

**Final Monitoring Report
for the
Guadalupe-Nipomo Dunes National Wildlife Refuge
Western Snowy Plover 2012 Breeding Season**



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Abstract

Field monitoring for breeding activities of the western snowy plover (*Charadrius nivosus nivosus*) and California least tern (*Sternula antillarum browni*) was conducted on the Guadalupe-Nipomo Dunes National Wildlife Refuge (Refuge), San Luis Obispo County, California during 2012. This monitoring occurred on the Refuge's 1.8 miles of coastal beaches and adjacent foredunes from 1 March to 30 September 2012. This was the twelfth consecutive year of western snowy plover and California least tern breeding season monitoring on the Refuge.

A total of 21 western snowy plover nests were found on the Refuge during 54 field surveys conducted during the 2012 breeding season. The first known nest was initiated on approximately 10 April, and the last on approximately 8 July. The first known hatch occurred on approximately 19 May, and the last known hatch was estimated to occur around 8 August. The peak periods for active nest numbers were during mid-May and mid-June. The maximum number of concurrently active nests detected was on 24 May and 16 June when 6 nests were active. On 14 May and 31 May, 5 nests were concurrently active.

A maximum of 17 male and 12 female western snowy plover were observed. Based on adult census numbers, numbers of concurrent nests, nest hatch dates, and numbers of concurrent broods, there is enough evidence to account for a minimum of 7 pairs of western snowy plover breeding on the Refuge during 2012.

Hatches occurred in 8 of the 21 nests (38% hatch rate), producing a minimum of 19 chicks. Of the 13 failed nests (62%), 8 were abandoned (38%), 4 were lost to predation (19%), and 1 was lost to high surf (5%). A total of 15 western snowy plover nests were protected with exclosures, with the first installed on 11 April. A total of 6 (40%) of the 15 exclosed nests hatched, 8 (53%) were abandoned, and 1 (7%) was lost to high surf. Only 2 (33%) of the 6 unexclosed nests were known to have hatched, and 4 (67%) were lost to predation.

The 21 nests found on the Refuge during 2012 was the lowest number observed since 2002. The 11-year average number of nests from 2002-2012 was 36 nests, while the 10-year average number of nests from 2002-2011 was 38 nests. During 2012, the nest hatch rate was 38%, which was close to the 39% mean hatch rate for the preceding 10 years. The total of 8 hatched nests producing 19 chicks in 2012 was well below the preceding ten-year means of 15 hatched nests and 39 produced chicks.

Since color banding of western snowy plover chicks has not been conducted on the Refuge since 2005, fledging success was not determined. However, based on an estimated 30.9-day fledge period, the first brood would have fledged around 17 June, and the last brood around 6 September.

Monitoring for breeding activities of California least tern was conducted concurrently with western snowy plover monitoring. California least tern were not observed on the Refuge in 2012.

No snowy plover eggs, chicks, or adults were known to have been injured or killed due to visitor or monitoring activities during the 2012 breeding season. The only observed take was the limited disturbance that occurred during authorized monitoring activities when adult and juvenile snowy plover periodically responded to the brief presence of the plover monitors.

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Introduction

The western snowy plover (*Charadrius nivosus nivosus*; formerly *Charadrius alexandrinus nivosus*) is a member of the family Charadriidae, which includes the plovers, dotterels, and lapwings. This small shorebird has an approximate adult length of 6.25 inches and wingspan of 17 inches (Sibley 2003). Preferred breeding habitats for the western snowy plover include sandy coastal beaches, barrier islands, barren shores of inland saline lakes, and river bars along the Pacific coastline of Washington, Oregon, California, and Mexico. In the interior portions of the western states this species also inhabits alkaline lakes, ponds, and river bars (Page et al. 2009). Due to a declining population size from a variety of factors, including loss of habitat from coastal development, increased human recreational use of beaches, increased spread of invasive plant species, and increased numbers of native and introduced predators (USFWS 2007, Page et al. 2009), the Pacific Coast breeding population of the western snowy plover was federally listed as threatened on 5 March 1993 (Federal Register 58(42)12864-12874) under provisions of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

The California least tern (*Sternula antillarum browni*; formerly *Sterna antillarum browni*) is a member of the family Laridae, which includes gulls, terns, skuas, and skimmers. This small seabird has an approximate adult length of 9 inches and wingspan of 20 inches (Sibley 2003). Preferred breeding habitats for the California least tern include shorelines of bays and coastal beaches of the Pacific Ocean in Southern California, Central California, San Francisco Bay, and Baja California (Thompson et al. 1997). Due to declining population sizes, primarily caused by loss of habitat from coastal development and recreational use of beaches, the California least tern was federally listed as endangered on 2 June 1970 (Federal Register 35(106)8491-8498) under the provisions of the Endangered Species Conservation Act of 1969 (16 USC 851 *et seq.*).

The Guadalupe-Nipomo Dunes National Wildlife Refuge (Refuge) was established by the U.S. Fish and Wildlife Service (USFWS) on 1 August 2000 as part of the Hopper Mountain National Wildlife Refuge Complex. The primary goals for establishing the Refuge were to conserve Central California coastal dune and associated wetland habitats, and to contribute to the recovery of federally listed plants and animals (USFWS 2000).

Anecdotal accounts suggest that western snowy plover (hereafter, referred to as snowy plover) have regularly nested on the Refuge since at least the late 1970's. California least tern (hereafter, referred to as least tern) have not been observed to nest on the Refuge since its establishment in 2000, even though potentially suitable breeding habitat exists there. However, in past years least tern have been periodically observed feeding in the ocean adjacent to the Refuge and flying over the Refuge beach. Least tern regularly breed approximately three miles to the north of the Refuge on the Oceano Dunes State Vehicular Recreation Area (SVRA) and approximately two miles to the south of the Refuge at the Santa Maria River Estuary and Rancho Guadalupe Dunes County Park.

Annual breeding season monitoring for snowy plover and least tern has been conducted on the Refuge since 2001 and has continued to the present. This monitoring has been conducted each year in accordance with the provisions included in *Biological Opinion for the Western Snowy Plover Management and Public Use Programs at Guadalupe-Nipomo Dunes National Wildlife*

Refuge, San Luis Obispo County, California (#1-8-01-FW-15) and subsequent revisions. The primary goals of this monitoring were to 1) acquire the best available scientific information for making Refuge management decisions involving snowy plover, least tern, and sensitive coastal habitats, and 2) assist with the recovery of these two federally listed bird species.

