

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.

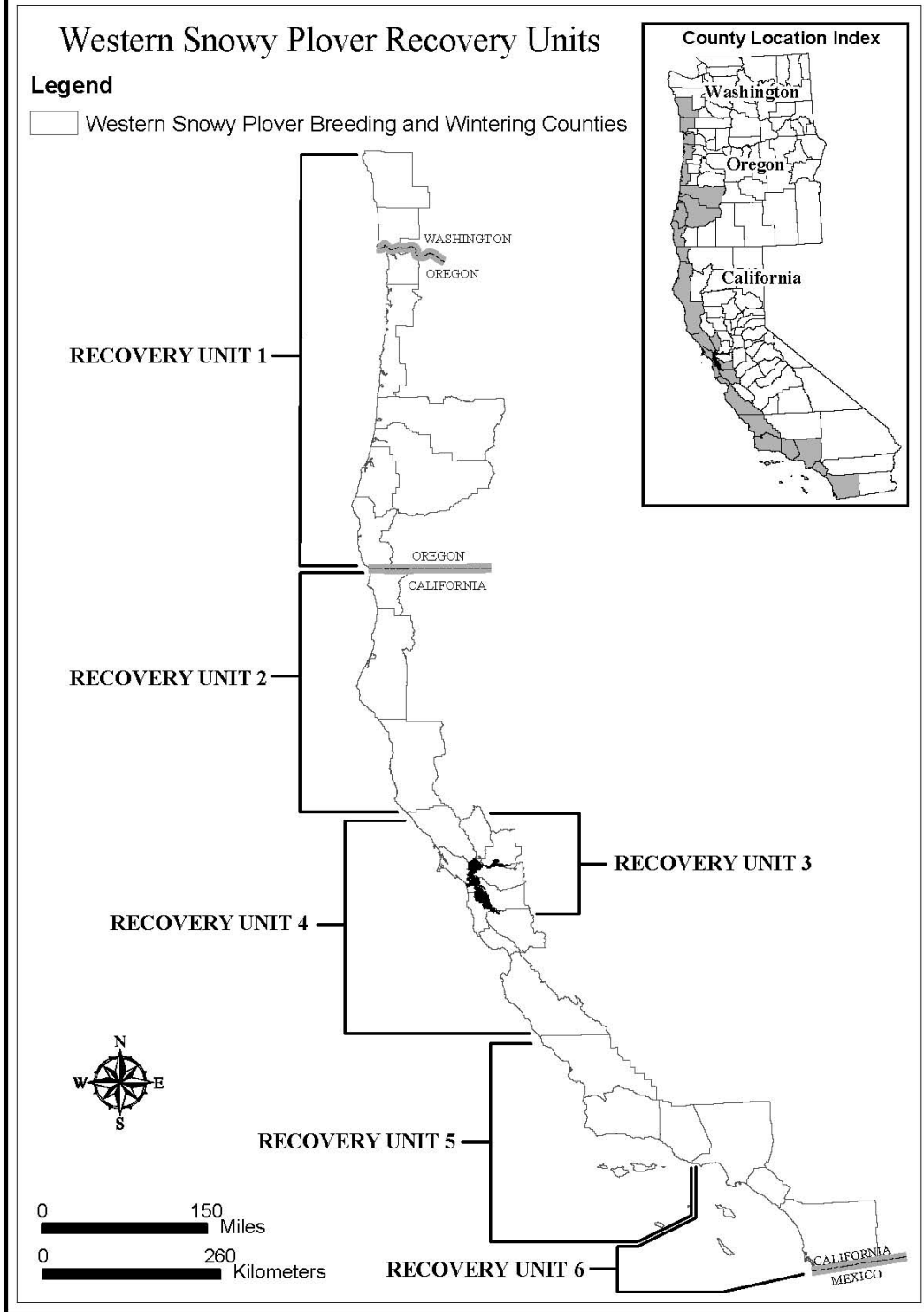


Figure A-2. Recovery Unit 1, Washington and Oregon.

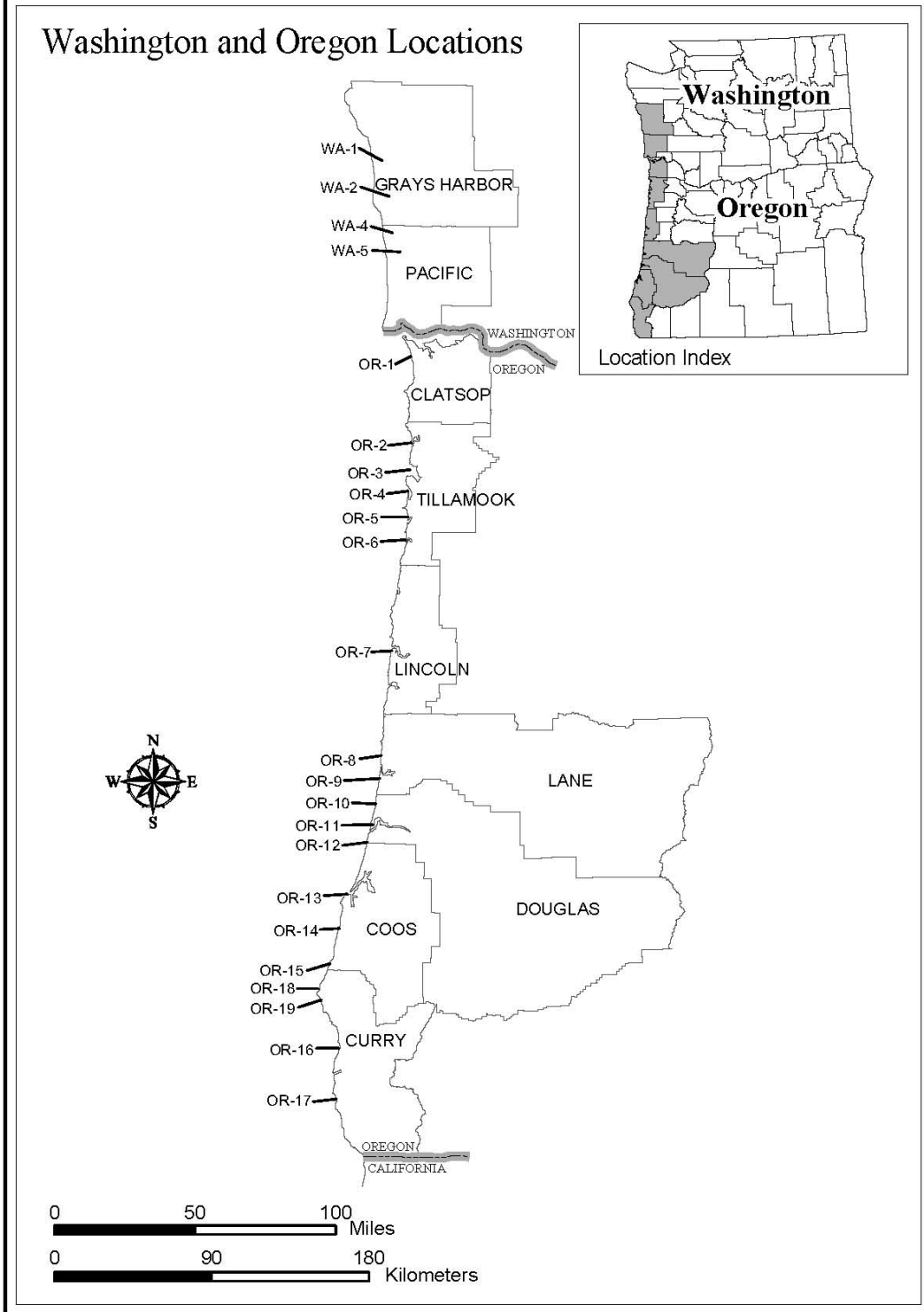


Figure A-3. Recovery Unit 2, Del Norte to Mendocino Counties, California.

Northern California Locations

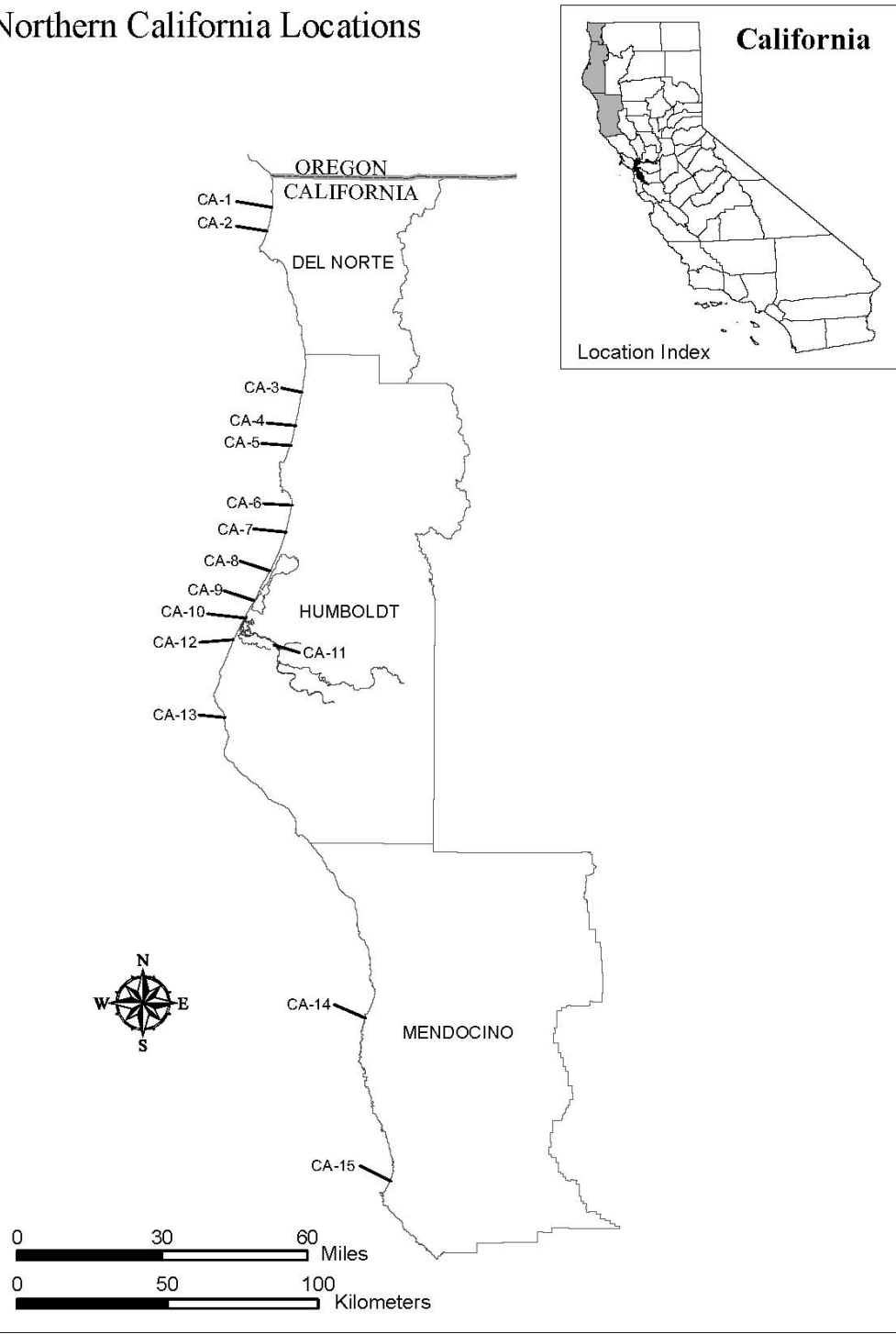


Figure A-4. Recovery Unit 4, Sonoma to Monterey Counties, California.

