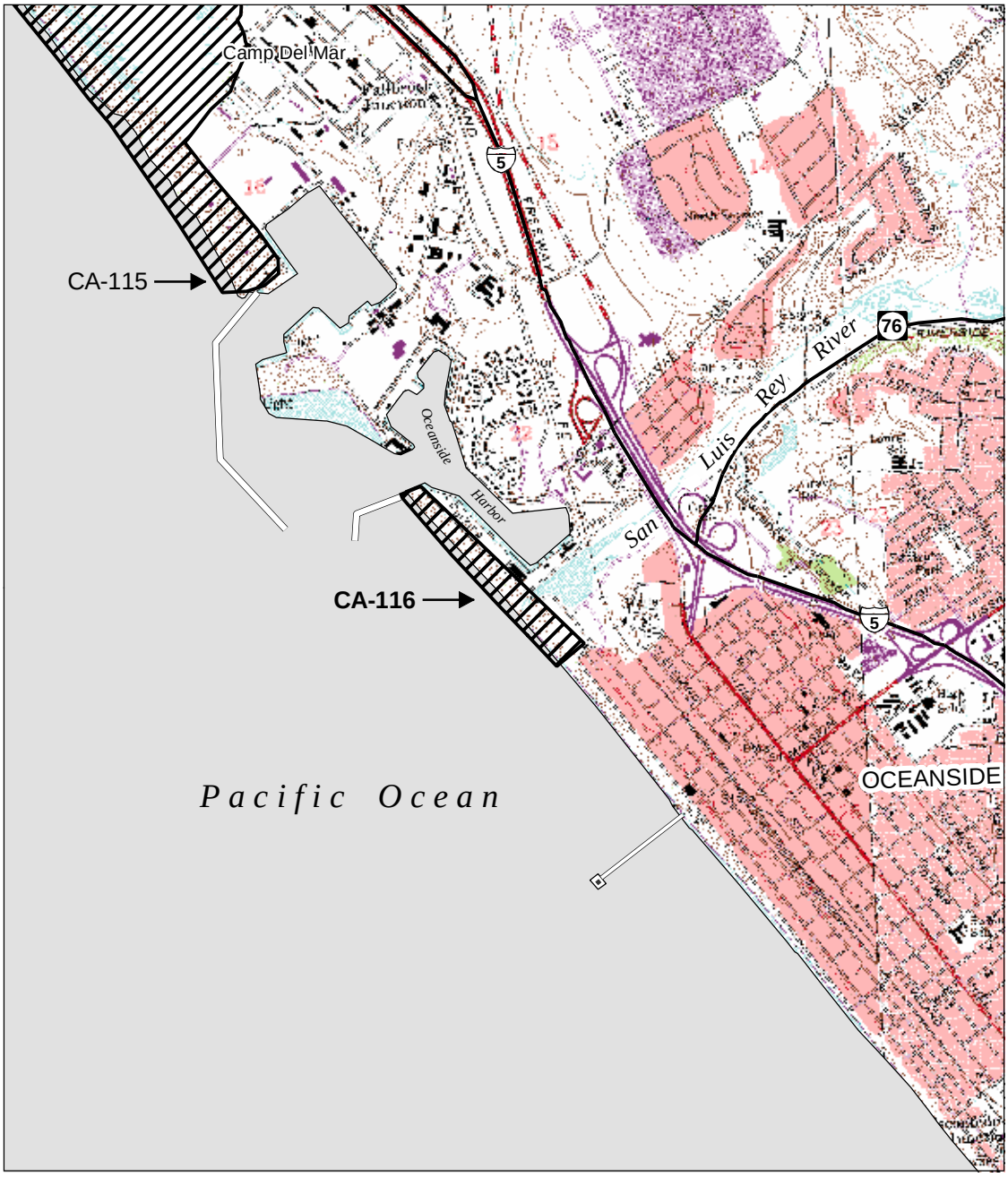
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 135. San Luis Rey River Mouth (CA-116), San Diego County, California.



Legend

WSPL Breeding & Wintering Locations

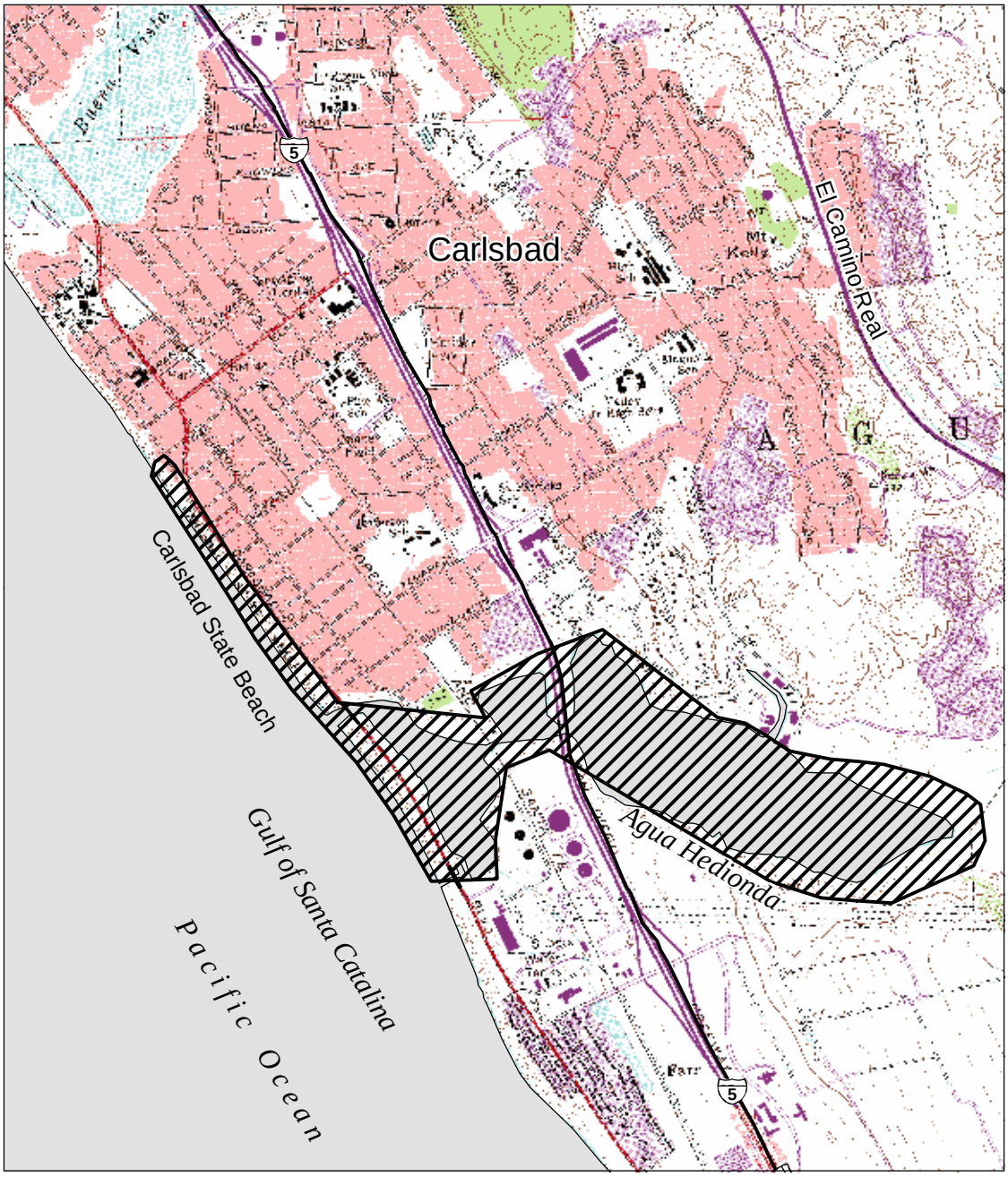
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 136. Agua Hedionda Lagoon/Beach (CA-117), San Diego County, California.



Legend

WSPL Breeding & Wintering Locations

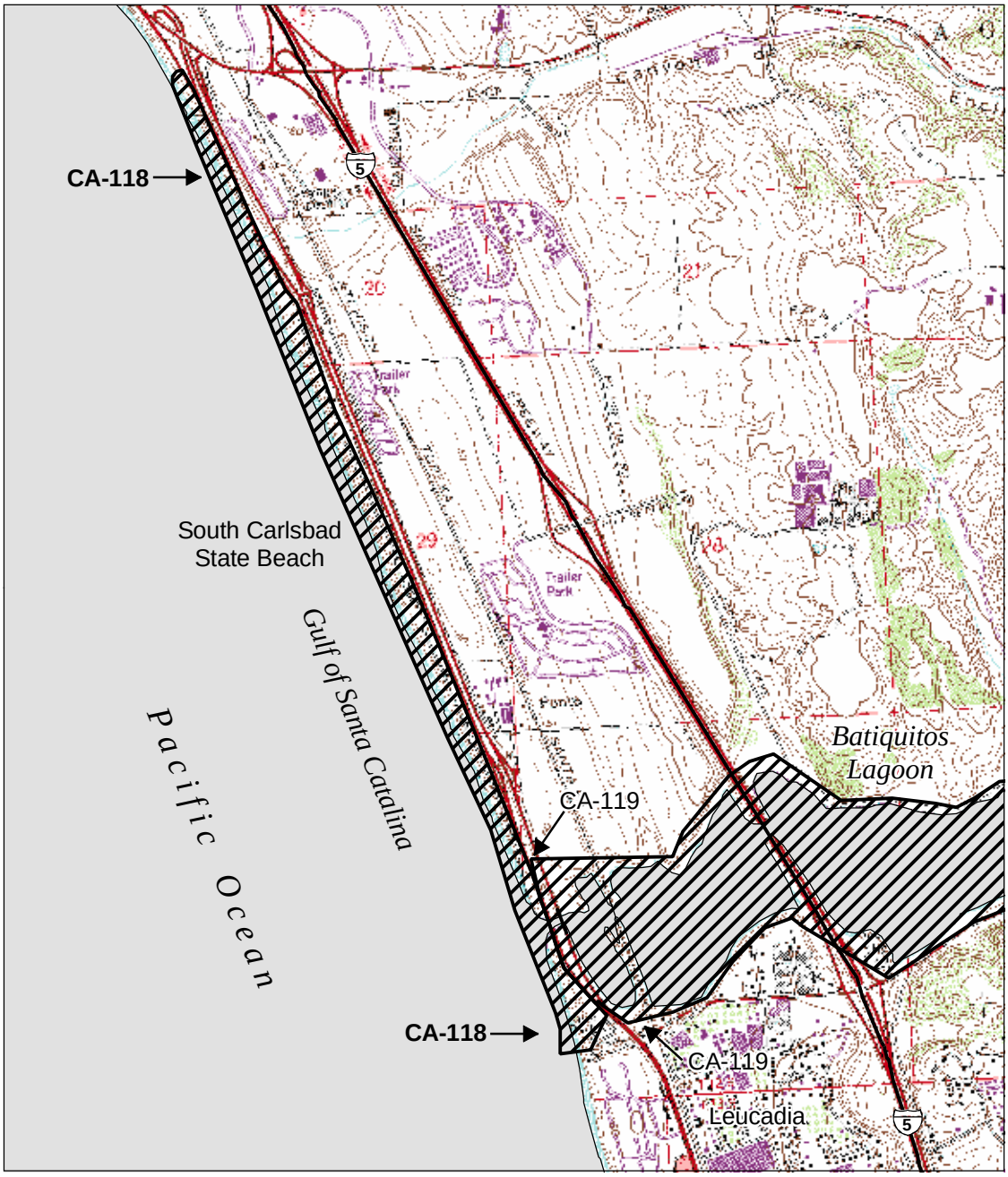
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 137. South Carlsbad Beach (CA-118), San Diego County, California.



Legend

WSPL Breeding & Wintering Locations

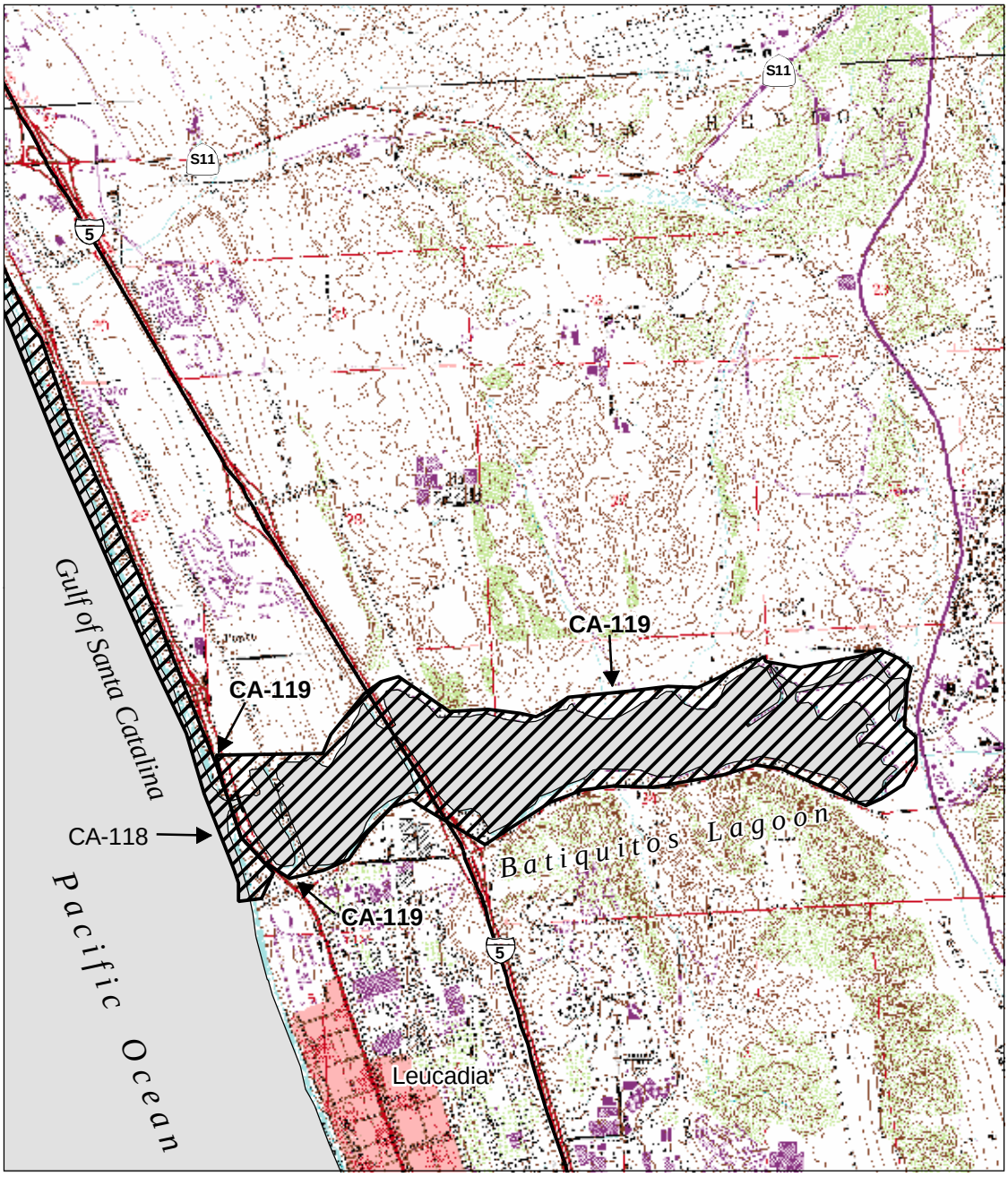
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 138. Batiquitos Lagoon (CA-119), San Diego County, California.



Legend

WSPL Breeding & Wintering Locations

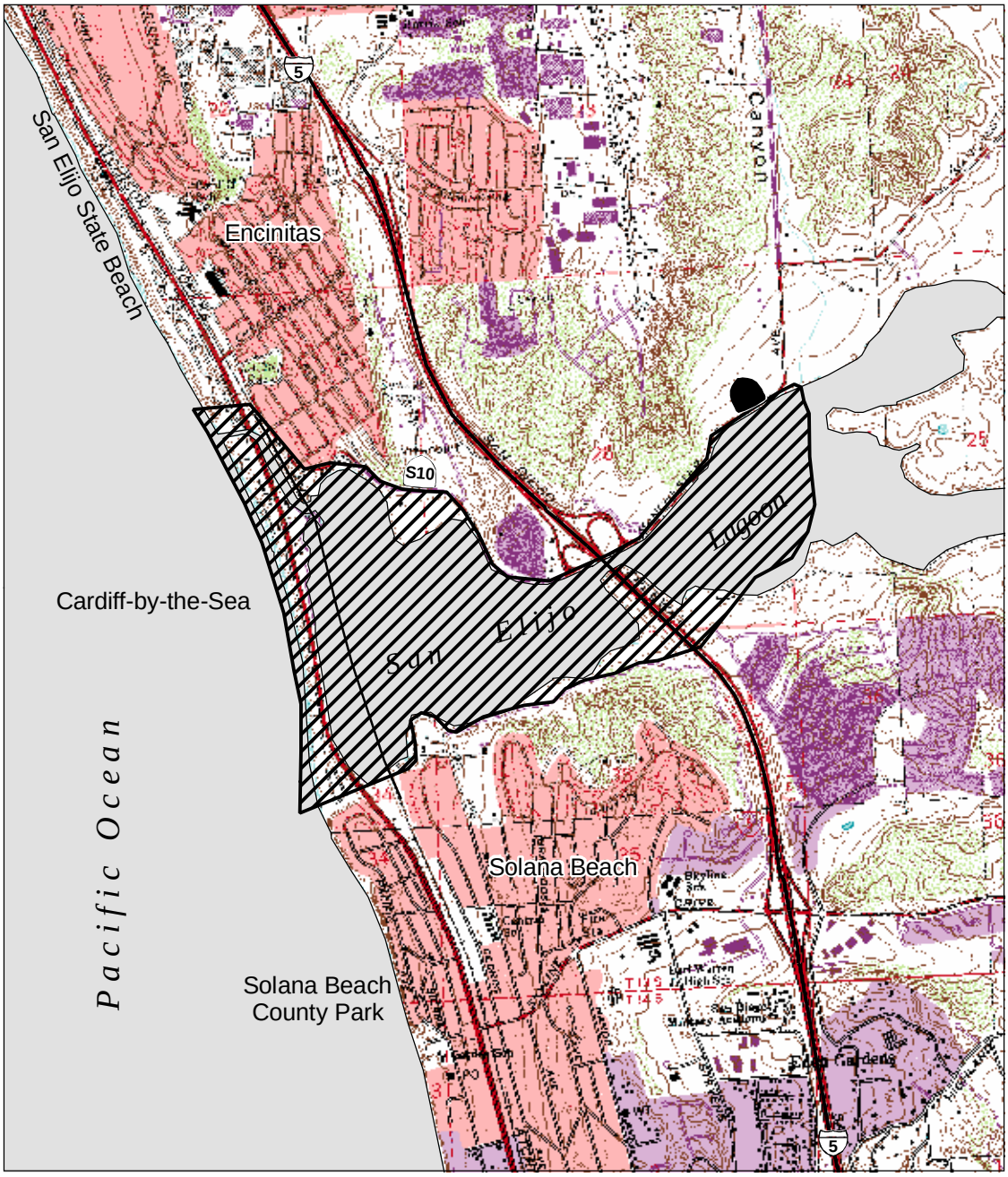
0.6 0 0.6 Miles

1 0 1 Kilometers

Scale 1: 40,000

N

Figure L - 139. San Elijo Lagoon/Beach (CA-120), San Diego County, California.



Legend

WSPL Breeding & Wintering Locations

0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 140. San Dieguito Lagoon/Beach (CA-121), San Diego County, California.

