



NESTING OF THE SNOWY PLOVER IN THE MONTEREY BAY AREA, CALIFORNIA IN 2011



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SYNOPSIS

Researchers and associates of PRBO Conservation Science (PRBO), the U.S. Fish and Wildlife Service (USFWS), and the California Department of Parks and Recreation (CDPR) monitored nesting Snowy Plovers on Monterey Bay in Monterey and Santa Cruz counties and on pocket beaches in northern Santa Cruz County in 2011. The objective was to assess the plover's response to management efforts by the government agencies to enhance the species' breeding success and increase its population size. Management actions undertaken by federal, state and county agencies continued to include the following measures alone or in combination:

- Closure of upper beach nesting habitat at Salinas River National Wildlife Refuge by USFWS.
- Signed and roped-off (symbolically-fenced) upper beach areas or individual nests by CDPR (Table 1).
- Nest exclosures to protect nests from predators as needed (Table 1).
- Predator removal by the Wildlife Services Division of the U.S. Department of Agriculture (USDA).
- Water management to provide nesting and feeding habitat in the former salt ponds in the Moss Landing Wildlife Management Area by PRBO with permission from the California Department of Fish and Game (DFG).

In 2011, breeding plovers reached near record numbers in the Monterey Bay area. Our estimate of 431 breeders is the second highest number recorded in the study area to date. It exceeded the USFWS recovery plan target of 338 breeders for our study area from Waddell Creek to Carmel River mouth and the 400-bird target for all of Recovery Unit 4. Even so, no plovers were detected nesting on the northern Santa Cruz County pocket beaches for the second (consecutive) year since the commencement of our studies there in 1988.

An above average return rate of breeding adults from 2010 and high recruitment rates of 2010 juveniles into the 2011 breeding population contributed to the increased number of breeders in 2011. The 71.9% male and 69.8% female return rates of banded plovers in 2011 exceeded the prior 12-year averages by 7% and 12%, respectively. Forty percent of the 268 color banded juveniles produced in 2010 recruited into this years' breeding population.

The success of the plover in maintaining its population into 2012 will be very much the result of its breeding success in the South Bay in 2011. There, 2011 nest hatching success exceeded the 14-year Bay-wide-average in 9 of 10 areas and fledging success in 5 of 10 areas. Seventy-three percent of 232 juveniles fledged in 2011 were from South Bay areas. In contrast, North Bay beaches produced only 10% of the fledged juveniles. In the North Bay areas of Moss Landing, Zmudowski Beach and Pajaro Spit clutch hatching success was extremely low, probably largely as result of high levels of egg depredation by one male Northern Harrier. Only 1 of 29 clutches hatched at Zmudowski State Beach. Fledging success was also below average in 3 of 4 North Bay areas.

The Salt Ponds contributed only 17% of the fledged juveniles in 2011. While the 72% clutch hatching rate exceeded the 14-year Bay-wide average, the 22-23% chick fledging rate was 45% below its 41.5% 14-year salt-pond average. We suspect multiple species of avian predators were responsible for the low fledging rate at the Salt Ponds.

Overall, however the plover had a successful breeding season. Although the 1.01 juveniles fledged per male was well below the study area average of 1.5, it was still sufficient to meet the USFWS recommended target of 1.0 fledged young per male for population stability.

INTRODUCTION

Staff and research associates of PRBO Conservation Science with assistance of staff and/or interns of the U.S. Fish and Wildlife Service and the California Department of Parks and Recreation have monitored nesting Snowy Plovers annually on the shores of Monterey Bay since 1984, and on small pocket beaches in northern Santa Cruz County since 1988, to assess the number of breeding plovers, number of nests, clutch hatching rate, chick fledging rate, and causes of egg and chick loss. Here we summarize the results of the 2011 monitoring effort.

STUDY AREA

The study area includes the beaches of Monterey Bay, former salt ponds in Elkhorn Slough (hereafter Salt Ponds), and pocket beaches in northern Santa Cruz County. For reporting purposes we divide up the study area as follows:

Monterey Bay Area

South Beach Subregion

Del Monte: Beach between the City of Monterey and Tioga Road, Sand City. Most of it is adjacent to Sand City. The beach is managed by CDPR.

Sand City: Beach between Tioga Road, Sand City and the south boundary of Fort Ord.

South Fort Ord: Beach between the south boundary of Fort Ord and site of former Stilwell Hall. It is managed by CDPR.

North Fort Ord: Beach between Stilwell Hall site and the Lake Court beach access to Marina State Beach. It is managed by CDPR.

Reservation Road: From the Lake Court beach access for Marina State Beach to Reservation Road. It is managed by CDPR.

Marina: The entire beach from Reservation Road to the Salinas River National Wildlife Refuge. It is managed by CDPR and the Monterey Peninsula Regional Park District. It is subdivided into four segments, all of which are completely or partly bordered by private property (Table 1).

Salinas River National Wildlife Refuge: The entire beach on the Salinas River National Wildlife Refuge (NWR), which is owned and managed by USFWS.

Salinas River North: The entire beach from the Salinas River NWR (or north of the Salinas River mouth) to the mouth of Elkhorn Slough. It is owned and managed by CDPR. It is further divided into three

segments – the north spit of the Salinas River, Monterey Dunes, and Molera/Potrero road segments (Table 1). The Monterey Dunes segment is backed by a beach front housing development. The northernmost section of the Molera/Potrero segment is backed by commercial development.

North Beach Subregion

Jetty Road to Beach Road: All the beach between Jetty Road (mouth of Elkhorn Slough) and Beach Road. It is divided into 3 segments all managed by CDPR (Table 1). The north end of the Pajaro spit is bounded by a beach front development.

Sunset/Manresa: The entire beach from Beach Road to the north boundary of Manresa State Beach. The south end of this subregion is backed by a beach front development. The beach is managed by CDPR.

Salt Pond Region

It includes approximately half of the former salt ponds in Elkhorn Slough that have been converted to managed, diked wetlands and are now encompassed within the California Department of Fish and Game's (DFG) Moss Landing Wildlife Management Area.