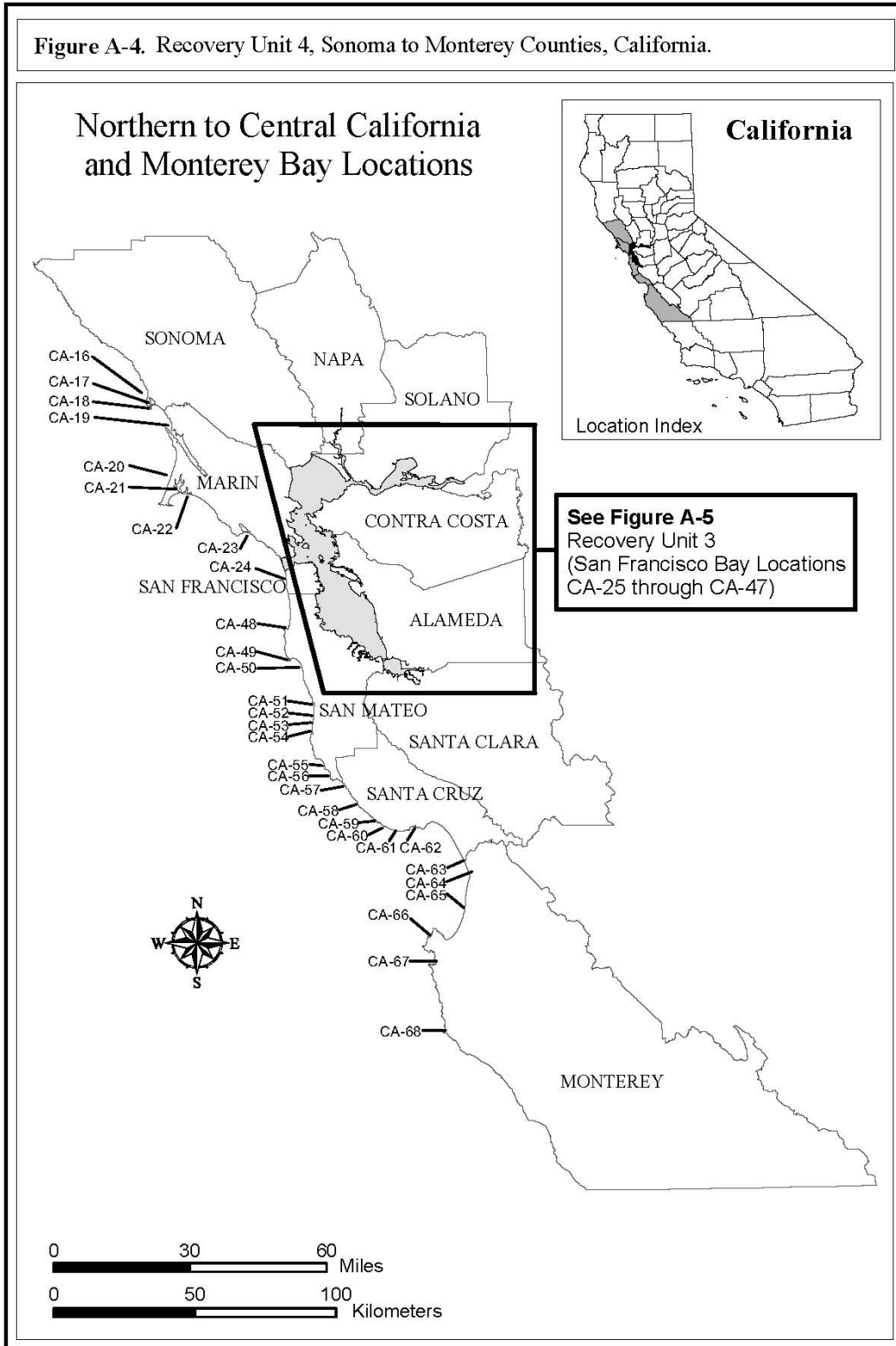


Figure A-5. Recovery Unit 3, San Francisco Bay, California.

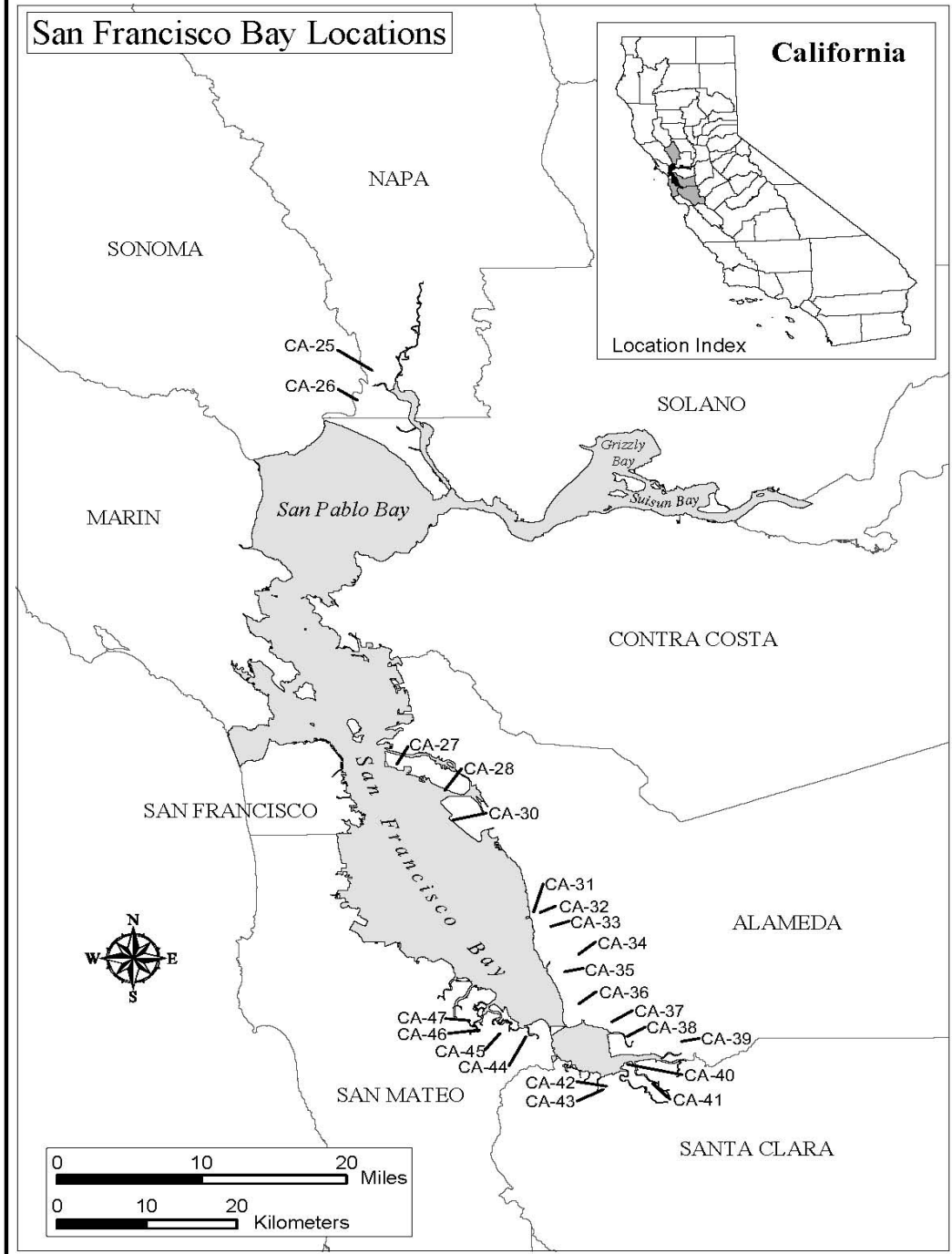


Figure A-6. Recovery Unit 5, San Luis Obispo to Ventura Counties, California.