During the 2012 breeding season, the majority of the snowy plover monitoring activities on the Refuge were conducted by California Department of Parks and Recreation biologists from the Oceano Dunes SVRA, under authority of USFWS recovery permit #TE-815214-5.1. Several field surveys were conducted by USFWS biologists under authority of Biological Opinion #1-8-01-FW-15. Although a new USFWS Recovery Sub-permit (# FWS-GND-0) was issued to the Refuge in August 2012, no field activities were performed during the 2012 snowy plover breeding season by USFWS biologists after this new sub-permit was issued.

Study Area

The Refuge is located in Central California, along the coast of southwestern San Luis Obispo County, and is part of the 18-mile long Guadalupe-Nipomo Dunes Complex that stretches from Pt. Sal in Santa Barbara County north to Pismo Beach in San Luis Obispo County (Fig. 1). The 2,553-acre Refuge shares a 1.8-mile boundary with the Pacific Ocean, and contains a variety of coastal habitats that are suitable for nesting by snowy plover and least tern. These suitable habitats include coastal beach strand, unvegetated and partially vegetated foredune, sand blowout, and active sand sheet. These habitats support a wide variety of wildlife species (Appendix A). Similar habitats exist immediately to the north of the Refuge on the Oceano Dunes SVRA, immediately to the south on the Guadalupe Restoration Project site (formerly known as the Guadalupe Oil Fields), and about two miles further south on the Rancho Guadalupe Dunes County Park.

Portions of the Refuge coastal strand and foredune habitats are vegetated with both native and non-native plants. Dominant native plant species include sand verbena (*Abronia latifolia*, *A. maritima*), beach saltbush (*Atriplex leucophylla*), beach morning glory (*Calystegia soldanella*), and beach bur (*Ambrosia chamissonis*). Dominant non-native species include sea rocket (*Cakile maritima*), European beachgrass (*Ammophila arenaria*), Hottentot fig (*Carpobrotus chilensis*), and purple ragwort (*Senecio elegans*).

The Refuge habitats vary in suitability for both breeding snowy plover and least tern, primarily based upon the density of vegetation. Breeding snowy plover and least tern both require non-vegetated or sparsely vegetated areas to nest, and several non-native invasive plant species have adversely affected coastal strand and foredune habitat on the Refuge. The northern half of the Refuge foredunes is heavily impacted by European beachgrass, and Hottentot fig is found intermittently throughout all portions of the Refuge foredunes. Purple ragwort is sporadically common in the interior and eastern portions of the Refuge foredunes.

Strong west and northwesterly winds of 25 to 35 miles per hour or more are common on the Refuge during the winter and spring months, but typically decrease during the summer months.

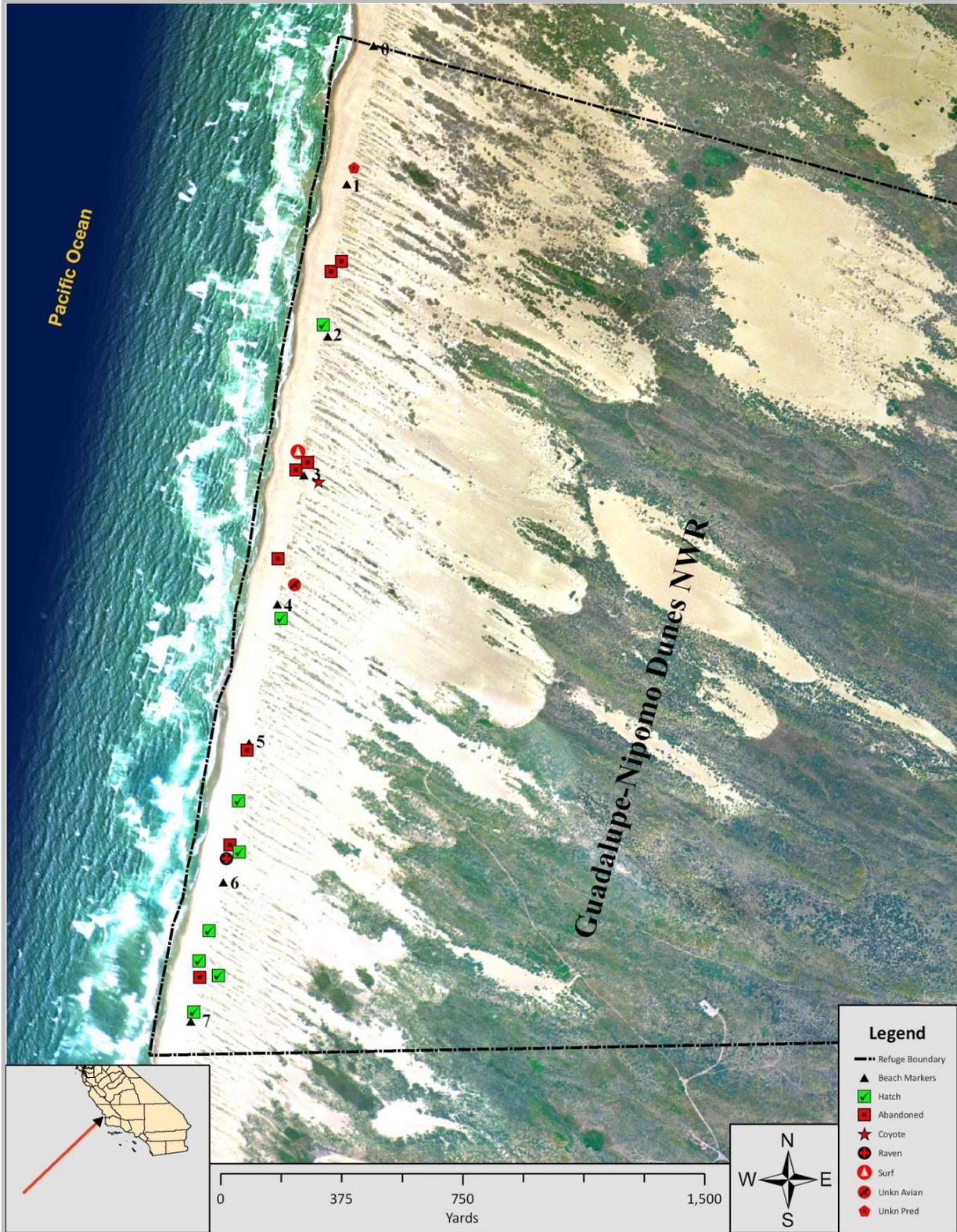


Figure 1. Map of western portion of Guadalupe-Nipomo Dunes NWR, San Luis Obispo County, California, depicting locations of detected snowy plover nests and nest fates during the 2012 breeding season. Beach markers 0-7 are positioned at 440-yard intervals from north to south

along the upper beach.

