



NESTING OF THE SNOWY PLOVER AT MONTEREY BAY AND ON BEACHES OF NORTHERN SANTA CRUZ COUNTY, CALIFORNIA IN 2010



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SYNOPSIS

Staff, and research 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 2010. 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 include:

- 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).
- Nest exclosures within signed and roped-off nesting areas 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 2010, at least 385 plovers nested in the Monterey Bay area. This represented a > 20% increase over the number of breeders during the past 3 years and 113.9% of the USFWS recovery plan target of 338 breeders for the study area from Waddell Creek to Carmel River mouth. The 385 breeders included 55 juvenile males and 47 juvenile females from 2009 that recruited into the population in 2010. No plovers were detected nesting on the northern Santa Cruz County pocket beaches for the first time since the commencement of our studies there in 1988.

Overall, 70.2% of the banded male and 73.6% of the banded female plovers that nested in 2009 returned and bred in 2010. The 2010 return rates exceeded the 1999-2009 averages of 66.9 % ($\pm 3.2\%$ SE) for males and 61.5% ($\pm 2.9\%$ SE) for females.

The 388 nests and 14 broods from undetected nests we found indicated plovers made at least 402 nesting attempts in the Monterey Bay area in 2010. The hatching rate of 60.6% of the total nests was 9% lower than the 66.3% ($\pm 3.5\%$ SE) average of the previous 11 years. At least 48% of the 153 nest losses in 2010 were attributed to predators. Of predator losses, 16.2% were attributed to mammals, 37.8% to birds and 45.9% to unknown predators. Gulls, ravens, and skunks were the identified predators taking the most nests.

Overall, the chick fledging rate in 2010 of 42-43% was essentially identical with the 42.2 % (± 2.6 SE) average from 1997-2009. There was considerable variation in the fledging rate among sub areas in 2010: North Salinas (68-71%), Salinas River NWR (59-61%), Molera/Potrero Road (55.3%), Sunset/Manresa (20.0%), middle Marina (22.6%), and Fort Ord (26%). The total of 280 chicks fledged in 2010 was 25% greater than the prior 13-year average of 224 fledglings. The majority of the fledglings (221) in 2010 were produced on the beaches. Three areas accounted for about half (49%) of the chicks fledged on the beaches. Fifty-four chicks fledged at the Salinas River NWR, 29 on Zmudowski State Beach, and 26 at Molera/Potrero beach. Although, the 2010 fledging rate of 1.37 young per male was 7% lower than the 1.47 average (± 0.12 SE) of the past 13 years, it was well above the level of one juvenile per male necessary for population stability (PRBO unpubl. data); this suggests a potential for a population increase in 2010 if overwinter adult survival and juvenile recruitment rates are at least average.

INTRODUCTION

Staff and research associates of PRBO Conservation Science (PRBO) 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 2010 monitoring effort.

STUDY AREA

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

Monterey Bay Beach Region

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 Stilwell Hall site 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 cover 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 2010, 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.

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 2010, there were symbolically fenced areas in the Fort Ord, Reservation Road, the Marina subregions, and the North Salinas River subregions (Table 1). Symbolic fencing was also used along the Jetty Road beach segment, 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 enclosures, 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 enclosures of this type were used in 2010 (Table 1). We also sometimes use gull enclosures – a symbolic fenced enclosure with a few lengths of cord stretched over the top that surrounds individual nests. Five gull-specific enclosures were used at the Pajaro spit in 2010 (Table 1).

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

Table 1. Number of Snowy Plover nests in enclosures or symbolic fences in 2010.

Subregions	Total Nests	Enclosure Only	Symbol. Fence Only	Enclosure & Symbolic Fence	Gull Enclosure & Symbolic Fence	Signs Only
Del Monte	2		2			
Sand City						
North Fort Ord	18		18			
Reservation Road	12		12			
Marina						
<i>Marina South</i>	8		8			
<i>Marina Middle</i>	22		18			
<i>Marina North</i>	7		4			
<i>Martin</i>	4		4			
Salinas River NWR	49		49			
Salinas River North						
<i>Salinas River N. Spit</i>	15		15			
<i>Monterey Dunes</i>	25		24			
<i>Molera/Potrero</i>	27		27			
Jetty to Beach Roads						
<i>Moss Landing</i>	30		28			
<i>Zmudowski Beach</i>	40		37			
<i>N. Pajaro R.M.</i>	44		38		5	
Sunset/Manresa	15		15			
Salt Ponds	70		70			
Total	388		367		5	

RESULTS

The 2010 Nesting Season

Number of Nesting Plovers

The 385 nesting plovers in the Monterey Bay/Northern Santa Cruz County Pocket Beach study area (hereafter study area) in 2010 represented a > 20% increase over the 314-317 breeders of the past 3 years and a return to the peak numbers of nesting plovers in the area from 2003 to 2006 (Fig.1). In 2010 there were 204 nesting males and 181 females. Most (365) of the nesting adults were uniquely color banded, included 55 juvenile males and 47 juvenile females from 2009 that recruited into the population in 2010. In addition to the banded birds were at least 8 unbanded male and 12 unbanded female breeders. No plovers were detected nesting on the northern Santa Cruz County pocket beaches in 2010. The 2010 total for our study area from Waddell Creek to Carmel River mouth exceeded the US Fish and Wildlife Service recovery plan target of 338 breeders for the area.

