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**DISTRIBUTION, PROTECTION AND NEST SUCCESS
OF SNOWY PLOVERS
AT POINT REYES NATIONAL SEASHORE
1996**

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A report of
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INTRODUCTION

The U.S. Fish and Wildlife Service has asked the Point Reyes National Seashore (PRNS) to implement a plan that will monitor and protect the federally threatened Snowy Plover (*Charadrius alexandrinus*) within park boundaries. The Point Reyes Bird Observatory (PRBO) is assisting the Point Reyes National Seashore by monitoring the current status of the Snowy Plover on Point Reyes Beach and Limantour Beach and by protecting all Snowy Plover nests found within park boundaries. PRBO's past Snowy Plover research on the Point Reyes National Seashore includes breeding and wintering season surveys since 1977 and intensive nest monitoring in 1977, between 1986 and 1989, and in 1995. This report documents the distribution, timing, and success of Snowy Plover nests on Point Reyes and Limantour beaches during 1996. It also compares breeding success in 1996 to that of previous years to provide a perspective on the current status of the Snowy Plover at Point Reyes National Seashore. This should aid the PRNS and PRBO in evaluating current conservation efforts and in developing a strategy for future habitat management to ensure the continued survival and reproduction of this threatened species.

METHODS

We conducted 9 full-length surveys of Point Reyes Beach, once every other week from 18 March through 10 July 1996, to determine the current abundance and distribution of breeding Snowy Plovers at Point Reyes National Seashore, Marin County, California. We also conducted a survey of Limantour Beach on or near the date of each Point Reyes Beach survey beginning in mid-March. These surveys required approximately 124 hrs of effort. We conducted one survey of Drake's spit on 27 April, 1996 which required 4 hrs of effort.

We separated Point Reyes Beach into four subareas: K = Kehoe Beach entrance to Abbott's Lagoon; NP = Abbott's Lagoon to North Beach parking lot; NB = North Beach parking lot to South Beach parking lot; and SB = South Beach parking lot to Lighthouse Beach. On days when two people were available, one observer walked two sections of the beach and the other covered the remaining two sections. If only one observer was available he or she surveyed half the beach one day and the other half on the following day. Using at least 8x30 power binoculars, the observer walked just below the high tide line, crossing above the line only when necessary to see the full width of the beach. The observer stopped every 50 to 100 m to scan at least 100 m ahead for plovers. On locating a plover, the observer approached close enough to determine the bird's age, sex, whether it was banded and, if so, the color band combination. Date, location (by subarea and obvious landmarks), and time of sighting were also recorded. The observer then walked around the bird so as not to flush it.

To determine the distribution of nests along Point Reyes Beach and Limantour Beach and to protect those nests we searched for nests three to four days a week in those areas, identified by full-length surveys, that were most likely to hold breeding birds. We used three methods to locate nests: (1) systematically searching microhabitats in which plovers were likely to place a nest; (2) watching females that behaved furtively from a concealed position approximately 100 m away; and (3) following plover footprints in fine sand. Upon locating a nest, the observer

viewed it with binoculars from a distance and recorded the contents. It is known that Snowy Plover eggs are laid at intervals ranging from 46.5 to 118 h and that the date of hatching is approximately 27 days after the clutch is completed (Page 1995). All but one nest were located prior to completion of a full clutch. Thus, it was possible to estimate initiation dates and potential hatching dates. Date, time, location of nest (by subarea and obvious landmarks), and identity of owners also were recorded. If a nest was found prior to the completion of a full clutch, we attempted to erect an exclosure around it when there were two eggs present. If a nest was found with three eggs already present, we erected an exclosure around it as quickly as possible. We erected exclosures around all but one nest using the protocol described in the U.S. Fish and Wildlife Service Exclosure Protocols for Snowy Plover nests (1994). Nest checks were made on each visit to the area to determine whether the nest was still active. For nests from which eggs disappeared prior to the projected hatching date, the empty nest and vicinity were examined for predator or human tracks to determine probable cause of clutch loss. On a nest's projected hatching date, checks were made frequently to determine if chicks were present. To obtain conclusive fledging rates, the adult and chicks were searched for on regular visits, and, once found, the number of chicks and location were recorded. Based on prior research (Page 1995), 28 days after hatching was defined as the date of fledging. Nest searches, nest checks and brood monitoring at Point Reyes and Limantour beaches required approximately 450 hrs of effort.