Heavy surf is common during the winter and spring months, with wave heights often in excess of 20 feet. Summer surf tends to be smaller in size.

The Refuge beach substrate is composed of sand. The presence of hard substrate materials such as shells, gravel, cobble, or boulders is rare, and surface bedrock is nonexistent. In most years, the Refuge beach is narrower in width and steeper in profile during the winter and spring months, and then grows wider and flatter during the summer and early fall months.

Typically, the Refuge beach and the seaward edge of the foredunes are heavily littered with marine debris such as logs, tree stumps, tree branches, small wood fragments, terrestrial plant leaves, kelp strands, marine mammal carcasses, bird carcasses, and a wide variety of trash.

Methods

Snowy Plover Monitoring

A minimum of two field surveys were scheduled each week, with a primary survey focus on the beach and foredune areas that are located within a quarter-mile of the beach. Periodic checks of inland dune ridges, sand blowouts, sand sheets, and other non-vegetated or sparsely vegetated habitats that were located within a half-mile of the beach were also conducted.

During each field survey we attempted to locate all snowy plover scrapes, nests, chicks, juveniles, and adults. The number of observed scrapes was counted during each nest survey, and the location of each nest scrape was rapidly approximated using the existing beach markers that are posted at one-quarter mile intervals along the upper beach (Fig. 1). If winds were not sufficient to erase all nest scrapes between surveys, field notes from recent field surveys were reviewed to avoid double-counting.

A nest was defined as a scrape in the substrate that contained at least one snowy plover egg. Eggless scrapes that contained convincing evidence of former snowy plover egg presence (such as egg shell fragments and/or egg yolk) were also classified as being a nest. Empty scrapes without evidence of eggs or chicks, and single eggs that were dropped by snowy plover outside of scrapes, were not counted as nests.

To uniquely identify snowy plover nests, they were consecutively numbered as they were discovered, starting with #1. Relevant data, such as nest locations, numbers of eggs, snowy plover presence, predator presence, brood locations, color band data, subsequent nest check data, nest fates, depredation events, and human visitor activities were recorded in field notebooks. The number of humans detected by direct observation or by interpreting tracks left in the sand or other evidence was also noted. Human visitor activities were classified as hiker, jogger, fishermen, or unknown.

After discovering an active nest, a retreat was made as necessary to avoid disturbing nesting birds. From a safe distance that would not flush nest-attending adults, usually at least 100 yards,

data for the nest location was recorded in a field notebook using descriptive text and sketches. In the descriptive text and sketch for each nest location, the approximate location was included using beach markers and existing landmarks (such as dunes, hillocks, vegetation, and readily recognizable pieces of debris). Nest locations were recorded using a GPS receiver (Magellan Medallion Gold), with a typical accuracy of 10-13 feet. The recorded waypoints were later plotted on a Refuge map using GIS software (ArcMap 9.3).

Warriner et al. (1986) determined for a small population of snowy plover breeding at the Pajaro River mouth, Monterey County, California, located about 135 air miles north of the Refuge, that the incubation period from the last egg laid to the last chick hatched averaged 27.4 days. Thus, this 27.4 day average was used to estimate the dates for unobserved hatches on the Refuge.

This 27.4 day average incubation period was also used to estimate clutch initiation dates for nests found with two-egg or three-egg clutches. For nests found with two-egg clutches, we added 2-3 days for the time it takes to complete a typical two-egg clutch to this 27.4 day average incubation period, and back-counted from the hatch date. For nests found with three-egg clutches, we added 4-5 days to account for the time it takes to complete a typical three-egg clutch to this 27.4 day average incubation period, and back-counted from the hatch date.

Nest fates were determined by direct observation or by evidence left at nest sites. Nests that disappeared before their expected hatch date were examined to determine the most likely cause of loss. When empty nests were found near or past their expected hatch date, we looked for eggshell pips in the nest, as well as chicks or displaying adults in the vicinity as indications of hatching. For empty nests that failed, the nest and surrounding area was checked for evidence of predation or other potential causes of failure. Searches were also conducted in the sand for buried eggs.

Warriner et al. (1986) also determined for the Pajaro River mouth population of snowy plover that the average fledge period was 30.9 days after hatching. We implemented this 30.9 day average to estimate fledge dates for snowy plover chicks on the Refuge.

Least Tern Monitoring

Monitoring for least tern was conducted concurrently with snowy plover monitoring. In California the least tern breeding season typically occurs from mid-April through early August (USFWS 1985). During this period, more focused observations for nesting least tern were conducted in suitable habitat. The air and ground was scanned for the presence of least tern and least tern vocalizations.

Symbolic Fencing

In an effort to protect breeding snowy plover and potentially breeding least tern from human activities, symbolic fencing was installed on 1 March and removed on 30 September. To create symbolic fencing, official area closure signs were attached to six-foot long metal posts and placed along the entire 1.8-mile length of the Refuge upper beach at intervals of 150 feet or less.

The beach area located west of the signs, mainly the “wet sand” area, remained open for public use throughout the breeding season. These signs were moved east (inland) or west (seaward) as beach conditions and snowy plover nest locations changed. Habitat closure signs were also placed at intervals of 50 feet or less along the northern and southern Refuge boundaries from the upper beach to about 200 feet inland.

Predator Management

Based on the success of their use on the Refuge during the 2009-2011 snowy plover breeding seasons (Applegate and Schultz 2009, Greenwald 2011, Greenwald 2012), nest enclosures were again deployed during the 2012 snowy plover breeding season as a predator management measure. Two types of nest enclosures were used, either a three-foot diameter bottomless cube or a four-foot diameter bottomless cylinder. During 2012, we deployed 10 of the cylinder-type enclosures and one of the square-type enclosures. Both types of enclosures were three feet tall, and were constructed of 2” x 4” mesh, 12.5-gauge, non-climb wire fencing that was connected with 70-pound strength, ultraviolet light-resistant, plastic cable ties. All enclosures were constructed with wire mesh tops, using the same non-climb wire fencing as the sides. After it was slowly and carefully centered over the snowy plover nest, we buried the edge of each enclosure about four inches (one mesh unit height) into the sand. Metal reinforcing rods (“rebar”) were used to secure the enclosures into the sand. These rods were 3/8” in diameter, 18” in length, and were bent in a “J”-shape to facilitate hooking over the bottom of the enclosure.