Legend

WSPL Breeding & Wintering Locations

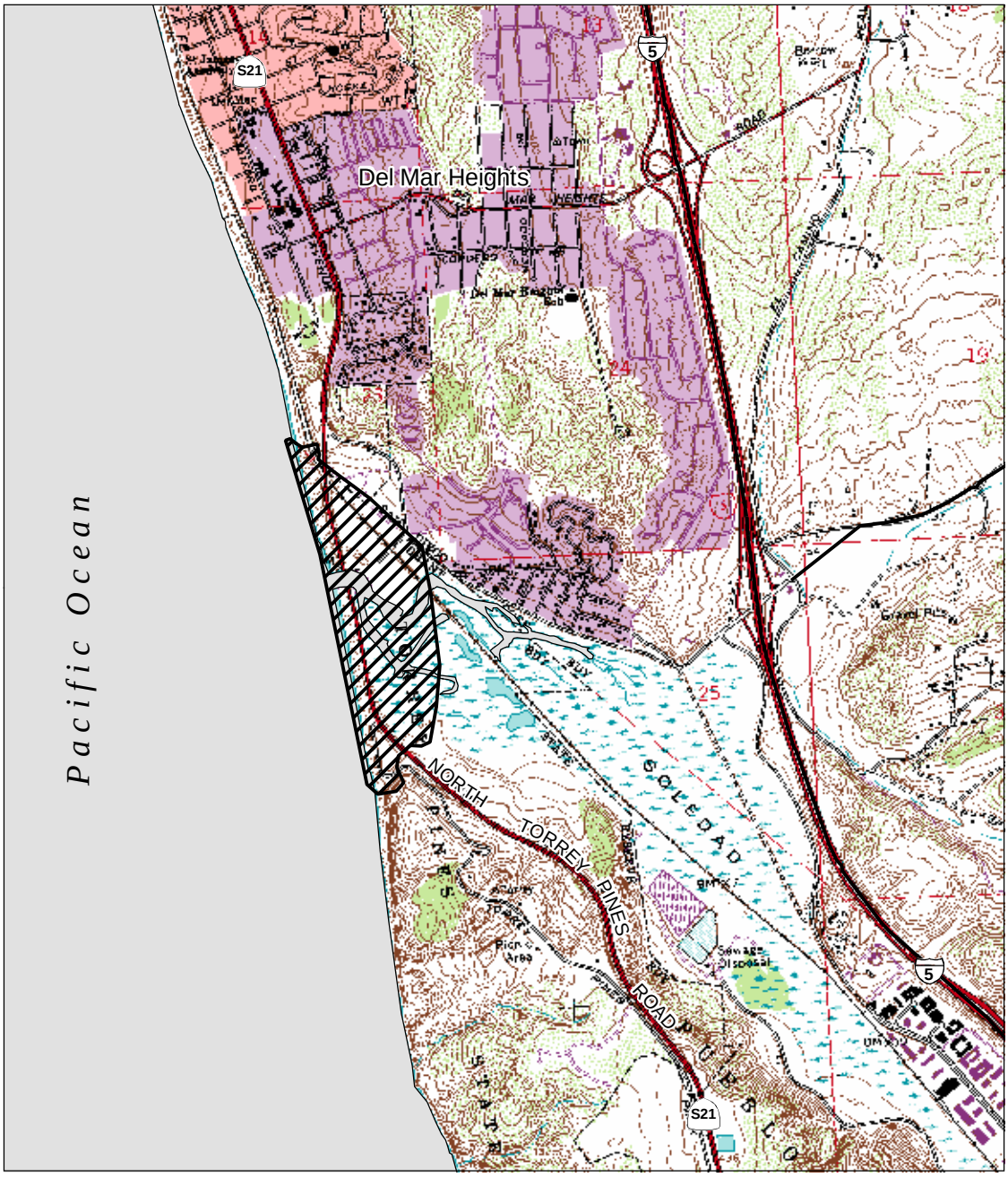
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 141. Los Penasquitos Lagoon/Beach (CA-122), San Diego County, California.



Legend

WSPL Breeding & Wintering Locations

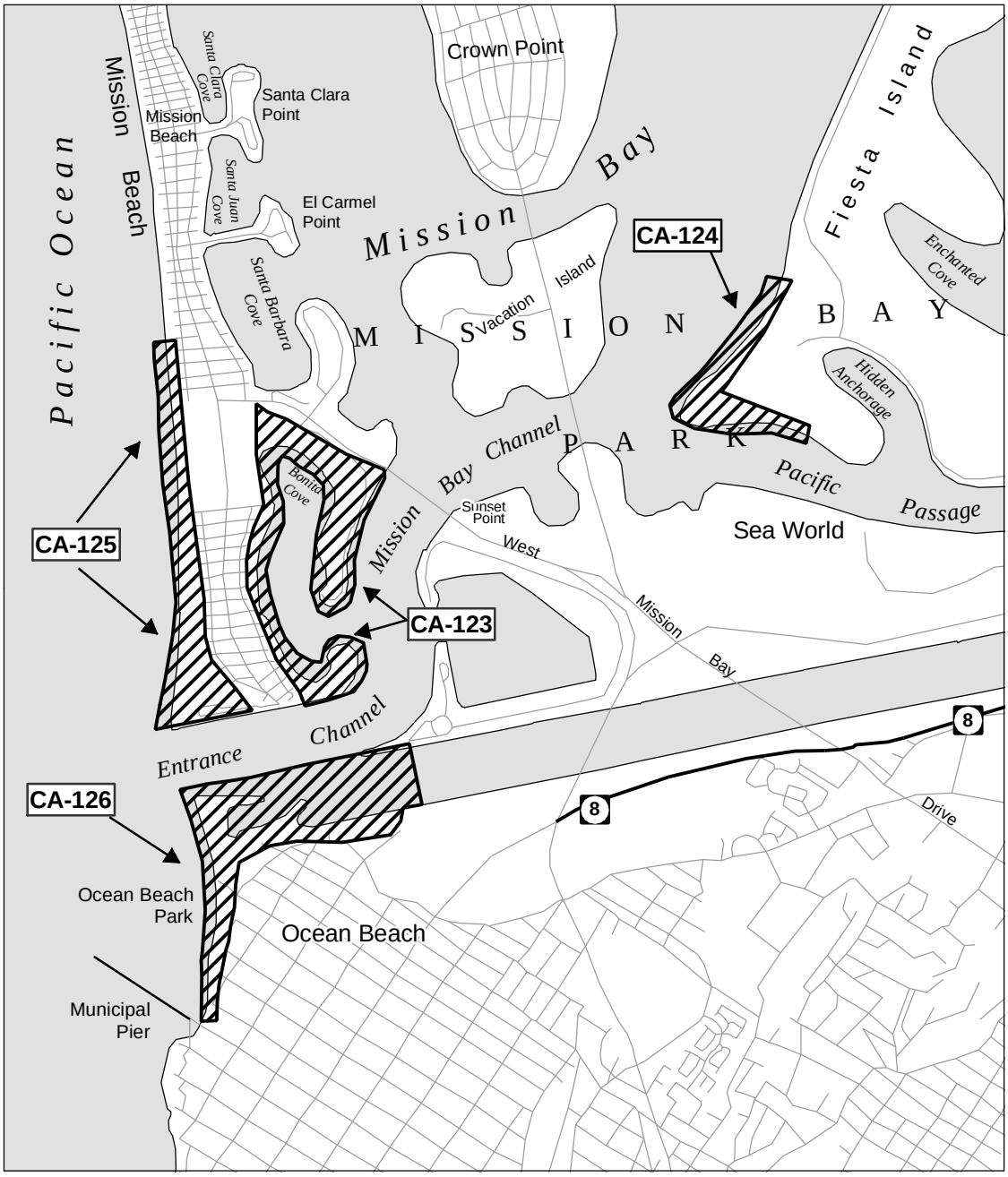
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 142. Mission Bay: Bonita Cove (CA-123); Mission Bay: Fiesta Island (CA-124); South Mission Beach (CA-125); Ocean Beach (CA-126), San Diego County, California.



Legend

WSPL Breeding & Wintering Locations

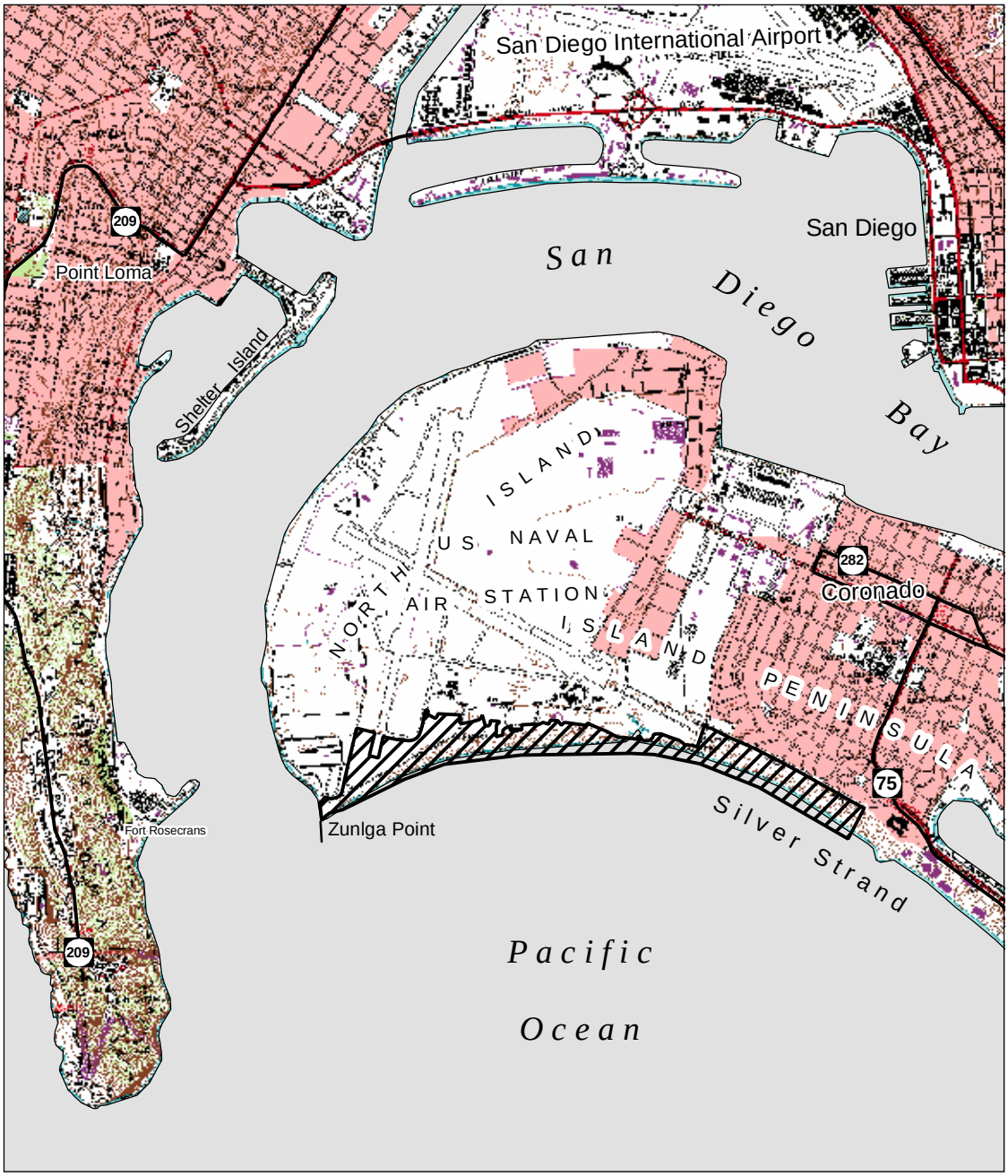
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 143. Naval Air Station & North Island Peninsula (CA-127), San Diego County, California.



Legend

WSPL Breeding & Wintering Locations

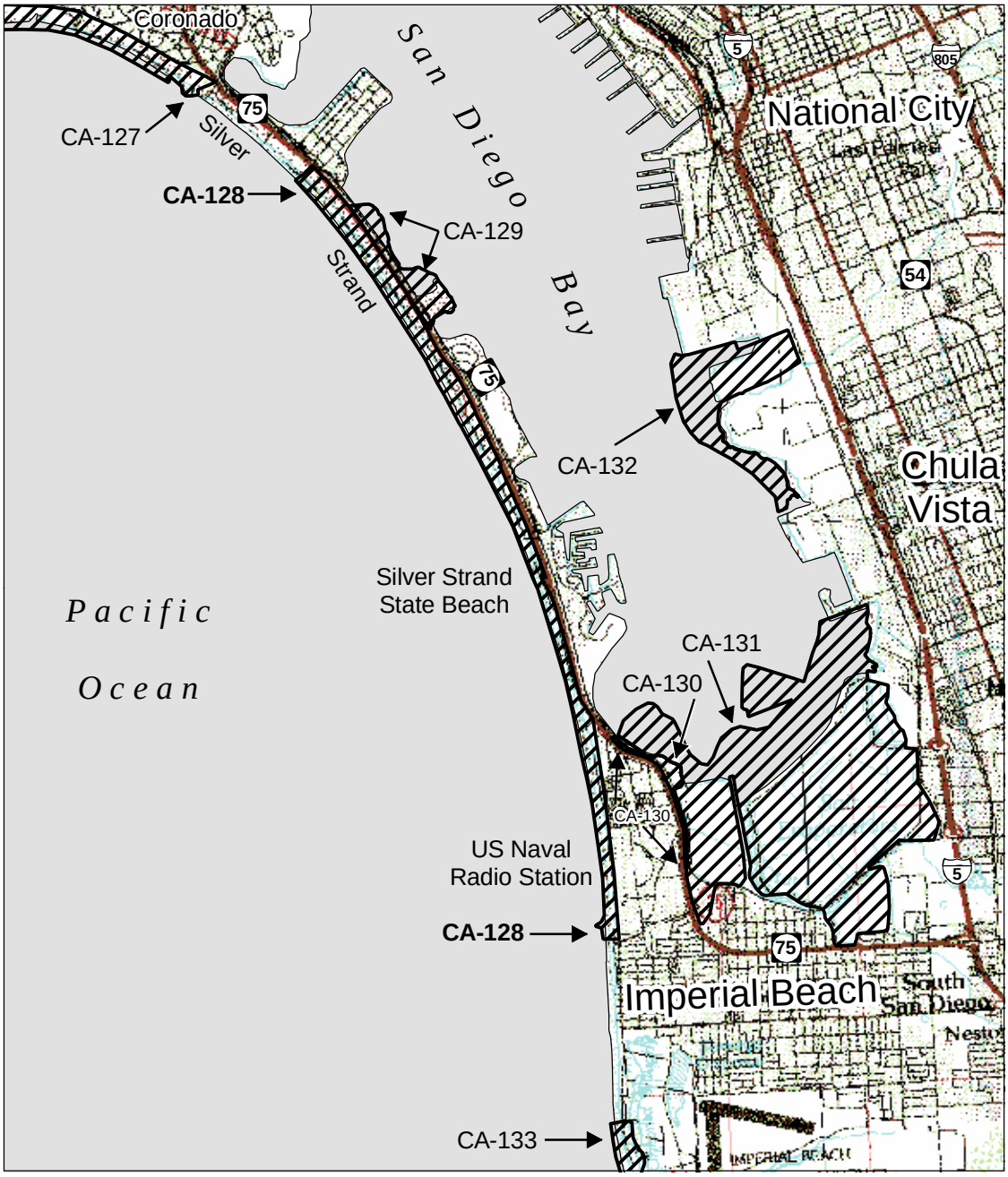
0.6 0 0.6 Miles

1 0 1 Kilometers

Scale 1: 50,000

N

Figure L - 144. NAB Coronado / Silver Strand State Beach (CA-128), San Diego County, California.



Legend

WSPL Breeding & Wintering Locations

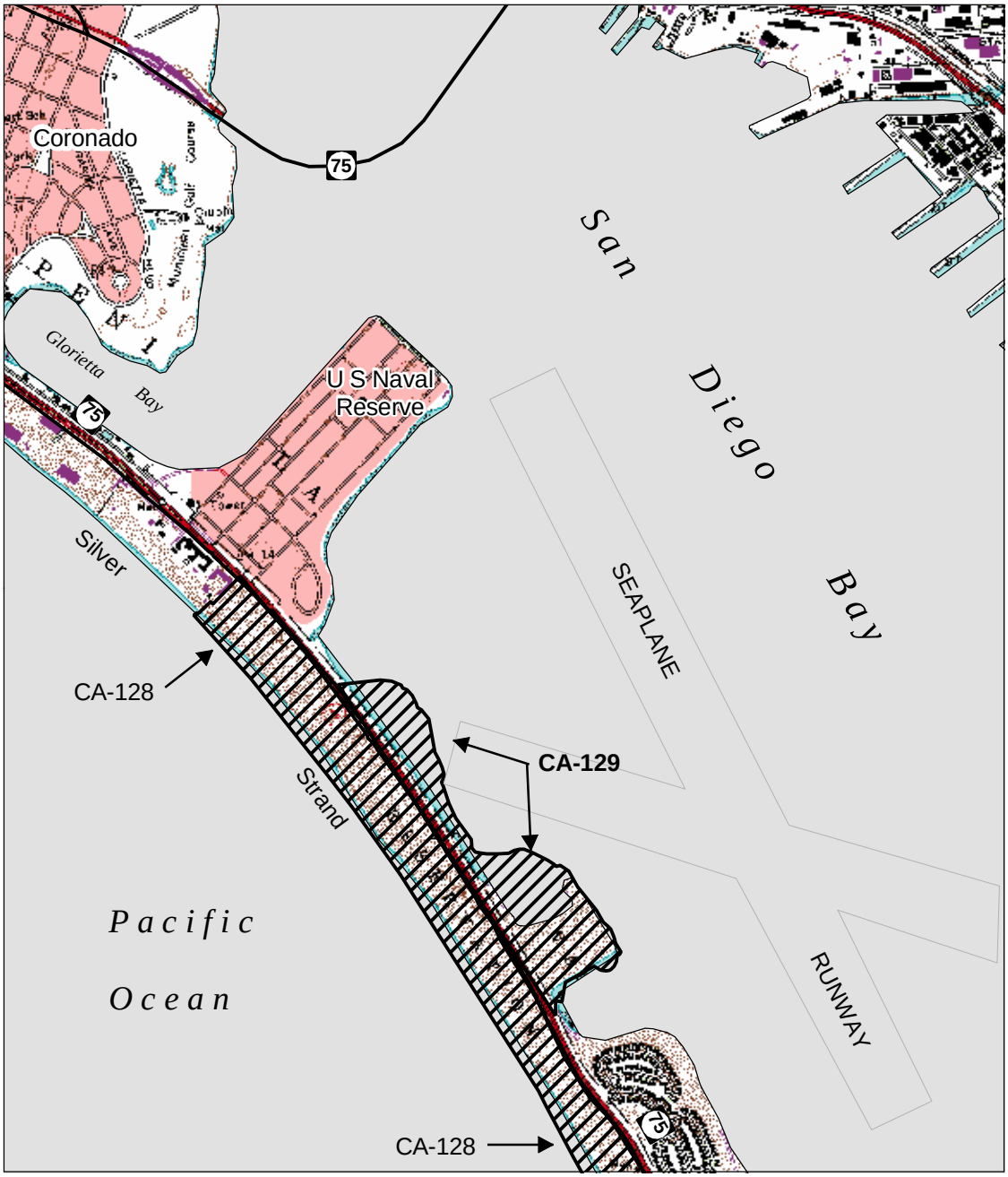
1 0 1 Miles

2 0 2 Kilometers

Scale 1: 80,000

N

Figure L - 145. Naval Air Base / Delta Beach Bay (CA-129), San Diego County, California.