All data collected in the field were transferred onto survey and nest data forms. Survey and nest data from the 1996 season were then compared with unpublished PRBO data from previous breeding seasons. Previous intensive nest finding on Point Reyes Beach was conducted in 1977, 1986 (efforts concentrated between Kehoe Beach and North parking lot), 1987, 1988, 1989, and 1995. Breeding success was evaluated in terms of number of nests, total eggs laid, percent of clutches hatching, percent of eggs hatching, percent of chicks fledged, and chicks fledged per egg. Because only one nest was located at Limantour beach during the 1996 season, breeding success was not evaluated for the site.

RESULTS AND DISCUSSION

The number of adult Snowy Plovers at Point Reyes National Seashore during the 1996 breeding season varied with the arrival and departure of individuals that did not breed at PRNS (Table 1). We estimated a total of 10-11 plovers attempting to breed at PRNS this season. This number is consistent with the observed steady decline of breeding individuals at Point Reyes Beach from 1987 to 1995 (Tables 2, 3).

We believe that the decline in the number of breeding plovers at Point Reyes National Seashore is mainly due to low reproductive success. For years previous to 1996 in which thorough season-long searches were made for Snowy Plover nests on the full length of Point Reyes Beach, the total number of nests and the total number of eggs laid steadily decreased (Table 4). A total of 74, 65, 61, and 20 nests were found in 1987, 1988, 1989, and 1995, respectively. In 1996, eight nests were found on Point Reyes Beach and one was found on Limantour Beach (Table 5).

The observed clutch hatching rates at Point Reyes Beach in all study years previous to 1996 (mean = 9.5%, range = 1.6% to 19.0%) were well below the average for the California coast

(mean = 54%, range = 18.7% to 86.8%) (Page 1995). In 1996, the clutch hatching rate at Point Reyes Beach rose to 75.0% (Table 4). One of the nests at Point Reyes Beach was unsuccessful. This nest (NP01) was unprotected and was predated by a raven prior to completion of a full clutch. We believe that the single egg found nearby, and protected by an exclosure, was the abandoned third egg of the depredated two egg clutch (NP01). The egg had probably been deserted by the female before we erected an exclosure around it. She was never observed near the egg. Although the male was observed incubating the egg inside the exclosure, he eventually deserted it, found a new mate and nested with the new mate close to the exclosure. We did not consider this abandoned egg to be a nest. Seven of the nests at Point Reyes Beach and one at Limantour Beach were protected with exclosures (Table 5); none of these were depredated. One nest (NP06) failed to hatch any eggs and another (NP08) only hatched 1 egg; the remaining two eggs were infertile.

Chick fledging rates at Point Reyes Beach ranged from 33.3% in 1989 to 80% in 1995 (mean = 50.5%) (Table 4) and were not particularly low compared to mean fledging rates from other coastal sites which typically vary from 30.0% to 45.0% (PRBO unpub. data). The chick fledging rate of 87.5% in 1996 was well above the mean of other coastal sites. We believe that the absence of some adept aerial predators such as the Loggerhead Shrike (*Lanius ludovicianus*) and American Kestrel (*Falco sparverius*) from along Point Reyes beaches may allow for the high chick fledging rate at Point Reyes Beach. The very small sample size of only one of three chicks fledged at Limantour Beach is not sufficient to assess fledging rate for the site.