On 16 March, before snowy plover nests were present, all 11 nest enclosures held in inventory by the Refuge were deployed as decoys. These decoy enclosures were placed in snowy plover breeding habitat near beach markers 1, 3, 5, and 7 (Fig. 1). The purpose of these decoy enclosures was to acclimatize local predators to the presence of enclosures, and, therefore not associate them with the presence of prey. Gradually, these decoy enclosures were removed from decoy status and used as real nest enclosures when plover nests became established.

Other than the installation of the nest enclosures, no other predator management strategies were employed during the 2012 snowy plover breeding season.

Human Visitor Use

Human visitor use information was gathered concurrently with snowy plover monitoring activities. Human visitor beach use was determined either by direct observation or indirect evidence (such as tracks in the sand, litter, or acts of vandalism). The dates, locations, and types of activities involved with trespass into posted plover breeding habitat were also recorded.

Low Flying Aircraft (LFA)

In 2008, the Federal Administration Agency (FAA) posted the entire Refuge and some adjacent areas in its Los Angeles Sectional Flight Chart with a 2,000 feet above ground level (AGL) flight restriction. During our surveys, any aircraft visually estimated to be flying over the Refuge foredunes or beach below 2,000 feet AGL was classified as a low flying aircraft (LFA). For each LFA event, attempts were made to record aircraft type, make, model, color, and N-number

(tail number). The time, date, location, estimated above ground level (AGL), and direction of travel were also recorded.

Data Trend Comparisons

During 2005, land surveyors from California State Parks and the USFWS determined that the Refuge northern boundary / Oceano Dunes SVRA southern boundary was mismarked. At the Pacific Ocean, the northern Refuge boundary was found to be erroneously located approximately 0.4 miles too far to the north. Accordingly, the Refuge northern boundary was re-mapped to the proper location 0.4 miles to the south, resulting in a Refuge beach length change from 2.2 miles to 1.8 miles. This change in boundary lines further resulted in the need to edit Refuge snowy plover survey data that were obtained during the 2001-2005 surveys to eliminate data that were actually recorded on the Oceano Dunes SVRA. To properly edit these data, complete sets of GIS data were needed for each snowy plover survey year on the Refuge. Complete sets of GIS data were found for 2002-2005, and Refuge data for these years were filtered from Oceano Dunes SVRA data. However, only partial GIS data were found for 2001, and we were unable to completely separate Refuge and Oceano Dunes SVRA data for that year. Therefore, we were unable to utilize breeding season data taken during 2001 in multi-year comparisons.

To compare the 2012 snowy plover breeding season at the Refuge with previous years, we used previous comprehensive Refuge data from 2002-2011 (Greenwald 2012).

Results

Field Survey Frequency

Field surveys were conducted from 8 March 2012 through 19 September 2012. During this 195-day (approximately 28-week) survey period, a total of 54 field surveys were conducted. This frequency of field surveys produced an average of 1.9 surveys per week.

As experienced in previous years on the Refuge, high winds sometimes occurred early in the morning and precluded us from starting surveys. More often, these high winds started later in the morning, typically between 10 am and 11 am, and would force us to end our field surveys early, before a complete Refuge survey could be completed. These high winds were primarily present during the months of March through May, and occasionally during June and July.

On 19 September 2012, high tides and high creek outflow precluded the ability of State Parks biologists to access the Refuge by crossing the mouth of Oso Flaco Creek, and field surveys were not performed. This was the only survey day of the 2012 season when Refuge access was physically blocked in any manner.

Adult Snowy Plover Population

During the 2012 breeding season, the highest numbers of adult snowy plover observed on the Refuge in one day was on 16 July, when 30 individual adults were detected. These 30 snowy

plover were represented by 10 males, 6 females, and 14 of unknown gender. Higher numbers of adult snowy plover were also observed on the Refuge on 4 May and 12 June. On 4 May, a total of 24 adult snowy plover was observed, represented by 12 males and 12 females. On 12 June, a total of 24 adult snowy plover was observed, represented by 17 males, 5 females, and 2 of unknown gender (Fig. 2, Appendix B).

The highest numbers of male snowy plover observed in one day was 17 individuals on 12 June and 12 individuals on 4 May. Also, 10 males were observed on 10 April, 8 June, and 5 July, and 16 July (Fig. 2, Appendix B).

The highest numbers of female snowy plover observed in one day was 12 individuals on 8 March and 4 May, and 11 individuals on 7 May. On 14 March, 8 females were observed (Fig. 2, Appendix B).

On 22 May, the Refuge participated in the standardized U.S. Pacific Coast Western Snowy Plover Breeding Season Window Survey (Breeding Window Survey). The Breeding Window Survey is an annual event coordinated by the USFWS, during which plover monitors from Washington to California attempt to obtain a census of breeding snowy plover numbers by scheduling surveys during the same day, or at least the same week. During the Breeding Window Survey, 14 adult snowy plover were observed on the Refuge, including 6 males and 8 females (Fig. 2, Appendix B).