Legend

WSPL Breeding & Wintering Locations

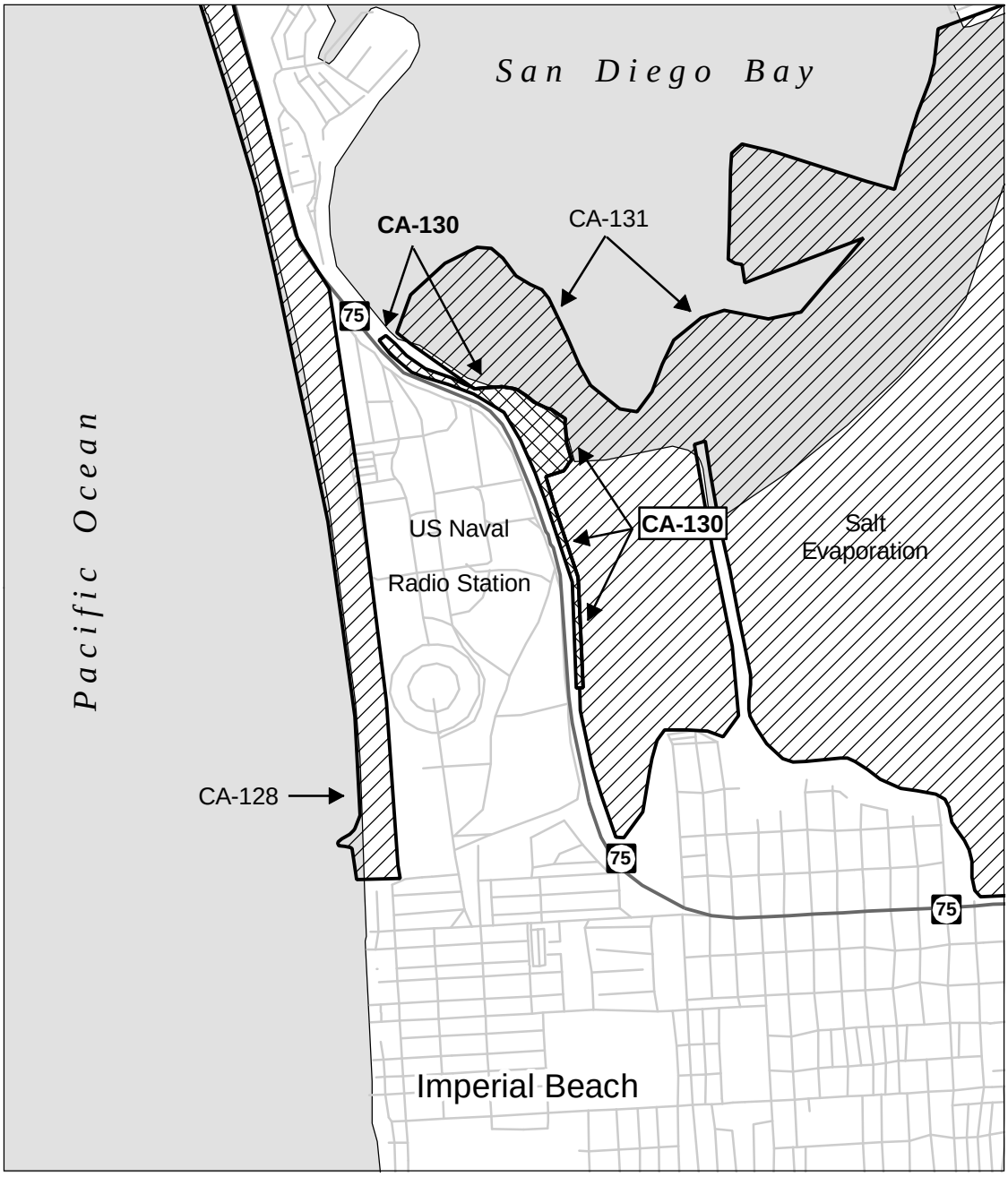
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 146. South San Diego Bay Marine Biological Study Area (CA-130), San Diego County, California.



Legend

WSPL Breeding & Wintering Locations

WSPL Breeding & Wintering Locations CA-130

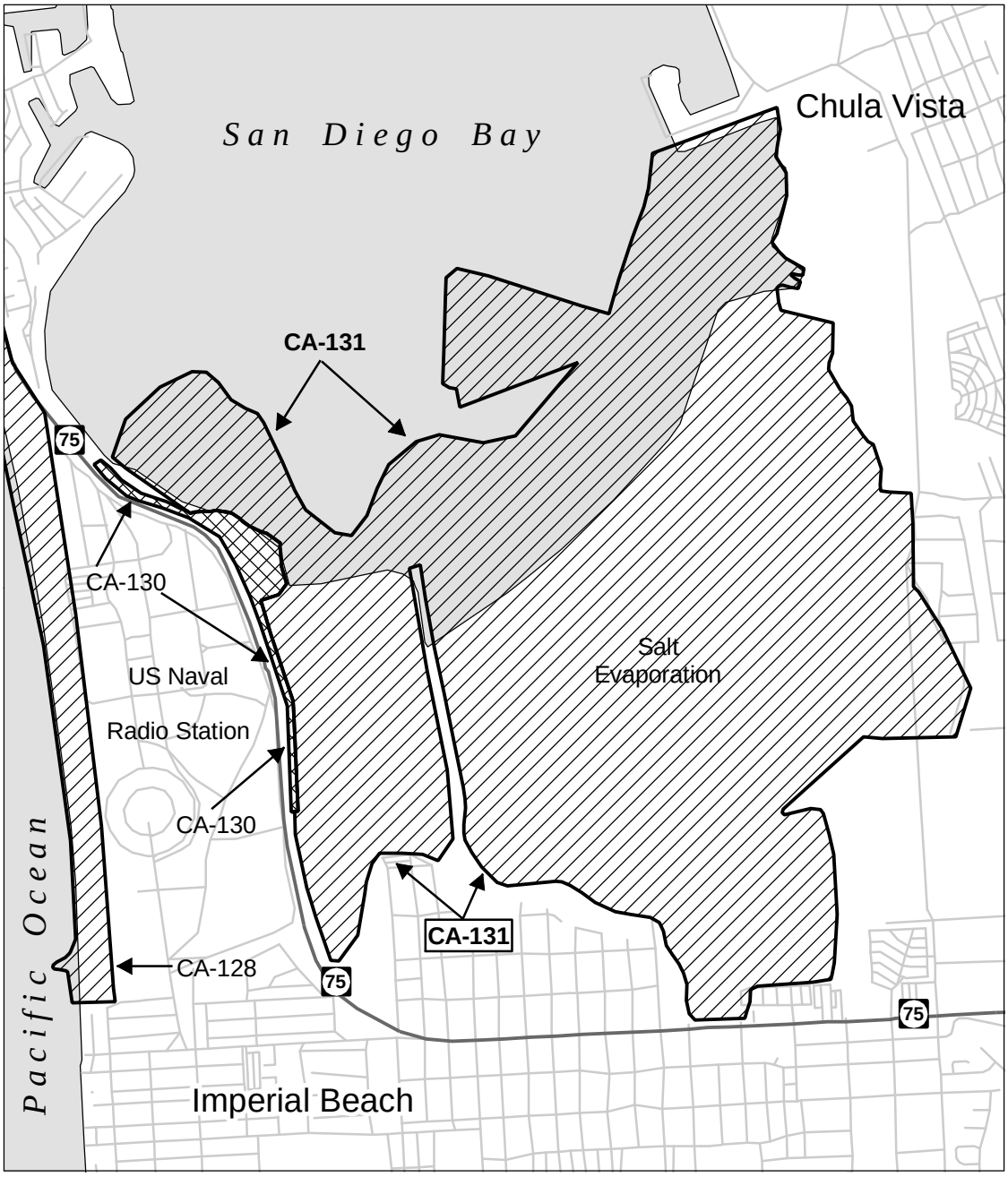
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 147. Western Salt Company (CA-131), San Diego County, California.



Legend

WSPL Breeding & Wintering Locations

WSPL Breeding & Wintering Locations CA-130

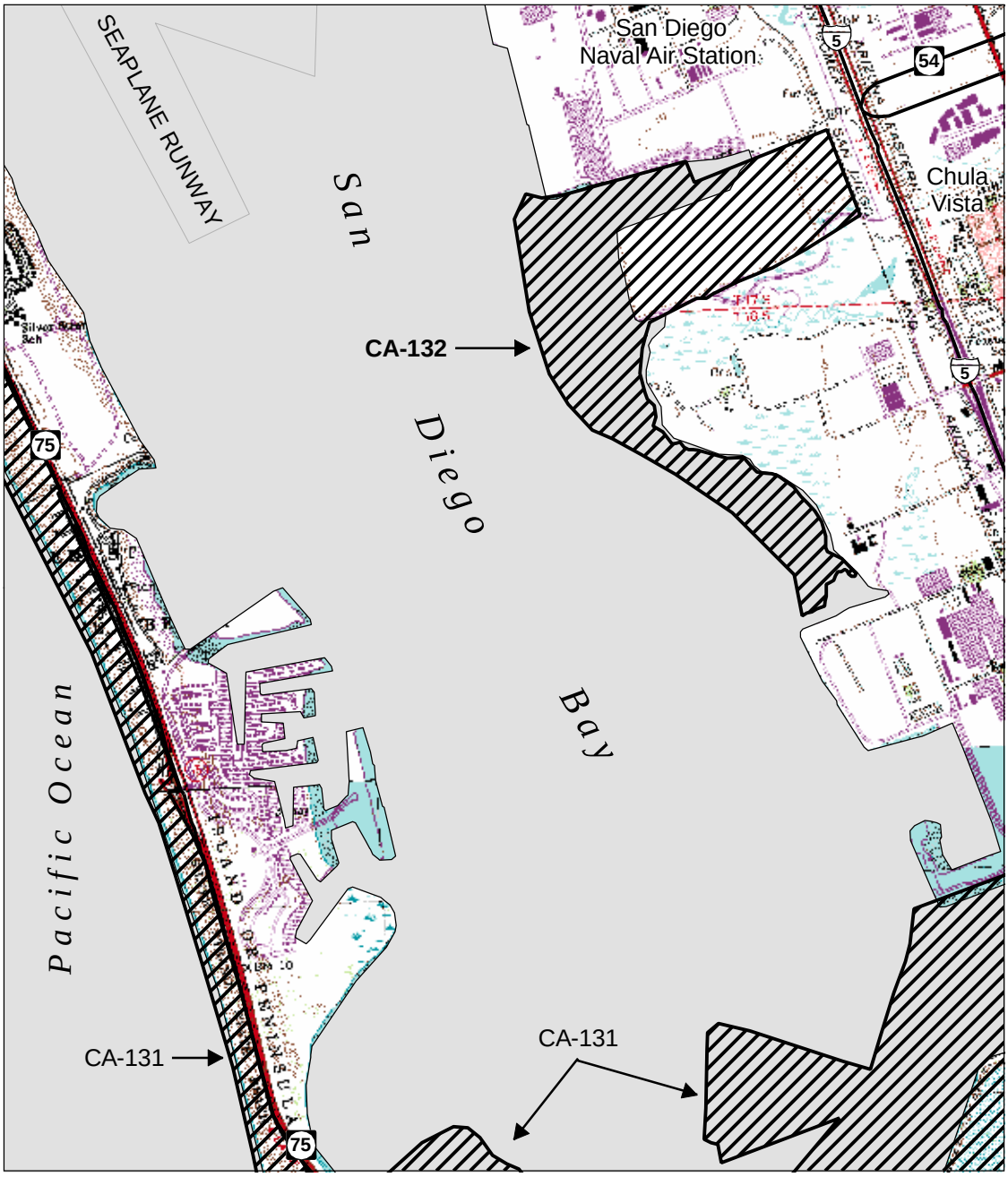
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 148. Sweetwater National Wildlife Refuge (CA-132), San Diego County, California.



Legend

WSPL Breeding & Wintering Locations

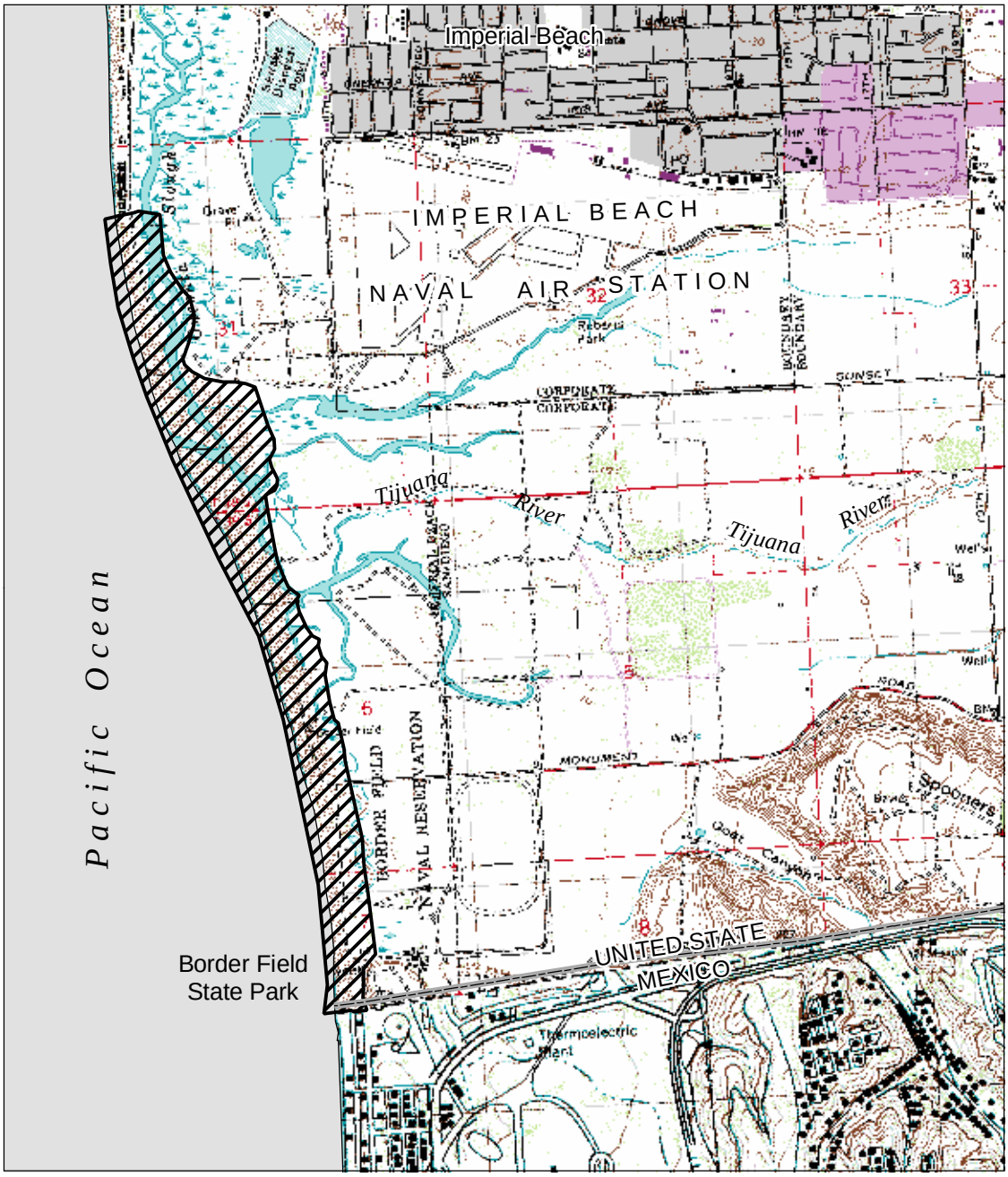
0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Figure L - 149. Tijuana River Beach (CA-133), San Diego County, California.



Legend

WSPL Breeding & Wintering Locations

0.5 0 0.5 Miles

0.8 0 0.8 Kilometers

Scale 1: 30,000

N

Appendix M. Agency and Public Comment on the Western Snowy Plover (*Charadrius alexandrinus nivosus*) Pacific Coast Population Draft Recovery Plan

I. Summary of Agency and Public Comment

On August 14, 2001, we released the *Western Snowy Plover Pacific Coast Population Draft Recovery Plan* (U.S. Fish and Wildlife Service 2001a) for a 120-day comment period for Federal agencies, State and local governments, and members of the public (U.S. Fish and Wildlife Service 2001b). The comment period ended on December 12, 2001. Opportunity to resubmit comments was provided due to the possibility that some comments submitted were not received due to shutdown in the U.S. Department of Interior's internet access, including receipt of outside electronic mail (U.S. Fish and Wildlife Service 2002). Comment resubmittals were accepted through February 15, 2002. Dr. Joe Buchanan, Dr. Mark Colwell, Dr. Doug George, Dr. Susan Haig, Dr. Christen Fritz, and Dr. Phillip E. Person were asked to provide peer review of the draft plan. Comments were received from three peer reviewers (Colwell, George, Haig).

This section provides a summary of general information about the comments we received, including the number of letters from various sources. A complete index of commenters, by affiliation, is available from the U.S. Fish and Wildlife Service, Ecological Services, Sacramento Fish and Wildlife Office, 2800 Cottage Way, Suite W-2605, Sacramento, California 95825. All comment letters are kept on file in the Sacramento Fish and Wildlife Office.

The following is a breakdown of the 112 total comment letters received from various sources:

Federal agencies - 10
State agencies– 8
military bases - 4

local governments – 11
academia - 4
professional – 6
business/industry – 3
recreational/ORV interests - 4
property rights/wise use groups - 3
environmental/conservation organizations – 15
individual citizens– 45

Peer review comments on the draft recovery plan were generally supportive. Comments emphasized the need to coordinate with other monitoring and recovery efforts throughout the country, consider social and carrying capacity issues in management and restoration, and better address effectiveness (or lack of effectiveness) of management activities. Although there were many detailed comments, suggestions for clarification, and editorial suggestions, the shortcomings identified by the individual peer reviewers were: 1) lack of discussion of importance of gravel bars as nesting habitat and their need for appropriate management; 2) lack of consideration of social factors in influencing selection of nesting sites and in potential for restoring western snowy plovers to former breeding sites; 3) need to more fully discuss carrying capacity and related issues; 4) need to coordinate western snowy plover assessments with other assessment efforts for western snowy plovers throughout the west and throughout North America; 5) need to understand the distribution of the western snowy plover distribution and status in Mexico; and 6) inadequate discussion of several management activities and needs (lack of enforcement as an impediment to recovery, supposed on-going management activities are minimal or non-existent, protection of wintering birds and wintering habitats needs to be high profile and implemented, exclosures have problems and may not always be appropriate). These comments are addressed below.

This section summarizes the content of significant comments on the draft recovery plan. A total of 112 letters were received. Some individuals submitted more than one letter, and some letters were prepared jointly by

more than one organization. Most contained one or more comments. Some letters raised similar issues. Many letters provided new information or suggestions for clarity. In these cases, the information was incorporated into the final version of the recovery plan. Some letters requested explanation of various points made in the draft recovery plan or their scientific basis. In these cases, the final recovery plan was revised to include an expansion or clarification of the particular section. Many comments were incorporated into the final version of the recovery plan. Many commenters simply provided their voice of support or opposition to the recovery plan. Some commenters suggested local or agency programs that could assist in achieving certain recovery actions and offered assistance in implementing recovery actions. Information and comments not incorporated into the final recovery plan were considered and noted, and may be useful in the future. Several comments were submitted that raise concerns, such as constitutional issues related to enforcement by the State of California and challenges to our basis for listing the Pacific coast population of the western snowy plover, which are beyond the focus of this recovery plan and therefore are not addressed herein. Major comments that were not incorporated or that require clarification in addition to their incorporation are addressed below. We thank all those who commented.