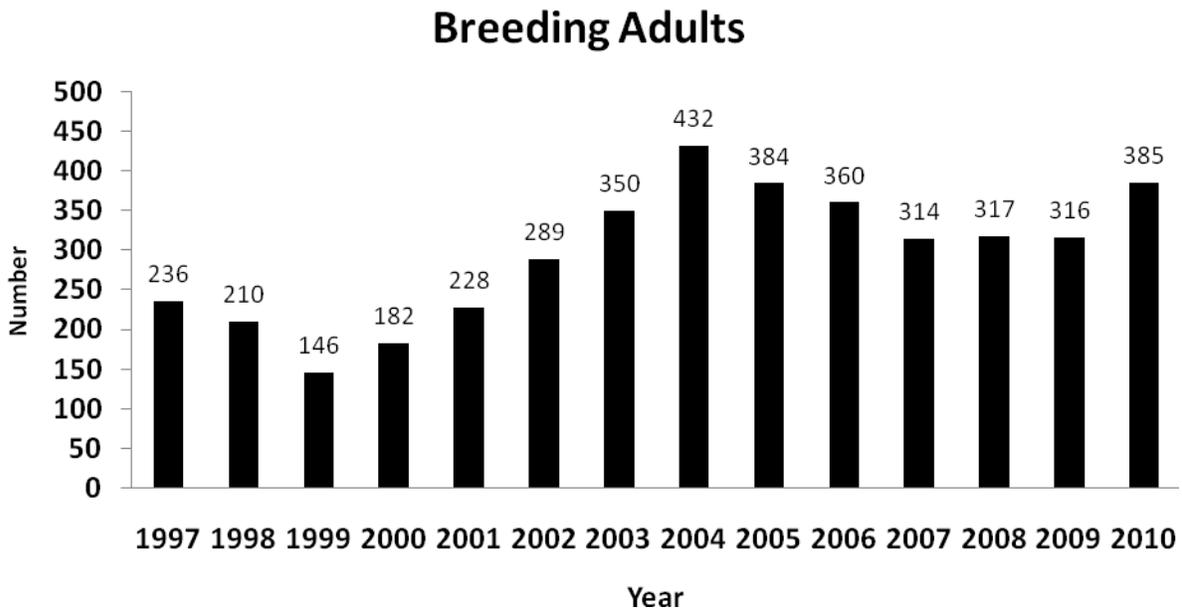


Figure1. Number of nesting Snowy Plovers in the Monterey Bay area.

Return Rates

Overall, 70.2% of the banded males and 73.6% of the banded females documented nesting in 2009 were found breeding in the study area in 2010 (Fig. 2). The 2010 return rates exceeded the 1999-2009 averages of 66.9 % ($\pm 3.2\%$ SE) for males and 61.5% ($\pm 2.9\%$ SE) for females. The typical pattern of higher return rates for males (Fig. 2) was reversed this year in which females exhibited the highest rates (Fig 2).