Northern Santa Cruz County Pocket Beach Region

We covered the four beaches known to support nesting Snowy Plovers in northern Santa Cruz County. **Wilder Creek Beach** and **Laguna Creek Beach** are owned and managed by CDPR. **Scott Creek Beach** is owned and managed by the County of Santa Cruz and **Waddell Creek Beach** is owned by the CDPR and by a private party.

MONITORING

We attempt to find all plover nests initiated in the study area. Unique color band combinations are used to individually mark plover adults and chicks. For color banding, adults are usually trapped on the nest. Chicks are captured in or near the nest at the time of hatching. Clutch hatching dates are estimated from egg laying dates, when known, or from egg flotation. They are further refined by examination of eggs for cracked shells, tapping chicks, or peeping chicks just before the estimated hatching date. Chicks are considered fledged if they survive 28 or more days after hatching. Monitors look for fledglings when they have reached 28 days of age by watching banded males known to have broods and by monitoring flocks of roosting plovers during the latter part of the nesting season. Fledging success for specific sites is always categorized by nest location, even in cases where broods move to adjacent areas before fledging. In 2011, we recorded the longitude and latitude of all nests with Global Positioning Units. These locations are depicted in Appendices 1-11. Monitoring is conducted under U. S. Fish and Wildlife Service Permit PRT 807078-13.

MANAGEMENT

Management agencies use a variety of techniques to improve the breeding success of the Snowy Plover in the study area. The upper beach at Salinas River NWR has been closed to the public since 1994 to protect nesting plovers. On California State Beaches symbolic fencing, consisting of signed, roped-off upper beach areas, is used to limit human disturbance to nesting and brood rearing areas and, in some cases individual

nests (Table 1). In 2011, there were symbolically fenced areas in the Fort Ord, Reservation Road, Marina and North Salinas River subregions (Table 1). Symbolic fencing was also used at Moss Landing, on the south side of the Pajaro River at Zmudowski State Beach, at the north spit of the Pajaro River, and at Sunset State Beach (Table 1).

While 10 foot by 10 foot single nest exclosures, made of 2-inch-wide by 4-inch-tall wire mesh fencing, standing 5-feet-high and 10 feet-long on each side have been used extensively in the past to protect nests from predators, their widespread use in the Monterey Bay area has been limited in recent years because of the effectiveness of a mammalian predator removal program conducted by USDA. No exclosures of this type were used in 2011 (Table 1). However, 15 circular mini exclosure 24-36 inches in diameter and 24 inches high were used at Pajaro Dunes (Table 1) after the area had experienced a large number of nest losses. We also sometimes use gull exclosures – a symbolic fenced exclosure with a few lengths of cord stretched over the top that surrounds individual nests. Four gull-specific exclosures were used at the Pajaro spit in 2011 (Table 1).

Table 1. Measures used to protect Snowy Plover nests in the Monterey Bay area.

Location	Total Nests	10 X 10 Excl. Only	Min Excl. Only	Symb. Fence Only	Fence & Mini Excl.	Fence & 10 X 10 Excl.	Fence & Gull Excl.	Sign Only
Del Monte	0							
Sand City	0							
Fort Ord	21			21				
Reservation Road	13			13				
Marina								
<i>Marina South</i>	7			7				
<i>Marina Middle</i>	18			16				
<i>Marina North</i>	9			7				
<i>Martin</i>	9			9				
Salinas River NWR	40			40				
Salinas River North								
<i>Salinas River N. Spit</i>	18			18				
<i>Monterey Dunes</i>	24			24				
<i>Molera/Potrero</i>	33			33				
Jetty to Beach Roads								
<i>Moss Landing</i>	38			38				
<i>Zmudowski Beach</i>	29			29				
<i>N. Pajaro R.M.</i>	87			68	15		4	
Sunset/Manresa	9			9				
Salt Ponds	88			88				
Total	443	0	0	420	15	0	4	0

We continued to manage water levels at the Salt Ponds to create dry nesting substrate and associated wet foraging areas for Snowy Plovers. Water is drawn down rapidly from some ponds at the beginning of the season to provide dry nest sites. Thereafter, flooding of remnant-wet areas is undertaken several times per month throughout the nesting season to maintain foraging habitat for adults and chicks.

RESULTS

The 2011 Nesting Season

Number of Breeders

A large number of plovers bred in the Monterey Bay area in 2011. We estimated 431 plovers nested; this represented a 12% increase over the previous year and only one bird fewer than the highest total recorded for the area -- 432 birds in 2004 (Fig. 1). The 2011 breeders consisted of 229 males and 202 females. All except 15 unbanded males and 17 unbanded females were uniquely color banded. Among the color marked breeders were 59 males and 49 females that fledged in the Monterey Bay area in 2010 and recruited into the population in 2011. No plovers were detected nesting on the northern Santa Cruz County pocket beaches in 2011 (Table 2). The 431 breeding adults for our study area, from Waddell Creek to Carmel River mouth, greatly exceeded the USFWS recovery plan target of 338 breeders for the area.