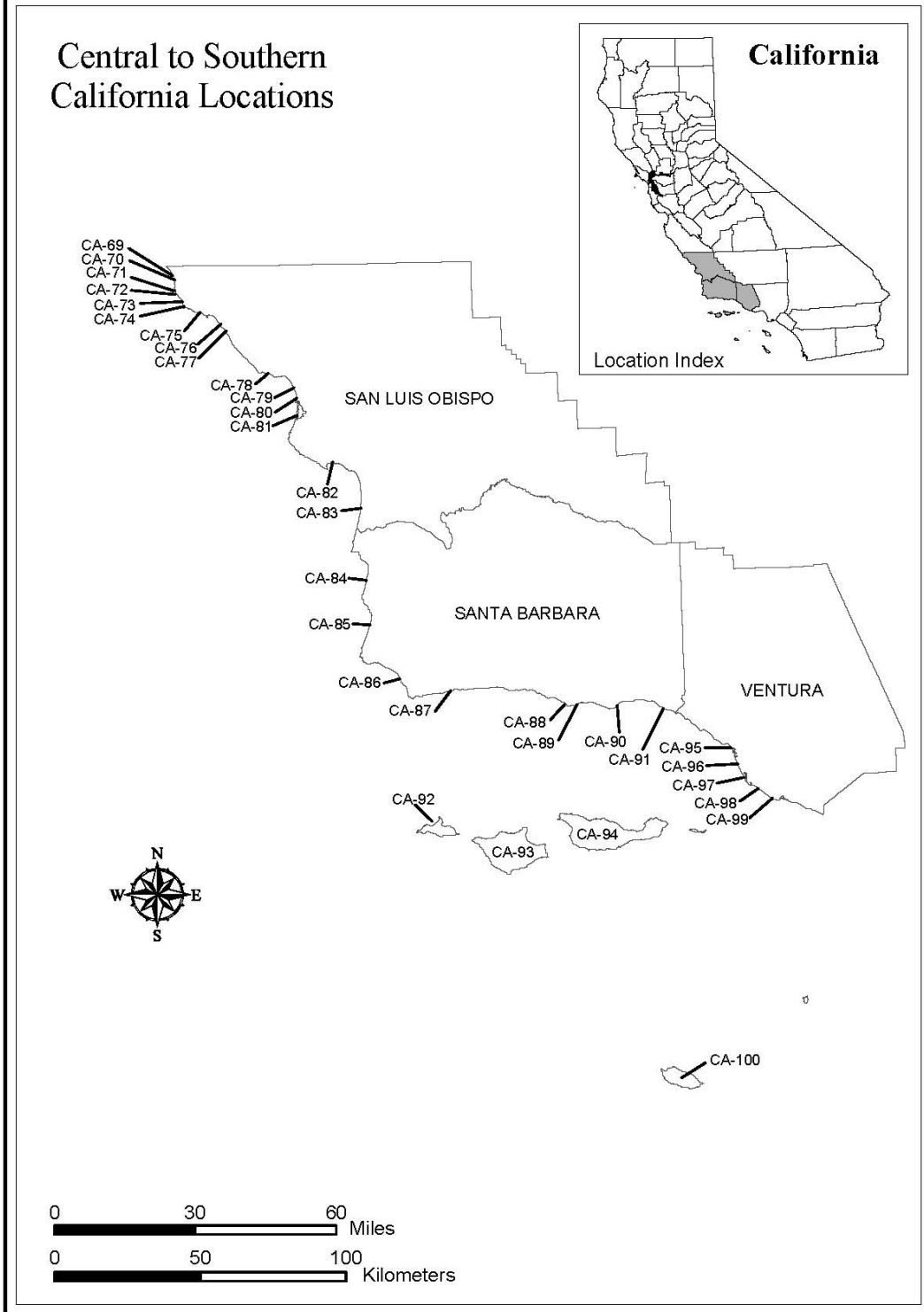
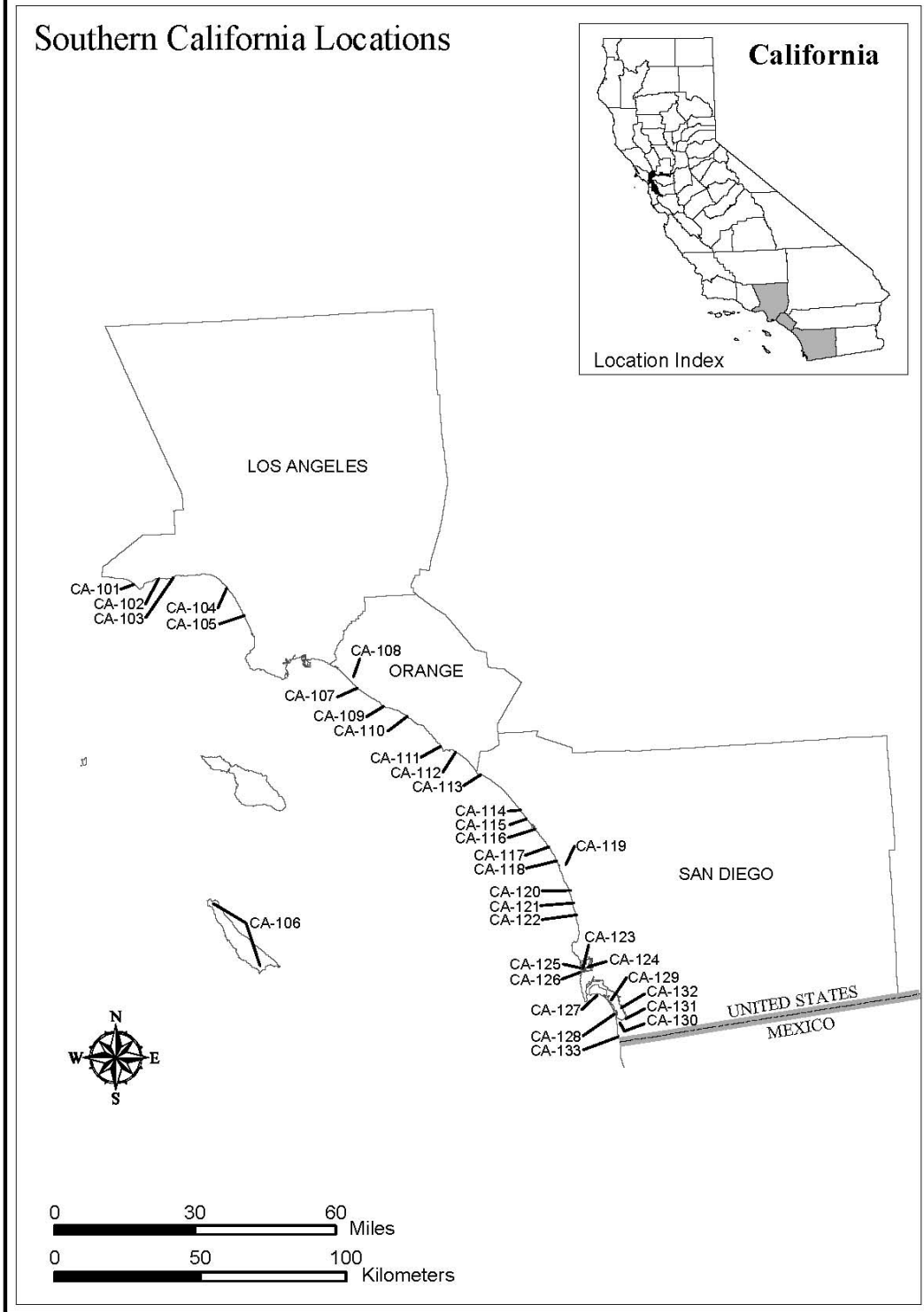


Figure A-7. Recovery Unit 6, Los Angeles to San Diego Counties, California.



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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Rob Klinger for data from Santa Cruz Island.
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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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Klinger, R., The Nature Conservancy, Santa Barbara, CA.

Leong, R., Napa-Solano Audubon Society, Fairfield, CA.

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C. *In Litt.* References

M. Fisher, California Department of Fish and Game, Smith River, CA. 1995. Letter to U.S. Fish and Wildlife Service, Sacramento, CA. 1 p + maps.

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) Manresa and Sunset State Beaches Pajaro River mouth (End of Sunset State Beach to Pajaro River) Moss Landing State Beach (Zmudowski State Beach through Moss Landing State Beach)	8-38 (13-37)	Total: 17-93 0-17 5-48 12-45	Total: 54 18 26 10	Est. 150-250	Total: 3-117 0-65 1-8 0-44 (all but 1 on Moss L)	250 (617)	13.7 (8.5)
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)	(7-11)*	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 enclosures); (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	
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.																									
					A																			Private	
OR-8	Heceta Head to Siuslaw River	12	C	C					CA		C	C		C			C	C	C	C	C	C	C	USFS, OPRD	
Additional for OR-8 (USFS): Increase volunteer interpretation/monitoring. Comment: Current management by County unknown																									
					A																			Lane County	
																								Private	
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 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 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 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
						A																		Del Norte County
																								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

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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-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.																							

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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-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	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.																						

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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-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.																							

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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	Exlosures	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					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	Exlosures	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	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 State Beach Parking area 26)	26	C	C			C	C	CA	C	C	C	C	CA	C	C	C	C	C	C	CA	C	CA	CDPR-Monterey District	
	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 willing-seller basis.																								
CA-64	Elkhorn Slough Mudflat/Salt Pond (AKA Moss Landing Wildlife Area)	80	C	C			C	C	CA	CA			C	CA	C	C	C	CA	C	C	CA	CA	A	CDFG	
	Additional for CA-64: Monitor erosion rate of bank separating Elkhorn Slough from salt ponds. 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	Exlosures	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

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-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

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-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
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
City of Morro Bay																								

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	Exlosures	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.																							

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-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			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																										

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-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 Private
	Comment for CA-97: Irregular 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-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.																								

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-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	
							A																	Orange County	
																								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 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 \times 1.286 \times 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.*, $S_1 = S_2 = \dots = S_{19}$, 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 $N(A)_t = N(1)_t + N(2)_t + \dots + N(20)_t$, 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*; Spendelov *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 otherwise¹. 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 (λ) 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 λ of .001. A change in fecundity of 0.08 (in relative terms), *e.g.* from 1.00 to 1.08, changes λ 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 λ 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 \times 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, λ 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.

Scenario No.	Description	Minimum	X - S.D.	Mean	X + S.D.	Lambda	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.

Scenario 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 ± 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.

Scenario No.	Description	Median outcome after 25 years, N	Probability 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.

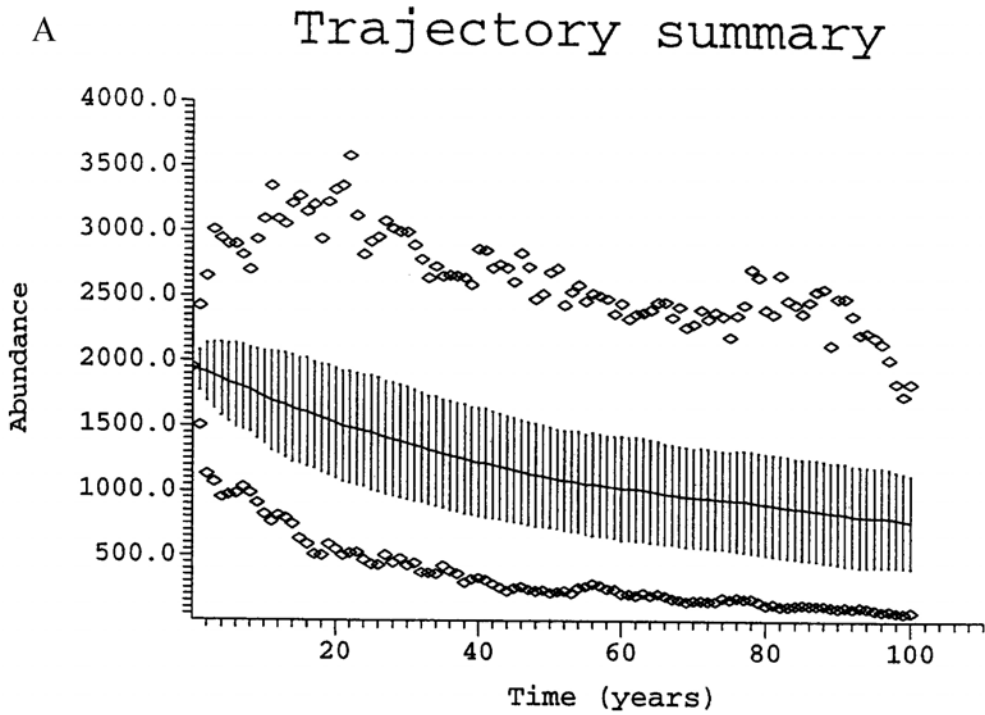
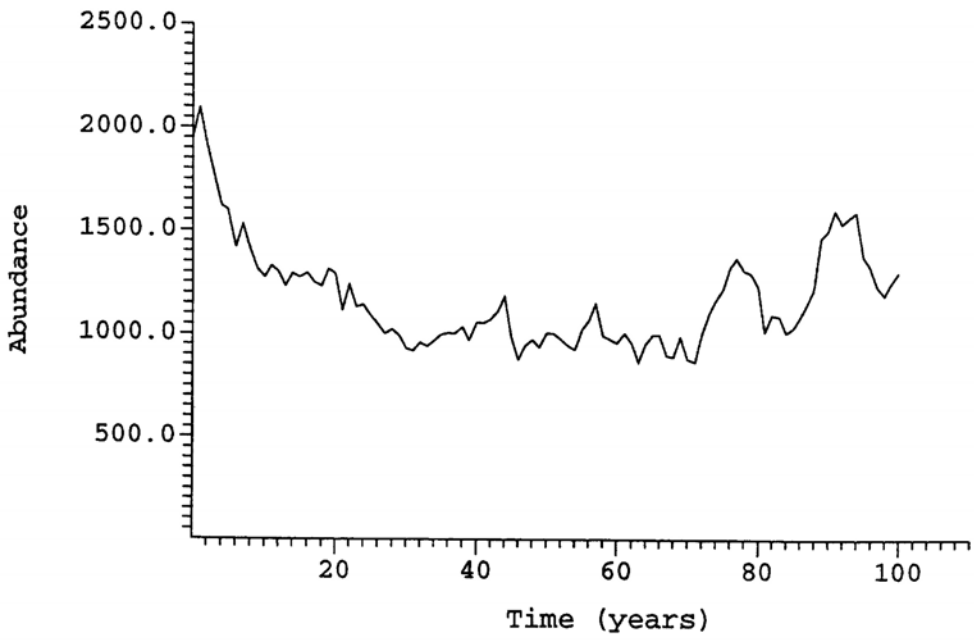
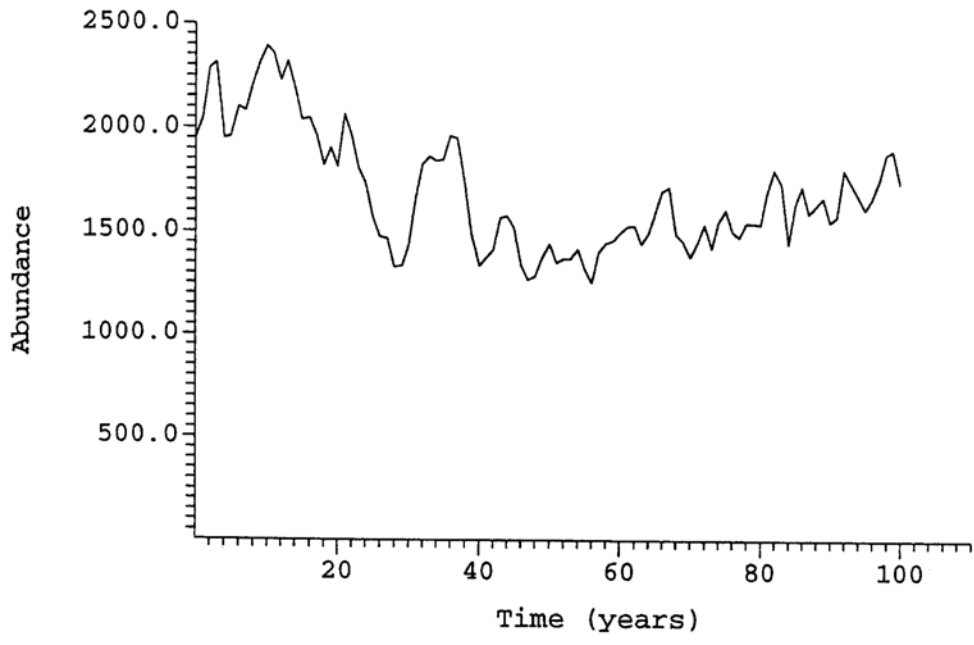