II. Summary of Comments and U.S. Fish and Wildlife Service Responses

Life history and ecology

Comment: Several comments were made in regard to the value of driftwood to the western snowy plover, or regarding the consistency of the following statements in the draft recovery plan: nests typically occur in flat, open areas with sparse or absent vegetation and driftwood; western snowy plovers often nest beside driftwood and it is an important component of breeding and wintering habitat; and too much driftwood can be detrimental if there is not sufficient open habitat to induce the birds to nest. One commenter wanted to know if a ban on driftwood collection was intended for the entire coastline.

Response: Tolerance and use of driftwood by western snowy plovers depends on individual site characteristics. High driftwood densities can decrease habitat suitability with a resultant decrease in western snowy plover nesting (*e.g.* Eel River Wildlife Area, Humboldt County, California, 2003). Alternatively, western snowy plovers have been observed using driftwood as nest platforms and as cover from predators and weather. Small pieces of driftwood are often present in association with nests, as are kelp, vegetation, algae, rocks, or man-made objects. Generally speaking, flat, open, and sparsely vegetated habitat with little driftwood or debris present is preferred. However, the coastal population of western snowy plovers also nests on gravel bars within varying sizes of cobble, and at dried salt ponds. The micro-habitat selected by an individual nesting pair depends on site-specific conditions and the nesting pair's experience. As a result, recommendations to ban driftwood collection at a particular site will be made on a site specific basis based on the best available scientific information.

Comment: One reviewer felt historical regional preference of the western snowy plover, including preferred climate, and historical climates of the regions along the west coast should be added to the recovery plan.

Response: Western snowy plover populations have always varied in response to the natural changes in weather and habitat condition. However, available data from survey records are not sufficient to assess the effects of long-term historical trends in climate upon populations. Severe storms, such as those occurring during El Niño years, can adversely affect western snowy plover populations by destroying nests. Nonetheless, western snowy plovers have been able to recover from these random natural events. Human influences over the past century, however, such as habitat destruction, invasion of introduced beach grass, and elevated predation levels have reduced the western snowy plover's ability to respond to these natural storm events.

Comment: Several commenters wanted to see a more detailed description of the western snowy plover's habitat attributes, including breeding habitat. One commenter felt the description was too vague and would include areas that do not support the western snowy plover.

Response: The Pacific coast population of western snowy plover inhabits wide, flat, sparsely-vegetated beach strands that are, for the most part, dynamic. Conditions change at breeding sites from year to year depending on winter and spring storm events, shifting sand dunes, river flows, salt pond flooding, and the vegetation that subsequently becomes established. Consequently, a definitive description of suitable habitat is not possible and could in fact be misleading. Sites that are suitable one year may not be suitable the next year. The habitat description in the draft recovery plan was written to include breeding habitat along the entire Pacific coast where the western snowy plover is found. Thus, there may be some areas that meet the broad habitat description but do not currently or historically support western snowy plover. Habitat requirements for the Pacific coast population of the western snowy plover in both the breeding and wintering seasons are described in section I.B.1. and I.B.4., respectively.

One of the commenters referenced Redwood National and State Parks beaches as meeting the habitat description. Recent survey results at these sites do not indicate they support western snowy plovers. Neither of these beaches is included in the recovery plan and as such, there are no plans to establish populations of western snowy plover in these locations.

Population status and trends

Comment: Many people commented that the population numbers and data were not up to date.

Response: The final recovery plan includes the most up to date data that has been made available to us.

Comment: Several reviewers felt the recovery plan should use data from the same years when comparing wintering population numbers at different sites.

Response: We agree that data from the same year should be used to compare population numbers at different locations, when possible. However, survey effort, methods, and timing have varied widely among years and among sites. Additionally, some locations have only been surveyed in a limited number of

years. The values in section I.B.4.a. are maximum numbers counted at the various locations; the values come from a variety of sources. Appendix B describes the various sources and the time spans during which wintering population data were collected for each state. The text in the final recovery plan has been modified to better describe the methods for deriving these numbers. We also have recommended as recovery actions development of standardized data collection methods to facilitate future comparisons among years and locations.

Comment: One commenter felt that since there are no historic population numbers for western snowy plovers, their historic range cannot be determined. They also feel that human alteration may have expanded the range of the western snowy plover and they can now be found in areas where they never lived before.

Response: While we cannot determine the pre-European settlement population numbers or range of western snowy plovers along the Pacific coast, we have data demonstrating that 33 of 53 (62 percent) coastal localities in California where western snowy plovers formerly bred were no longer occupied by the late 1970s, indicating a strong probability that rangewide populations had decreased from historical levels (Page and Stenzel 1981). Moreover, survey results indicate that population declines continued further from 1980 to 2000. Since 2000, intensive management has contributed to population increases.

In addition, we have strong indications that human alteration has, in most cases, reduced habitat for western snowy plovers rather than expanding it. For example, it is known that the introduction and spread of beachgrass during the 20th century has progressively reduced or eliminated western snowy plover habitat in extensive tracts of coastal beaches and dunes throughout large sections of its range. One exception may be the San Francisco Bay. Although we have no data on pre-settlement use of San Francisco Bay by western snowy plovers, it is possible that construction of salt ponds may have improved plover habitat quality in this area, which currently supports 5 to 10 percent of the U.S. Pacific coast breeding population.

Comment: Current data on the number of western snowy plovers that occur on Commander Navy Region Southwest lands is underrepresented.

Response: Because data collection at different nesting sites throughout the State of California is not standardized, for broad-scale comparability of overall population levels and trends the Recovery Plan emphasizes the general information obtained with consistent methodology from the window surveys. We acknowledge that more detailed breeding data collected by the Navy is useful and relevant to site-specific management.

Carrying capacity

Comment: Several commenters felt that carrying capacity for the western snowy plover needs to be determined prior to setting recovery goals. They also wanted to know how we planned on calculating carrying capacity.

Response: While we agree that it would be desirable to know the carrying capacity of a particular beach for western snowy plover, it would be very time intensive to estimate. Such calculations would require detailed site-specific demographic data, including parameters that could change dynamically and unpredictably from year to year with weather conditions, predator populations, and land management methods. We do not believe that such an estimate would contribute substantially to the recovery of the species, and therefore we do not intend to estimate one. In the absence of such estimates, a population viability analysis was done to aid in developing recovery criteria.

While we do not intend to estimate carrying capacity, we do provide guidance on management goals for various locations (see Appendix B). Individual location management goals are numbers that we believe are achievable with intensive management. Collectively, these numbers are about 20 percent higher than the recovery criteria subpopulation sizes. These numbers are meant to be flexible, taking into consideration variations in habitat conditions, management opportunities from year to year, location differences, and new scientific data. Routine reviews for applicability, value, and success of the final recovery plan will occur and the final recovery plan will be revised as needed.

Habitat Degradation

Comment: One commenter wanted the U.S. Fish and Wildlife Service to review and comment on all development proposals to alert land use authorities to the possible effects of the development.

Response: We review development proposals subject to sections 7 and 10 of the Endangered Species Act. However, it is not within our authority to review all development proposals. Recovery action 5.2 recommends periodic meetings and/or workshops to inform Federal, State, and local resource management and regulatory agencies, and City and County planning departments about threats, research, and management needs for western snowy plovers. Additional actions (*i.e.* 1.3, 2.1, 3) recommend monitoring and evaluation of threats to western snowy plovers and their habitats, and development of mechanisms to eliminate or ameliorate those threats.

Comment: One commenter felt we should consider mitigation measures for unavoidable development activities that affect western snowy plover habitat.

Response: Recovery plans are guidance documents, and set forth what we believe are the actions and management direction necessary to downlist and delist species. The purpose of recovery plans is not to provide details regarding mitigation for project impacts. The discussion of mitigation requirements for project impacts is best conducted during consultation pursuant to section 7 or 10 of the Endangered Species Act.

Comment: Several commenters wanted to see a discussion of the benefits of beach nourishment and were concerned that the recovery plan might unduly restrict beach nourishment efforts.

Response: A discussion of the benefits and concerns with beach nourishment can be found in section I.D.1.b.i. The final recovery plan also includes recovery actions (2.2.3, 4.1.2) to evaluate the potential benefits of beach nourishment to western snowy plover habitat. Issues associated with beach nourishment including timing, duration, equipment used, and sand grain size and color, need to

be considered and coordinated with us to determine if they adversely affect western snowy plovers or their habitat. Sand replenishment projects can be permitted through section 7 or section 10 of the Endangered Species Act with the appropriate avoidance and minimization measures to prevent adverse effects on the western snowy plovers. However, the recovery plan is not a regulatory document and does not place any additional regulatory restrictions on beach sand replenishment activities.

Comment: One commenter recommended discussing pampas grass (*Cortaderia jubata* and *C. selloana*), in addition to European beach grass. Another commenter pointed out that Oregon used scotch broom and native shore pine for dune stabilization and these have had some negative consequences for the western snowy plover.

Response: We agree that pampas grass, scotch broom, and other invasive plants can be a localized issue at some western snowy plover areas, both breeding and wintering. However, most habitat related issues associated with nonnative vegetation infestations are a result of the European beachgrass invasions. We agree that in some areas scotch broom and shore pine have negatively affected western snowy plovers. Habitat restoration at the site level should consider all invasive nonnative plants. These species are discussed in the recovery plan towards the end of the section entitled "Encroachment of Introduced Beachgrass and Other Nonnative Vegetation".

Comment: Several commenters felt that European beachgrass is the greatest threat to the western snowy plover and that there needed to be a permanent solution to beachgrass removal. Some commenters also felt that there was not enough effort set forth in the draft recovery plan to reduce European beachgrass. One commenter suggested that the U.S. Fish and Wildlife Service should coordinate with the U.S. Forest Service on European beachgrass control.

Response: We agree that European beachgrass is a threat to the western snowy plover. The recovery plan discusses threats to the western snowy plover according to the five listing criteria defined in the Endangered Species Act. The recovery plan indicates that reasons for decline and degree of threat vary by

geographic location. Some areas of the western snowy plover's range have a higher degree of threat from European beachgrass than other areas.

We also agree that there needs to be a permanent solution to control European beachgrass and that coordination with all entities involved is necessary. Experiments to find effective and cost-efficient methods of removing or eradicating European beachgrass are ongoing. Recovery action 2.2.1.1 deals with the removal of nonnative and other intrusive vegetation, including European beachgrass, from existing and potential breeding sites. Prioritized removal and control strategies for introduced beachgrass are needed for each recovery unit and may be decided by each recovery unit working group. Recovery action 4.1.1 specifically addresses the need to further investigate effective and cost-efficient methods for habitat restoration by removal of introduced beachgrass.

Comment: One commenter stated that herbicides are harmful to wildlife, including western snowy plovers, and suggested the use of rock salt to control beachgrass. Several other commenters had suggestions for controlling European beach grass. These included: salt water treatment; hydraulic mining; solarization, which involves covering the beach grass in black plastic; and biocontrol.

Response: Land managers and working groups in each recovery unit will decide on the most effective method to control beachgrass in their areas. The method chosen should be the least harmful to western snowy plovers in that recovery unit area. The use of rock salt, salt water, solarization, biocontrol, and hydraulic mining to eradicate beachgrass may be investigated under Recovery action 4.1.1.

Comment: The discussion regarding marine mammal displacement of plovers on the Channel Islands is not adequately supported.

Response: The information provided in this section is consistent with a Navy comment letter received from management at San Nicolas Island on December 17, 2001.

Predation and Predator Control

Comment: A commenter noted that there is no predator management plan for Oregon, even though Mark Stern's study showed 68 percent nest failure from predation (Table C-1, pages C-8 through C-10).

Response: During the 2002 and 2003 nesting seasons, Federal and State agencies approved and implemented an integrated predator management program for the Pacific coast population of the western snowy plover in Oregon. The decision followed public review and comment on an analysis of the effects of the proposed predator control methods, and alternatives, to protect the western snowy plover in Oregon. Agencies involved were the U.S. Fish and Wildlife Service, Coos Bay District of the Bureau of Land Management, Siuslaw National Forest, Oregon Parks and Recreation Department, Oregon Department of Fish and Wildlife, and APHIS-Wildlife Services. These agencies implemented the program to assist in western snowy plover recovery by improving western snowy plover nesting and fledging success while recreation and habitat management efforts continue. Predator control occurred at selected western snowy plover breeding sites along the Oregon coast. In 2002, these included Coos Bay North Spit, Bandon Beach, New River and Floras Lake. These sites are located on lands managed by the Bureau of Land Management and Oregon Parks and Recreation Department in Coos and Curry Counties. In 2002, predator damage management was directed toward problem red foxes, ravens, crows, skunks and raccoons. Feral cats, coyotes, mink, opossum, weasels, gray fox, rates, mice, or gulls that were found to pose a threat to western snowy plovers were also targeted with lethal and/or nonlethal methods. Individual problem raptors (birds of prey) will be managed primarily with nonlethal methods. In 2003, predator control efforts were on-going on BLM and OPRD land, and began on lands managed by the U.S. Forest Service in Lane and Douglas Counties in 2004. These efforts have continued in subsequent years.

Comment: One commenter recommended against capturing or killing of predatory birds protected under the Migratory Bird Treaty Act.

Response: In some instances it may be necessary to enable western snowy plover nesting success by removing native bird species. The recovery plan recommends

this option only when warranted and feasible and also notes that the management agency is required to obtain the appropriate Federal and State permits.

Comment: Several commenters were concerned about relying solely on predator management programs. Commenters felt the recovery plan should focus on the removal of problem individuals, nonnative predators, and balancing unintentional human encouragement of larger native predator populations or the recovery plan should include a recovery action which studies the effects predators have on western snowy plover populations. One commenter felt that the draft recovery plan tried to avoid the removal of predators.

Response: The draft recovery plan lists many actions which managers should consider to prevent excessive predation on western snowy plovers, including the removal of predators. Multiple actions must be considered because of the number of sites and the different management actions which would be necessary at each individual location. This allows flexibility for land managers in their management plans. Recovery action 2.4.4 recommends removing predators only where warranted and feasible, focusing on the elimination of nonnative predators, controlling native predators by removal or nonlethal means when possible, and focusing on problem individuals. The preferred method of predator control will depend on the site conditions and should be decided with input from the recovery unit working group.

Recovery action 4.2 calls for the development and testing of new predator management techniques to protect western snowy plover nests and chicks. Specifically it calls for investigating techniques to identify predators and investigate predator management at a landscape level. Information on any additional effects predators may have on western snowy plover populations may be gathered during these investigations.

Comment: One commenter felt the draft recovery plan was contradictory by recommending both the placement of dead corvids and gulls and also the removal of bird and mammal carcasses. Another commenter felt the use of carcasses to discourage gulls and ravens from predating on western snowy plover is promoted without qualified documentation and carcasses may attract scavengers.

Response: Not every recovery action listed in the draft recovery plan will be appropriate for every western snowy plover location. In some locations gulls may be discouraged from depredating western snowy plovers when carcasses are present. However, if carcasses are numerous or present close to western snowy plover nests, they may act as attractants to corvids or mammalian scavengers, thereby causing an increase in the risk of nest predation. Implementation of the recovery actions will differ by location based on site-specific conditions, and before this strategy is implemented at a locality the appropriate Fish and Wildlife Office should be consulted to assess whether the benefits to western snowy plovers outweigh the risks. We agree that more research is needed on the use of carcasses for predator aversion. Recovery action 4.2.3 addresses this issue. Recovery action 4 is dedicated to the need for further scientific investigations that would facilitate the recovery of the western snowy plover. Recovery actions 2.4.4 and 2.4.5 address the issue of removal of both predators and animal carcasses.

Comment: Several commenters felt that captive rearing of western snowy plover eggs should be included in the recovery plan.

Response: Captive propagation is a last resort after all attempts to recover the species in the wild have failed (U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration 2000). Collecting and rearing of eggs in captivity is not feasible with every species. Western snowy plover chicks are precocial (capable of moving around on their own immediately after hatching). Upon hatching chicks immediately imprint on the adults and follow them around, learning essential behavioral skills that help to ensure their long-term survival. This behavior makes it difficult to rear western snowy plovers in captivity for release to the wild. Another problem with captive rearing is that although it might increase the population of western snowy plovers in the short term, if other threats to western snowy plovers were not addressed the population would begin to decrease once captive rearing was stopped.

Comment: One commenter felt that using taste aversion techniques on coyotes and American kestrels is inappropriate, scientifically unproven, untested, and untried.

Response: The draft recovery plan does not discuss the use of taste aversion techniques specifically on coyotes and/or American kestrels. The draft recovery plan recommends the investigation of many forms of aversion techniques, including taste aversion. We recognize that there are both obstacles and advantages to development of effective aversion techniques that can be efficiently applied in the field. These obstacles and advantages need to be carefully evaluated before taste aversion is implemented in the field. The research called for in the recovery plan should help us decide the best course of action with regard to aversive techniques.

Comment: Several commenters felt that hawks should not be encouraged to nest near beaches. One commenter felt that the draft recovery plan should forbid nest boxes in or near western snowy plover areas. Another felt that lethal predator control should be applied to corvids and other species protected by the Migratory Bird Treaty Act. Commenters were in support of predator removal and felt not enough effort was going into the removal of avian predators, while other commenters expressed their concern with avian predator removal, stating that the recovery plan action to remove predators where warranted and feasible should not include the capture and killing of birds protected under the Migratory Bird Treaty Act.

Response: We agree that hawk nest boxes should not be placed in areas that western snowy plovers use; the recovery plan focuses on advising appropriate management in areas designated as western snowy plover habitat. If land managers are responsible for areas outside of western snowy plover habitat per se (i.e., near beaches), they may, at their discretion, implement additional measures to benefit western snowy plover in these other areas.

Removal of native species, such as hawks, should only be done in cases where their range extensions have been human-abetted or where high rates of western snowy plover adult, chick, or egg predation (which cannot be countered with predator exclosures) are occurring. Lethal control of native predator species should be avoided whenever possible.

Recovery action 2.4 presents alternatives regarding predator management. Nonlethal methods should be implemented before resorting to lethal methods.

Migratory birds, such as raptors, are sensitive species that should be managed nonlethally to the extent practicable. However, the generalist group of birds known as corvids (crows and ravens primarily) has capitalized on human activities to expand historic ranges and population densities to the point where they have become significant predators on western snowy plovers at some sites. Reducing corvid populations, and which methodologies are to be used, is dependant on predation pressure, site conditions, and governing regulations, including the Migratory Bird Treaty Act.

Comment: One commenter wanted to see additions to the recovery plan regarding litter and garbage removal at beaches. Specifically, the commenter recommended placing predator-proof trashcans outside of beach areas, emptying them frequently, and providing beach cleanup days.

Response: The draft recovery plan specifies placing predator-proof trashcans only on beaches because this is the habitat that western snowy plovers use. While it generally may be beneficial to place these trashcans in areas outside of western snowy plover habitat, this recovery plan is focused on recovering the western snowy plover, with the intent to decrease predator attractants within western snowy plover habitat. The recovery plan also recommends frequent trash removal in general, but stresses emptying uncovered trashcans more frequently since they are a larger lure to predators. Finally, actions that may aid in the recovery of the western snowy plover, but are not included in the draft recovery plan, may be applied by local groups as long as they are coordinated with the recovery unit working group.

Comment: One commenter was concerned that predator control was not planned for the Oregon Coast because it is not included in Table C-1 as a management activity.

Response: Table C-1 in Appendix C presents information on existing and needed management activities throughout the range of the western snowy plover, based on a 1998 survey of public land managers and private conservation organizations and subsequent updates to this information. For locations where information on current land management activities is not available, the table is left blank. This table is intended to provide preliminary, interim guidance for public land

managers, private conservation organizations and private landowners regarding management measures which should receive emphasis at their locations. In the future additional management measures for all locations identified in Table C-1 will be identified and prioritized on a site-specific basis through coordination and discussions between members of each of the six recovery unit working groups. Table C-1 in the final recovery plan identifies multiple locations in Oregon and elsewhere where exclosures and predator control are either current management activities or require additional management. Predator control in Oregon is being implemented cooperatively by State and Federal agencies under an integrated predator management program.