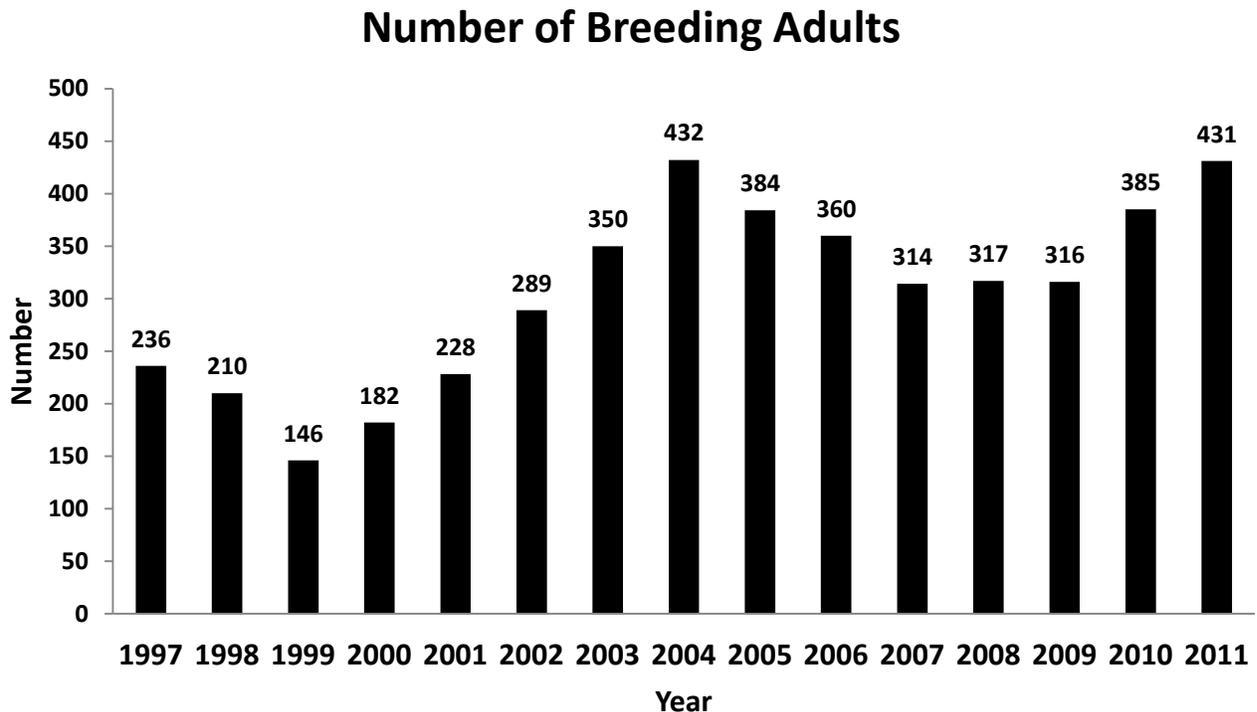


Figure 1. Number of nesting Snowy Plovers in the Monterey Bay area.

Return Rates

Return rates of both sexes were above average in 2011. Overall, 71.9% of the banded males and 69.8% of the banded females that we documented nesting in 2010 were found breeding in the study area in 2011 (Fig. 2). The 2011 return rates exceeded the prior 12-year-average of 67.2 % for males and 62.5% for females by 7% and 12%, respectively. As is in most years, male return rates exceeded female rates (Fig 2).

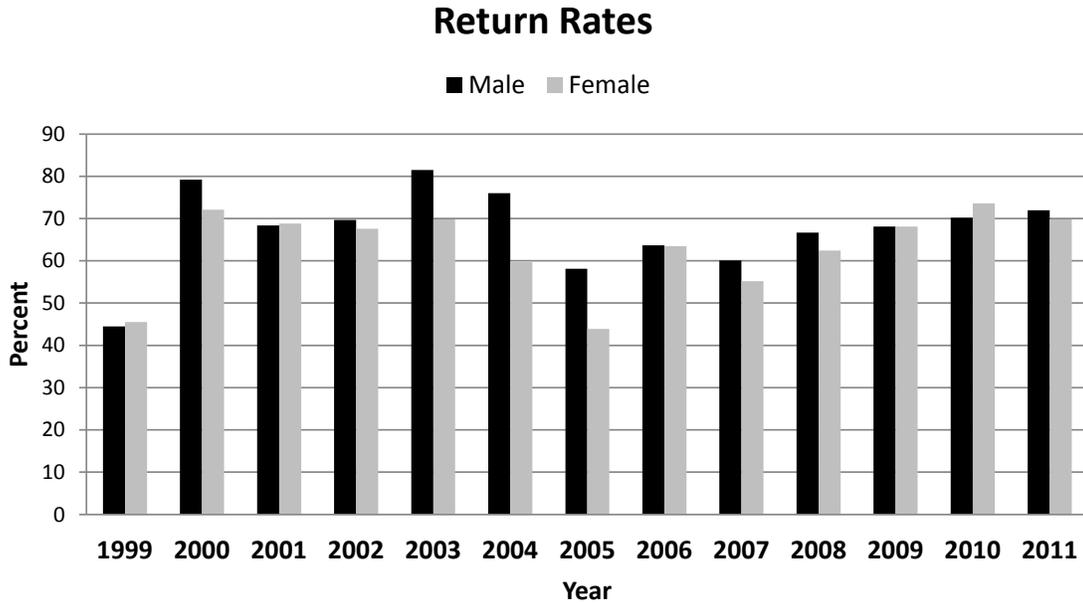


Figure 2. Return Rates of Nesting Snowy Plovers at Monterey Bay.