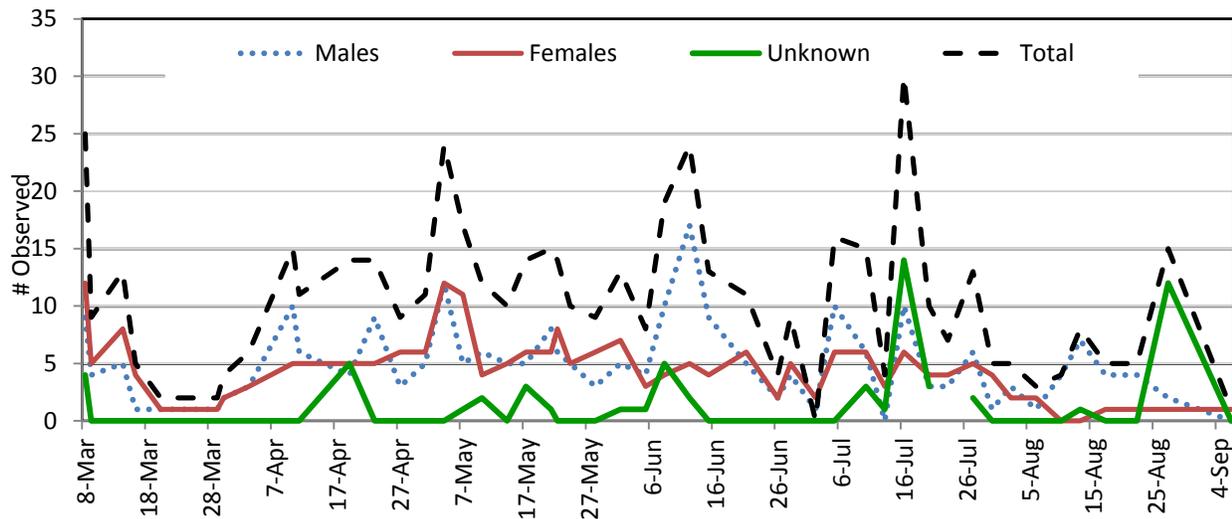


Figure 2. Numbers of adult western snowy plover observed on the Guadalupe-Nipomo Dunes NWR during the 2012 breeding season.

Snowy Plover Nests

During the 2012 breeding season, a total of 21 snowy plover nests were found on the Refuge (Table 1). The first known nest was initiated on approximately 10 April, and the last on

approximately 8 July. The first known hatch occurred on approximately 19 May, and the last known hatch was estimated to occur around 8 August (Fig. 3, Appendix C).

Table 1. Summary of fates for the 21 snowy plover nests observed at the Guadalupe-Nipomo Dunes NWR during the 2012 breeding season.

Nest Fate	With Enclosure		Without Enclosure		Combined Totals	
	# Nests	% of Enclosed Nests	# Nests	% of Unenclosed Nests	# Nests	% of All Nests
Hatched	6	40%	2	33%	8	38%
Abandoned	8	53%	0	0%	8	38%
Surf	1	7%	0	0%	1	5%
Predation	0	0%	4	67%	4	19%
Coyote	0	0%	1	17%	1	5%
Raven	0	0%	1	17%	1	5%
Corvid	0	0%	1	17%	1	5%
Unknown Avian	0	0%	1	17%	1	5%
Totals:	15	71%*	6	29%*	21	100%

*= Percent of combined total of 21 nests.

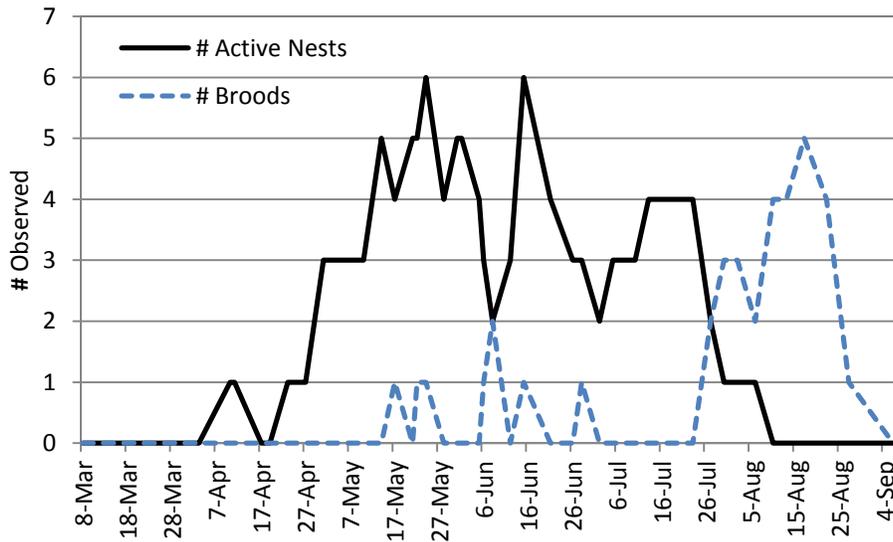


Figure 3. Numbers of active snowy plover nests and broods detected by date on the Guadalupe-Nipomo Dunes NWR by date during the 2012 breeding season.

The peak periods for active nest numbers were during mid-May and mid-June. The maximum number of concurrently active nests detected was on 24 May and 16 June when 6 nests were active. On 14 May and 31 May, 5 nests were concurrently active (Fig. 3).

Based on predation data from previous years on the Refuge, and the reported early 2012 breeding season nest predation losses on sites adjacent to the Refuge, we began to install nest enclosures

on a case-by-case basis on 11 April. By the end of the breeding season, a total of 15 (71%) of the 21 nests had been protected with nest exclosures (Table 1).

Fourteen (67%) of the 21 snowy plover nests were located along the upper beach or edge of the foredunes, and seven (33%) were located in the foredunes at distances of up to about 60 yards inland from the upper beach (Fig. 1).

Collectively, 8 out of 21 nests were observed or detected to have hatched one or more eggs, resulting in a 38% nest hatch rate. Among the 8 hatched nests, 6 (75%) were protected by exclosures, and 2 (25%) were not protected by exclosures (Table 1, Appendix C). For the remaining 13 nests, 8 were abandoned, 4 were lost to predators, and 1 was lost to wash from high surf. Based on evidence primarily produced in the form of tracks, we suspect that the 4 nest losses resulted from 1 predation event from each of the following: common raven (*Corvus corax*), unidentified corvid, coyote (*Canis latrans*), and unidentified avian predator (Table 1, Appendix C). The unidentified corvid likely was a common raven or American crow (*Corvus brachyrhynchos*).

For the 15 nests that were protected by exclosures, 6 (40%) hatched, none were lost to predators, 8 (53%) were abandoned, and 1 (7%) was lost to wash from high surf. For the 6 nests that were not protected by exclosures, 2 (33%) hatched, 4 (67%) were lost to the above-mentioned depredation, and none were lost to abandonment or high surf (Table 1, Appendix C).

A minimum of 51 eggs were laid in the 21 detected nests, however, since some nests were depredated before the completed clutches were observed by field biologists, the actual total number of eggs was likely larger. For the 8 nests with hatches, 4 nests hatched three chicks, 3 nests hatched 2 chicks, and 1 nest hatched at least 1 chick, for a total detected production of 19 snowy plover chicks. The observed egg hatch success was 37% (19 of 51 eggs hatching) (Appendix C).