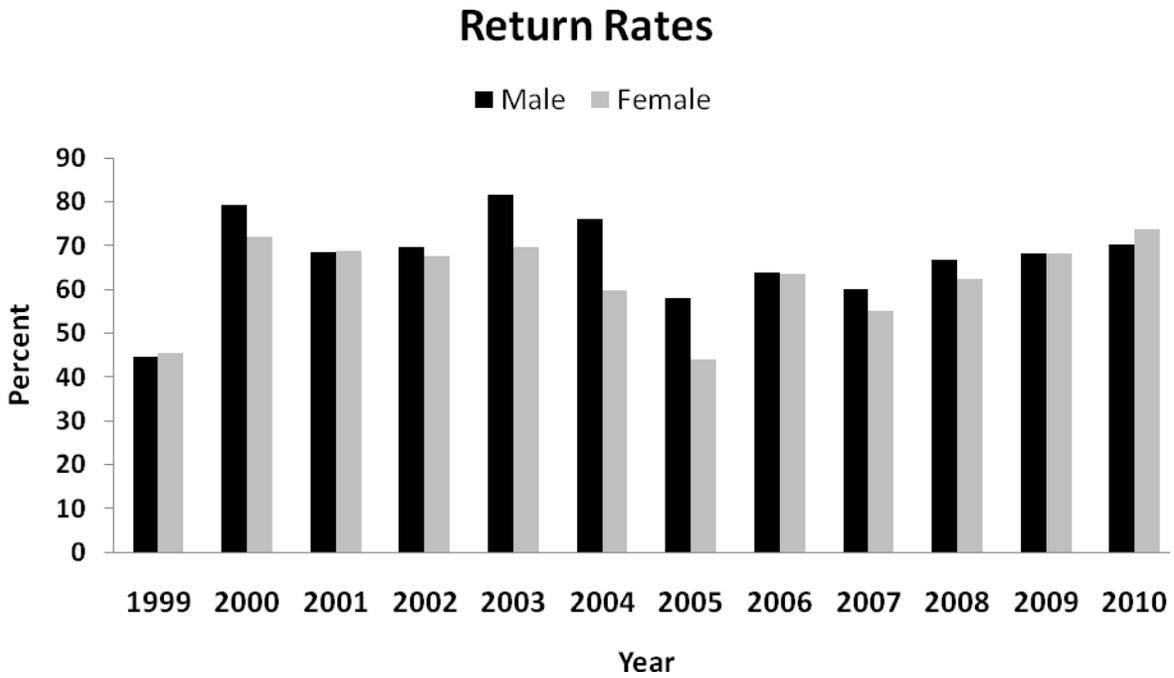


Figure 2. Banded Snowy Plovers nesting in consecutive years at Monterey Bay.

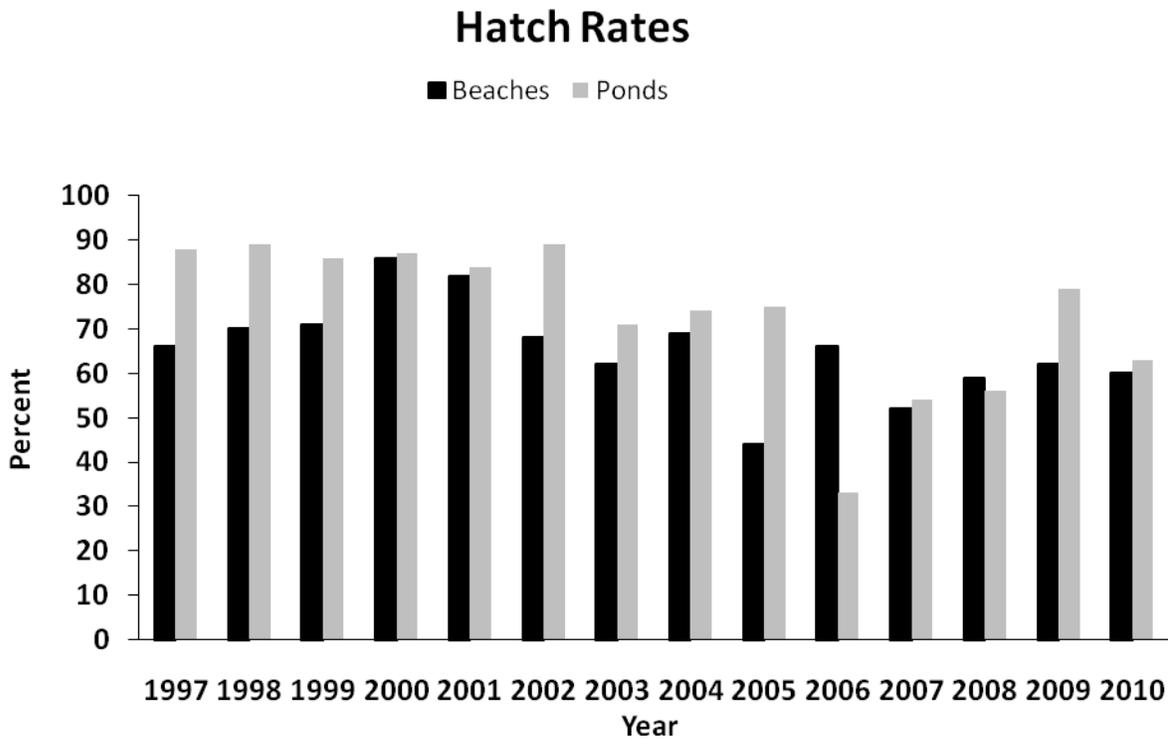


Figure 3. Clutch hatching rates of Snowy Plovers at Monterey Bay.

Table 2. Nesting success of Snowy Plovers in the Monterey Bay area in 2010. Juv. is Juvenile and Att. is Attempt.