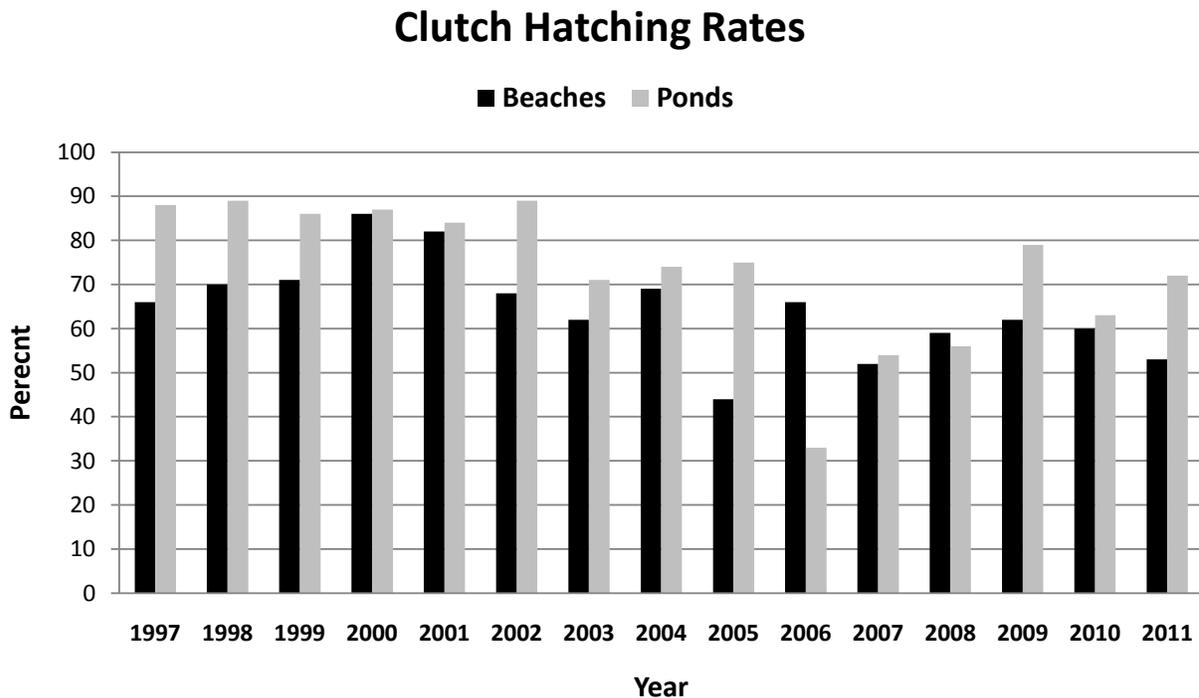


Figure 3. Clutch hatching rates of Snowy Plovers at Monterey Bay.

Table 2. Breeding success of Snowy Plovers in the Monterey Bay area in 2011. Juv. is Juvenile and Att. is Attempt.

Regions	Nest Attempts		Chicks		Juv.	% Nests	% Chicks Fledge		Juv. Per
	Nests	Broods	Low	High		Hatch	High	Low	Nest Att.
Del Monte-Reserv. Rd.									
<i>Del Monte</i>	0	0	0	0	0	0.0	0.0	0.0	0.00
<i>Sand City</i>	0	0	0	0	0	0.0	0.0	0.0	0.00
<i>Fort Ord</i>	21	0	49	49	16	90.5	32.7	32.7	0.76
<i>Reservation Road</i>	13	0	38	38	7	100.0	18.4	18.4	0.54
Marina									
<i>Marina South</i>	7	0	12	12	5	71.4	41.7	41.7	0.71
<i>Marina Middle</i>	18	2	46	50	15	88.9	32.6	30.0	0.75
<i>Marina North</i>	9	0	21	21	14	77.8	66.7	66.7	1.56
<i>Martin</i>	9	0	16	20	9	100.0	56.3	45.0	1.00
Salinas NWR	40	9	102	122	55	85.0	53.9	45.1	1.12
Salinas River N									
<i>N. Salinas River</i>	18	0	46	47	20	94.4	43.5	42.6	1.11
<i>Monterey Dunes</i>	24	1	54	55	15	83.3	27.8	27.3	0.60
<i>Molera/Potrero</i>	33	3	34	40	13	45.5	38.2	32.5	0.36
Jetty-Beach Rds.									
<i>Moss Landing</i>	38	0	21	21	4	23.7	19.0	19.0	0.11
<i>Zmudowski Beach</i>	29	0	3	3	0	3.4	0.0	0.0	0.00
<i>Pajaro Spit</i>	87	0	48	48	11	21.8	22.9	22.9	0.13
Sunset/Manresa	9	2	12	13	9	33.3	75.0	69.2	0.82
TOTAL BEACHES	355	17	502	539	193	52.7	38.4	35.8	0.52
SALT PONDS	88	2	170	174	39	71.6	22.9	22.4	0.43
<i>Wilder Creek</i>	0	0	0	0	0	0.0	0.0	0.0	0.00
<i>Laguna Creek</i>	0	0	0	0	0	0.0	0.0	0.0	0.00
<i>Scott Creek</i>	0	0	0	0	0	0.0	0.0	0.0	0.00
<i>Waddell Creek</i>	0	0	0	0	0	0.0	0.0	0.0	0.00
TOTAL S. CRUZ	0	0	0	0	0	0.0	0.0	0.0	0.00
GRAND TOTAL	443	19	672	713	232	56.4	34.5	32.5	0.50

Clutch Hatching Rates

We found 443 nests and 19 broods from undetected nests indicating at least 462 nesting attempts in the Monterey Bay area in 2011 (Table 2). The clutch-hatching rate (percent of nests documented hatching at least one egg) was 52.7 % on Monterey Bay beaches and 71.6% in the Salt Ponds. These rates excluded all nesting attempts documented only from the detection of broods. The clutch hatching rate on the beaches of Monterey Bay was 19% lower than the 65.5% average of the previous 14 years (Fig. 3). Only 9 of 38 nests hatched at Moss Landing Beach, 1 of 29 nests at Zmudowski Beach and 19 of 87 at Pajaro Dunes. Plovers fared better in the Salt Ponds where the 2011 hatching rate was only 2% below the 14-year average of 73.4%.

In 2011, at least 57% of the 193 nest losses were attributed to predators (Table 3). Of the 109 predator losses, 13.8% were attributed to mammals, 58.7% to birds and 27.5% to unknown predators. While the usual predators (skunks, gulls, and ravens) were identified to have taken some nests, a male harrier was probably responsible for most of the unidentified avian losses in the Moss Landing to Pajaro River Spit areas, but only very rarely was a harrier observed taking a nest (1 instance) or were harrier tracks found at a depredated nest (2 instances). Many clutches were incomplete when they were depredated and showed signs of spilled egg yolk or egg white in the empty scrapes. We believe a Whimbrel was also responsible for 3 nest losses. As in recent years very few losses were attributed to canines (Table 4). Clutch desertion was responsible for 11% of the nest failures -- a lower rate than the 14% average from 1997-2011 (Table 3). Only one loss was attributed to humans in 2011 (Table 4). High tides, strong winds and rain together claimed at least 11% of the failed nests in 2011. This rate was lower the 15% average from 1997-2011. Two nests had non-viable eggs (Table 4).

Table 3. Total of Snowy Plover clutches lost and percent attributed different causes, 1997-2011. Unk. is unknown.