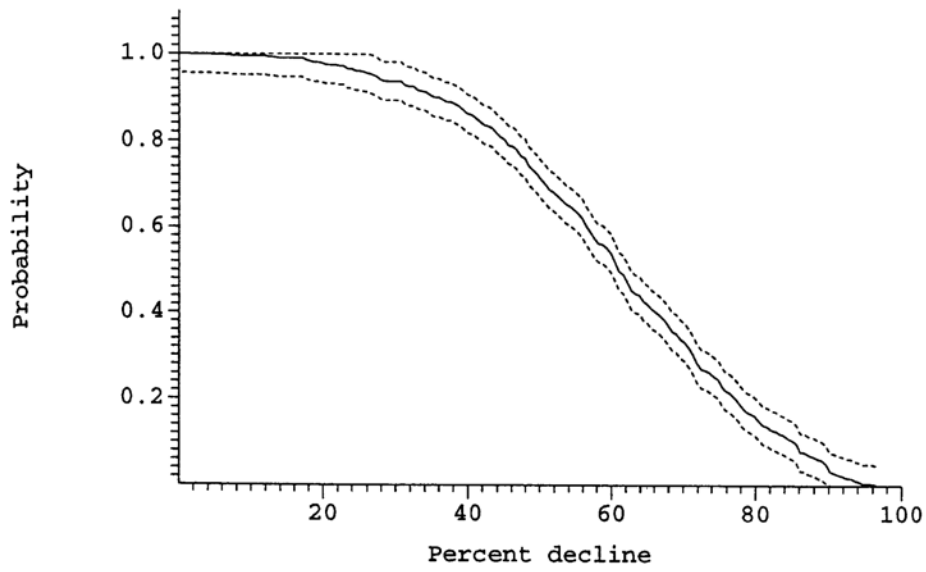
Figure D-1. Scenario 1: Status Quo (see text). A) Population trajectory for the metapopulation. Diamonds indicate maximum and minimum (400 simulations, total). Horizontal line indicates mean trajectory. Vertical lines connect mean \pm 1 standard deviation of outcome. B) Population trajectories for two 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 \pm 1 standard deviation. Diamonds show maximum (among 400 simulations).

B

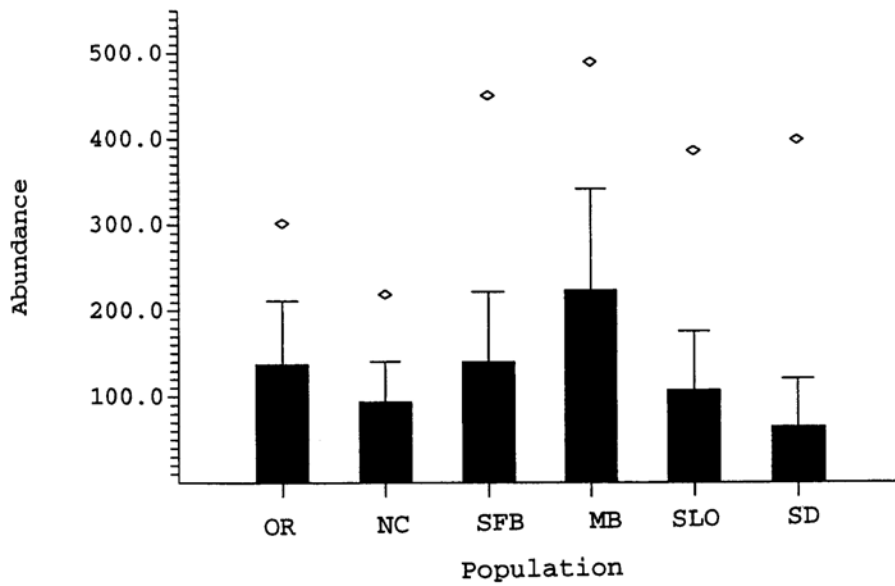
Trajectory summary



C Terminal percent decline



D Population structure



Trajectory summary

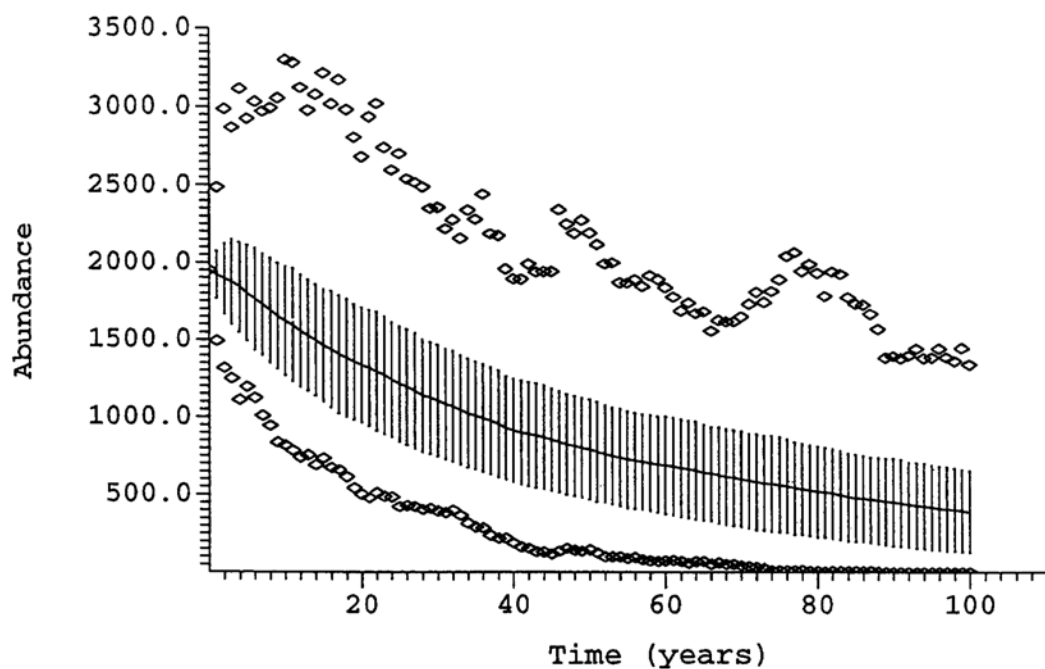


Figure D-2. Scenario 2: Status Quo with 75 percent adult survival instead of 76 percent. Population trajectory for the metapopulation. Diamonds indicate maximum and minimum (400 simulations, total). Horizontal line indicates mean trajectory. Vertical lines connect mean \pm 1 standard deviation of outcome.

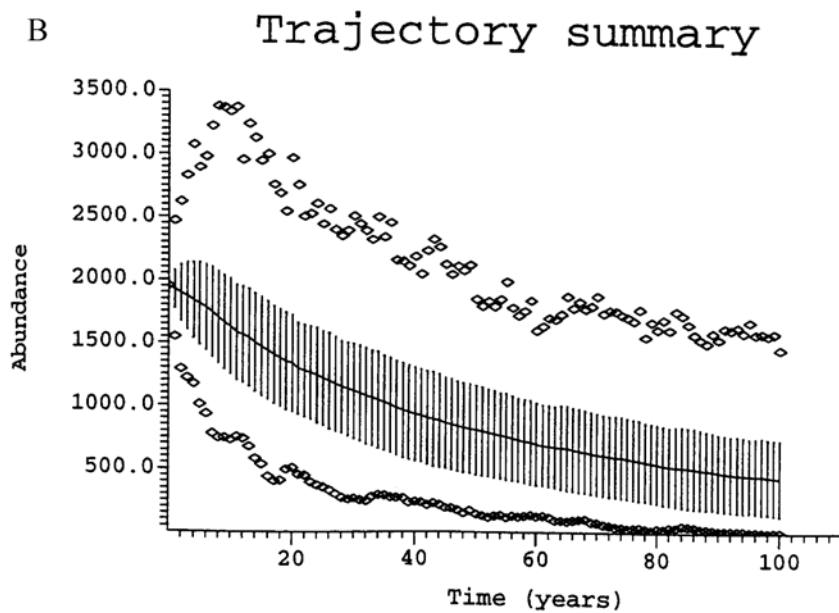
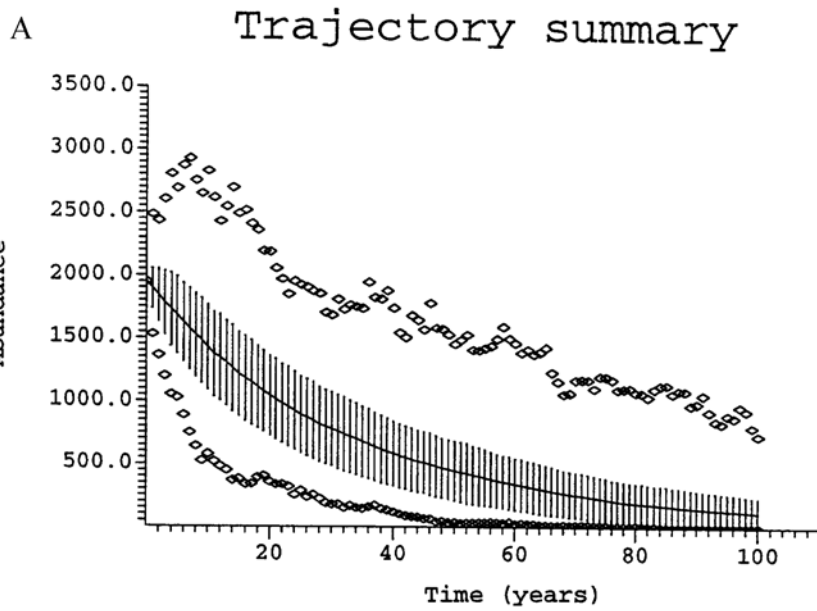


Figure D-3. Scenarios 4 and 5: Status Quo with reduction in juvenile survival (equivalently, reproductive success) by 10 percent (A) and by 4 percent (B). In each Figure panel: Population trajectory for the metapopulation. Diamonds indicate maximum and minimum (400 simulations, total). Horizontal line indicates mean trajectory. Vertical lines connect mean \pm 1 standard deviation of outcome.