Comment: Several commenters felt that recovery should focus on the threats of predation and nonnative beachgrass. Others felt that the threats should be listed in order of greatest threat to lesser threats.

Response: We agree that predation and nonnative beachgrass invasions are serious threats to the western snowy plover and its recovery. Given this, the recovery plan places removal of nonnative vegetation (2.2.1), erection of predator exclosures where appropriate (2.4.3), removal of predators where warranted and feasible (2.4.4), as priority 1 actions in the implementation schedule. Threats when mentioned in the recovery plan are listed in order of the listing factors to maintain consistency throughout the recovery plan and with other documents dealing with this species (the listing package, critical habitat designation, *etc.*).

Comment: Several commenters had concerns and questions about nest exclosures. One commenter wanted to know what the procedures were for placing signs near western snowy plover nests and habitat areas. Other commenters wanted to know what types of nest exclosures were the best, what areas they should be used in, and should exclosures be covered or not.

Response: Placement of signs along with other management tools and strategies used to aid in the recovery of the western snowy plover will be determined by the recovery unit working groups based on site-specific information. Appendix F contains information on types of exclosures.

Comment: One commenter wanted a discussion of the effects to visual esthetics from installing warning signs that are large enough to read from a distance of 300 feet. Another commenter felt that kiosks located at the beach may detract from the natural beauty of the landscape; information should be available at visitor centers.

Response: We are not recommending installing signs that can be read from a distance of 300 feet. Rather, we believe signs posted to inform the public of sensitive areas and management prescriptions, or to educate the public regarding coastal resources, should be posted in areas where they will be encountered by users approaching the targeted management area. In this way the public is made aware of the management issue, why the prescription is in place, and what is expected of the public before reaching areas where western snowy plovers occur.

As identified in Appendix K, kiosks are one of several methods mentioned to provide public outreach and education. Generally, we are not promoting the construction of new infrastructure in wildlife habitat. The intent is to provide a means to disseminate basic information where facilities currently exist in a manner that does not disturb the habitat of the western snowy plover. Furthermore, we recognize that structures like kiosks may provide roosting or perching habitat for avian predators.

Comment: A commenter stated that some predators are getting around fences on Coos Bay North Spit. Another commenter noted that cats and gray foxes had been able to climb over fences in southern California. Another commenter felt that more fencing should be done to protect western snowy plovers and allow more access by humans. There is a need for further studies to determine the effectiveness of nest exclosures to ensure their use is statistically valid.

Response: Although not completely predator proof, the large fence encompassing the 1994 Habitat Recovery Area and South Spoil does inhibit predators as indicated by fewer tracks inside the fence than outside the fence. The fence is inspected regularly throughout the nesting season and repairs are made when necessary. In addition to the fence, the predator control effort currently underway targets western snowy plover predators both inside and outside the fenced area.

With respect to fencing in general, the timing and extent of its use should be determined on a site-by-site basis. Active predator management may complement the use of fencing if appropriate for individual sites based on the level of predation risk and other management considerations, and has potential to significantly increase nesting and fledging success (*e.g.*, programs on Navy and Marine Corps lands in southern California, integrated predator management on the Oregon coast).

Based upon the pre- and post-exclosure use population numbers, there is an overwhelming trend of increased nest success when use of exclosures has been implemented as needed. Investigation of methods to determine effective predator management techniques is one of the research needs identified in Recovery action 4.2. Thus, we recommend that studies of the effectiveness of the existing nest exclosure designs be conducted to identify how to improve nest success and predator avoidance.

Nest exclosures are just one of many conservation tools used to protect the western snowy plover and aid in the recovery of the western snowy plover. Nest exclosures, alone, likely will not protect the western snowy plover from increased disturbance by human recreation. Increasing access to areas that are not already disturbed by humans may cause an increase in western snowy plover mortality. In addition, added fencing for nest exclosures may add additional perching areas for western snowy plover predators.

Comment: Appendix F should also include a description of square exclosures, “net tops”, and other design alternatives as an acceptable form of nest protection from site specific predator conditions.

Response: Some discussion of mesh/netted tops and square exclosures is included in section I.F.2.a of the recovery plan. The protocol currently states that “permittees who want to make modifications to these protocols should confer with us and obtain permission prior to making changes to the exclosure designs described in these protocols.” We discuss these issues as options for nest exclosures, but state that these would need to be considered on a case-by-case basis.

Comment: Nest exclosures may give western snowy plovers a false sense of security and may be advantageous to predators that may key in on exclosures as means of identifying nests for predation. In addition, exclosures may draw negative public attention towards nests.

Response: Based on the available literature, there is no indication that western snowy plovers are less vigilant when utilizing a nest exclosure. However, the decision whether to use nest exclosures at a given locality should use local information about predator populations and public use in order to balance the costs and benefits of potentially increased vandalism and predation risk to fledglings and adults vs. reduction of nest predation. Based on information provided in annual reports submitted in association with valid section 10(a)(1)(A) recovery permits, we will periodically review the use of exclosures. In cases where findings suggest that nest exclosures decrease vigilance or are otherwise advantageous to western snowy plover predators, then alternatives may be implemented. Appropriate outreach and education programs focusing on beach users should assist in minimizing the effects of human visitation to nest exclosures.

Comment: The recovery plan should address the potential effects of exclosure maintenance, and recommend managers monitor the construction, use, and maintenance of exclosures to determine if such activities cause adverse effects on nesting success.

Response: Erecting nest exclosures may only be conducted by individuals trained to conduct such activities. Such activities may only be authorized via a permit issued pursuant to section 7, 10(a)(1)(A), or 10(a)(1)(B) of the Endangered Species Act. Monitoring and reporting requirements of such permits stipulate that incidents of excessive harm or harassment associated with such permits be reported to us and corrective measures should be incorporated as appropriate.

Natural events

Comment: Some commenters felt that the goal of 250 western snowy plovers for Oregon and Washington is very difficult, if not impossible, to achieve because the

recovery plan failed to adequately assess the effects of naturally occurring events on western snowy plover populations.

Response: We and our cooperating agencies agree that meeting the goal of 250 breeding individuals in Oregon and Washington is challenging. However, recommended subpopulation sizes represent the best professional judgement of the western snowy plover recovery team's technical subteam and are based on a site-by-site evaluation of historical records, recent surveys, and future potential with dedicated, proactive management. Overall, the recovery criteria for population size and distribution for the Pacific Coast population of western snowy plover represent only a portion of its historical abundance and distribution, but the reflect what the technical subteam identified as achievable.

Reproductive success is one of the more sensitive demographic parameters, and will be critical to the western snowy plover's success. To mitigate for large-scale catastrophic events, a variety of management techniques are being employed to ensure long-term reproductive success. Examples include increasing the number of existing western snowy plover breeding, wintering and dispersal sites through habitat restoration and protection measures, and dispersing these sites throughout the western snowy plover's range (Appendix C). In addition, increasing the number of nests and fledgling success though habitat restoration, nest exclosures, predator control, and seasonal beach restrictions will help to keep western snowy plover numbers elevated and contribute to recovery of the species. Substantial population increases in Oregon and Washington since 2000 indicate that recently implemented management actions have benefitted the species, and show the potential for achieving the goal of 250 breeding birds in this recovery unit.

Disturbance by Humans and Domestic Animals

Comment: One commenter stated eliminating humans from beaches allows predators (*e.g.* crows, coyotes, *etc*.) to decimate western snowy plover populations.

Response: Human disturbances may draw predators to beaches. This is discussed in subsection I.D.3. of the recovery plan, entitled Disease and Predation. Predators, such as corvids, attracted by the presence of human activities (*e.g.*

improper disposal of trash), frequent beaches in increasing numbers. Gulls have greatly expanded their range and numbers, especially along the United States portion of the Pacific coast, as a result of human-supplied food sources. Beach litter and garbage also attract predators such as skunks and coyotes. Buick and Paton (1989) found that losses of hooded plover (*Charadrius rubricollis*) nests with human footprints around them were higher than at those without footprints, suggesting "that scavenging predators may use human footprints as a visual cue in locating food." Additionally, it has been speculated that predators of western snowy plovers may benefit from a decline in wariness by western snowy plovers nesting on beaches that are subject to high levels of human disturbance (Persons and Applegate 1997). The continued settlement and use of coastal areas by humans generally has been associated with increased populations of predators.

Comment: One commenter wanted to know how we arrived at the conclusion that pedestrian traffic is responsible for a decline in western snowy plover populations. They asked for an explanation of how a pedestrian taking one minute to walk past a nest, or a vehicle taking 10 seconds to drive past a nest is a greater form of disturbance than a field biologist's work associated with the nest site.

Response: We acknowledge that we could better understand declines in snowy plover populations. However, the literature available at this time suggests that pedestrian traffic has a negative effect on western snowy plover populations. Several studies are cited in the recovery plan (see section I.D.5.b.i) establishing that western snowy plover reproductive success is lower in areas with high recreational activity compared to beaches with low recreational activity. Pedestrian traffic also has been shown to have an effect on nesting, foraging, and the fledging success of western snowy plover chicks.

Regarding the level of impact to the species from field biologists compared to pedestrians, biologists monitoring western snowy plover are limited to a few days a year, whereas recreationists may frequent western snowy plover nesting sites daily, throughout the breeding season. While monitoring may result in disturbance, surveys and monitoring are necessary to determine if we are achieving our measurable and objective recovery criteria. In addition, while

construction of exclosures causes short-term disturbance to nesting birds, evidence indicates that appropriate use of exclosures can provide increased nesting success through protection from nest predation.

Comment: One commenter suggested that human use of beaches should be encouraged to encourage western snowy plover use of habitat behind the foredunes.

Response: Western snowy plover nest in sites that are near water. Page and Stenzel (1981) found that nests were usually within 100 meters of water, but could be several hundred meters away when there was no vegetative barrier between the nest and water. We are not aware of documentation indicating that western snowy plovers nest behind foredunes. Encouraging western snowy plovers to use marginal nesting habitat behind the foredunes would very likely reduce their chances of reproductive success. Additionally, encouraging human use of beaches may increase nest abandonment rather than nest relocation. Western snowy plover that breed on the coast and inland are very site faithful in the winter (Point Reyes Bird Observatory unpublished data) and may continue to return to the same site and continually abandon these sites due to human disturbance. The encouragement of human use on beaches could also increase predators attracted by improper disposal of trash. Furthermore, dunes are absent from many beaches along the Pacific coast.

Comment: Several commenters wrote that the amount of discussion on human disturbance was a lot greater than that given to other discussions on causes for declines.

Response: Human disturbance has been identified as one of the primary causes of decline in the Pacific coast population of the western snowy plover. This disturbance is both direct and indirect (*e.g.* beach and water-related recreation, dogs, motorized vehicles, beach cleaning, beach fires, predation, equestrian traffic, oil spills, livestock grazing, and contaminants). We have included detailed discussion of human disturbance because of its importance as a threat to the plover and because many aspects of this threat can be ameliorated with

appropriate management. Such management will advance the recovery of the Pacific Coast population of western snowy plover.

Comment: One commenter noted that the section "Litter, Garbage, and Debris" should mention efforts to promote clean camping through implementation of an integrated predator management strategy.

Response: We believe that the recovery plan appropriately emphasizes trash management, and we agree that this should include promoting clean camping. Some efforts to implement trash management have been undertaken in Oregon as part of their integrated predator management strategy. In 2002 and 2003, the Oregon Working Team approved Action Plans for Integrated Predator Management, which lists trash management as one of the nonlethal tools to be used at all nesting western snowy plover sites to control the predator population. Trash management is also listed in the January 2002 Environmental Assessment entitled, "Predator Damage Management to Protect the Threatened Pacific Coast Population of the Western Snowy Plover".

Comment: There were a few comments supporting banning dogs on the beach and a few for allowing dogs free access of beaches with owner supervision. One commenter felt since studies indicate that western snowy plovers flush from the nest when people and dogs are present between 1 and 820 feet from the nest, people and dogs may pose a significant disturbance to western snowy plovers and additional beach closures should be considered.

Response: We recognize that management of pets on beaches can be controversial. The draft recovery plan states that it is preferable to prohibit pets on beaches and other habitats where western snowy plover are present because noncompliance with leash laws can cause serious adverse effects to western snowy plovers. The recovery plan also recommends that if not prohibited, pets should be leashed and under manual control of their owners. While some members of the public may be able to control their dogs with their voice, the majority of dogs are not able to withstand the temptation of chasing another animal.

We are aware of the studies indicating disturbance and flushing as a result of human or dog encroachment in the vicinity of nests. Closure of beaches is generally conducted at the discretion of the land manager based on evaluation of nesting status at a given beach. The draft recovery plan recommends beach closure (seasonal or permanent) as another possible management tool.

Motorized Vehicles

Comment: Discuss potential effects due to patrol vehicles repeatedly flushing western snowy plovers from their nests.

Response: Patrol vehicles have the same potential effects as other authorized vehicle use. The potential effects from patrol vehicles should be considered cumulatively with overall site management. The use of patrol vehicles for public safety and enforcement of management prescriptions needs to be considered when determining the necessity, frequency, and timing of the patrols. As is the case with other authorized vehicle use, patrols should minimize impacts to plovers by avoiding nesting areas and driving slowly (5-10 mph) in the wet sand while traversing stretches of beach.

Comment: Many commenters felt that off-road vehicle use was beneficial because it causes sand disturbance and this could minimize the spread of European beachgrass.

Response: The effectiveness of sand disturbance from off-road vehicles at minimizing the spread of European beachgrass has not been demonstrated scientifically. In contrast, the adverse effects of motor vehicle use on western snowy plovers have been documented. Because vehicles disturb breeding and wintering western snowy plovers, and because it has not been shown that vehicles minimize the spread of nonnative plants, we do not agree that off-road vehicle use is beneficial.

Comment: Some commenters felt that if ORV use areas are closed for the western snowy plover, than others should be opened as mitigation.

Response: Making such recommendations is beyond the scope of this recovery plan, which is oriented to removing the Pacific coast western snowy plover population from the List of Endangered and Threatened Wildlife and Plants.

Comment: One commenter felt that motor vehicle restrictions on Coos Bay North Spit were unjustified.

Response: The Coos Bay North Spit supports one of the largest and most productive western snowy plover populations in Oregon, and is crucial to achieving recovery goals for the Oregon/Washington Recovery Unit. As discussed in this recovery plan, motor vehicle use on beaches has been documented to result in harassment of plovers, nest abandonment, destruction of eggs, and death of chicks and adults. We believe that vehicle closures at this location are an appropriate measure to maintain breeding productivity and increase western snowy plover populations in Oregon.

Comment: Many commenters felt that they were not allowed input into the recovery plan process.

Response: Public involvement in this recovery planning process included the opportunity to submit comments on the draft recovery plan. These comments have been reviewed. Many are incorporated in the final recovery plan, and some are addressed here in Appendix M. In addition, there were public meetings when the draft recovery plan was released. Furthermore, local organizations and agencies are encouraged to participate in recovery unit regional working groups to help develop regionally specific recovery actions and actions.

Comment: One commenter asked for more guidance in determining when off-road vehicles should be banned.

Response: We do not believe that additional general guidance would be appropriate because management actions for each location are determined based on site-specific information. Some management actions have already been established and can be found in the summary and table of Current and Additional Needed Management Activities in Appendix C of the recovery plan. Banning or

limiting the use of off-road vehicles may be necessary for the recovery of the western snowy plover in some locations where the use of off-road vehicles is causing disturbance, mortality, or habitat degradation.

Comment: One commenter felt that habitat degradation by off-road vehicles is several magnitudes less destructive than beach-raking machines.

Response: We agree that beach-raking is destructive and degrades western snowy plover habitat. The final recovery plan advises restrictions on beach-raking as well as off-road vehicle use. Recovery actions 2.3.5 and 2.4.1.3 address beach-raking issues.

Comment: Several commenters were concerned with the effects of beach grooming on the prey base of the western snowy plover and wanted to see changes in beach cleaning/grooming practices.

Response: The recovery plan identified beach cleaning as a threat to the western snowy plover, both directly and to their prey base. In addition, action 2.3.5 of the recovery outline recommends using alternatives to mechanized beach cleaning, and action 2.4.1.3 emphasizes the need to remove litter and garbage from beaches manually.

Coastal access

Comment: Several commenters were concerned about reductions in beach access and beach closures and want to see an “improved management plan” implemented that balances human recreation with the needs of the western snowy plover. In addition, some commenters felt there was unfairness in the management of beaches in different locations along the Pacific coast.

Response: We agree there should be a balance between human recreation and western snowy plover needs, and we feel the recovery plan reflects this. Management measures to protect western snowy plover should be determined on a site-by-site basis; factors to consider include the configuration of habitat as well as types and amounts of on-going pedestrian activity.

Types and degree of each threat varies by beach, causing beach management practices to be site-specific and depend upon the involvement of these Federal, State, and local government agencies. Under section 7(a)1 of the Endangered Species Act, Federal agencies are required to actively promote the conservation of listed species on lands under Federal agency jurisdiction. State and local government agencies, including State planning agencies and city and county planning and community resource departments, have the primary responsibility for overseeing land uses within their jurisdictions. The Recovery section of the recovery plan (II.A.2) includes further discussion of the roles of the Federal, State, local, and private sector.

Comment: One commenter felt user education and regular patrols would do more to improve western snowy plover habitat than shutting the public out of traditional coastal access. Another commenter requested that prior to implementing new restrictions such as no vehicles, leashed dogs, or no wood gathering, we should consider other management options such as enclosures, habitat restoration, and enforcement that minimize the loss of recreational opportunities.

Response: Public education and regular patrols are important components to managing lands that are western snowy plover breeding and wintering habitat. However, education and enforcement are only part of the solution. Temporary, seasonal closures direct use away from the most important western snowy plover areas while providing for public use.

We believe habitat restoration, predator management, and managing human activities are all required to achieve recovery. Different sites will have different primary management needs. Some sites may require more direction to humans than others, and some sites may instead require habitat restoration. However, all three components to management need to be considered on a local site specific basis. Consequently, management recommendations and planning identified in Appendix C will vary across the western snowy plover's range.

Comment: There were many comments both for and against beach closures. Some commenters felt beach closures should be a last resort and could be hurtful

to local economies, while others felt the best way to protect the western snowy plover was through full beach closures.

Response: We are required by law to write a recovery plan that identifies necessary management actions and criteria for the recovery and delisting of the western snowy plover. We believe that beach closures are likely to be a necessary component of western snowy plover management in some areas, and therefore, they are identified as a management option in the plan. We also believe it is neither feasible nor desirable to completely eliminate beach recreation in most western snowy plover habitat. Many factors are considered when deciding on beach closures. The recovery plan identifies management options and recognizes that local land managers must determine how to balance the various interests of the public while advancing the recovery of the western snowy plover population.

Comment: One person commented that the description of known wintering locations is very broad and wondered if managers must apply guidelines to the entire areas. In addition, the commenter wanted further clarification of types of activities that adversely affect wintering western snowy plovers.

Response: The list of wintering areas in Appendix B was compiled from many years of data. Wintering plovers have not been observed at many of the locations in Table B-1. We recommend monitoring known and potential wintering locations to gain further information on wintering locations for the plover. We hope that this information will help maximize survival and recruitment of western snowy plovers into the breeding population. We recommend that land managers confer with local plover working groups to determine whether monitoring of wintering locations in their area is appropriate.

Potential adverse effects to wintering populations of the western snowy plover are discussed in the threats section of the recovery plan and include natural coastal formation processes, dredging, channel maintenance projects, and recreational use by humans and their pets.