Year	Total Nest Losses	Mammal Predator	Avian Predator	Unknown Predator	Human	Wind Tide Rain	Desertion	Non-Viable	Unk. Cause	Lost at Hatch
1997	47	11	15	6	17	15	26	4	6	0
1998	43	2	23	7	9	28	12	9	9	0
1999	31	13	3	13	6	23	29	13	0	0
2000	27	0	19	26	0	15	30	11	0	0
2001	51	2	45	6	4	2	22	8	12	0
2002	87	13	39	2	3	17	17	1	7	0
2003	91	10	25	4	1	9	13	3	34	0
2004	129	6	23	12	8	20	11	2	19	0
2005	216	16	47	5	3	9	6	1	14	0
2006	123	33	12	25	0	10	9	2	9	0
2007	162	12	37	14	2	10	10	5	9	0
2008	138	11	37	20	1	17	1	4	7	2
2009	113	11	33	9	2	19	4	11	12	0
2010	153	8	18	22	3	20	9	3	16	1
2011	193	8	33	16	1	11	11	1	20	0
Mean	107	10	27	12	4	15	14	5	12	0

Table 4. Causes of Snowy Plover nest loss at Monterey Bay in 2011. Unk. is Unknown, and Pred. is Predator.

Locations	Avian Predator					Mammalian Predator			Unk.	Human	Tide	Wind	Non-	Desert.	Cause	Lost at	Total
	CORA	WHIM	Gull	NOHA	Unk.	Canine	Skunk	Unk.	Pred.				Viable		Unk.	Hatch	
Del Monte																	0
Sand City																	0
Fort Ord														1	1		2
Reservation Road																	0
Marina South														1	1		2
Marina Middle											1				1		2
Marina North										1				1			2
Martin																	0
Salinas NWR											1				5		6
N. Salinas River															1		1
Monterey Dunes								2						1	1		4
Molera/Potrero						2			3	1	5	1		2	4		18
Moss Landing	1		1		8	1			6		6	2		3	1		29
Zmudowski Beach	1		1		9		5		4		2	1	1	1	4		28
Pajaro River Spit	1	3	7	2	25		5		2		1			5	17		68
Sunset/Manresa					3						1				2		6
Salt Ponds	1				1				15				1	7			25
Wilder Creek																	0
Laguna Creek																	0
Scott Creek																	0
Waddell Creek																	0
Total	4	3	9	2	46	3	10	2	30	1	12	9	2	22	38	0	193

Chick Fledging Rates

Chick fledging rates were below average in 2011. The 36-38% of the chicks fledged on the beaches was about 9% below the 40.8% average from 1997-2010, and the 22-23% rate about 45% below the 41.5% average in the salt ponds (Table 2, Fig. 4). There was considerable variation among sub areas with samples of > 20 chicks; highest rates were at North Marina (67%) and Salinas River NWR (45-54%), and lowest rates at Reservation Road (18%) and Moss Landing (19%, Table 2).

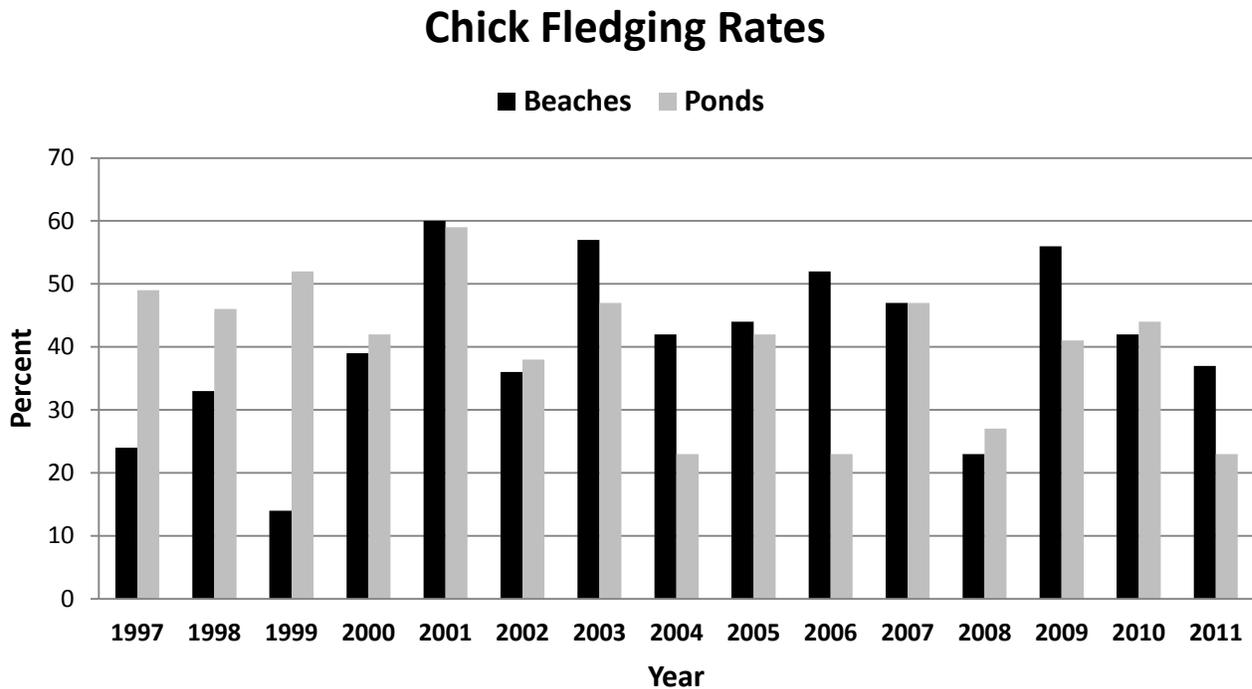


Figure 4. Percent chick fledging rates of Snowy Plovers in the Monterey Bay area.

Number of chicks fledged

The total of 232 chicks fledged in 2011 was 2% greater than the prior 14-year average of 228 fledglings. Twenty-five of the 232 fledged chicks were unbanded and 207 were banded. The majority of the fledglings (193) in 2011 were produced on the beaches; 39 were from the Salt Ponds. The number of fledglings from the beaches in 2011 exceeded the prior 14-year beach-average of 169 by 14% but the 39 fledglings from the salt ponds were 28% fewer than the 14-year salt pond average of 54 birds. The South Bay accounted for 88% of the 193 fledglings from the beaches.