Regions	Nest Attempts		Chicks		Juv.	% Nests	% Chicks Fledge		Juv. Per	Hatch
	Nests	Broods	Low	High		Hatch	High	Low	Nest Att.	Nests
Del Monte-Reserv. Rd.										
<i>Del Monte</i>	2	0	3	3	1	50.0	33.3	33.3	0.50	1
<i>Sand City</i>	0	0	0	0	0	0.0	0.0	0.0	0.00	0
<i>Fort Ord</i>	18	1	46	47	12	83.3	26.1	25.5	0.63	15
<i>Reservation Road</i>	12	0	29	29	9	83.3	31.0	31.0	0.75	10
Marina										
<i>Marina South</i>	8	0	1	1	0	12.5	0.0	0.0	0.00	1
<i>Marina Middle</i>	22	0	31	31	7	54.5	22.6	22.6	0.32	12
<i>Marina North</i>	7	1	9	12	3	42.9	33.3	25.0	0.38	3
<i>Martin</i>	4	1	8	9	4	50.0	50.0	44.4	0.80	2
Salinas NWR	49	2	88	91	54	69.4	61.4	59.3	1.06	34
Salinas River N										
<i>N. Salinas River</i>	15	1	24	25	17	60.0	70.8	68.0	1.06	9
<i>Monterey Dunes</i>	25	1	40	42	18	64.0	45.0	42.9	0.69	16
<i>Molera/Potrero</i>	27	1	47	47	26	59.3	55.3	55.3	0.93	16
Jetty-Beach Rds.										
<i>Moss Landing</i>	30	3	49	52	23	56.7	46.9	44.2	0.70	17
<i>Zumdowski Beach</i>	40	0	79	79	29	72.5	36.7	36.7	0.73	29
<i>Pajaro Spit</i>	44	0	61	61	17	54.5	27.9	27.9	0.39	24
Sunset/Manresa	15	0	5	5	1	13.3	20.0	20.0	0.07	2
TOTAL BEACHES	318	11	520	534	221	60.1	42.5	41.4	0.67	191
SALT PONDS	70	3	131	133	59	62.9	45.0	44.4	0.81	44
<i>Wilder Creek</i>	0	0	0	0	0	0.0	0.0	0.0	0.00	0
<i>Laguna Creek</i>	0	0	0	0	0	0.0	0.0	0.0	0.00	0
<i>Scott Creek</i>	0	0	0	0	0	0.0	0.0	0.0	0.00	0
<i>Waddell Creek</i>	0	0	0	0	0	0.0	0.0	0.0	0.00	0
TOTAL S. CRUZ	0	0	0	0	0	0.0	0.0	0.0	0.00	0
GRAND TOTAL	388	14	651	667	280	60.6	43.0	42.0	0.70	235

Clutch Hatching Rates

We found 388 nests and 14 broods from undetected nests indicating at least 402 nesting attempts in the Monterey Bay area in 2010. Three nests at Zmudowski were unusual in that they were in an agricultural field where there was a mixture of dry and shallowly-flooded habitat. The two nests on the Del Monte beach section were north of the southern Sand City boundary.

The clutch-hatching rate (percent of nests documented hatching at least one egg) was 60.1% on Monterey Bay beaches and 62.9% in the Salt Ponds. These rates excluded all nesting attempts documented only from the detection of broods. The 60.1% clutch hatching rate on the beaches of Monterey Bay was 9% lower than the 65.9% ($\pm 3.1\%$ SE) average of the previous 13 years (Fig. 3). At the salt ponds, the 62.9% of the clutches hatched in 2010 fell 15% below the 13-year average of 74.2% ($\pm 4.7\%$ SE). The overall hatching rate of 60.6% of the total nests in 2010 was 9% lower than the 66.3% ($\pm 3.5\%$ SE) average of the previous 11 years (Fig. 3).

In 2010, at least 48% of the 153 nest losses were attributed to predators (Table 3). Of the 74 predator losses, 16.2% were attributed to mammalian predators, 37.8% to avian predators and 45.9% to unknown predators. Gulls, ravens, and skunks were the identified predators taking the most nests (Table 4). Canines were documented taking only two nests. Clutch desertion was responsible for 9% of the nest failures -- a lower rate than the 14% average from 1997-2010 (Table 3). Four losses were attributed to humans in 2010 (Table 4). High tides, strong winds and rain together claimed at least 20% of the nests in 2010. This rate exceeded the 15% average from 1997-2010. Five of the six nests lost to rain were in the salt ponds where the eggs sank into soft mud which subsequently hardened locking the eggs in place. Four nests had non-viable eggs (Table 4).

Table 3. Total of Snowy Plover clutches lost and percent attributed different causes, 1997-2010. 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
Average	101	11	27	12	4	15	14	5	11	0

Table 4. Causes of Snowy Plover nest loss at Monterey Bay in 2010. Rac. is Raccoon, Opp. is Opossum, Unk. is Unknown, and Pred. is Predator.

Locations	Avian Predator				Mammalian Predator						Unk.	Human	Tide	Wind	Rain	Non-Viable	Desert.	Cause Unknown	Lost At Hatch	Total	
	Raven	Crow	Gull	Unk.	Rac.	Cat	Canine	Skunk	Opp.	Unk.											Pred.
Del Monte				1																1	
Sand City																				0	
Fort Ord													3							3	
Reservation Road											1							1		2	
Marina South	4															1	1	1		7	
Marina Middle	2										3	1		1		1	1	1		10	
Marina North											2		1	1						4	
Martin											1							1		2	
Salinas NWR			2	1							5			2				1	4	15	
N. Salinas River			5															1		6	
Monterey Dunes				1							3	1						1	2	1	9
Molera/Potrero							2				2	1	2			1	1	1	1	1	11
Moss Landing	1			1									3	3				4	1		13
Zmudowski Beach												1	1	4	1	1	1	2			11
Pajaro River Spit			4					7						3				2	4		20
Sunset/Manresa	3			1				2		1								6			13
Salt Ponds				2							17				5			1	1		26
Wilder Creek																					0
Laguna Creek																					0
Scott Creek																					0
Waddell Creek																					0
Total	10	0	11	7	0	0	2	9	0	1	34	4	10	14	6	4	14	25	2	153	