Snowy Plover Broods

Because color banding of snowy plover chicks has not been conducted on the Refuge since 2005, fledge dates, specific brood movement, or the survival of specific broods or chicks could not be established. However, our observations indicated that broods used both beach and foredune habitats, with the greatest number of observations being made in the upper beach habitat and seaward edge of the foredunes.

Although chicks and brooding adults were evasive and secretive, field biologists managed to acquire 39 brood observations on 17 different dates from 21 May until 27 August. From 10 August through 22 August, 4 to 5 broods were observed per day (Fig. 3). Field biologists accumulated 17 observations with 3 chicks per brood, 16 observations with 2 chicks per brood, and 5 observations with 1 chick per brood. One brood observation indicated that 2 intermingled broods of 3 chicks each were grouped together (Appendix D).

Two of the snowy plover broods observed on the Refuge during 2012 were determined to have hatched offsite. Based on color bands present on chicks, a brood observed on the Refuge on 30

July and 13 August was determined to have originated from the ODSVRA. After comparing information from the Chevron Guadalupe Oil Fields (Paradis 2012) with our field notes, a brood observed on the Refuge on 2 August was suspected to have originated on the Chevron Guadalupe Restoration Project (Appendix D).

Using the 30.9-day average fledge period determined by Warriner et al. (1986), we estimated that the first Refuge brood would have fledged around 17 June, and the last brood around 6 September.

Color Banded Snowy Plover

A total of 39 different color band combinations were detected on snowy plover on the Refuge during 2012. We were able to determine the origin for 36 (92%) of these color band combinations, but were unable to determine the origin for 3 (8%) of these color band combinations. The origins of the 36 known color band combinations included 1 from Oregon and 35 from California.

The exact banding location of the Oregon snowy plover was undetermined. This individual from Oregon displayed the greatest distance of movement detected from any banded snowy plover observed on the Refuge during the 2012 breeding season.

The origins of the 35 California snowy plover included 2 from Monterey County, 29 from San Luis Obispo County, and 4 from Santa Barbara County (Table 2). The two color band combinations that originated from Monterey County included 1 from Fort Ord that was banded in 2011, and 1 from Salinas State Beach that was banded in 2010. The 29 color band combinations that originated from San Luis Obispo County included 28 from Oceano Dunes SVRA and 1 from the Refuge. Of special note, the snowy plover that originated on the Refuge was banded as a chick there in 2002. The 4 color band combinations that originated from Santa Barbara County were all from Vandenberg AFB (Table 2).

Due to a shortage of available unique color combinations for banding snowy plover on the Pacific Coast of the United States, in recent years both Oceano Dunes SVRA and Vandenberg Air Force Base have been repeating the use of color combinations from earlier years (Doug George, PRBO Conservation Science, pers. comm., 2011). A total of 10 of the 28 color band combinations observed on the Refuge during 2012 from Oceano Dunes SVRA were used in two different years from 2001 to 2011. Therefore, we were unable to determine the exact year of banding for these 10 color band combinations. However, the 18 color band combinations that were used during just one year indicated that the snowy plover observed on the Refuge during 2012 were banded on the Oceano Dunes SVRA from 2007 to 2012 (Table 2).

Complete electronic versions of the Refuge 2012 breeding season color band data sets were sent to PRBO Conservation Science (Frances Bidstrup and Doug George) and the Oceano Dunes SVRA (Amber Clark, Ronnie Glick, Joanna Iwanicha, and Stephanie Little).

Table 2. Summary of origins and banding years for snowy plover color band combinations observed on the Guadalupe-Nipomo Dunes NWR during 2012.

Location Banded	County*	Year Banded**	# Combinations
Oregon	Unknown	2010	1
Fort Ord	Monterey	2011	1
Salinas State Beach	Monterey	2010	1
GNDNWR	San Luis Obispo	2002	1
Oceano Dunes SVRA	San Luis Obispo	2007	2
Oceano Dunes SVRA	San Luis Obispo	2008	3
Oceano Dunes SVRA	San Luis Obispo	2009	1
Oceano Dunes SVRA	San Luis Obispo	2010	2
Oceano Dunes SVRA	San Luis Obispo	2011	6
Oceano Dunes SVRA	San Luis Obispo	2012	3
Oceano Dunes SVRA	San Luis Obispo	2010/2002	2
Oceano Dunes SVRA	San Luis Obispo	2006/2001	1
Oceano Dunes SVRA	San Luis Obispo	2008/2001	1
Oceano Dunes SVRA	San Luis Obispo	2010/2002	1
Oceano Dunes SVRA	San Luis Obispo	2010/2003	1
Oceano Dunes SVRA	San Luis Obispo	2010/2005	1
Oceano Dunes SVRA	San Luis Obispo	2010/2007	1
Oceano Dunes SVRA	San Luis Obispo	2011/2003	1
Oceano Dunes SVRA	San Luis Obispo	2011/2008	2
Vandenberg AFB	Santa Barbara	2011	3
Vandenberg AFB	Santa Barbara	?	1
Undetermined	?	?	3
Total Combinations:			39

* = All reported counties are located in California. ** = In recent years, both Oceano Dunes SVRA and Vandenberg AFB have been repeating the use of color band combinations from earlier years.

Least Tern Breeding Activities

Least tern were not detected on the Refuge during 2012. As in the last 12 breeding seasons, least tern breeding activities were not detected on the Refuge.

Predators

On several occasions, common raven, peregrine falcon (*Falco peregrinus*), red-tailed hawk (*Buteo jamaicensis*), merlin (*Falco columbarius*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), western scrub jay (*Aphelocoma californica*), and loggerhead shrike (*Lanius ludovicianus*) were observed roosting or actively hunting along the beach and/or foredunes.

Other potential snowy plover predators that were either observed or detected by tracks or scat in the Refuge beach or foredunes included wild pig, northern raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), and great horned owl (*Bubo virginianus*) (Appendix A). Coyote and wild pig tracks were observed on nearly all Refuge surveys this season. As was previously mentioned, predators destroyed 4 (19%) of the 21 detected snowy plover nests. All four of these depredated nests were not protected by an enclosure (Table 1).

Human Visitors

Through direct observation and evaluation of tracks and other evidence, a total of 106 human visitors were recorded on the Refuge beach and foredunes during the 2012 snowy plover breeding season. The determined activities for these 106 visitors included 8 hiking (8%), 71 surf fishing (67%), 20 jogging (19%), and 7 unknown activities (7%) (Table 3).