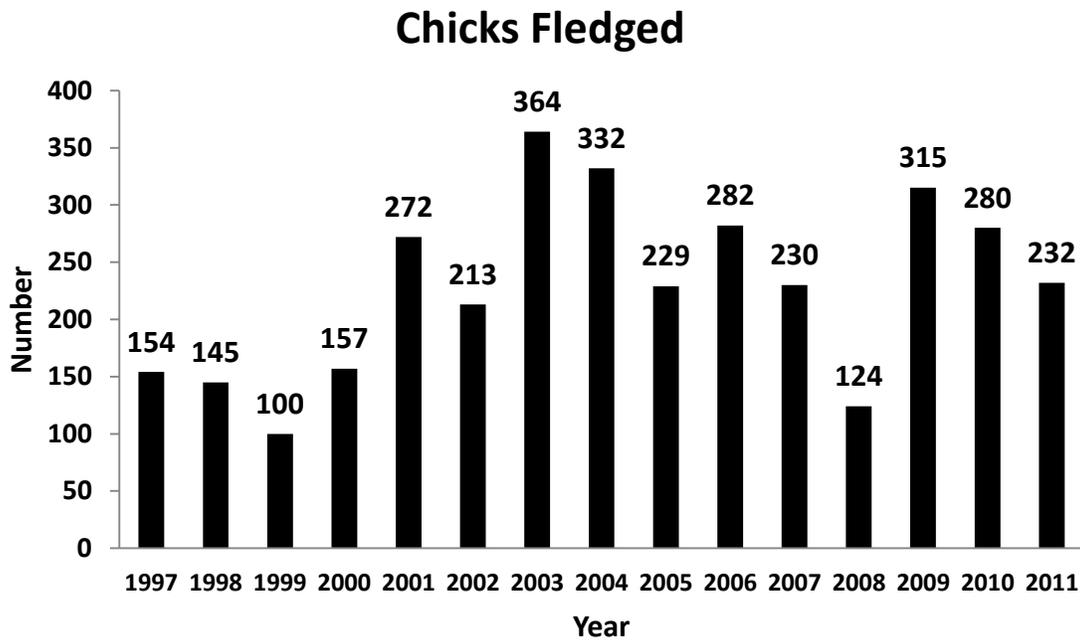


Figure 5. Number of chicks fledged at Monterey Bay.

Young Fledged Per Male

The 2011 fledging rate of 1.01 young per male was 31% lower than the 1.46 average of the past 14 years (Fig. 6). However, the fledging rate in 2011 was at the level suggested for population stability since one young per male is projected to be sufficient to prevent the population from declining (USFWS Recovery Plan).

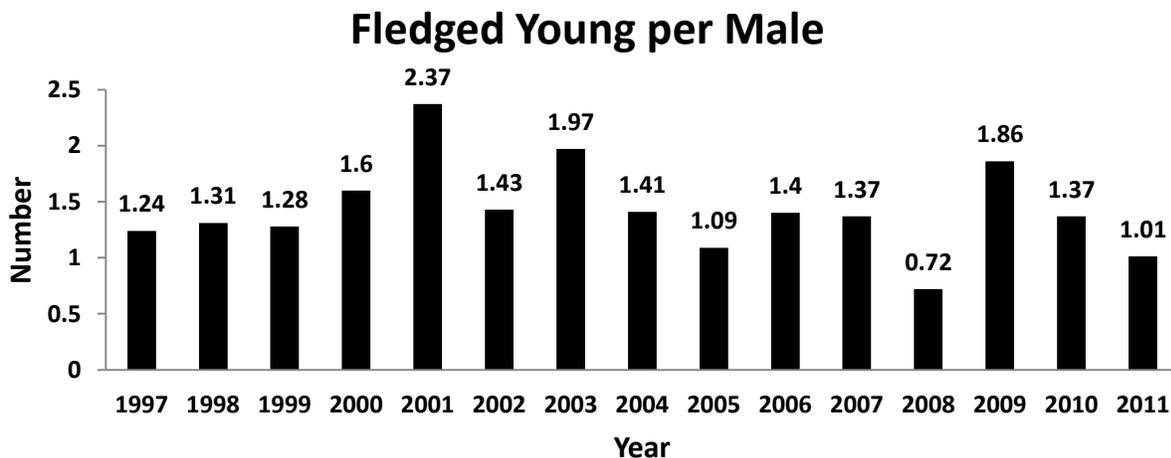


Figure 6. Mean number of juveniles reared per male at Monterey Bay.

DISCUSSION

Recovery of the Snowy Plover population continues to be successful in the Monterey Bay area as reflected by its population size relative to the target suggested for the area in the USFWS Recovery Plan. The breeding population of 431 Snowy Plovers estimated for the Monterey Bay area in 2011 was 28% larger than the USFWS recommended target of 338 adults for our Monterey Bay region study area. The USFWS target was first surpassed in the Monterey Bay area in 2003. Since then the population has exceeded the USFWS target in 6 of 9 years

The 431 plovers for the Monterey Bay area in 2011 also exceeded the USFWS target of 400 breeders for Recovery Unit 4 – all coastal nesting areas from Sonoma County through Monterey County. The only other year that this has happened was in 2004.

The USFWS window survey in late May is the underlying method to estimate the size of the U.S. Pacific coast population but our data continue to suggest it underestimates population size. In 2011, only 287 adults were recorded in the study area on the late May 2011 window survey. Our estimated number of breeders for the Monterey Bay area exceeded the window survey by a factor of 1.5 times.

High recruitment of Monterey Bay area juveniles into the breeding population continues to be a significant contributor to sustaining the Monterey Bay population. Forty percent (108) of the 268 color-banded juveniles that were produced in 2010 recruited into the population in 2011. This was slightly greater than the 36% recruitment rate in 2010.

The success of the plover in maintaining its population into 2012 will be very much the outcome of the high breeding success of plovers in the South Bay in 2011. Of the total 232 juveniles fledged in the Monterey Bay area in 2011, 72.8% (169) were from South Bay areas. This number is the outcome of high clutch hatching and chick fledging rates. In the South Bay, nest hatching success in 2011 exceeded the 14-year average of 65.5% in 9 of 10 beach areas (Table 2). Fledging success also exceeded the 40.8% average in 5 of 10 areas. Red-tailed hawks were unusually absent from much of the Marina beach area after April this year and the high fledging rates at the Marina North and Martin areas may be attributable to their absence there.