Chick Fledging Rates

Chick fledging rates in 2010 were about the average of the past 13 years. In 2010, 41-43% of the chicks fledged on the beaches compared with the average of 40.7% (± 4.0 SE) from 1997-2009, the 44-45% in the salt ponds with the 41.3% (± 3.0 SE) from 1997-2009, and the overall 42-43% rate with the 42.2% (± 2.6 SE) average from 1997-2009 (Appendix 12). There was considerable variation among sub areas in 2010. Highest beach rates were at North Salinas (68-71%), Salinas River NWR (59-61%), and Molera/Potrero Road (55.3%) and lowest rates at Sunset/Manresa (20.0%), middle Marina (22.6%), and Fort Ord (26%, Table 2).

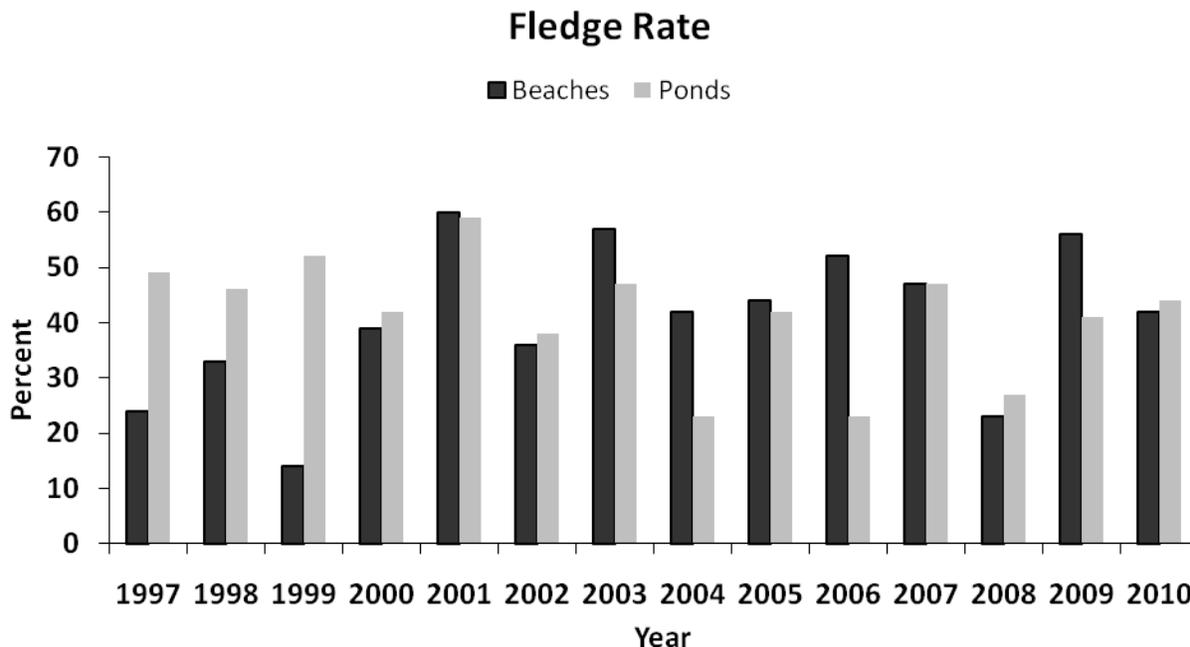


Figure 4. Percent chick fledging rates of Snowy Plovers in the Monterey Bay area.

Number of chicks fledged

The total of 280 chicks fledged in 2010 was 25% greater than the prior 13-year average of 224 fledglings. In 2010, 268 of the fledged chicks were banded and 12 were unbanded. The majority of the fledglings (221) in 2010 were produced on the beaches and 59 were from the Salt Ponds. The number of fledglings from the beaches in 2010 exceeded the average of 165 from the 13 prior years by 34% and the average of 54 from the salt ponds by 9%. Three areas accounted for about half (49%) of the chicks fledged on the beaches. Fifty-four chicks fledged at the Salinas River NWR, 29 on Zmudowski State Beach, and 26 from the Molera/Potrero beach segment (Table 2).