Through evaluation of tracks, we detected that at least 6 visitors trespassed into posted snowy plover habitat. The total of 6 detected trespass incidents among a total of 106 visitors represents a trespass rate of 6% for all visitors combined. The levels of detected trespass ranged from 10 to 30 feet inside posted plover habitat from distances ranging from a few yards to about a quarter-mile (Appendix E).

Table 3. Summary of human visitor activities recorded on the Guadalupe-Nipomo Dunes NWR during the 2012 snowy plover breeding season.

Activity	# Visitors	% Total Visitors
Hiking	8	8%
Fishing	71	67%
Jogging	20	19%
Unknown	7	7%
Total	106	100%

Low Flying Aircraft (LFA)

A total of 4 LFA events were observed during the 2012 snowy plover breeding season, including 3 airplanes and 1 ultralight. One of the airplanes was a biplane. Estimated above ground level (AGL) altitudes for these LFA ranged from 30 feet to 200 feet (Table 4).

Take of Snowy Plover or Least Tern

No snowy plover or least tern eggs, chicks, or adults were known to have been injured or killed due to visitor activities or monitoring activities during the 2012 breeding season. The only

observed take was the limited harassment that occurred during authorized monitoring activities when adult and juvenile snowy plover periodically responded to the brief presence of plover monitors. Field biologists were unable to determine the level of harassment that was caused by the trespass of human visitors into posted snowy plover breeding habitat or LFA that flew over this habitat.

Table 4. Summary of low flying aircraft observed over the Guadalupe-Nipomo Dunes NWR during the 2012 snowy plover breeding season.

Aircraft Type	# Observed Aircraft	Estimated AGL* (ft)
Airplane	3	50-200
Ultralight	1	30
Total	4	30 - 200

*AGL = above ground level

Discussion

Adult Snowy Plover Population

As stated previously, the maximum number of adult snowy plover observed on the Refuge in one day was 24 individuals. The highest numbers of male snowy plover observed in one day was 17 individuals, and the highest numbers of female snowy plover observed in one day was 12 individuals (Fig. 2, Appendix B). Although census numbers indicated that up to 12 pairs of snowy plover had the potential to occur on the Refuge, not all of the observed individuals were likely to have bred on the Refuge during 2012. Some of the snowy plover observed on the Refuge may have been visitors that were breeding on the adjacent Chevron Guadalupe Restoration Project, Ocean Dunes SVRA, or other nearby sites. Also, the possibility exists that not all adult snowy plover residing on the Refuge actually bred in 2012.

Based on the adult census numbers (Fig. 2, Appendix B), numbers of concurrent nests and broods (Fig. 3), and nest initiation and hatch dates (Appendix C), there is enough information to account for a minimum of 7 pairs of western snowy plover breeding on the Refuge during 2012.

Snowy plover population data collected during a range-wide breeding window survey only reflects the observations made during one particular day during an entire breeding season. During surveys conducted about two weeks before and two weeks after the range-wide breeding window survey on 22 May, daily totals of 24 adult snowy plover were observed. Therefore, the Breeding Window Survey likely only detected a portion of the breeding adult snowy plover on the Refuge (Fig. 2, Appendix B).

During the previous ten years (2002-2010), the number of adult snowy plover observed on the Refuge during the Breeding Window Surveys has ranged from a low of 7 (in 2007) to a high of 32 (in 2006), with an average of 22. Therefore, the sighting of 14 adult snowy plover (6 males and 8 females) during the 2012 Breeding Window Survey was about 33% lower than the mean from the previous ten years (Table 5). However, the numbers of snowy plover observed during the 2012 Breeding Window Survey were close to the suspected minimum of seven breeding pairs for this breeding season.

Table 5. Guadalupe-Nipomo Dunes NWR snowy plover breeding season range-wide window survey adult census data from 2002-2012. The 11-year mean is calculated for years 2002-2012. The 10-year mean is calculated for years 2002-2011.

Year	Total Adults	Male	Female	Adult - Unknown Gender	Unknown Age
2002	17	8	9	0	1
2003*	26	NA	NA	NA	NA
2004	31	15	14	2	0
2005	25	12	11	2	0
2006	32	17	13	2	0
2007	7	3	4	0	0
2008	25	14	11	0	0
2009	14	9	5	0	0
2010	11	4	6	1	0
2011	27	13	14	0	0
2012	14	6	8	0	0
Mean (11-Yr.)	21	10	10	1	0
Mean (10-Yr.)	22	11	10	1	0

* During the 2003 breeding window survey, snowy plover were not differentiated by gender or age. Therefore, data for 2003 were only used for determining "total adults" annual mean data.

Snowy Plover Nests

By mean percentages for the ten years preceding 2012, March has produced 7% of the annual nests, followed by April with 24%, May with 30%, June with 33%, and July with 8%. By monthly mean nest numbers, these mean monthly percentages correlate to 2 for March, 9 for April, 11 for May, 12 for June, and 3 for July. Since 2002, no snowy plover nest has been known to have been initiated on the Refuge beyond the month of July. The monthly patterns of nest initiation numbers during 2012 appeared to be similar to the previous ten years, with March (no nests) and July (1 nest / 5% of annual) being the least productive for nest initiations and May (10 nests / 48% of annual) and June (7 nests / 33% of annual) being the most productive (Table 6).

The cumulative detected nest total on the Refuge for the 11-year period from 2002-2012 was 400, with 154 (39%) successful nest hatches, and 412 chicks produced. The cumulative detected nest total on the Refuge for the 10-year period from 2002-2011 was 379, with a total of 146 (39%) hatches (Fig. 4, Fig. 5, Table 7, Table 8).

Table 6. Snowy plover nest initiations on the Guadalupe-Nipomo Dunes NWR by month from 2002-2012.