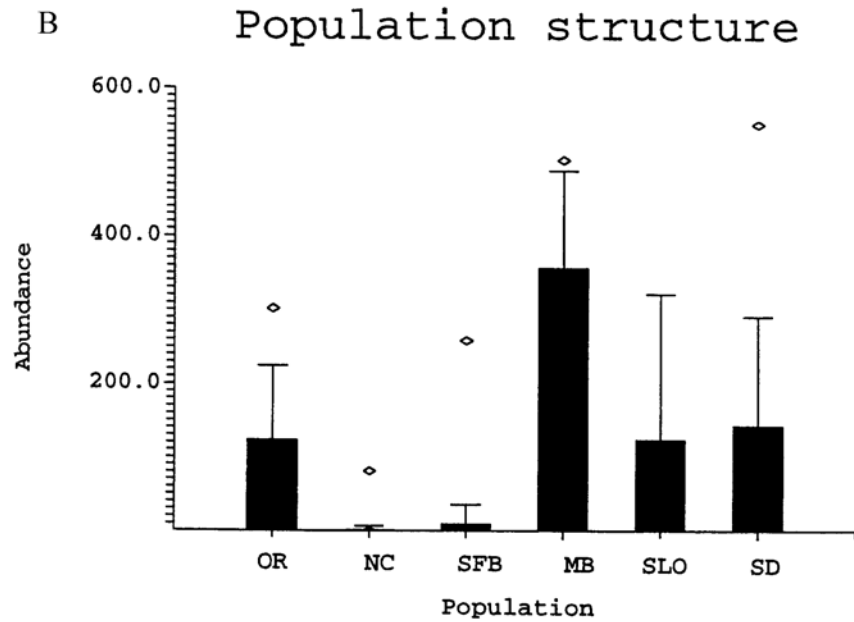
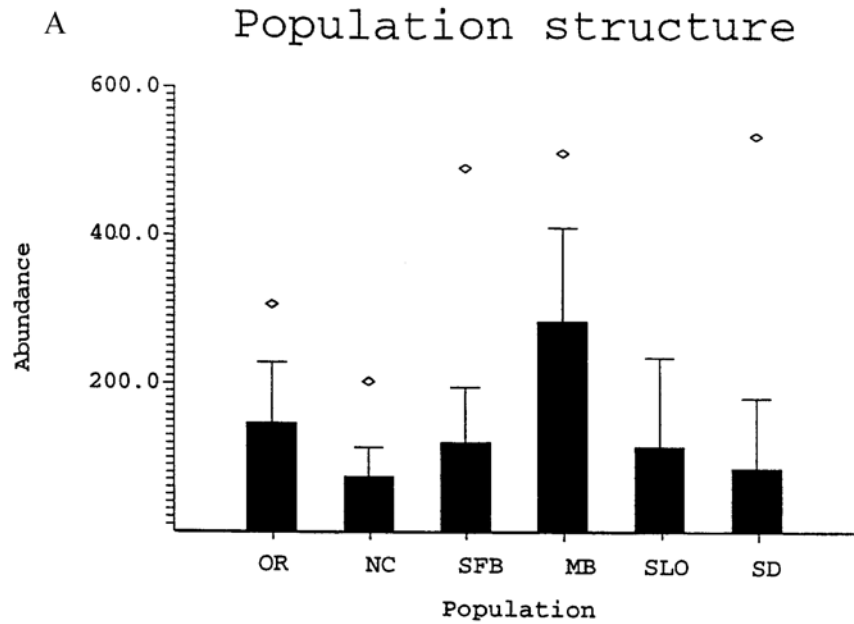


Figure D-4. Scenarios 8 and 9: Status Quo with reduction in dispersal. A) Dispersal reduced by 1/2 (Scenario 8). B) No dispersal (Scenario 9). For each Figure panel: Abundance for each subpopulation at the end of 100 years. Bars indicate means; vertical lines with bar indicate +1 standard deviation. Diamonds show maximum (among 400 simulations).

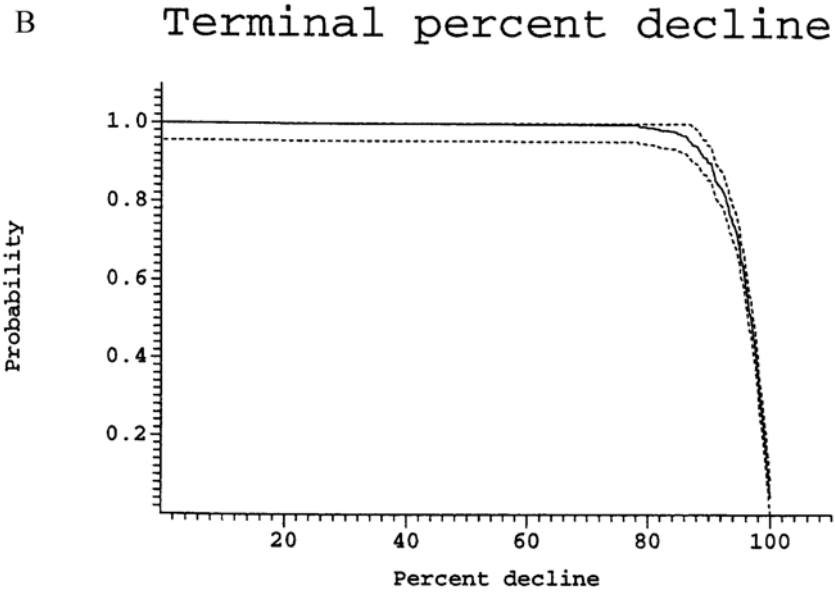
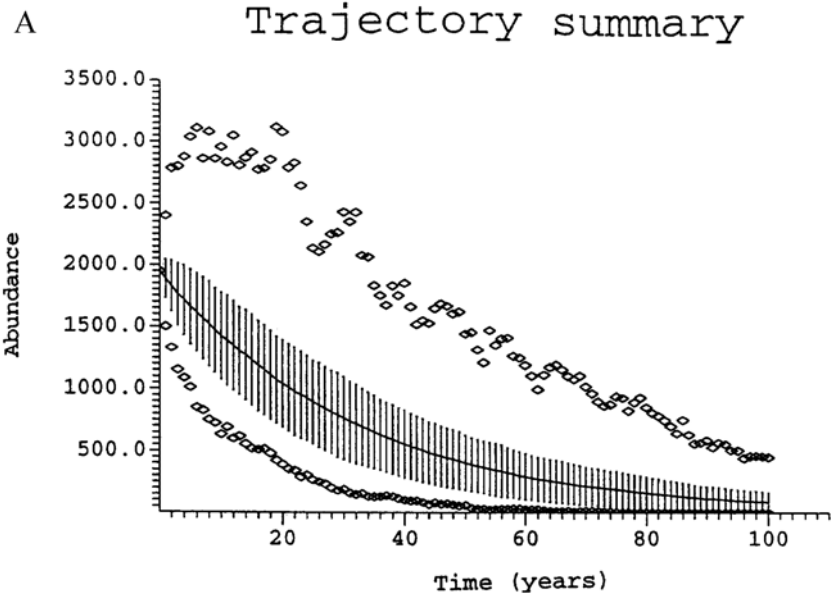


Figure D-5. Scenario 12: No Management. A) Population trajectory for the metapopulation. Diamonds indicate maximum and minimum (400 simulations, total). Horizontal line indicates mean trajectory. Vertical lines connect mean +/- 1 standard deviation of outcome. B) Probability that at the end of 100 years the metapopulation will have declined below specified level. Dotted lines indicate approximate 95 percent confidence interval.

Trajectory summary

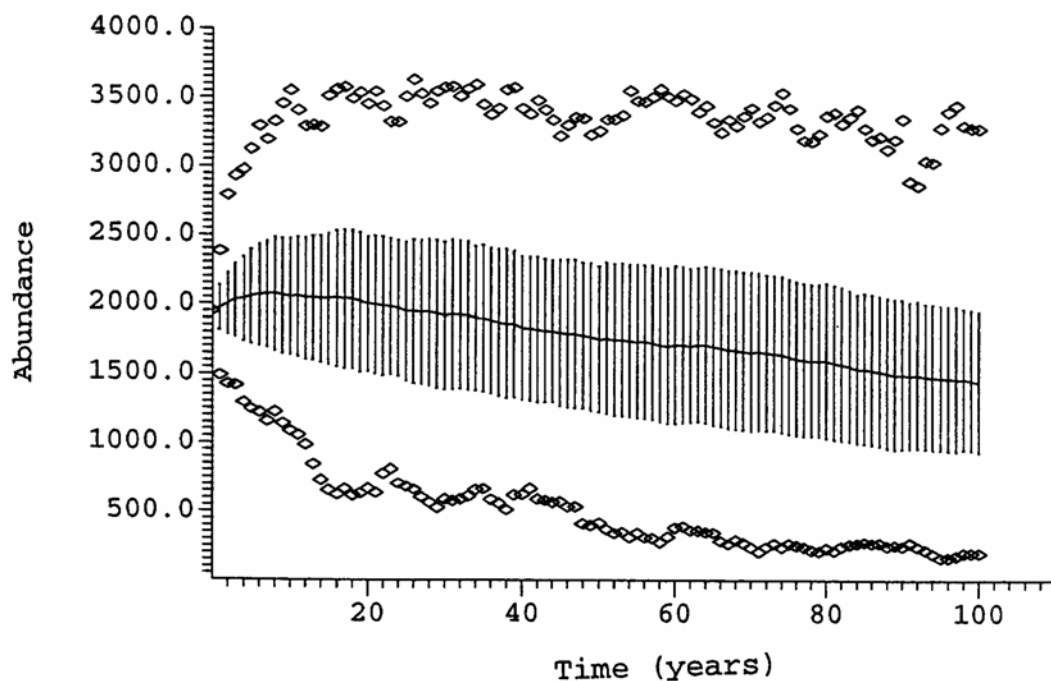


Figure D-6. Scenario 14: Improve reproductive success in San Luis Obispo/Santa Barbara/Ventura subpopulation and Status Quo elsewhere; see text. Population trajectory for the metapopulation. Diamonds indicate maximum and minimum (400 simulations, total). Horizontal line indicates mean trajectory. Vertical lines connect mean \pm 1 standard deviation of outcome.