In contrast, North Bay beaches produced only 10.3% (24) of the fledged juveniles. All North Bay areas were characterized by very low clutch hatching success (Table 2). In the Moss Landing, Zmudowski Beach and Pajaro Spit areas the very low clutch hatching success was probably largely the result of high levels of egg depredation by one male Northern Harrier. Clutch hatching success was particularly low at Zmudowski Beach where only 1 of 29 clutches hatched. Fledging success was also below the 14-year Bay-wide average of 40.8% in three of the four North Bay beach areas (Table 2). The exception, the Sunset/Manresa area, only hatched 12-13 chicks.

The Salt Ponds contributed only 16.8% (39) of the 232 fledged juveniles in 2011. While the Salt Pond 72% clutch hatching rate in 2011 exceeded the 14-year Bay-wide average, the 22-23% chick fledging rate was well below the 42 % Bay-wide average. It was also 28% below the 14-year Salt Pond average of 54 fledged juveniles. Locally nesting Red-tailed Hawks, two over summering Peregrine Falcons, and owls were all likely predators of chicks in the salt ponds, and their activities may have been the chief contributor to the low fledging success.

We believe predators continue to be the primary of cause egg and chick loss for the Snowy Plover in the Monterey Bay area. In recent years, consistently more nest losses have been attributed to avian predators than mammalian predators (Table 3). Ravens and gulls appear to be the main avian predators and skunks the main mammalian predator on Monterey Bay area beaches. The high levels of clutch depredation by a harrier on three North Bay beaches this year is an uncommon phenomenon although a harrier was also the suspected cause of unusually high levels of egg loss on South Bay beaches in 2005.

There was also evidence of adult losses to predators during the early part of the breeding season. At Monterey Dunes, a Merlin was seen eating a plover on 12 April; a depredated plover carcass found on 19 April was possibly another of its victims. Two adult plovers disappeared between April 8th and April 10th and their nests were subsequently abandoned. Four additional adults, that were expected to nest, also disappeared between the 29 March and 5 May. Most of these plovers may have been taken by the Merlin but other predators cannot be ruled out.

Overall, however the plover had a successful breeding season and this success should be sufficient to sustain the population at its current size in 2012 given average over-winter survival and recruitment rates. Although the 1.01 juveniles that fledged per male was well below the study area average of 1.5, it was still sufficient to meet the USFWS recommended target of 1.0 fledged young per male for population stability.

ACKNOWLEDGEMENTS

Lynne Stenzel of PRBO and Bernadette Ramer greatly assisted with the fieldwork at Pajaro Dunes and Laird Henkel and Lara White with the fieldwork in southern Monterey Bay. Amy Palkovic deserves special thanks for preparing the nest maps. This project was conducted collaboratively by PRBO Conservation Science, the Salinas River National Wildlife Refuge Unit of the Don Edwards San Francisco Bay National Wildlife Refuge of the U. S. Fish Wildlife Service, the California Department of Parks and Recreation, the California Department of Fish and Game, the Wildlife Services Unit of the U. S. Department of Agriculture, and the Monterey Bay Aquarium. Thanks to Jenny Erbes for use of the cover photo.



Appendix 1. Overview of Snowy Plover nest locations in the Monterey Bay area in 2011.



Appendix 2. Snowy Plover nest locations at the northern section of and just north of Sunset State Beach in 2011. This map does not include 2 additional nests that were found as broods.



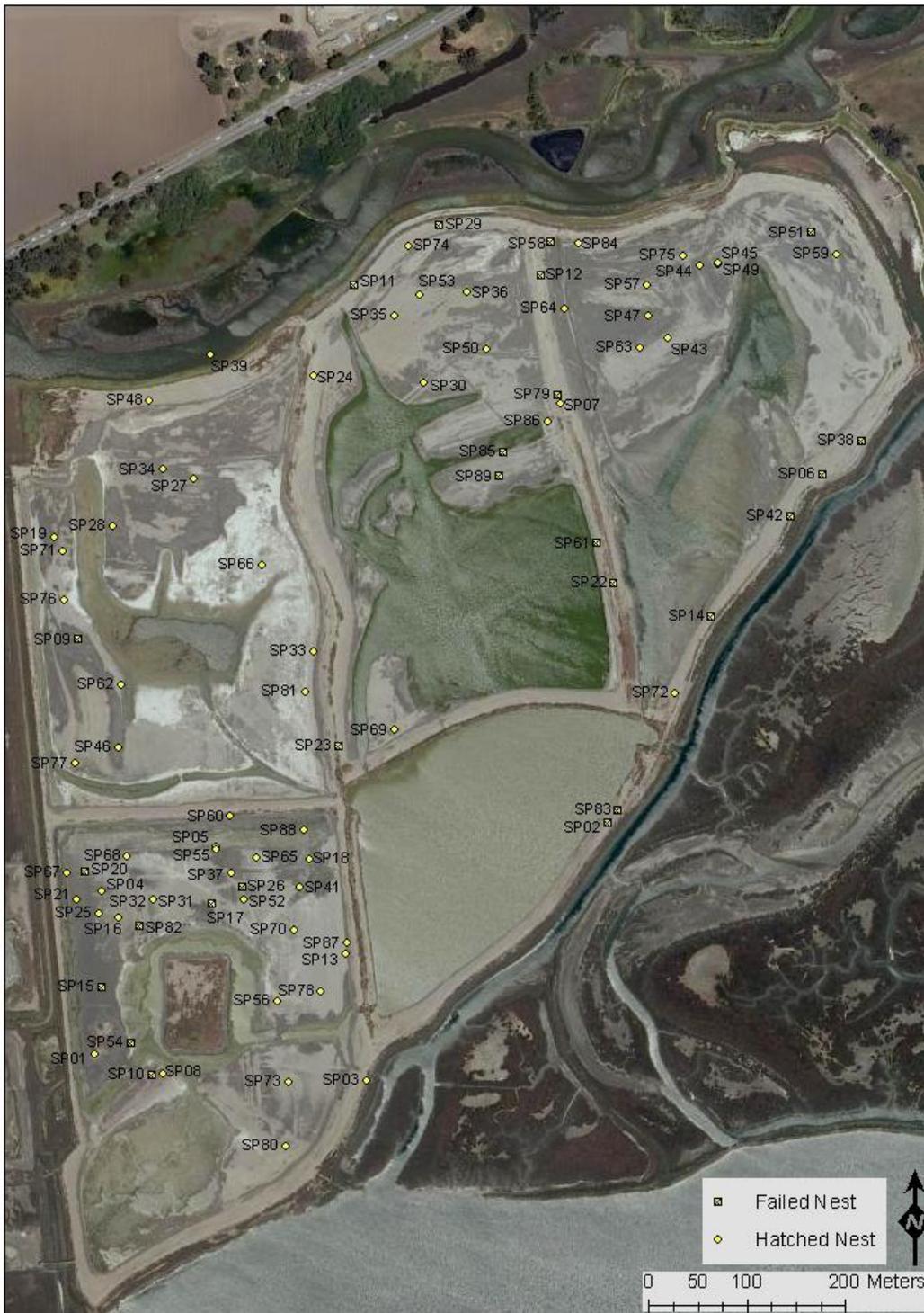
Appendix 3. Snowy Plover nest locations at the Pajaro Spit at Sunset and Zmudowski State Beaches in 2011.