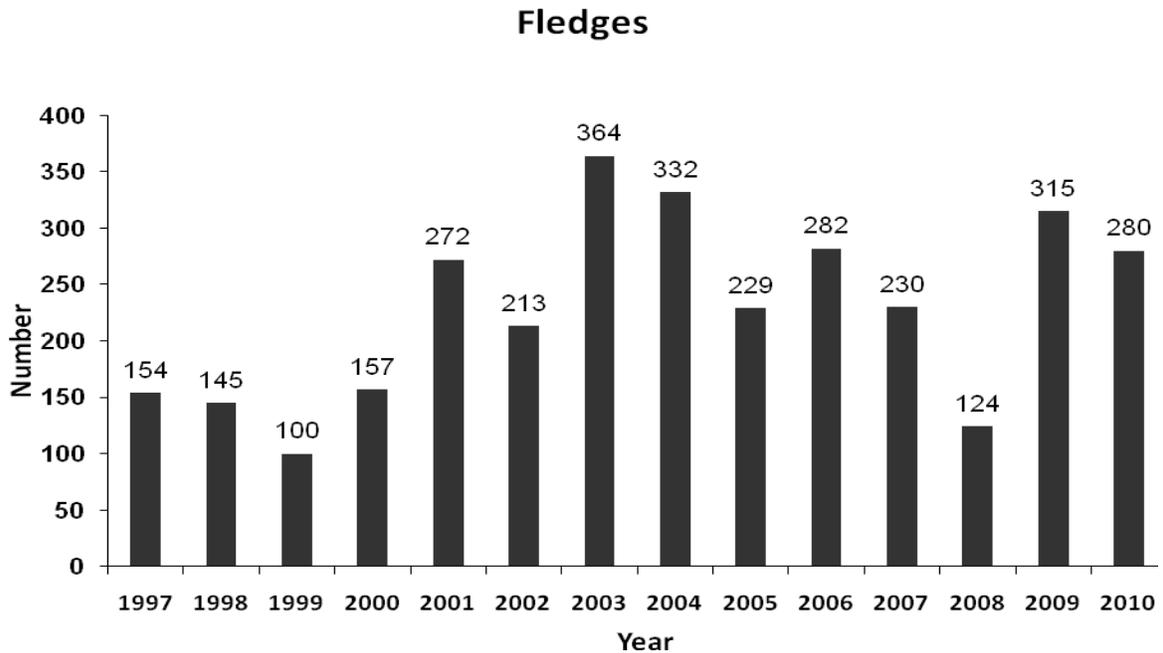


Figure 5. Number of chicks fledged at Monterey Bay.

Young Fledged Per Male

The 2010 fledging rate of 1.37 young per male was 7% lower than the 1.47 average (± 0.12 SE) of the past 13 years (Fig. 6). Nevertheless, the overall fledging rate in 2010 was well above the level for population stability since one young per male is projected to be sufficient to prevent the population from declining (PRBO unpubl. data).

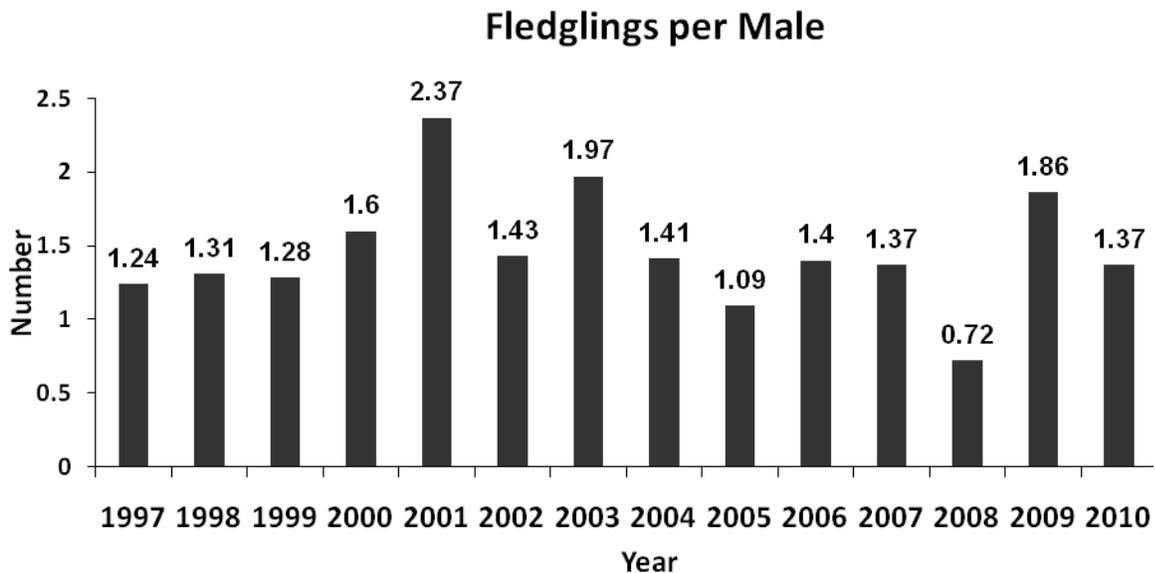


Figure 6. Mean number of juveniles reared per male at Monterey Bay.

DISCUSSION

The 385 adults that breed in the Monterey Bay area in 2010 represented a > 20% increase in number of breeders over the past 3 years and exceeded the target of 338 breeders for the study area in the USFWS recovery plan by 14%. The increase was primarily the result of the large number of 2009 juveniles that recruited into the population in 2010 and the above average return rates of males and females. Thirty-six percent (102) of the 287 banded juveniles that fledged in the Monterey Bay area in 2009 recruited into the 2010 population. The 2010 return rate of males was 4.9% above the prior 13-year average and the female rate 19.7% above average. Only 265 adults were recorded in the study area on the late May 2010 window survey. The actual number of breeders exceeded the window survey by a factor of 1.45 times. No plovers were documented breeding on the beaches of northern Santa Cruz County for the first time since the commencement of our studies.