The number of chicks fledged per egg also is a valuable measure of breeding success. The rates of .03, .01, and .07, chicks fledged per egg at Point Reyes Beach in 1988, 1989, and 1995, respectively, fall below the averages of .18, .23, and .10 for central California sites in 1988, 1989, and 1991, respectively (Page 1988, 1990, 1991). The number of chicks fledged per egg rose to .58 at Point Reyes Beach in 1996 (Table 4).

All of the birds attempting to breed and all of the nests found on Point Reyes Beach in 1996 were found between North Beach parking lot and Abbott's Lagoon (Tables 1, 5). In all previous years of study at Point Reyes Beach the majority of nests have been located in this same subarea (Table 6) (Hickey 1995).

Continued efforts to increase clutch hatching rate by reducing predation of eggs most likely will be the most effective means to increase the reproductive success and the size of the breeding population of Snowy Plovers at Point Reyes National Seashore. Breeding plovers are less likely to retain their territory after losing a clutch to predation than to other causes (Warriner et al. 1986). The effects of reducing clutch predation could both increase the number of potential locally-produced breeders and increase the likelihood that established breeders retain their Point Reyes territories and thus increase the population size of the Snowy Plover at Point Reyes National Seashore.

RECOMMENDATIONS

Because the use of exclosures on Point Reyes Beach in 1996 helped to increase the clutch hatching rate by 61.5% over the observed mean at the site, and increase the egg hatching rate by 53.7% above the observed mean at the site, we recommend the continued use of exclosures to increase Snowy Plover reproductive success at Point Reyes National Seashore. Depending on further evaluation of the potential usefulness of conditioned taste aversion as a management tool, we may also recommend the use of CTA to deter predators from depredating nests.

ACKNOWLEDGEMENTS

Jack Dineen, Peter Goldman, Helen Pratt, Stan Siddle, and Sophie Webb volunteered time and energy on surveys of Point Reyes Beach, Drake's spit and Limantour spit. National Americorps volunteers helped erect and disassemble exclosures. This project was funded by the National Park Service and by members of the Point Reyes Bird Observatory.

Table 1. Number of adult Snowy Plovers within various subareas of Point Reyes Beach and Limantour Beach during the 1996 breeding season.

Date	Number of Individuals					
	K	NP	NB	SB	L	Total
03/18/96	0	41	0	0		41
03/19/96	-	-	-	-	36	
04/02-03/96	21	10	0	-		31
04/02/96	-	-	-	-	20	
04/16/96	8	10	0	0		18
04/18/96	-	-	-	-	12	
04/29/96	-	-	-	-	3	
04/30/96	0	8	0	0		8
05/03/96	-	-	-	-	9	
05/14/96	0	6	0	0		6
05/14/96	-	-	-	-	2	
05/27-28/96	0	3	0	0		3
05/27/96	-	-	-	-	2	
06/10-11/96	0	7	0	-		7
06/12/96	-	-	-	-	2	
06/25-26/96	0	6	0	0		6
07/09/96	-	-	-	-	3	
07/10/96	0	15	0	0		15

K = Kehoe Beach to Abbott's Lagoon mouth

NP = Abbott's Lagoon mouth to North Beach parking lot

NB = North Beach parking lot to South Beach parking lot

SB = South Beach parking lot to Lighthouse Beach

L = Limantour spit

Table 2. Numbers of Snowy Plovers believed to have nested on Point Reyes Beach over the duration of each of the 1986, 1987, 1988, 1989, 1995, and 1996 seasons.

Year	Total		
	Females	Males	Total
1986	22-23	19-21	41-44
1987	25-26	25-28	50-54
1988	21-22	19-20	40-42
1989	18-20	16-17	34-37
1995	6	6	12
1996	5-6	5	10-11

Table 3. Number of adult Snowy Plovers within various subareas of Point Reyes Beach on mid-season breeding surveys in 1977, 1988, 1989, 1991, 1994, 1995, and 1996.