Comment: Two commenters note that the draft plan fails to address the Public Trust doctrine and Oregon State law allowing beach access.

Response: The Public Trust Doctrine of law provides that the State of Oregon holds submerged and submersible land in trust for the benefit of all the people. Under this doctrine, the general public has a right to fully enjoy these resources for a wide variety of public uses including navigation, commerce, recreation, and fishing. According to the courts, and with few exceptions, the people of Oregon own the bed and banks of all navigable streams, rivers, and lakes up to the ordinary high water line. This land is commonly referred to as "submerged and submersible land." In addition, the people of Oregon also own all land subject to tidal influence (with the exception of those parcels the State may have sold since statehood). This land is commonly referred to as "tidelands." However, access to these navigable waters is not guaranteed (*e.g.*, private property, areas closed for wildlife). Oregon Parks and Recreation Department is allowed through State rule, which is authorized by State statute, to determine what kinds of access are to be allowed on their lands or those lands they regulate under the “Beach Bill”.

With passage of Oregon’s "Beach Bill" in 1967, the State's policy was to "preserve and maintain its jurisdiction over ocean beaches for the public's use” (ORS 390.610(1)). The "Beach Bill" also declared the public interest in such land requires the State to do whatever is necessary to preserve and protect scenic and recreational uses of Oregon's seashore and ocean beaches (ORS 390.610(4)). The statutory authority to restrict recreational use on the ocean shore is found under ORS 390.660 and implemented under OAR 736-021-0040(3). Oregon Parks and Recreation Department is allowed through State rule, which is authorized by State statute, to determine what kinds of access are to be allowed. In other words, Oregon Parks and Recreation Department has responsibility for Oregon beaches and would be a primary agency with authority to close areas of beaches and enforce such closures.

Contaminants and Oil spills

Comment: One reviewer suggested that, in addition to identifying locations of western snowy plover habitat, Area Contingency Plans should identify safe access

corridors that would avoid effects to western snowy plovers during responses to oil or chemical spills. This reviewer also said that Area Contingency Plans should note all regular and emergency U.S. Fish and Wildlife Service contact information (*e.g.*, resource managers, biologists or contract personnel) that could provide consultative assistance to spill response agencies during an actual spill response.

Response: Area Contingency Plans currently contain information on routes of beach entry and exit that provide the least risk to natural resources and public safety. This information is updated as necessary with our input during periodic reviews of Area Contingency Plans. In addition, U.S. Fish and Wildlife Service personnel and personnel from other land management agencies (*e.g.*, the National Park Service and the U.S. Bureau of Land Management) are part of the multi-agency spill response process and provide input to the Incident Command on the importance of using these safe access corridors during spill response and clean-up operations.

To increase protection of threatened and endangered species during oil spill responses, we have recently entered into a Memorandum of Understanding with the Coast Guard and the Environmental Protection Agency. This Memorandum of Understanding defines a process for multiple levels of consultation under section 7 of the Endangered Species Act before, during, and after oil spills, including consultation on Area Contingency Plans. This consultation process is intended to ensure that issues such as safe access corridors through western snowy plover habitat are incorporated into Area Contingency Plan revisions and are implemented during spill responses. Per the Memorandum of Understanding, regular and emergency contact information for U.S. Fish and Wildlife Service personnel who will handle section 7 consultations during pre-spill planning activities and actual spills will be provided to the multi-agency Area Committees that are responsible for updating Area Contingency Plans.

Comment: One reviewer questioned whether 70,000 gallons was the appropriate figure for the volume of oil spilled in the M/V New Carissa incident. This reviewer suggested using a range of 70,000 to 140,000 gallons based on information from the National Oceanic and Atmospheric Administration. This

reviewer also recommended incorporating major findings of a report by Mark Stern of The Nature Conservancy on effects of the New Carissa oil on western snowy plovers into the recovery plan.

Response: In accordance with the regulations for Natural Resource Damage Assessments at 15 CFR Part 11, the agencies that are trustees for natural resources (Trustees) affected by the New Carissa spill prepared a Notice of Intent to Conduct Restoration Planning (Bureau of Land Management 2001). The Notice of Intent described the Trustees' determinations regarding the incident, including the determination that 25,000 to 70,000 or more gallons of oil were released into the waters off the coast of Oregon. This determination was based on a synthesis of spill response information from the Coast Guard and National Oceanic and Atmospheric Administration. In an effort to eliminate text irrelevant to recovery of the western snowy plover, details of each of the oil spills mentioned in the recovery plan, including individual volumes of spills, have been summarized and/or incorporated by reference.

Comment: One reviewer suggested that the effects, if any, to western snowy plovers from the August 2001 M/V Tristan oil spill should be considered in the recovery plan.

Response: The M/V Tristan oil spill did not affect western snowy plovers or their habitat. A Natural Resource Damage Assessment is in progress for effects to other natural resources.

Comment: One reviewer said that opportunistic sampling of eggs to assess effects of contaminants will bias study outcomes and may not produce much useful information.

Response: Because the western snowy plover is a threatened species, random samples of eggs from western snowy plover nests cannot be collected to assess potential effects of contaminants on the species. Instead, opportunistic sampling of eggs that fail to hatch is proposed, as has been done for a variety of other threatened and endangered avian species (*e.g.*, Schwarzbach *et al.* 2001, Allen *et al.* 2000). Contaminant concentrations in eggs that fail to hatch are not an unbiased sample of contaminant concentrations in the western snowy plover population. However, this type of sampling is very useful for

evaluating causes of egg failure and determining whether maximum contaminant concentrations in populations are in the toxic range (Wilber 1980). By comparing concentrations of contaminants in failed-to-hatch western snowy plover eggs to screening criteria that have been developed for other species (*e.g.*, ducks, stilts, and avocets; Skorupa 1998, Siler *et al.* 2003) contaminants specialists can evaluate whether contaminants are potentially implicated in the failure of the western snowy plover eggs to hatch.

Comment: One reviewer suggested that the recovery plan should note that in 1999, western snowy plover nesting and brooding success rates at the North Spit of Coos Bay, where the New Carissa grounded, were the highest rates ever recorded at that site.

Response: Western snowy plover nesting and fledging success rates at the North Spit of Coos Bay were not the highest ever recorded during 1999, the year of the New Carissa spill (Stern *et al*. 2000). In 1994, western snowy plover nesting success was slightly higher at this site than in 1999. In 1991, fledging success (assumed to be the term the commenter refers to as brooding success) was higher on the North Spit than in 1999.

The key issue regarding the New Carissa spill and western snowy plovers was the effects on the South Beach of Coos Bay's North Spit. The South Beach, located in the stretch of coast closest to the New Carissa grounding, was one of the most heavily oiled areas, was subject to continuous cleanup and beach monitoring, and was proximal to salvage activities (Stern *et al*. 2000). During the 1999 nesting season, there was no nesting by western snowy plovers and only extremely limited use by western snowy plover broods on the South Beach. Western snowy plovers had nested on the South Beach every year from 1990 until 1999 (Stern *et al*. 2000). In 1999, many of the birds that nested on the South Beach in 1998 nested at other locations on Coos Bay's North Spit that were further inland from the vessel grounding site and were minimally impacted by cleanup operations (Stern *et al*. 2000). Based on monitoring data through 2005, 1999 is the only year since 1990 in which no western snowy plovers nested on the South Beach of Coos Bay's North Spit (Larry Mangan, Bureau of Land Management, personal communication 2003; Lauten *et al.* 2006). The New Carissa Trustees feel that it is likely that the oiling and response activities associated with the New Carissa spill were the major reason for western snowy plovers not nesting on the South Beach in 1999 (Larry Mangan, Bureau of Land Management, pers. comm. 2003).

Comment: One reviewer said the presentation of the facts relating to the 1995 finding of three dead adult male western snowy plovers in the vicinity of outfalls near Monterey, California, is weak and insufficiently effective to link the outfall with the mortalities. This reviewer also suggested that there are other possible explanations (*e.g.*, dispersal to another location, death from causes unrelated to the outfall) besides the outfall for the disappearance of a fourth adult male western snowy plover from this vicinity between 1995 and the subsequent breeding season.

Response: We believe that the description of the three male western snowy plover deaths in the Monterey area in 1995 is accurate. As indicated, three dead western snowy plovers were found in an area containing local outfalls, including an outfall connected to a sewage treatment plant at Monterey Bay. A necropsy was performed on one of the dead birds. The necropsy indicated that the dead bird had an enlarged liver, but it could not be determined whether there was a relationship between the mortality and the outfall. The discussion of the disappearance of the fourth male western snowy plover has been expanded to indicate that factors unrelated to the outfall have not been ruled out in the bird's disappearance.

Conservation Efforts

Comment: The Draft Bolsa Chica Restoration Plan should retain cell 4 for nesting purposes.

Response: The Western Snowy Plover Recovery Plan establishes recovery goals for each recovery unit as well as management goals at specific breeding sites needed to achieve the recovery goal. The management goal for Bolsa Chica is 70 breeding adults. Where specific management efforts should be focused within each site is outside the scope of the recovery plan. Specific management actions should be determined by the onsite managers within the overall strategy of achieving the management goal for that site. The importance of retaining cell 4 to achieve the management goal for Bolsa Chica will need to be addressed in the Bolsa Chica restoration plan and supporting documents.

Law enforcement

Comment: Several commenters wanted enforcement of existing laws and regulations strengthened such as the no-dogs-on-the-beach law and the no-pets-off-the-leash law at

CA-18. One commenter wanted laws and regulations enforced to minimize loss of recreational activities.

Response: We acknowledge the need to balance human recreational activities with the recovery needs of the western snowy plover. The recovery plan mentions the need to implement and enforce pet restrictions in Recovery action 2.3.2. On Federal lands, Federal agencies are required under section 7(a) (1) of the Endangered Species Act to actively promote the conservation of listed species and enforce laws and regulations accordingly. Enforcement of laws and regulations on non-Federal lands falls under the jurisdiction of State and local governments. Management and enforcement of laws and regulations on beaches are based on site-specific information. Land managers should evaluate whether the current recreational activities pose a threat to western snowy plovers and implement appropriate enforcement measures. Public education and outreach will also contribute to a successful balance of recreational activities and the recovery needs of the western snowy plover.

Comment: One commenter was not convinced that new State and local ordinances, rules and regulations were needed to enforce beach closures, and added that enforcement may be limited by lack of staff or financial resources.

Response: A recovery plan is advisory in nature and does not mandate agreement to or implementation of any of the recovery actions proposed. A recovery plan is a reference document that identifies actions that, if implemented, are expected to recover a species. The recovery plan suggests that appropriate regulations, ordinances, or rules be developed where appropriate and necessary, and suggests that such regulations, ordinances, or rules may better enable law enforcement officers to conduct necessary enforcement actions, appropriate regulations, ordinances, or rules should be developed where appropriate and necessary. The need for added enforcement is also addressed under recovery action 2.3.8.1.

Habitat acquisition

Comment: One commenter believed that the recovery plan should recommend that the U.S. Fish and Wildlife Service initiate an aggressive program of land acquisition to

provide refuges that increase the habitat available for western snowy plover breeding and allow a more natural predator-prey relationship.

Response: We recognize the need for land acquisition to aid in the recovery of the western snowy plover. Land acquisition is further discussed within the recovery plan under Recovery action 3.8.

Comment: Habitat management actions should be carefully reviewed for their effects to other species.

Response: We agree that management actions should be carefully reviewed for their effect on other birds, mammals, and plants on the coastline. Many management measures, such as the removal of nonnative vegetation, will benefit a broad array of species within the coastal dune ecosystem. However, some single species management actions are also necessary to facilitate the recovery of this species. Federal agencies are required under section 7 of the Endangered Species Act to ensure that their actions will not jeopardize federally listed species. State agencies also follow similar guidance. Many mechanisms exist (National Environmental Protection Act, section 7, State and local review) for review of site-specific actions and their effects to all special status species, including the western snowy plover.

Use of volunteers

Comment: One commenter thought it would be important to calculate volunteer man hours needed and the value per hour, to get a more accurate cost of recovery.

Response: The recovery plan does not specifically depend on the use of volunteers. However, Federal and State agencies may find the use of volunteers helpful in implementing the recovery plan and reducing recovery costs. Because the use of volunteers for implementing conservation measures for the western snowy plover has been successful to date, Appendix K of the recovery plan includes guidelines for a volunteer program. Costs calculated in the Implementation Schedule do not assume the use of volunteers. However, creating volunteer programs has a cost and is considered part of the costs under Recovery action 5.

Public outreach and education

Comment: Several commenters emphasized the need to establish and maintain an active public and school education campaign that concentrates on the status and biology of the western snowy plover.

Response: We recognize the importance of public education, especially in instances of beach closures or restrictions. Given this, the recovery plan stresses the importance of public support and public education. Recovery action 5 discusses public information and education programs and Appendix K provides detailed information on the western snowy plover and strategies for reaching various audiences. We felt that public education and outreach was such an important issue that we dedicated Appendix K solely to act as guidance in an effort to increase public awareness.

Comment: Several commenters felt there had been inadequate public and local government involvement.

Response: We believe that there has been adequate public and local involvement in preparation of this plan. We researched land records and sent out a letter to all landowners and stakeholders regarding the development of the recovery plan. The recovery team represented many stakeholder groups including: California Department of Parks and Recreations, California Department of Fish and Game, Oregon Department of Fish and Game, Point Reyes Bird Observatory, Washington Department of Fish and Game, Oregon Natural Heritage Program, National Park Service, U.S. Department of the Navy, C & M Stables, San Francisco Bay National Wildlife Refuge, U.S. Marine Corps Bureau of Land Management, Fishphone, Monterey Peninsula Regional Park District, County of Santa Barbara, California Association of 4 Wheel Drive Clubs, Inc., Washington State Parks and Recreation, and the U.S. Department of the Air Force. A stakeholder team was formed as an official part of the recovery team.

In addition, the notice of availability of the draft recovery plan was sent to at least 800 affected or interested parties. Copies of the draft recovery plan were also distributed to local libraries. A public comment period was open for 120 days and then extended 60 additional days to allow for submittal of additional comments. We also gave two presentations in eight cities in critical geographic locations in California, Oregon, and Washington in October 2001.

Consultations, HCPs, and other regulatory actions

Comment: One commenter requested that a list of Habitat Conservation Plans that are being prepared be included in the recovery plan. Other commenters also requested that the status of various HCPs be updated.

Response: We have included a discussion of HCPs in Section I.F.6 of this plan. This section discusses the status of all completed HCPs as well as those HCPs we know are being developed.

Regulatory protection and policies of local governments

Comment: One commenter asked how the recovery plan can legally ask for changes to State and local laws.

Response: A recovery plan is a guidance document; not a regulatory document. The recovery plan outlines those actions that, if implemented, would result in the delisting of the western snowy plover. All participation in implementing the recovery strategy or specific recommended actions in the recovery plan is voluntary. The primary goal of this recovery plan is the delisting of the western snowy plover. Although the Fish and Wildlife Service and the National Oceanic and Atmospheric Administration - Fisheries are responsible under the Endangered Species Act for developing and implementing recovery plans, individuals and entities outside of these agencies often have pertinent information, skills, and authorities that can facilitate the design and implementation of an effective recovery program. While the recovery plan itself cannot change State or local laws, participating State and local governments and agencies may make changes under their respective jurisdictions where necessary or appropriate.

Comment: The U.S. Fish and Wildlife Service should provide insight on how it will aid the Coastal Commission in encouraging local jurisdictions to update Local Coastal Plans.

Response: Recovery action 3.6 suggests that we should encourage and assist the California Coastal Commission and Oregon Department of Land Conservation and Development to ensure that Local Coastal Plans, Local Comprehensive Plans, and Implementing Measures for coastal planning jurisdictions incorporate recovery measures for the western snowy plover when they are updated. We intend to aid the California

Coastal Commission through interactions in the western snowy plover regional working groups which should include participants from Federal, State, and local governments.

Comment: One commenter asked that we clarify what coastal program revisions the Fish and Wildlife Service is recommending.

Response: We recommend that when coastal programs are updated, they should be reviewed for consistency with this recovery plan.

Recovery Criteria

Comment: One commenter felt it would be difficult to assess the recovery objective of 1.0 chick fledged per male.

Response: We believe that estimating the number of chicks fledged per male is feasible. Males were selected because the population viability analysis in Appendix D modeled males. Males were chosen in the analysis because their demographic parameters can be estimated with greater certainty, and because they are responsible for post-hatching parental care and are likely to limit reproductive success. To aid in assessing this recovery objective, banding would occur, as necessary, in order to determine the number of chicks fledged per male. Action 4.3.2 recommends developing a sampling method to assess the number of chicks fledged per male in each recovery unit.

Comment: The U.S. Fish and Wildlife Service has not provided justification for selecting 3,000 as the minimum number of breeding adults required for 10 years to consider delisting. The year to year variation in population size makes this criterion unrealistic.

Response: Recovery Criterion 1 provides the desired distribution of western snowy plovers by recovery unit. The numbers are based on a site-by-site evaluation of historical records, recent surveys, and future potential, but are below the "Management Goal Breeding Numbers" identified in Appendices B and C. The Management Goal Breeding Numbers were estimated by the recovery teams based on individual knowledge and available beach habitat. Recovery Criterion 1, developed through population viability analysis in Appendix D, is approximately 83 percent of these numbers. Those scenarios in Appendix D where the population does not reach 3,000 are associated with population declines, and in several cases, substantial probabilities of extinction. Under growth

scenarios where the species appears to maintain long-term viability the population is expected to reach or exceed 3,000 birds. Three thousand western snowy plovers is approximately a 70 percent increase from the time of listing. We believe this increase, sustained over a 10 year period, is needed to ensure long-term viability of the U.S. population. Assessing population size as an average over an extended time period of 10 years reduces the fluctuation due to inter-annual variability and allows increased confidence that population levels reflect conditions sustained over time as needed for recovery, rather than short-term fluctuations. Maintaining a coastal population of 3,000 western snowy plovers over a 10 year period through targeted management would indicate that the threats which resulted in the western snowy plover's listing have been removed or mitigated.

Management Goals

Comment: Appendix C sets low expectations for Recovery Unit 6 (Los Angeles to San Diego Counties) apparently because it anticipates too much political pressure and the burden of providing breeding areas by restrictive beach management is passed to other recovery units. Recovery Unit 2 (Del Norte, Humboldt, and Mendocino Counties) has a greater number of additional management needs identified in Appendix C and also a greater percentage increase in the number of breeding adults than Recovery Unit 6.

Response: There is a greater potential to restore degraded habitats in Del Norte, Humboldt, and Mendocino Counties than there is in southern California. More habitat has been converted or lost in southern California than in the north. The recommendations in the recovery plan reflect this difference.

Comment: One commenter believed it was unfair that northern Oregon and Ocean Beach in San Francisco County, California have fewer restrictions under the recovery plan than do sites in southern Oregon.

Response: Several locations in southern Oregon support active breeding populations of western snowy plovers. We believe that management of these sites to support improved reproductive success and population growth is an appropriate measure to achieve recovery goals for the Oregon/Washington Recovery Unit. Locations in northern Oregon historically supported breeding populations but are not currently occupied. The recovery plan identifies habitat restoration and management at these locations as important to

restoring breeding populations in northern Oregon, and these actions are currently being planned by the Oregon Parks and Recreation Department in conjunction with their habitat conservation plan. Wintering populations of western snowy plovers are known to occur at Ocean Beach in San Francisco County, but this site is not known to support a breeding population.

Comment: The recovery plan assigns virtually all of the burden for population recovery in Recovery Unit 6 to beaches located in San Diego County, while ignoring coastline in Los Angeles and Orange Counties that might be viewed as potential habitat. Comparable management effort for snowy plovers by all landowners should be a goal of the recovery plan.