Trajectory summary

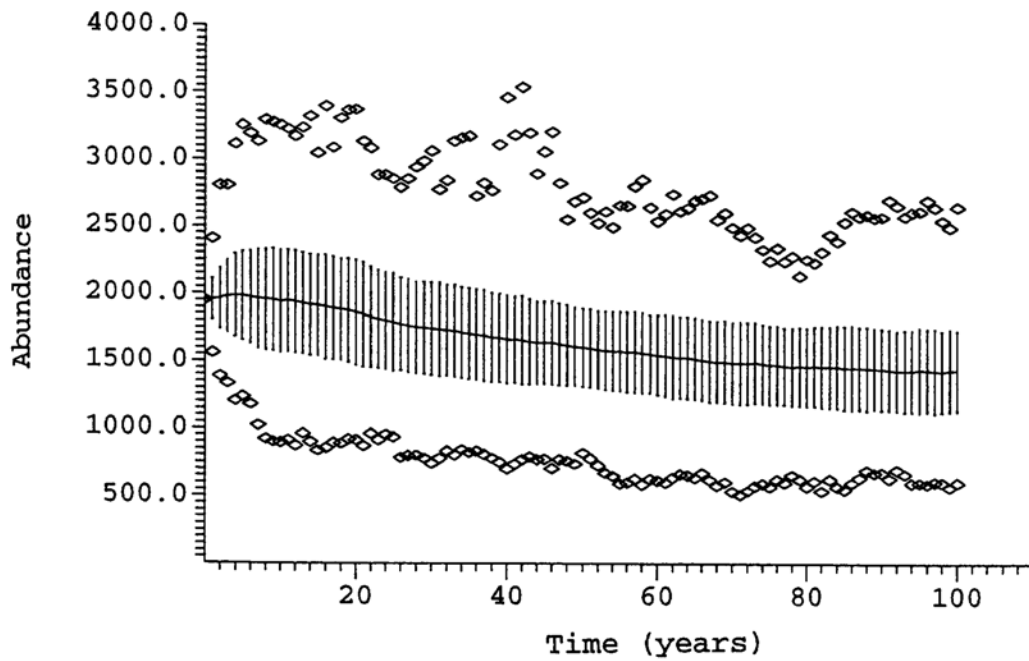


Figure D-7. Scenario 16: Improve reproductive success in San Francisco Bay and Northern California Coast subpopulations, Status Quo elsewhere; see text. Population trajectory for the metapopulation. Diamonds indicate maximum and minimum (400 simulations, total). Horizontal line indicates mean trajectory. Vertical lines connect mean +/- 1 standard deviation of outcome.

Population structure

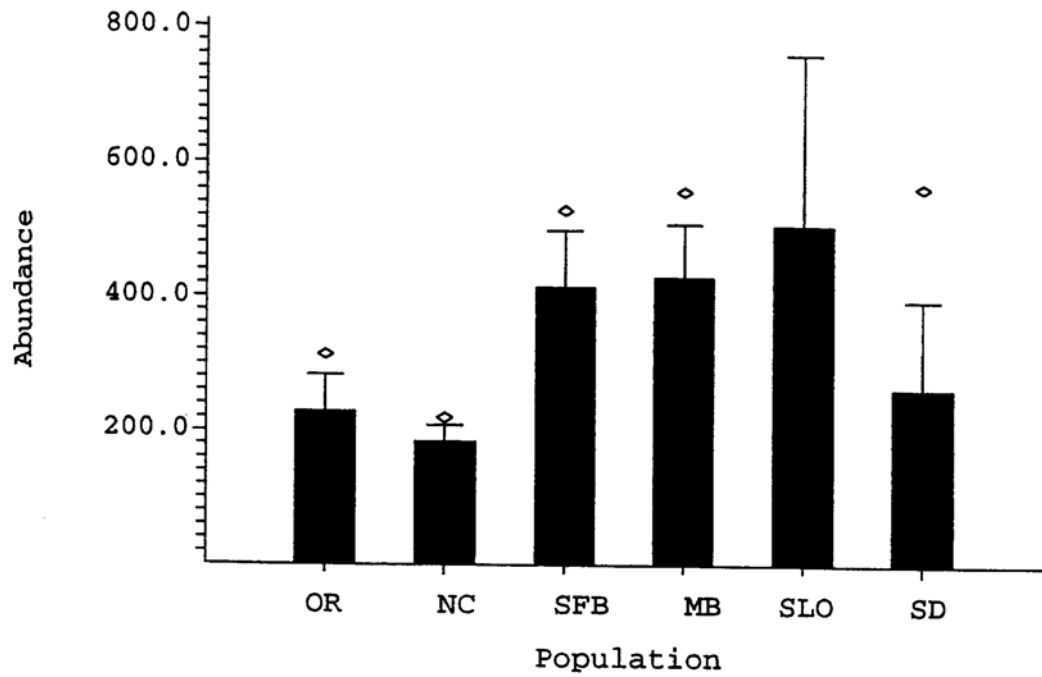


Figure D-8. Scenario 17: Management at all areas (see text). Abundance for each subpopulation at the end of 100 years. Bars indicate means; vertical lines with bars indicate + 1 standard deviation. Diamonds show maximum (among 400 simulations).

Trajectory summary

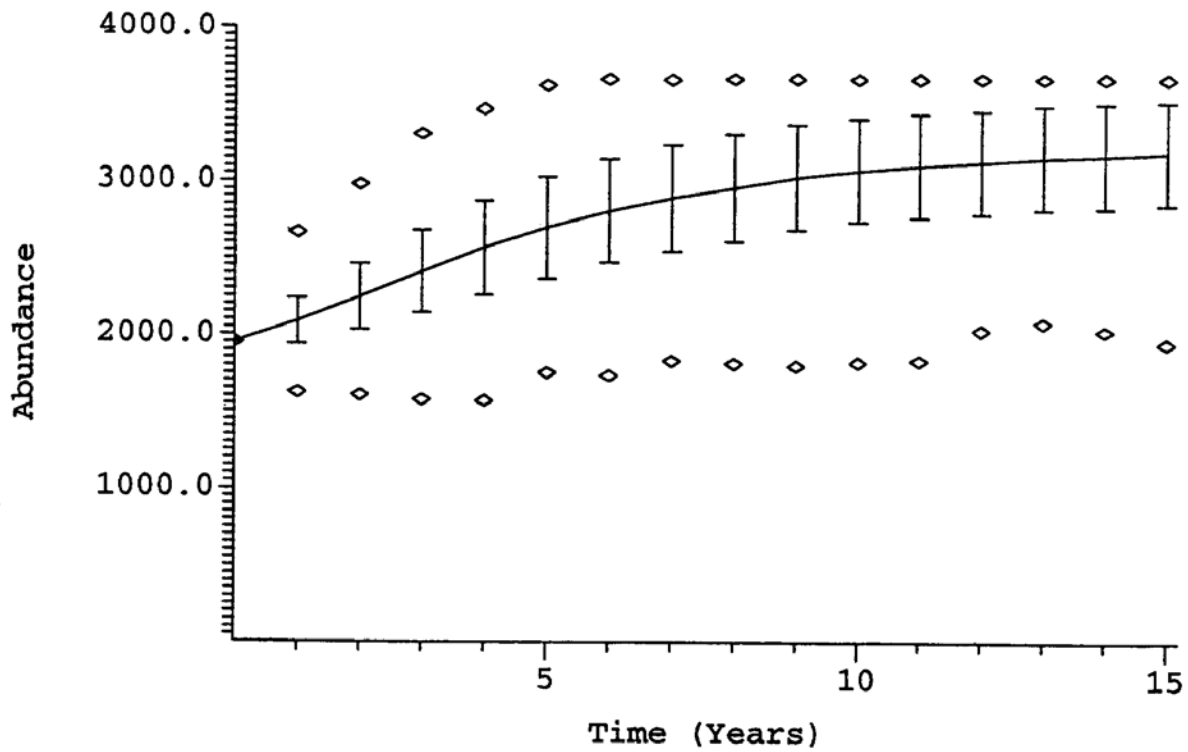


Figure D-9. Scenario 18: Recovery of western snowy plovers assuming 1.3 chicks fledged per male in all subpopulations. Population trajectory for the metapopulation is shown for first 15 years of the scenario. Diamonds indicate maximum and minimum (400 simulations, total). Horizontal line indicates mean trajectory. Vertical lines connect mean \pm 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 its 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 (<i>Layia carnosa</i>)	Endangered/Endangered (CA)
Coastal dunes milk vetch (<i>Astragalus tener</i> var. <i>titi</i>)	Endangered/Endangered (CA)
Hoffman's slender-flowered gilia (<i>Gilia tenuiflora</i> var. <i>hoffmanii</i>)	Endangered
Howell's spineflower (<i>Chorizanthe howellii</i>)	Endangered/Threatened (CA)
Island malacothrix (<i>Malacothrix squalida</i>)	Endangered
Menzies' wallflower (<i>Erysimum menziesii</i>)	Endangered/Endangered (CA)
Monterey gilia (<i>Gilia tenuiflora</i> ssp. <i>arenaria</i>)	Endangered/Threatened (CA)
Monterey spineflower (<i>Chorizanthe pungens</i> var. <i>pungens</i>)	Threatened
Soft-leaved Indian paintbrush (<i>Castilleja mollis</i>)	Endangered
Sonoma spineflower (<i>Chorizanthe valida</i>)	Endangered/Endangered (CA)
Tidestrom's lupine (<i>Lupinus tidestromii</i>)	Endangered/Endangered (CA)
Federally-listed animals	
El Segundo blue butterfly (<i>Euphilotes battoides allyni</i>)	Endangered

Taxon (Scientific Name)	Federal Status/State Status
Morro shoulderband snail (<i>Helminthoglypta walkeriana</i>)	Endangered
Myrtle's silverspot butterfly (<i>Speyeria zerene myrtleae</i>)	Endangered
Smith's blue butterfly (<i>Euphilotes enoptes smithi</i>)	Endangered
California brown pelican (<i>Pelecanus occidentalis californicus</i>)	Endangered/Endangered (CA)
California least tern (<i>Sterna antillarum browni</i>)	Endangered/Endangered (CA)
Pacific pocket mouse (<i>Perognathus longimembris pacificus</i>)	Endangered
Tidewater goby (<i>Eucyclogobius newberryi</i>)	Endangered
Coho salmon (<i>Oncorhynchus kisutch</i>)	Varies by geographic area
Steelhead trout (<i>Oncorhynchus mykiss</i>)	Varies by geographic area
Federally-proposed plants	
La Graciosa thistle (<i>Cirsium loncholepis</i>)	Proposed Endangered/Threatened (CA)
Nipomo mesa lupine (<i>Lupinus nipomensis</i>)	Proposed Endangered/Endangered (CA)
Federal Candidate Animals	
Streaked horned lark (<i>Eremophila alpestris strigata</i>)	Candidate
Animals delisted or proposed for delisting	