The overall hatching rate of 60.6% of the total nests in 2010 was 9% lower than the 66.3% ($\pm 3.5\%$ SE) average of the previous 11 years (Fig. 3). Highest rates were at Fort Ord where 83.3% of 18 nests hatched and at Zmudowski State Beach where 72.5% of 40 nests hatched. Lowest hatching rates were at South Marina where only 12.5% of 8 nests hatched and at Sunset/Manresa where 13.3% of 15 nests hatched. Ravens were responsible for over half the nest losses at South Marina and ravens and skunks were likely responsible for most of the nest losses at Sunset/Manresa.

Across all areas, 48% of all nests losses were attributed to predators – about average for the 13-year period from 1997-2010. Gulls, ravens, and skunks were the identified predators taking the most nests in 2010 (Table 4).

Chick fledging rates in 2010 were about the average of the past 13 years. In 2010, the overall 42-43% rate was essentially identical with the 42.2% (± 2.5 SE) average from 1997-2009 (Appendix 12). There was considerable variation among sub areas in 2010. Highest beach rates were at North Salinas (68-71%), Salinas River NWR (59-61%), and Molera/Potrero Road (55.3%) and lowest rates at Sunset/Manresa (20.0%), middle Marina (22.6%), and Fort Ord (26%, Table 2).

The 280 fledged chicks in 2010 exceeded the prior 13-year average of 224 fledglings by 25%. As hatching rates were below average and fledging rates about average, the greater than average number of breeding adults in 2010 was primarily responsible for the higher than average number of fledglings. The 2010 production of 1.37 juveniles per male (Fig. 6), although below average, is above the level of one fledgling per male needed for population stability suggesting a potential for a population increase in 2010 if overwinter adult survival and juvenile recruitment rates are at least average.

ACKNOWLEDGEMENTS

Lynne Stenzel of PRBO assisted with the fieldwork at Pajaro Dunes and Laird Henkel 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.

Appendix 12. Summary of data.

Annual numbers of nesting male (M) and female (F) Snowy Plovers at Monterey Bay.

Sex	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
M	124	111	78	98	115	149	185	235	210	201	168	173	169	204
F	112	99	68	84-86	113 ¹	140	165	197	174	159	146	144	147	181
Total	236	210	146	182	228	289	350	432	384	360	314	317	316	385

Percent of banded Snowy Plovers nesting in consecutive years at Monterey Bay

Sex	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
M	44.5	79.2	68.4	69.7	81.5	76.0	58.1	63.7	60.1	66.7	68.1	70.2
F	45.5	72.1	68.8	67.6	69.8	59.7	43.9	63.5	55.2	62.4	68.1	73.6

Percent clutch hatching rates of Snowy Plovers at Monterey Bay.

Regions	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Beaches	66	70	71	86	82	68	62	69	44	66	52	59	62	60
Salt Ponds	88	89	86	87	84	89	71	74	75	33	54	56	79	63
Santa Cruz B.	89	69	71	74	47	60	43	33	43	75	67	50	100	-
All Regions	-	-	78	85	78	72	63	69	47	62	52	58	65	61

Chick fledging rates (%) of Snowy Plovers at Monterey Bay.

Regions	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Beaches	24	33	14	39-40	59-61	35-36	56-59	42-43	43-45	51-53	46-48	23-24	56-57	41-43
Salt Ponds	49	46	52	42	59	38-39	47	23	42	23-24	47	27	40-42	44-45
Santa Cruz B.	39	38	56	27	18	8-9	33	25-30	0	0	0	0	0	0
All Regions	34	39	36	39	56-57	35-36	53-56	39-40	42-44	48-50	46-47	24	52-53	42-43

Number of chicks verified fledged at Monterey Bay by the end of the nesting season.

Regions	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Beaches	56	57	17	75	174	138	292	301	196	273	203	102	263	221
Salt Ponds	82	76	68	67	91	73	68	28	33	9	27	22	52	59
Santa Cruz B.	16	12	15	15	7	2	4	3	0	0	0	0	0	0
All Regions	154	145	100	157	272	213	364	332	229	282	230	124	315	280

Mean number of juveniles reared per male at Monterey Bay.

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
All Regions	1.24	1.31	1.28	1.60	2.37	1.43	1.97	1.41	1.09	1.40	1.37	0.72	1.86	1.37

¹ Note that the estimated number of females for 2001 has been reduced by one individual to correct an error in the 2001 report.



Appendix 1. Overview of Snowy Plover nest locations in the Monterey Bay area in 2010.



Appendix 2. Snowy Plover nest locations at the northern section of Sunset State Beach in 2010.



Appendix 3. Snowy Plover nest locations at the Pajaro Spit at Sunset and Zmudowski State Beaches in 2010.



Appendix 4. Snowy Plover nest locations at Zmudowski State Beach and the adjacent agricultural fields in 2010.