Response: As described in Recovery Criterion 1, the goal for Recovery Unit 6 is 500 breeding adults. The total of 615 from site-specific management goals in Appendix B allows for some variation among sites. Funding and other management priorities may affect the level of management and choice of on the ground management actions. We are looking for opportunities within Los Angeles and Orange Counties where management actions will contribute to overall breeding population totals for the recovery unit, and in the final recovery plan we have increased the management goal for the Bolsa Chica wetlands (CA-108) in Orange County to reflect recent habitat restoration at that site. However, the recovery plan looks to Federal lands, where available, to provide leadership in western snowy plover management. Federal lands in Recovery Unit 6 are disproportionately located within San Diego County; as such, the recommended site-specific population goals reflect that land ownership distribution.

Comment: The best quality habitat on Redwood National and State Parks, Gold Bluffs Beach (CA-3), has a management goal of 0 breeding birds and is identified as supporting primarily wintering and/or migrating western snowy plovers. One commenter questioned why all Redwood National and State Park beaches are currently viewed by the U.S. Fish and Wildlife Service as potentially suitable nesting habitat.

Response: Gold Bluffs Beach is considered historical nesting habitat. Yocom and Harris (1975) stated that western snowy plovers could be expected regularly on Gold Bluff Beach near Orick.

Comment: One commenter suggested that the management goal of 4 breeding adults for Hollywood Beach (CA-97) is too low, and that a greater number of birds currently attempt to nest there.

Response: The management goal reflects our understanding that the area is heavily used by local residents and daily visitors and that the proximity of residences directly on the beach may preclude some recovery actions, such as beach closures, necessary to obtain higher breeding adult numbers. However, we will continue to review additional information from monitoring efforts and modify the management goal and the recovery plan accordingly, per Recovery action 6.

Comment: The recovery plan calls for Ormond Beach (CA-98) to yield only 50 breeding adult birds, whereas, NBVCPM (CA-99) is tasked with 110 breeding adult birds. Yet Ormond Beach is about 3 times larger than the small, narrow, convex beach of NBVCPM.

Response: Survey data indicates that location CA-99 has historically had larger breeding populations than CA-98 (Appendix B). The delineated area within CA-99 is also greater than CA-98 (259 vs. 106 hectares) due to its greater linear extent, although Ormond Beach is comparatively broader. However, we will continue to review additional data on breeding population, habitat quality, and management actions, and management goals may be modified accordingly, per Recovery action 6.

Management activities

Comment: Commenters expressed concerns about the future management of the Haul Road in MacKerricher State Park. Some commenters wanted the road to be removed through a low-impact road removal and beach restoration plan and other commenters wanted reconstruction and relocation of the road.

Response: California State Parks is currently developing a management plan for the Preserve portion of MacKerricher State Park. Access, recreation and other activities, coastal and archeological resources, and listed species are all being considered in the recovery plan. The Haul Road will be considered in the context of State Parks' guidelines for managing State Preserves and the western snowy plover.

Comment: One commenter said that the management notations in Appendix C failed to include needed management changes for Hollywood Beach (CA-97).

Response: We understand that the area is heavily used by local residents and daily visitors and that the proximity of residences directly on the beach may preclude some recovery actions, such as beach closures. The Ventura Fish and Wildlife Office is currently working with the County of Ventura to alter its beach grooming actions on Hollywood Beach. This effort has arisen as a result of complaints by local residents concerned about the western snowy plover and access to the beach by nonresidents.

Coordination, participation and working groups

Comment: Several commenters noted the need for dedicated Fish and Wildlife Service staff or a western snowy plover coordinator for Oregon and Washington.

Response: In Oregon, the Bureau of Land Management, Forest Service, Oregon State Parks and Recreation Department, the Oregon Department of Fish and Wildlife and the Oregon Natural Heritage Program are in favor of establishing a coordinator position. At this time, the Fish and Wildlife Service is unable to fill such a coordinator position, due to lack of funding.

Comment: The U.S. Fish and Wildlife Service should establish a central location and point of contact to track the status of the western snowy plover across the species' range.

Response: Our Arcata Fish and Wildlife Office holds lead responsibility for coordinating implementation of western snowy plover recovery. The Recovery Plan recommends maintaining a staff position in the Arcata Field and Wildlife Office with the primary responsibility of implementing the western snowy plover recovery plan, including coordination and tracking of range-wide status.

Comment: A comprehensive annual status report including information on nesting locations, nesting attempts, population estimates, productivity and mortality should be provided to all land managers.

Response: We propose in the Recovery Plan to provide adequate staff to produce such a report. Until data collection is more standardized across the species' range, the annual status report may not have comprehensive information for each site.

Comment: One commenter believes there is a need to coordinate with other western snowy plover assessments throughout the west and throughout North America as a tool in assessing distribution, abundance, modeling, and status information. The commenter also believes that efforts to understand the western snowy plover's distribution in Mexico should be coordinated with similar efforts for the piping plover.

Response: We agree. Coordination with other western snowy plover assessments may provide valuable information on the distribution and status of the species and the Pacific Coast population. Coordination may also provide additional information on management activities that could benefit the Pacific Coast population of the western snowy plover. Recovery action 9 has been added to address this coordination need. We also agree that, to the extent possible, recovery efforts for the western snowy plover should be coordinated with other species, particularly species with similar habitat needs and distribution.

Recovery actions

Comment: One commenter suggested adding development of a model to describe suitable and potentially suitable breeding habitat to Recovery action 4 (Undertake scientific investigations that facilitate recovery efforts).

Response: Habitat modeling, if completed, should be done on a local site or regional basis that incorporates events specific to the area being studied. We believe habitat modeling on a range-wide basis probably is not realistic due to regional variation and dynamic conditions.

Comment: One commenter said that increasing numbers of pinnipeds may be the primary factor affecting western snowy plover reproductive success on San Nicolas Island. Because of the increasing number of pinnipeds using the Island for breeding and hauling out, the commenter believes that achieving the recovery goal of increasing western snowy plovers from the current 78-116 breeding adults to 150 breeding adults is unlikely. The recovery goals for San Nicolas Island should be similar to that of San

Miguel Island, which is also a main breeding area for pinnipeds. The commenter also questioned the feasibility of recovery action 1.8 “discourage pinnipeds from usurping western snowy plover nesting areas,” based on their largely unsuccessful attempts to exclude pinnipeds.

Response: The commenter accurately represented the pinniped problem on San Nicolas Island. Many beaches where western snowy plovers have historically nested have been overrun by pinnipeds. We currently have no mechanism to discourage the behavior. However, the proposed recovery goal of 150 breeding adults (not pairs) seems reasonable given that the area has recently accommodated up to 116 individuals. Part of the recovery effort includes working with NOAA Fisheries on pinniped controls to reach the recovery goal. This could include testing various methods of excluding pinnipeds from beaches where western snowy plovers nest. However, we will review additional information from monitoring efforts and modify the management goal and the recovery actions accordingly per recovery action 6, if necessary.

Banding

Comment: The U.S. Fish and Wildlife Service mentions that since 1977 several thousand western snowy plovers have been banded on the Pacific Coast and that banding may harass and possibly accidentally injure or kill western snowy plovers. Two commenters requested further discussion of mortality due to banding.

Response: Banding has resulted in direct or indirect injury and mortality. Injuries are known to have occurred during banding. We suspect that injuries, and possibly death have resulted from grains of sand being lodged between metal bands and the western snowy plover’s leg. Additionally, some evidence indicates that western snowy plover entanglement in discarded fishing line may be complicated by leg bands; increasing the potential for injury.

Measures to reduce the potential adverse effects of banding have been implemented, involving the capture and handling of birds, and modifications to the bands themselves. Banding is authorized only for those projects that provide information towards western snowy plover recovery and conservation. Recovery action 4.6.2 includes continued efforts to improve banding techniques to minimize banding injuries.

Comment: The commenter recommended the practice of banding western snowy plovers on Vandenberg Air Force Base be ceased immediately because he believes that fledging success and return rates for nonbanded western snowy plovers are higher than for banded western snowy plovers and that banding causes abnormally high levels of chick predation.

Response: Banding is a valuable tool that enables researchers to identify individuals and calculate fledging success, return rates, migration patterns, and population size. Without banding, it is difficult, if not impossible, to identify individual western snowy plovers. Therefore, demographic and dispersal data are difficult to obtain without banding western snowy plovers. Although injuries from banding have been observed in a small fraction of the western snowy plovers banded along the Pacific coast, we are unaware of any studies that correlate banding to abnormally high levels of predation.

In fact, several studies have documented high levels of reproductive success and return rates for banded western snowy plovers. In Monterey Bay, where nearly all western snowy plover chicks are banded, fledging rates as high as 56.8 percent have been documented (Page *et al.* 2002). In addition, return rates of 72.1 percent have been recorded for female western snowy plovers and 79.2 percent for males in Monterey Bay (Page *et al.* 2002). Annual survival rates for color banded, juvenile western snowy plovers (from fledging to 12 months of age) at Vandenberg Air Force Base are similar to survival rates of juvenile western snowy plovers banded elsewhere along the Pacific coast. Annual juvenile survival rates for fledged young averaged 51 percent from the Oregon Coast, 45 percent from Monterey Bay, and 45 percent from the San Diego coast (U.S. Fish and Wildlife Service 2001a). On Vandenberg Air Force Base, 50 percent of western snowy plovers banded in 2001 were re-sighted in 2002 (SRS Technologies 2002).

Critical habitat

Comment: Several commenters asked questions regarding: (a) the critical habitat designation for western snowy plover, (b) 5-year review delisting petition (c) the outreach plan.

Response: Many of these issues are beyond the scope of this recovery plan. To the extent these issues are relevant to the recovery plan they are addressed in responses to comments below.

Comment: Several commenters suggested that it is inappropriate to develop a recovery plan for the Western Snowy Plover Pacific Coast Population at this time. One commenter stated that the draft recovery plan should be revoked until a full review of the economic analysis for critical habitat had been conducted. Another commenter felt that the western snowy plover listing 5-year review needs to be conducted before we finalize the recovery plan.

Response: We think the development of a recovery plan is appropriate. The development of a recovery plan is mandated by the Endangered Species Act, under section 4(f)(1), which calls for the development and implementation of recovery plans for the conservation and survival of federally listed endangered and threatened species and unless such a recovery plan will not promote the conservation of the species. We believe that the development of a recovery plan for the western snowy plover will help promote the conservation of this species.

The process of designating critical habitat is distinct from the process of preparing a recovery plan, and is not a necessary precondition for completion of a final recovery plan. At present critical habitat has been designated for the western snowy plover. Public comment was taken on the proposed critical habitat and the draft economic analysis for the critical habitat (U.S. Fish and Wildlife Service 2005), and the 5-year review of the western snowy plover has also been completed (U.S. Fish and Wildlife Service 2006).

Comment: One commenter felt the Draft Recovery Plan for Tidal Marsh Ecosystems in Northern and Central California needs to be published for public comment and coordinated with the draft plan prior to finalizing the recovery plan.

Response: We recognize it is important to coordinate the two recovery plans, especially the implementation of the two recovery plans. We believe that any conflict between the habitat requirements of the federally listed western snowy plovers and salt marsh species must be avoided by a systematic long-term regional conservation strategy, consistent

with the general recovery goals of the recovery plan and the specific recovery goals and actions that may be recommended in the Draft Recovery Plan for Tidal Marsh Ecosystems in Northern and Central California. The western snowy plover recovery plan identifies recovery areas within the San Francisco Bay, but currently does not have recommended site-specific management goals in recognition of the potential conflicts with recovery goals of salt marsh species. Management goals will be established in coordination with the development of the Draft Recovery Plan for Tidal Marsh Ecosystems in Northern and Central California and incorporated as described under Recovery action 2.6 in the narrative outline of recovery actions. We do not believe the Draft Recovery Plan for Tidal Marsh Ecosystems in Northern and Central California needs to be published prior to finalizing the Western Snowy Plover Recovery Plan to achieve this coordination. Additionally, we do not want to further delay the publication of the Western Snowy Plover Recovery Plan until the Draft Recovery Plan for Tidal Marsh Ecosystems in Northern and Central California is published, because the publication of a finalized recovery plan assists Federal, State, local, and private sector partners in managing their properties and influences funding available from a variety of sources. We do not think waiting for publication of the Draft Recovery Plan for Tidal Marsh Ecosystems in Northern and Central California is warranted.

Comment: Several commenters thought the recovery plan should be consistent with the critical habitat designation and should not include any additional areas for protection.

Response: As discussed in section in the Federal Regulatory Program section of the Introduction (section I. F. 4.A), critical habitat designations are not necessarily intended to encompass a species' entire current range. Recovery plans, however, address all areas determined to be necessary for recovery of listed species and identify the needed measures to achieve recovery. These areas are inclusive of the areas designated as critical habitat, but also encompass other areas that are considered necessary to achieve recovery of this species.

Comment: In the final critical habitat rule for the western snowy plover, the U.S. Fish and Wildlife Service alluded to a relationship between recovery planning and critical habitat designation. The recovery plan, however, does not explain such a relationship. This should be addressed fully in the final recovery plan.

Response: Critical habitat and its role in the recovery plan is discussed in the Introduction, in the Federal regulatory section of the Conservation Efforts section (I.F.4.a).

Comment: The recovery plan should have considered the Denver Court Decision of performing an economic impact study on the draft recovery plan's fiscal impacts to off highway vehicle recreational access, associated motorcycle/all terrain vehicle dealers, recreational vehicle parks, trailer manufacturers, and other local businesses and tourism interests

Response: While the case name is not specified, we think the comment references the Tenth Circuit Court's decision in *New Mexico Cattle Growers Association v. FWS*, 248 F.3d 1277 (10th Cir. 2001), in which the Court held that, in designating critical habitat, the Fish and Wildlife Service must analyze all of the economic impacts of the critical habitat designation. As discussed above, designation of critical habitat is a regulatory action that is distinct from the Service's development of this recovery plan. In contrast, the recovery plan is not a regulatory document; rather, it delineates actions that we believe are necessary to recover and/or protect listed species. The Tenth Circuit's holding with respect to the analysis required for a critical habitat designation does not apply to the development of the recovery plan.

Comment: The recovery plan needs to address minimization of social and economic impacts of implementing recovery actions.

Response: Our July 1994 policy (U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration 1994) states that implementation of recovery plans will be accomplished through the means that will provide for timely recovery of the species while minimizing social and economic impacts. It further states that we will involve all affected interests in implementation of the recovery plan through the development of a participation plan. Participation plans developed through recovery unit working groups will address social and economic impacts of implementing recovery actions.

Comment: One commenter questioned why salt ponds in the San Francisco Bay were included as recovery areas while they were not included in the 1999 designation of critical habitat for the Pacific Coast population of the western snowy plover.

Response: The 1999 critical habitat designation is no longer in force; it has been replaced by a September 2005 critical habitat designation (U.S. Fish and Wildlife Service 2005). As discussed in section I.F.4.a above, the areas identified in recovery plans as important for recovery of the species may not be identical to designated critical habitat Critical habitat designations may exclude areas for a variety of reasons and are not necessarily intended to encompass a species' entire current range. Recovery plans, however, address all areas determined to be important for recovery of listed species and identify needed management measures to achieve recovery. Areas within the San Francisco Bay recovery unit were excluded from critical habitat due to the multi-agency management plan that is currently in preparation for the restoration of San Francisco Bay tidal marsh habitat (U.S. Fish and Wildlife Service 2005). We believe that western snowy plover habitat in San Francisco Bay is important for recovery of the species.

Funding

Comment: Several commenters were concerned about the effects of the recovery plan on local economies and local businesses, reductions in the value of coastal real estate, and increases in work for enforcement agencies due to massive civic disobedience. In addition, one commenter wanted to see social and economic impacts of implementing the recovery plan minimized.

Response: A recovery plan is not a regulatory document and does not mandate agreement to, or implementation of, any of the recovery actions proposed. A recovery plan is a reference document that identifies actions that, if implemented, are expected to recover the species. Any actions that are implemented must follow appropriate State, local, or Federal laws and regulations. Specific arrangements for accomplishing recovery actions would be worked out at the time of planning and implementing the action and should include all appropriate stakeholders, including local governments, businesses, and enforcement agencies.

Comment: One commenter asked whether the cost of providing wardens, agents, or officers to enforce protective measures in breeding habitat is included within the estimated cost of recovery of $33,450,000 stated on page vii of the draft recovery plan, and if not, the commenter asked who will be assuming the costs of enforcement

Response: No, the cost of the action providing wardens, agents, or officers to enforce protective measures in breeding habitat is not incorporated into the total estimated cost of recovery. This is because the cost depends on the intensity of use of the specific areas and is difficult to predict. As mentioned in the implementation schedule, the responsible parties for this action are: the U.S. Fish and Wildlife Service, Division of Law Enforcement; Land Management Agencies and Organizations and other Cooperators; Cities; and Counties. (The total estimated cost of recovery has been revised to $149,946,000)

Comment: Calculations are not included in the plan for loss of tourism revenue due to the recovery plan.

Response: Section 4(f)(1)(B)(iii) of the Endangered Species Act calls for the estimates of the time required and the cost to carry out those measures needed to achieve the recovery plan's goal and to achieve intermediate steps toward that goal. Neither the loss of tourism revenue, nor any benefits from being near open space areas have been calculated into our estimate for cost for recovery. We do not believe that including such estimates is appropriate in a recovery plan. In addition, we do not have the data necessary to calculate such estimates.

Comment: Some commenters were concerned that costs were not estimated for many recovery actions listed in the implementation schedule and that cost estimates were not accurate.

Response: Many costs cannot be accurately estimated at this time because they depend on the outcomes of other actions or on evaluation of site-specific needs. However, costs for many more recovery actions have been estimated in the final recovery plan in an effort to increase the accuracy of the cost estimate.

Recreation

Comment: One commenter felt that recreational activities create no significant habitat modifications or impair essential behavior patterns of western snowy plover. In addition, the commenter stated that recreation, legal or illegal, isn't measurable and that trespasses onto western snowy plover closures pose no actual threat to the western snowy plover because the closures are larger than the western snowy plovers need or use. They also

state that there have been no studies conducted in Oregon or Washington examining western snowy plover tolerances to human activities. Another commenter felt more studies should be done on the effects of recreational activities on the western snowy plover and should be included as a recovery plan objective.

Response: The current data support the idea that human recreational activities cause significant habitat and behavior modifications in western snowy plovers (*e.g.*, Lafferty *et al.* 2006). The effects of recreational activity on western snowy plovers is measurable through variables such as nesting success, behavior modification, or direct mortality.

We recognize the need for additional studies of the effects of recreational activities on the western snowy plover. We have used the best available information on this subject. Recovery action 4.10 has been updated to include the need for these additional studies.

Comment: To avoid prejudice against humans, one commenter wanted to see information on killdeers' (*Charadrius vociferus*) behaviors and responses to pedestrians and other human disturbances cited in the recovery plan in addition to other western snowy plover species.

Response: Although western snowy plover and killdeer are in the same family and genus they have very different nesting requirements. Killdeer nesting requirements are less restrictive than those of the western snowy plover. Unlike snowy plovers, killdeer are adaptable generalists that occur in a wide range of open habitats and will nest on gravel roads, in busy equipment yards, and beside aircraft runways, indicating some tolerance for human disturbance. Their selection of nesting habitat and behavior is not a good indication of western snowy plover requirements. Therefore, killdeer are not cited in the recovery plan.

Appendices

Comment: Several commenters felt that Appendix C was biased. One commenter wanted Appendix C deleted.