Date	Number of Individuals				
	K	NP	NB	SB	Total
05/18/77	2	22	1	4	29
05/12-13/88	3	10	3	7-10	20-23
05/03/89 *	6	8	3	0	17
05/14/91	3	15	5		23
06/21/94	2	2	5	1	10
05/10-11/95	4	0	4	0	8
05/14/96	0	6	0	0	6

* Known population size for 05/03/89 = 32

K = Kehoe Beach to Abbott's Lagoon mouth

NP = Abbott's Lagoon mouth to North Beach parking lot

NB = North Beach parking lot to South Beach parking lot

SB = South Beach parking lot to Lighthouse Beach

Table 4. Measures of breeding success of Snowy Plovers on Point Reyes Beach, 1986 to 1989, 1995, and 1996.

Year	area	# nests	total eggs laid	% clutches hatching	% eggs hatching	# eggs hatched	# chicks fledged	% chicks fledged	chicks fledged per egg
1986	PR north	34	96	29.0	29.0	28	5	18.0	.05
1987	PR north	57	151	14.0	13.2	20	10	50.0	.06
	PR south	17	47	35.3	32.0	15	5	33.3	.10
	PR total	74	198	19.0	18.0	35	15	43.0	.07
1988	PR north	46	114	4.3	4.4	5	3	60.0	.03
	PR south	19	47	15.8	12.7	6	2	33.3	.04
	PR total	65	161	7.7	6.8	11	5	45.5	.03
1989	PR north	48	112	0.0	0.0	0	0	-	.00
	PR south	13	34	7.7	8.8	3	1	33.3	.03
	PR total	61	146	1.6	2.0	3	1	33.3	.01
1995	PR north	15	42	6.7	7.1	3	3	100	.07
	PR south	5	13	20.0	15.4	2	1	50.0	.08
	PR total	20	55	10.0	9.1	5	4	80.0	.07
1996*	PR north	8	24	75.0	66.7	16	14	87.5	.58
	PR south	0	0	-	-	-	-	-	-
	PR total	8	24	75.0	66.7	16	14	87.5	.58

PR north = Kehoe Beach entrance to North Beach parking lot

PR south = North Beach parking lot to Lighthouse Beach

PR total = entire length of Point Reyes Beach

* 7 nests protected, 1 unprotected nest (consisted of 2 eggs and a dumped third egg)

Table 5. Location, timing, and fate of each Snowy Plover nest found at Point Reyes National Seashore during the 1996 breeding season.

nest # & location	date found	date protected	date hatched	# eggs laid	# eggs hatched	chicks fledged
NP01	04/09/96	-	-	2	0	-
*	04/14/96	04/15/96	-	1	0	0
NP02	04/30/96	05/01/96	05/26/96	3	3	2
NP03	05/02/96	05/04/96	06/02/96	3	3	3
NP04	06/03/96	06/04/96	07/01/96	3	3	3
NP05	06/06/96	06/07/96	07/07/96	3	3	3
NP06	06/24/96	06/26/96	abandoned	3	0	0
NP07	07/02/96	07/05/96	08/02/96	3	3	2
NP08	07/10/96	07/12/96	08/09/96	3	1	1
L01	04/26/96	04/29/96	05/27/96	3	3	1

* - Third egg of NP01 which was depredated at 2 egg stage

Table 6. Number of Snowy Plover nests within various subareas of Point Reyes Beach, 1987 to 1996.

Year	Number of nests				
	K	NP	NB	SB	Total
1987	9	47	6	11	73
1988	5	39	7	12	63
1989	6	41	7	6	60
1995	4	11	5	0	20
1996	0	8	0	0	8

K = Kehoe Beach entrance to Abbott's Lagoon mouth

NP = Abbott's Lagoon mouth to North Beach parking lot

NB = North Beach parking lot to South Beach parking lot

SB = South Beach parking lot to Lighthouse Beach

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