Appendix 5. Snowy Plover nest locations near Jetty Road at Zmudowski and Moss Landing State Beaches in 2010. This map does not include 3 additional nests that were found as broods.



Appendix 6. Snowy Plover nest locations at the salt ponds in the Moss Landing Wildlife Management Area in 2010. This map does not include 3 additional nests that were found as broods.



Appendix 7. Snowy Plover nest locations at the northern section of Salinas River State Beach in 2010. This map does not include 1 additional nest that was found as a brood.



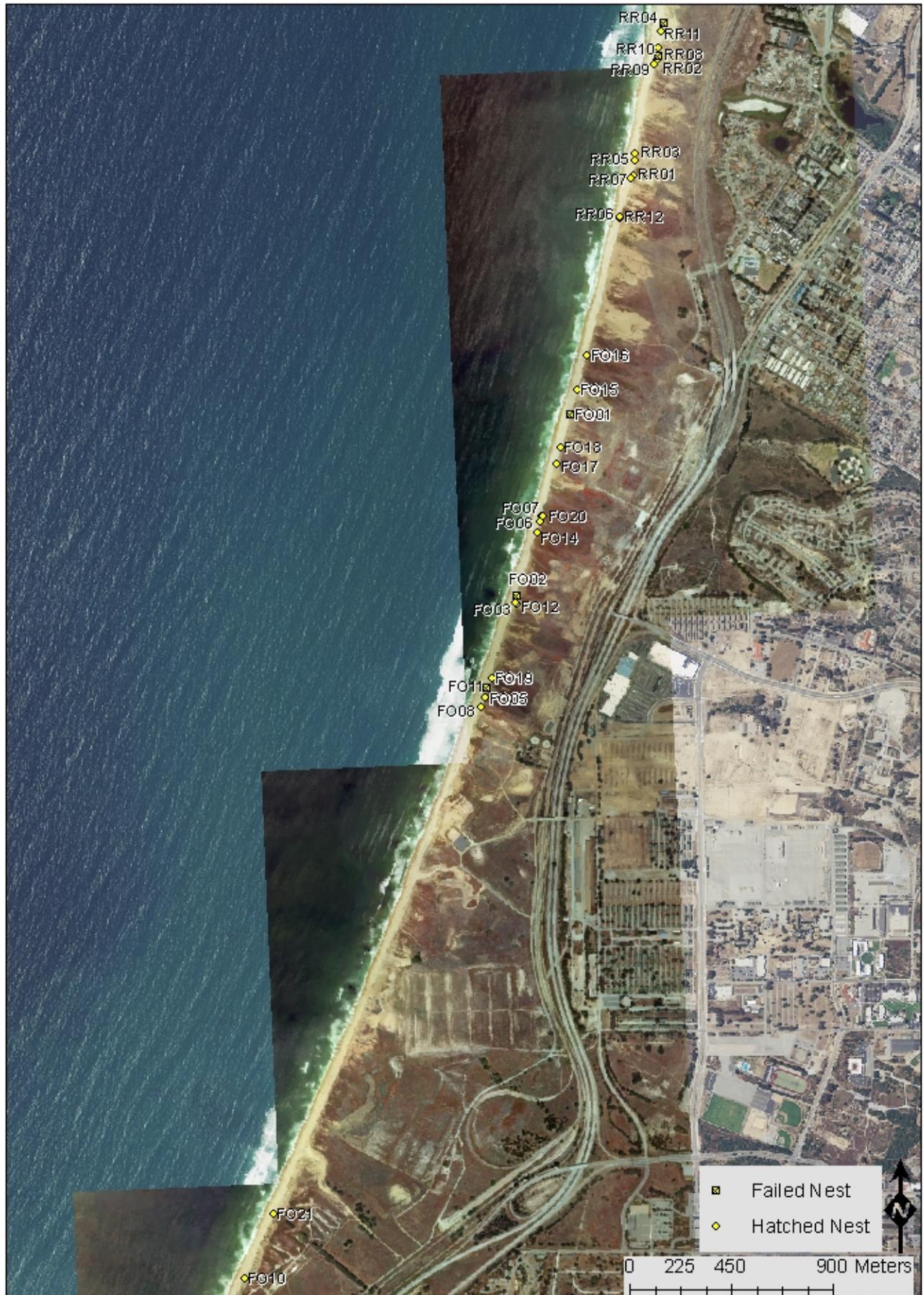
Appendix 8. Snowy Plover nest locations at the southern section of Salinas River State Beach in 2010. This map does not include 2 additional nests (1 MD and 1 SN) that were found as broods.



Appendix 9. Snowy Plover nest locations at the Salinas River National Wildlife Refuge and the Martin dunes in 2010. This map does not include 3 additional nests (2 SX and 1 SG) that were found as broods.



Appendix 10. Snowy Plover nest locations at Marina beach in 2010. This map does not include 1 additional nest (MN) that was found as a brood.



Appendix 11. Snowy Plover nest locations at Marina State Beach and Fort Ord Dunes State Park in 2010. This map does not include 1 additional nest (FO) that was found as a brood.