Taxon (Scientific Name)	Federal Status/State Status
American bald eagle (<i>Haliaeetus leucocephalus</i>)	Endangered (1978); Threatened (1995); Delisted (2007)/ Threatened (WA); Endangered (CA)
American peregrine falcon (<i>Falco peregrinis anatum</i>)	Delisted (1999)/Endangered (WA, CA)
Plant species of concern	
Northcoast phacelia (<i>Phacelia insularis</i> var. <i>continentis</i>)	Species of concern
Beach spectacle pod (<i>Dithyrea maritima</i>)	Species of concern/Threatened (CA)
Pink sand-verbena (<i>Abronia umbellata</i> ssp. <i>breviflora</i>)	Species of concern/Endangered (OR)
San Francisco spineflower (<i>Chorizanthe cuspidata</i> var. <i>cuspidata</i>)	Species of concern
Surf thistle (<i>Cirsium rhotophilum</i>)	Species of concern/Threatened (CA)
Animal species of concern	
Barrier beach tiger beetle (<i>Cicindela latesignata latesignata</i>)	Species of concern
Belkin's dune fly (<i>Brennania belkini</i>)	Species of concern
Gabb's tiger beetle (<i>Cicindela gabbi</i>)	Species of concern
Globose dune beetle (<i>Coelus globosus</i>)	Species of concern
Little bear scarab beetle (<i>Lichnanthe ursina</i>)	Species of concern

Taxon (Scientific Name)	Federal Status/State Status
Mimic tryonia snail (<i>Tyronia imitator</i>)	Species of concern
Morro blue butterfly (<i>Icaricia icarioides morroensis</i>)	Species of concern
Mudflat tiger beetle (<i>Cicindela trifasciata sigmoidea</i>)	Species of concern
Oblivious tiger beetle (<i>Cicindela latesignata obliviosa</i>)	Species of concern
Oso Flaco flightless moth (<i>Areniscythis brachypteris</i>)	Species of concern
Oso Flaco patch butterfly (<i>Chlosyne leanira</i>)	Species of concern
Oso Flaco robber fly (<i>Ablautus schlingeri</i>)	Species of concern
Point Conception Jerusalem cricket (<i>Ammopelmatus muwu</i>)	Species of concern
Point Reyes blue butterfly (<i>Icaricia icarioides</i> ssp.)	Species of concern
Rude's longhorn beetle (<i>Necydalis rudei</i>)	Species of concern
Salt marsh skipper (<i>Panoquina erans</i>)	Species of concern
Sandy beach tiger beetle (<i>Cicindela hirticollis gravida</i>)	Species of concern
White sand bear scarab (<i>Lichnanthe albopilosa</i>)	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 1998a). In 1995, a small population was rediscovered on Vandenberg Air Force Base (D. Keil

pers. comm. 1995 in U.S. Fish and Wildlife Service 1998a). 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 1998b).

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 1999a). 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 Service 1998a). 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 1999a).

Menzies' wallflower (*Erysimum menziesii*) 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. *eurekaense*, 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. Subspecies *eurekaense* 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 *eurekaense* 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 *eurekaense*, 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 1998a). 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 1998a).

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 1998a). 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 1998a).

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 1998a).

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 1998a). At the Pocket Field location, the paintbrush is associated with non-native iceplant (*Carpobrotus* sp. and *Mesembryanthemum* sp.), native milkvetch (*Astragalus miguelsis*), 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 1998a).

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 1998a).

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 1998c). 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 senescence 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 1998a).

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 1998a). 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 1998a). 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 1994b).

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 1998c).

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 1999a). However, they also are found in dune habitats along the coast (Rogers 1999a), 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 1999b, 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 1999b).

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 rhotophilum*) 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 rhotophilum*. 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 1998a). 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 1998a). 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 pubescence is moderately dense and golden.

Distinguishing features are the barely, longitudinally impressed, and shining pronotal disk, dilated antennal segments, and shining, coarsely punctate elytra¹ (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 Hesperariidae. 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 1982a). 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 1982b). 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 1982b). Habitats of this subspecies include mudflats and sandy areas in coastal estuaries. It has been found at the Tijuana Estuary National Wildlife Refuge (Nagano 1982a), the Border Field State Park in San Diego County (Nagano 1982b), 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 1982b).

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 1982b).

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 1982b); 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 1982b).

White sand bear scarab beetle. 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 setae¹ along the elytra² and dorsum³ (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 not 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 enclosure 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 enclosure;
9. refill the trenches, insuring that the wire lies flush with the sand surface, allowing plovers to move freely through the enclosure;
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 enclosure set-up, ready enough wood strapping (2.5 x 5 centimeters) (1 x 2 inches) to be attached to two sides of the enclosure;
2. on the wood strapping, place small hooks, used to hold the twine, at 15 centimeter (6 inch) intervals;
3. after completion of enclosure perimeter, attach wood strapping (2.5 centimeters x 5 centimeters) (1 x 2 inches) along 2 sides of the enclosure with bailing wire;

4. attach twine to hooks creating parallel rows as you move along the enclosure, ensuring the twine is taut;
5. if twine loosens, tighten it by wrapping it around the hooks.

B. The Circular Exclosure

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 roll 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 enclosure;
7. place the two fence posts inside the enclosure 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 enclosure 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 enclosure, 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 Enclosure Set-up

Enclosures 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.

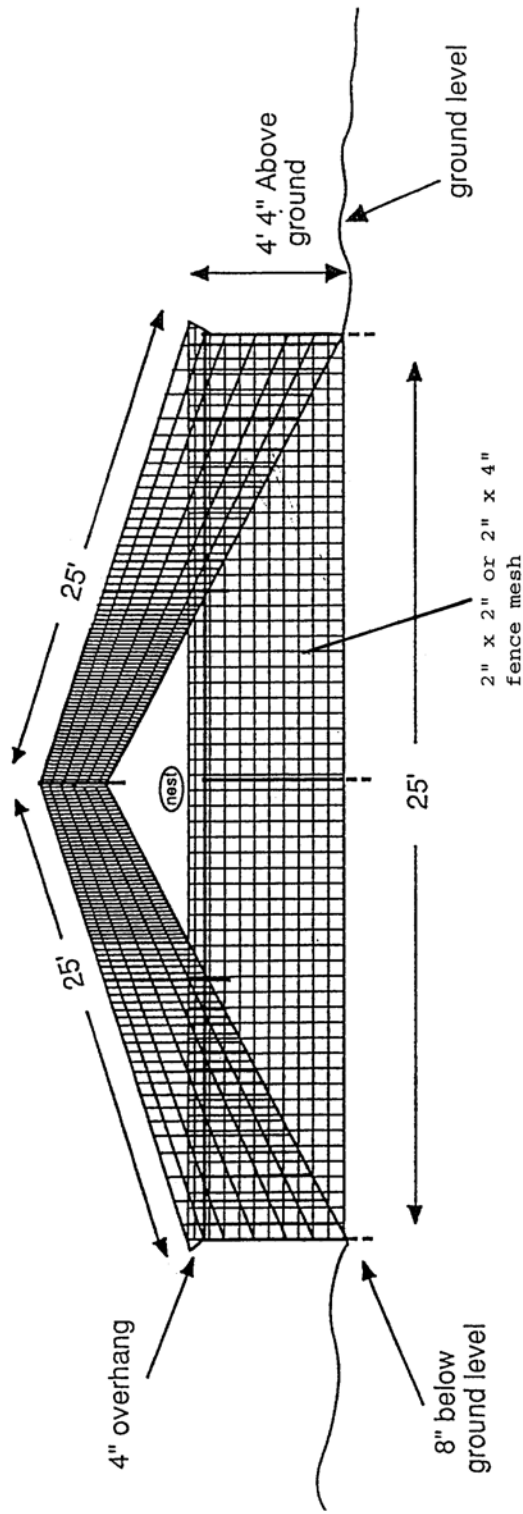
IV. Monitoring Exclosures

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.

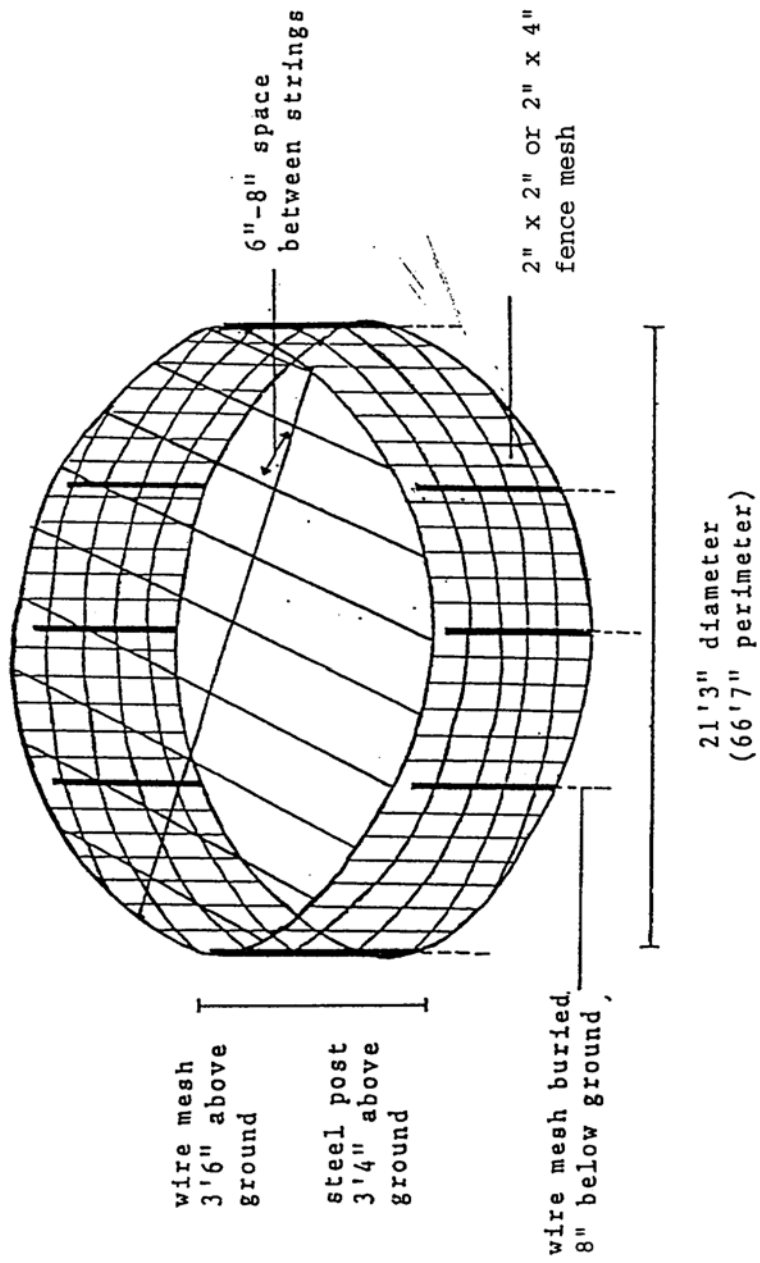
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SOURCE: M. PARKER, SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE

Figure F-1. Triangular Exclosure Design



SOURCE: M. STERN, THE NATURE CONSERVANCY

Figure F-2. Circular Enclosure 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 (1 st)	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 organization 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, environmentally-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 neighborhoods.	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. Environmentally 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	<p>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.</p>	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., implementation 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	<p>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).</p> <p>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).</p>	<p>U.S. Forest Service and U.S. Bureau of Land Management</p> <p>National Fish and Wildlife Foundation</p>
Partners for Fish and Wildlife	<p>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.</p>	U.S. Fish and Wildlife Service
Wetlands Reserve Program	<p>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.</p>	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

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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

(760) 431-9440

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

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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In particular we would like to thank Kathleen Castelein and David Lauten from the Oregon Natural Heritage Information Center, Mark Stern from The Nature Conservancy, Ron LeValley from Mad River Biologists, and Gary Page from Point Reyes Bird Observatory for sharing their expert knowledge of Snowy Plover breeding biology and monitoring in Oregon and California.