Response: Table C-1 provides preliminary, interim guidance for public land managers, private conservation organizations, and private landowners regarding management measures which should receive emphasis at their locations. In the future, additional

management measures for all locations identified in Table C-1 are to be determined and prioritized on a site-specific basis through coordination and discussions between members of each of the six recovery unit working groups because they have on-the-ground, day-to-day, experience with what is currently being done in those areas. They also may be determined through the development of management plans for State and Federal lands under recovery actions 3.3 and 3.4. In addition, action 6.2 recommends that management measures recommended in Appendix C be reviewed periodically and revised as necessary.

Management Goal Breeding Numbers in Table C-1 represent population targets of breeding adults that we believe can be achieved under intensive management. These numbers are meant to be flexible, considering variations in habitat conditions and management opportunities from year to year and from location to location.

Comment: Several commenters felt that the management goals for number of breeding adults in various areas are too low or too high.

Response: As stated in Appendix B of the draft plan, management goals represent population targets that we believe can be achieved under a very intensive management scheme. On a rangewide basis, these targets are approximately 20 percent higher than the recovery criteria subpopulation sizes. These management goals were originally drafted by the technical subteam of the western snowy plover recovery team, and have been modified for certain locations to reflect updated information about habitat quality, population status, and management strategies. The numbers are meant to be flexible, considering variations in habitat conditions and management opportunities from year to year. In addition, Recovery Action 6.2 recommends that management goals be reviewed periodically and revised as necessary. As the recovery plan is a long-term document, it is prudent to base recovery goals on needs for long-term viability of the species, rather than current land use constraints that may change through time. There is no specific time limit associated with the recovery actions in the recovery plan. This recovery plan is a blueprint for the recovery of the species, and it is understood that recovery may take many years.

Comment: One commenter questions why no restrictions on fireworks are included in Appendix C.

Response: We believe that fireworks restrictions should be part of the management plans identified in Appendix C. Recovery action 2.3.3 is: "Prevent disturbance from disruptive recreational activities where breeding western snowy plovers are present." Since the Fourth of July occurs during the breeding season, we believe management of fireworks and the spectators that come to watch them, should be addressed in beach management plans that conform to this Recovery Action.

Comment: Appendix C proposes to prohibit kites from Clam Beach, an area with a breeding management goal of 6 adult birds; however, only eight of the listed sites prohibit kites and only one other site recommends prohibiting kites. All of the sites currently prohibiting kites or recommending prohibition have higher management goals than Clam Beach. The commenter recommends that the kite prohibition be deleted at Clam Beach.

Response: The recommendation regarding kite flying would be seasonal. Depending on local western snowy plover use and distribution, it may be possible to identify areas where kite flying could be compatible with western snowy plover management. The number of breeders on Clam Beach (Moonstone County Park to the Mad River) currently exceeds 6 western snowy plovers, however, their reproductive success if very low. Of the 19 breeding western snowy plovers on Clam Beach in 2002, only 0.25 chicks per adult male fledged. This is far below the 1.0 chick per adult male estimate provided in the Population Viability Analysis (Appendix D) needed to maintain a stable population. Consequently, any management prescription that reduces disturbance to nesting western snowy plovers and bolsters reproductive success is encouraged.

Comment: One commenter suggested that the Mandalay Bay/Santa Clara River Mouth (CA-96) area in Appendices A, B, and L should be split into two areas because it is under management of two different agencies. The area is made up of Mandalay State Beach and McGrath State Beach. The commenter also noted that the name of the area was incorrect.

Response: Although Ventura County Parks and Recreation operates Mandalay State Beach, both it and McGrath State Beach are under the supervision of the California Department of Parks and Recreation. We believe that the California Department of Parks and Recreation is ultimately the party that would implement recovery actions on its

beaches. Therefore, we believe this area should not be split into two separate areas. The name has been changed to Santa Clara River Mouth/Mandalay State Beach.

Comment: The PVA is heavily dependent on the Monterey population data, and does not include datasets from Naval Base Ventura County Point Mugu. Data should be compared with other landowners throughout the range of the plover.

Response: The PVA uses data from Monterey, Oregon, and San Diego. At the time of development, the most comprehensive dataset was from Monterey. Future revision of the PVA is identified in Recovery action 4.11, and we recommend that future demographic analyses should include all available datasets as appropriate.

Errors/Comments in Breeding and Wintering Locations

Comment: One commenter thought the management goals found in Appendix B of the recovery plan seemed low for some sites in San Mateo, Monterey, and Santa Cruz Counties.

Response: The management goals in Appendix B are not requirements, they are targets that are meant to be flexible and based on site-specific conditions, and can be modified with reference to new scientific data as it is made available.

Comment: Some commentors questioned whether Bastendorff Beach should be designated as critical habitat when it is not occupied by western snowy plovers. Commenters also questioned its inclusion in Recovery Area OR-13.

Response: Bastendorff Beach was not included in the final designation of critical habitat on September 29, 2005 (U.S. Fish and Wildlife Service 2005). Bastendorff Beach was historically used by western snowy plovers, and its inclusion in Recovery Area OR-13 reflects this historical usage. However, within recovery areas beach restrictions to help reduce disturbance to western snowy plovers are targeted at sites where western snowy plovers are known to be nesting. Biologists do not currently know of any western snowy plovers using Bastendorff Beach, and the habitat there is currently not suitable for western snowy plover breeding. There are no plans to close or restrict beach access on any portions of Bastendorff Beach for western snowy plovers.

Surveys

Comment: A few reviewers felt that regular surveys of suitable habitat and/or documented nesting, roosting, and foraging areas should be done as well as window surveys.

Response: We agree that regular surveys of suitable habitat should occur in addition to the window surveys. However, the monitoring guidelines in Appendix J were written to provide guidance for monitoring the entire Pacific coast population using the most cost- and time-effective methods. Surveyors in the different regions would be required to obtain a section 10(a)(1)(A) permit, at which time additional guidance on different monitoring methods may be given. In addition, each region may create regional monitoring guidelines for the western snowy plover.

Oregon Issues

Comment: One commenter has the understanding that the western snowy plovers are not really native to the Reedsport, Oregon area, based on a comment made by a biologist at a meeting in Coos Bay several years ago. They question why the Fish and Wildlife Service is trying to establish western snowy plovers in Oregon if there are lots of western snowy plovers in California.

Response: Western Snowy Plovers are native to Oregon. The biologist may have meant to say that western snowy plovers in Oregon are in the northernmost portion of their range, which extends from southern Washington south to southern Baja California. Western snowy plovers have been documented as breeding in Oregon as early as the late 1890's and were considered a resident species by Gabrielson and Jewett (1940). Historically the coastal population of the western snowy plover was found along the entire Oregon coast with documentation of over 20 areas of use from the Columbia River to the Pistol River outlet on the southern coast. The western snowy plover is rarely seen in its former north coast range; it can be found essentially year-round at nine sites between Baker Beach and Floras Lake (as of 2006). Only recently a few birds have been observed north of Alsea Bay at Bayocean Spit, Necanicum Spit, and Sand Lake (Marshall *et al*. 2003).

Comment: One commenter stated that the Oregon Department of Fish and Wildlife's 1978-1993 breeding population surveys conducted between 1978 and 1993 and winter count surveys conducted between 1985 and 1994 do not list Sixes River mouth (OR-18) or Elk River Mouth (OR-19) as included in the surveys, and that western snowy plover were not observed during breeding and winter surveys conducted at Pistol River (OR-17) during this period. The areas do not appear to have been used historically by the western snowy plover.

Response: "Breeding" and "wintering" surveys conducted prior to 1990 were usually window surveys (one-two days per season) with the exception of studies specific to the New River and Coos Bay area. In many years, surveys were not conducted at all in some of the more remote and smaller sites (*i.e.*, Elk, Sixes and Pistol Rivers) due to time limitations, weather, or lack of personnel. Thus, the seasonal "surveys" should not be considered definitive for determining presence, absence, or abundance. What was seen on a given day was a matter of chance, at least in these small beach areas. Birds could have easily attempted to nest at any of those areas earlier or later in the season, and still go undetected, especially if nesting attempts failed.

Western snowy plovers were listed as "permanent resident" for the Pistol River by Gabrielson and Jewett (1940). Marshall *et al*. (2003) cite an incidental report of a western snowy plover(s) at the Sixes River mouth. The fact that there are either no "historical", or in some cases current, records for Elk, Sixes, or Pistol Rivers does not imply that birds did not use those areas. These areas were included in the recovery plan because with some habitat restoration work and predator and recreation management, they have potential as nesting areas. They could also serve as useful connections (*i.e.*, resting and foraging areas) up and down the coast for the improving the survival of the overall meta-population.

Comment: A commenter noted that additional nesting locations at Tahkenitch Creek and Oregon National Recreation Area Dunes Overlook need to be included.

Response: The Tahkenitch Creek and Dunes Overlook areas are included within location OR-10 . With respect to discussion in the text of the draft recovery plan, in the first paragraph on page 22 "site" refers to beaches where western snowy plovers were observed during the Oregon Department of Fish and Wildlife annual window survey. It does not refer to nesting areas. Not all western snowy plover locations were surveyed

each year, for whatever reason (*i.e.*, lack of staff time, or sites were dropped from the survey due to poor habitat).

Comment: Two commenters wanted an explanation of an account at Siltcoos Beach in 1999, when field biologists allegedly stood by and watched as one crow destroyed seven plover nests.

Response: This account is incorrect. No biologist "stood by" and watched a crow depredate plover nests. In the vast majority of nest predations, the fate of a nest is determined by after-the-fact observation of the nest remains. Predators leave different clues as to who the culprit was. Sometimes scavenging of abandoned nests may also occur, though this is difficult to determine. In 1999, several plover nests were depredated by corvids within a three day period at Siltcoos in Lane County. This occurred early in the nesting season and when the predator problem was noted, the culprit had already depredated multiple nests. Adjustments to the nest exclosures were made immediately and refined until the corvid predation problem ceased.

Comment: One commenter suggested that more nesting areas similar to the Coos Bay North Spit (behind the foredune) should be established to meet recovery targets, instead of beach restrictions on beaches that are more valuable to the public and less valuable to plovers.

Response: We disagree that beaches in Oregon are not valuable to plovers. Historically, there have been over 20 areas of plover use on the Oregon Coast, all of these on open, sandy beaches. The beach can provide key nesting and brooding habitat for plovers. The habitat restoration area at Coos Bay North Spit was first established in the 1970s and 1980s when plovers nested at two dredge spoils. Today, the site is 67 hectares (166 acres) in size and both the inland habitat restoration areas (behind the foredune) and adjacent beach provide the most productive nesting areas on the Oregon Coast. The challenge in creating more sites similar to Coos Bay North Spit is the high cost of creating and maintaining such large habitat restoration areas.

Military Issues

Comment: The recovery plan appears to assert that military land uses on Camp Pendleton should be subordinate to conservation land uses, and indeed to recreational land uses. It suggests unacceptable limitations on military training both on Camp Pendleton's beaches and in military special-use airspace above its beaches.

Response: We acknowledge the military mission includes land uses beyond recreation. We also acknowledge that accommodation of the western snowy plover and other listed species has required the Marine Corps to adjust its actions to achieve its military mission. Through development and implementation of the Programmatic Activities and Conservation Plans in Riparian and Estuarine/Beach Ecosystems on Marine Corps Base Camp Pendleton and the resulting biological opinion (the "Riparian BO"), we worked together to find mutually acceptable solutions to address the western snowy plover and other riparian/beach listed species on Camp Pendleton. We commend the management actions that the Marine Corps has implemented to benefit western snowy plovers at Camp Pendleton, including habitat manipulation, population monitoring, predator management, access control, and educational outreach. We believe that the recent growth in the populations on Camp Pendleton is attributable to that management, showing that the Marine Corps is a good land steward while at the same time achieving its military training mission. We look forward to continuing to work together to address military training and conservation concerns at the Base, because, as described in this recovery plan, we believe Federal lands will be important to the recovery of western snowy plovers.

Comment: The most recent surveys on Camp Pendleton show that the Base currently supports a breeding population of approximately 75 western snowy plovers. The draft recovery plan suggests a management goal for Camp Pendleton of 215 breeding western snowy plovers. This would represent 39 percent of the total management plan for the entire Recovery Unit and a 300 percent increase in the Base's population of western snowy plovers. These recovery objectives cannot be reached without severe effects to military training.

Response: The Management Goal Breeding Numbers described in Appendices B and C are intended to be informal targets for management and are flexible. The management goals for Camp Pendleton include 15 breeding adults at San Onofre State Beach, 40 at

Aliso/French Creek Mouth (White Beach), and 160 at the Santa Margarita River Estuary. In 2006, the breeding window survey for western snowy plovers detected 126 plovers on Camp Pendleton. The window survey is an index survey, a "snapshot" of the plover population, and represents a minimum population. Even at a minimum, this represents considerable growth since the population estimate cited. We commend the Marine Corps for the management that has achieved this growth and anticipate that ongoing management in existing snowy plover management areas will continue to contribute to recovery.

Comment: The recovery plan suggests that "aircraft operations within snowy plover habitat should require a minimum altitude of 152 meters (500 feet) for aircraft and a higher altitude for helicopters. Aircraft operations that have already established guidelines allowing aircraft to fly under the 152 meter (500 foot) threshold should raise the limits to this minimum threshold or higher as needed." (p. 146.) This "recovery task" would have a direct impact on military operations, and would be unacceptable to the Marine Corps.

Response: Recovery plans are guidance documents. We have already addressed the Marine Corps training and operational activities, including aircraft activities, on the Camp Pendleton in the Riparian BO. In the Riparian BO, we concluded that as part of the Marine Corps overall activities, including the stewardship activities described in the Beach Ecosystem Plan, the Marine Corps may conduct the addressed activities in the manner described in the opinion. The Marine Corps has implemented avoidance and minimization measures on Camp Pendleton, such as those incorporated into the Range and Training Regulations and other programmatic instructions. Further, the Marine Corps has funded monitoring and management activities, such as predator control and habitat improvement, that has benefitted western snowy plovers. This recovery plan will not change the Riparian BO. Training may continue as described in the Riparian BO. For example, aircraft, as described in the Riparian BO, may continue to fly as low as 91 meters (300 feet) over nesting areas on the beach, as opposed to the recovery plan's recommended 152 meters (500 feet). This difference is due, in large part, to the benefits western snowy plovers receive because of the Marine Corps' ecosystem-based management that benefits western snowy plovers and other species.

Comment: Military training and western snowy plover nesting can successfully co-exist, which should be stated in the Plan.

Response: We recognize the potential for western snowy plovers to successfully nest on training beaches where appropriate species management is implemented, as demonstrated at Naval Base Coronado and Marine Corps Base Camp Pendleton.

Comment: Sikes Act requirements need to be taken into consideration in the development of the Recovery Plan.

Response: The contributions of the INRMPs have been acknowledged in the Plan.

General Comments

Comment: Several commenters felt that the amount of money and time expended to keep the western snowy plover from going extinct was not worth the effort.

Response: The recovery of listed species is mandated by law. Congress found in 1973 that various species of fish, wildlife, and plants in the United States have been rendered extinct. Other species have been so depleted in numbers that they are in danger of extinction. For some species there is an imminent threat that they will become extinct very soon. Congress also found that these species are of value to the Nation and its people. For this reason they enacted the Endangered Species Act. The Endangered Species Act reflects the value Congress and the American people place upon the natural resources of the United States and their diversity. The Endangered Species Act directs us to conserve endangered and threatened species and the ecosystems upon which they depend.

Comment: The recovery plan inappropriately elevates single-use management for western snowy plovers over multiple use of public lands.

Response: The purpose of the recovery plan is to identify actions that, if implemented, are expected to lead to recovery of the western snowy plover. It is advisory in nature and does not mandate agreement to or implementation of any of the recovery actions proposed. Public land management agencies that implement actions identified in the recovery plan should consider and seek to appropriately balance multiple uses across the lands they manage, assessing alternatives under processes such as the National Environmental Policy Act (NEPA).

Comment: One commenter wanted to know how implementation of the recovery plan will affect private businesses in and around western snowy plover habitat areas.

Response: A recovery plan is advisory in nature and does not mandate agreement to or implementation of any of the recovery actions proposed. A recovery plan is a reference document that identifies actions that, if implemented, are expected to recover a species. Economic effects of implementing recovery actions will depend on particular local circumstances; specific proposals to implement actions may be evaluated through processes such as NEPA or the California Environmental Quality Act (CEQA).

Comment: The recovery plan fails to acknowledge that recovery will require severe damage and alteration of ecosystems to provide western snowy plover an unnatural advantage and allow it to reproduce at inflated levels.

Response: The objective of this recovery plan is to ensure the long-term viability of the U.S. Pacific coast western snowy plover population so that this population can be removed from the Federal list of endangered and threatened species. The recovery plan does not call for severe damage of ecosystems to create habitat for the western snowy plover. Long-term management and protection actions can be found in section 3 of the recovery outline. All the recovery unit areas in the recovery plan are historical western snowy plover breeding or wintering sites. In addition, the recovery plan has taken into account and given careful consideration to other species that share habitat with the western snowy plover.

Comment: Several commenters felt that the recovery plan should include more site-specific management actions and that the Pacific coast population of western snowy plover should be broken down into smaller unit areas.

Response: Six recovery units have been established. The recovery units cover the following areas: (1) Oregon and Washington; (2) Northern California (Del Norte, Humboldt, Mendocino Counties); (3) San Francisco Bay (locations within Napa, Alameda, Santa Clara, and San Mateo); (4) Monterey Bay (including coastal areas along Counties of Monterey, Santa Cruz, San Mateo, San Francisco, Marin, and Sonoma); (5) San Luis Obispo, Santa Barbara, and Ventura Counties; (6) Los Angeles, Orange, and San Diego Counties. The rationale for this approach is discussed in detail in section II.B of the recovery plan.

Each recovery unit includes many breeding and wintering locations. Specific management goals and actions for each location can be found in Appendixes B and C. Each recovery unit will have a working group that would include members who are specialists in that recovery unit area. Representation from the full contingency of Federal, State, local, and private land owners and other parties who have a stake in western snowy plover conservation within each of the six recovery units will be needed to implement the recovery actions recommended in the recovery plan. In addition, a summary and table of current and additional needed management activities for western snowy plover, categorized by breeding and wintering locations, can be found in Appendix C of the recovery plan. The management activities identified in Appendix C are based on the best available information as we finalize this plan. We understand that as more information becomes available adjustments may be appropriate; review of Appendix C is identified as part of recovery action 6.2.

Comment: One commenter wanted demographic responses to management actions documented and provided for peer review of the methods.

Response: The Fish and Wildlife Service agrees that demographic responses to management actions should be shared with others. Communication, evaluation, and coordination play a major role in western snowy plover recovery efforts

Comment: Recovery Criterion 3 should be removed and only Federal actions should be included in the recovery plan. The U.S. Fish and Wildlife Service has no authority to create this requirement.

Response: Section 4(f)(2) of the Endangered Species Act of 1973, as amended (Act) states that: the Secretary, in developing and implementing recovery plans, may procure the services of appropriate public and private agencies and institutions, and other qualified persons. In addition, our Recovery Plan Participation and Implementation Policy (U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration 1994) provides a Participation Plan process, which involves all appropriate agencies and affected interests in a mutually-developed strategy to implement one or more recovery actions. This cooperative policy is intended to minimize social and economic impacts consistent with timely recovery of species listed as threatened or endangered under the Act. Recovery plans are guidance documents; not regulatory

documents. No agency or other entity is required by the Act to implement the recovery strategy or specific recommended actions in a recovery plan.

Comment: Several commenters felt the recovery plan should outline a standard research protocol for the western snowy plover.

Response: We agree that there is a need for standard research guidelines for more effective comparisons of data. Monitoring Guidelines for the Western Snowy Plover can be found in Appendix J of the recovery plan. More discussion about monitoring and scientific investigation needs can be found under Recovery actions 1.5 and 4.3.

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