Appendix 4. Snowy Plover nest locations at Zmudowski State Beach in 2011.



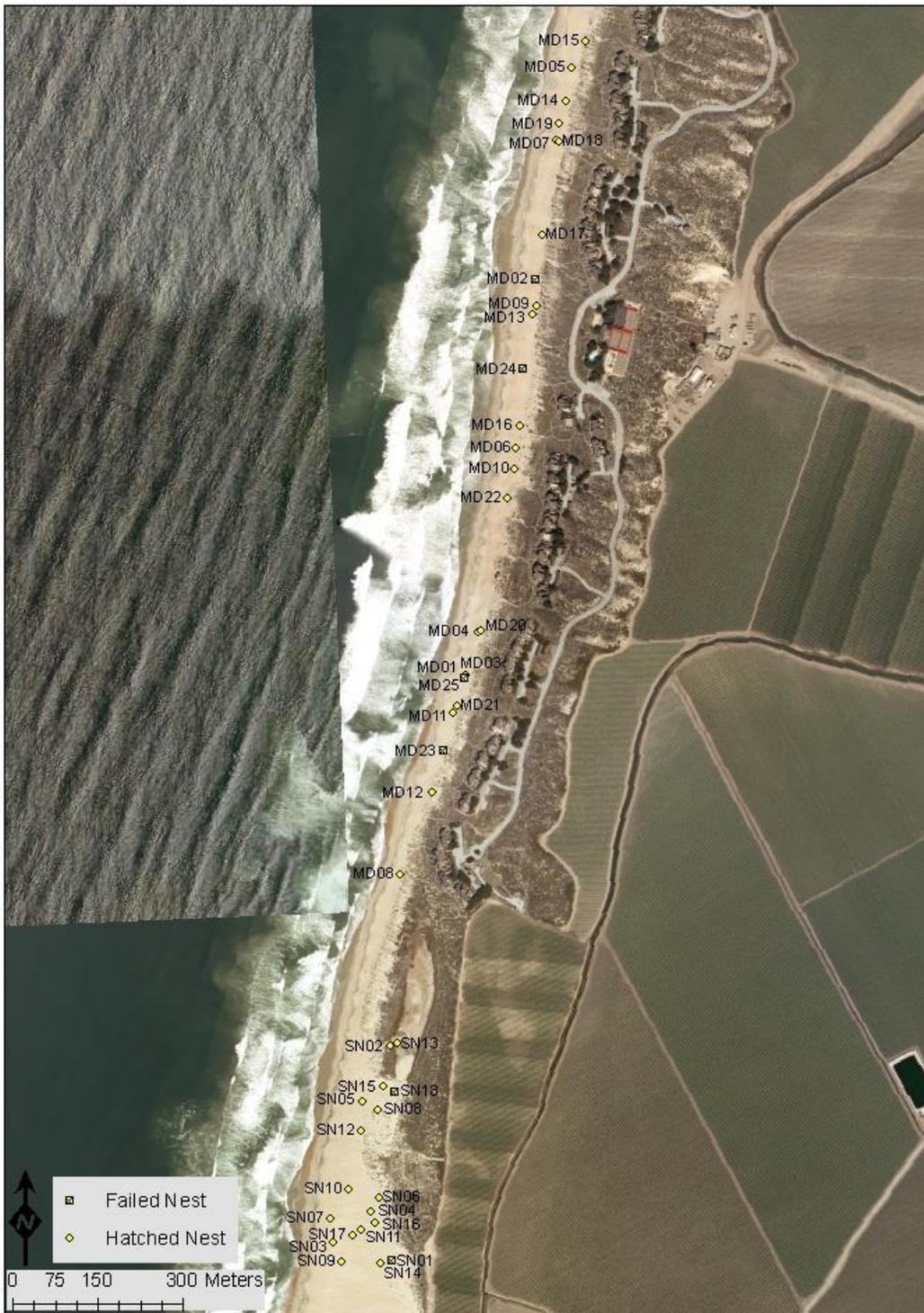
Appendix 5. Snowy Plover nest locations near Jetty Road at Zmudowski and Moss Landing State Beaches in 2011.



Appendix 6. Snowy Plover nest locations at the salt ponds in the Moss Landing Wildlife Management Area in 2011. This map does not include 2 additional nests that were found as broods.



Appendix 7. Snowy Plover nest locations at the northern portion of Salinas River State Beach in 2011. This map does not include 2 additional nests that were found as broods.



Appendix 8. Snowy Plover nest locations at the southern portion of Salinas River State Beach in 2011. This map does not include 1 additional nest that was found as a brood.



Appendix 9. Snowy Plover nest locations at the Salinas River National Wildlife Refuge and the Martin dunes in 2011. This map does not include 9 additional nests that were found as broods.



Appendix 10. Snowy Plover nest locations at Marina beach in 2011. This map does not include 2 additional nests that were found as broods.



Appendix 11. Snowy Plover nest locations at Marina State Beach and Fort Ord Dunes State Park in 2011.