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 by 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 device (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 always 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 bird's band combination; this is an important accuracy check. This may be done by 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 device (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

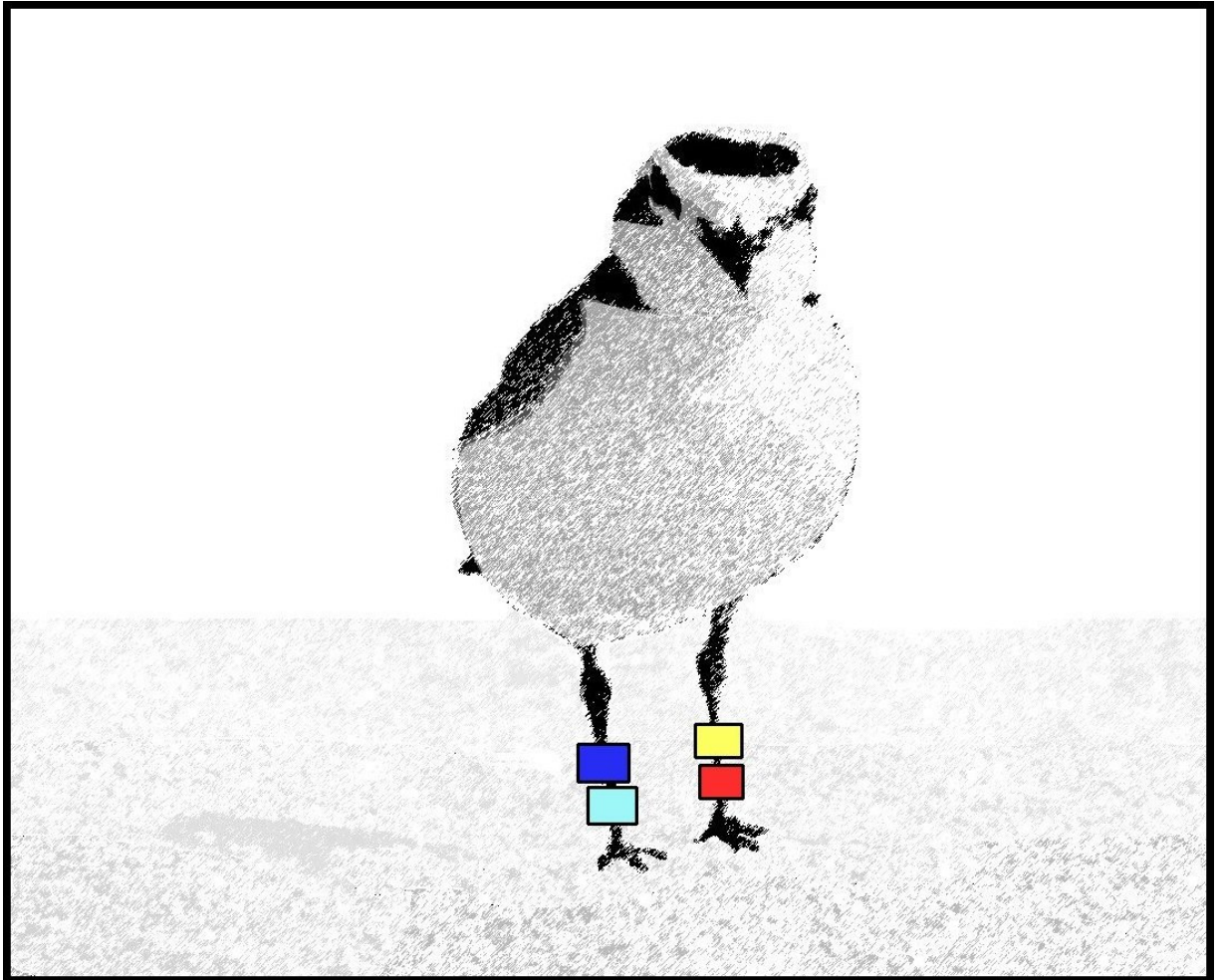


Figure J-1. Example of banded Snowy Plover. In this picture the bird has a yellow band (Y) above a red band (R) on its left leg and a blue band (B) above an aqua band (A) on its right leg. This combination should be recorded as YR:BA.

APPENDIX K

**INFORMATION AND EDUCATION
PLAN**

for the

**WESTERN SNOWY PLOVER
PACIFIC COAST POPULATION**

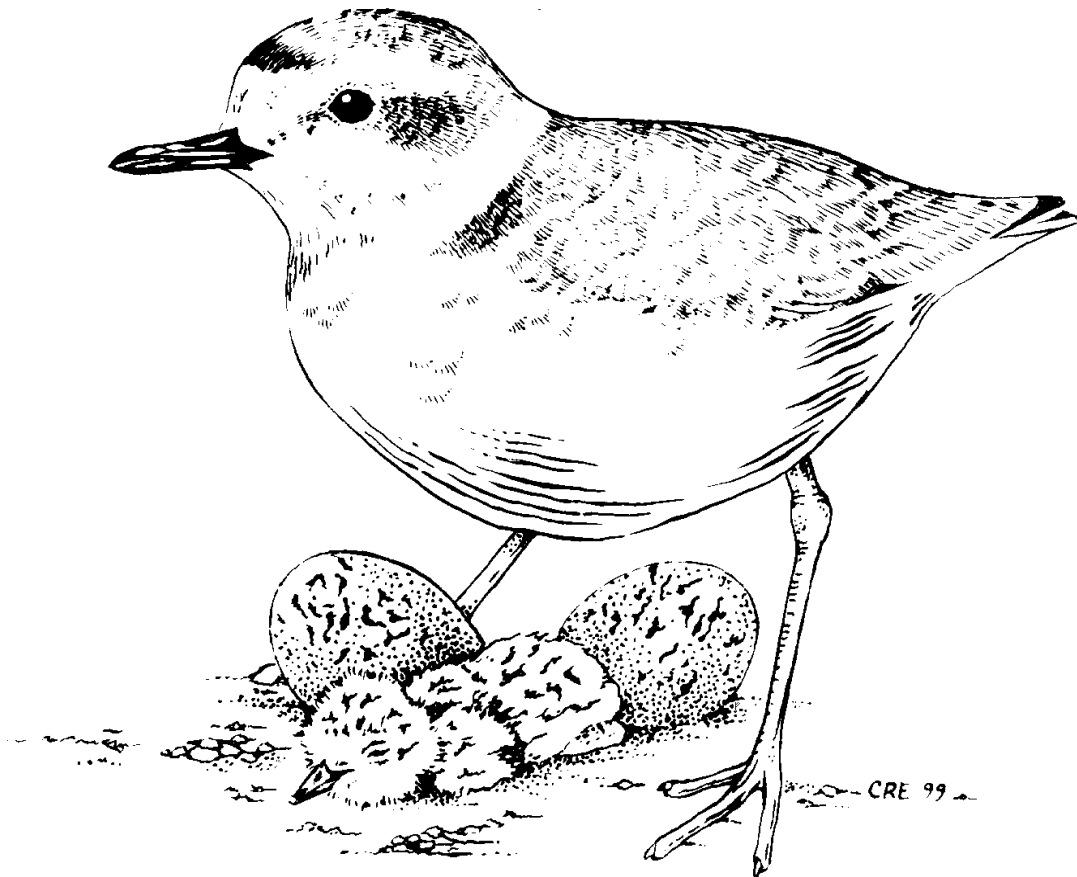


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INTRODUCTION

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 fill in the blank... (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

Surf/dive retailers

Outdoor and fish bait retailers

Horse riding/rental establishments

Campgrounds

Local mailings to target groups

User group associations

Visitor centers

Offices that issue fishing and camping permits

Wind/Water surfing retailers

Kite retailers

Pet shops

OHV rental and retailers

Veterinary clinics

Local motels

Tourist bureaus

Local restaurants

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 if 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 and 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
<p>4. Customized Materials for Key Target Audiences</p>		<p>Fact Sheets (per 3,000) <i>Development and printing</i> \$200-\$500 <i>Distribution</i> \$300-\$960</p> <p>Tricolor Brochures (per 3,000) <i>Development and Printing</i> \$1,750-\$2,800 <i>Distribution</i> \$300-\$960</p> <p>Slide Shows <i>Development and Production</i> \$300-\$1,500 <i>Reproduction of six copies</i> \$300-\$900</p> <p>Signs \$1000 - \$5,000</p> <p>15 Minute Video <i>Development and Production</i> \$15,000-\$60,000 <i>Reproduction of 200 copies</i> \$600-\$1,000 <i>Distribution of 200 copies</i> \$250-\$500</p> <p>Radio Message Production \$1,000-\$3,000</p> <p>Radio Message Distribution \$800-\$2,000</p> <p>Web Page \$1,500-\$15,000</p> <p>Bi-Annual Regional Newsletters <i>Development and Distribution</i> \$2,850- \$3,500</p>

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
<p>9. Continue or Expand Current Efforts To Distribute Customized Materials to Key Target Audiences</p>		<p>\$1,500-\$12,000</p>
<p>10. Standardized Public Outreach Process During Recovery Plan Release, Agency Planning, and Major Section 7 Consultation</p>		<p>Project Specific Mailing List <i>Clerical costs</i> \$300 Press Releases <i>Development and distribution of 3 press releases</i> \$2,250 Fact Sheets with Maps (per 3,000) <i>Development and printing</i> \$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</p>

INFORMATION AND EDUCATION PLAN COSTS

C. Nesting Season Activities

ACTION	DESCRIPTION	COST ESTIMATES
11. Media Exposure Effort		Press Releases <i>Development and Distribution per Release</i> \$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

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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 it 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 to 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.

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(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.
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STREET ADDRESS	CITY/STATE/ZIP CODE
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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			
<input type="checkbox"/> I am 18 years of age or older.		<input type="checkbox"/> I am under 18 years of age (Attach a signed Parental/Guardian Permission Form)	
CHECK ONE			
<input type="checkbox"/> I know of no health limitations which may restrict my performance of assigned duties.		<input type="checkbox"/> I DO know of health limitations which may restrict my performance of assigned duties.	
The following information is to be provided <i>only</i> 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>I hereby volunteer my services as a Volunteer for the job duties attached.</i>	
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
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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, 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 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, agent,
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.

K-59

SIGNATURE	PRINTED NAME	ADDRESS (optional)	TELEPHONE NO. (optional)

PERSONS UNDER 18 YEARS OF AGE MAY NOT SIGN THIS FORM (Use reverse if needed)

Volunteer Hours Record

Date Completed _____
Reassign Volunteer <input type="checkbox"/>

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				
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.