Year	Month										Total #
	March		April		May		June		July		
	#	% of Year	#	% of Year	#	% of Year	#	% of Year	#	% of Year	
2002	3	7	6	14	14	33	14	33	5	12	42
2003	4	12	4	12	7	21	17	50	2	6	34
2004	0	0	10	20	10	20	27	54	3	6	50
2005	1	3	9	24	13	34	13	34	2	5	38
2006	0	0	14	38	8	22	11	30	4	11	37
2007	2	9	5	22	6	26	5	22	5	22	23
2008	4	10	6	15	12	31	15	38	2	5	39
2009	5	10	18	36	13	26	7	14	7	14	50
2010	3	12	8	31	9	35	5	19	1	4	26
2011	4	10	11	28	16	40	9	23	0	0	40
2012	0	0	3	14	10	48	7	33	1	5	21
11-Year Data (2002-2012)											
Total	26		94		118		130		32		400
Mean	2	7	9	24	11	30	12	33	3	8	36
10-Year Data (2002-2011)											
Total	26		91		108		123		31		379
Mean	3	7	9	24	11	28	12	32	3	8	38

During the 10-year period from 2002-2011, the total number of snowy plover nests found each season has ranged from a low of 23 (during 2007), to a high of 50 (during 2009), with a mean of 38. Therefore, the 21 nests detected during 2012 represents the lowest number of nests found on the Refuge in 11 years, and is about 45% lower than the annual average number of nests for the previous ten years (Fig. 4, Table 6, Table 7).

The Refuge snowy plover nest hatching success for the 10-year period from 2002-2011 has ranged from a low of 7 in 2007 (30% hatch rate) to a high of 21 in 2005 (55% hatch rate), with a mean of 15 hatches (39% hatch rate). Accordingly, the production of 8 hatched nests during 2012 was 7 nests (47%) lower than the mean for the previous ten years. However, the 38% hatch rate for 2012 was close to the 39% mean hatch rate for the previous ten years. Based on comparable hatch success rates between 2012 and the preceding 10 years, the low production of hatchlings in 2012 appears to be a result of the low nest numbers (Fig. 4, Table 7). The low nest

numbers that were observed in 2012 appear to be a result of the low number of breeding pairs of snowy plover on the Refuge during this year.

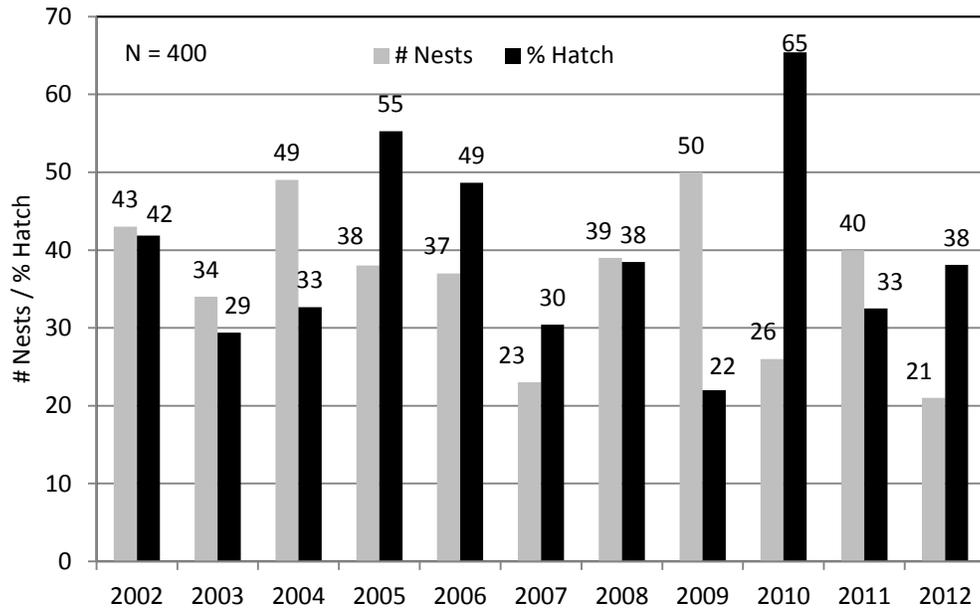


Figure 4. Snowy plover nest numbers and hatch success rates detected on the Guadalupe-Nipomo Dunes NWR by year from 2002 through 2012. For the 11-year period from 2002-2012, 400 nests were detected, with a mean annual nest hatch rate of 14 nests (40% success rate).

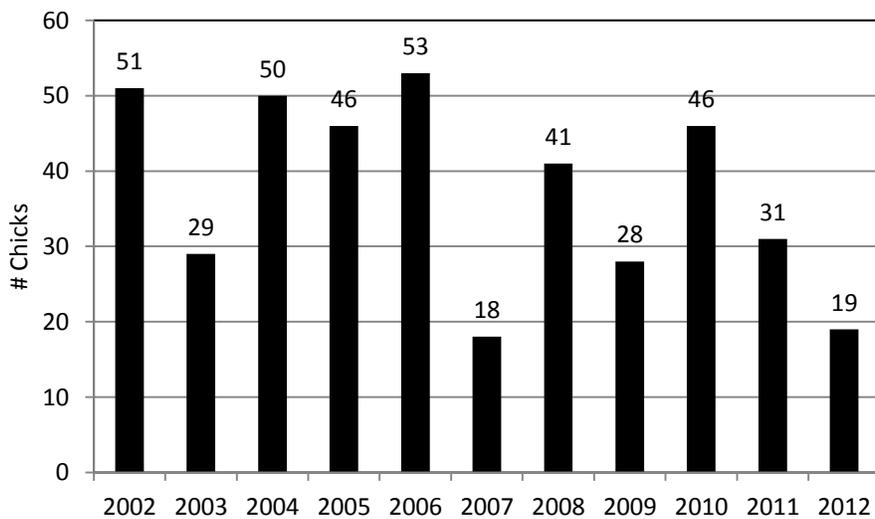


Figure 5. Numbers of detected snowy plover chicks hatched by year on the Guadalupe-Nipomo Dunes NWR from 2002-2012.

As mentioned previously, a total of 8 (38%) of the 21 detected snowy plover nests were abandoned, and all of the abandoned nests were protected with exclosures. Since 8 of the 15 exclosed nests were abandoned, this resulted in a 53% abandonment rate for exclosed nests.

None of the non-exclosed nests were abandoned (Table 1, Appendix C). The overall abandonment rate of 38% for 2012 has been the highest level in the past 11 years. During the last 11 years, only 2011 exhibited a higher nest abandonment number, with 10 nests. However, the nest abandonment rate for 2011 was only 25% (Table 7). The abandonment of 8 nests during 2012 was twice the 10-year mean abandonment rate of 4 nests and about 3.5 times the mean abandonment rate of 11%. One important consideration regarding nest abandonment percentage rates for 2012, is that this year had the smallest number of nests recorded in 11 years.

A possibility exists that predators have associated the presence of nest exclosures with the presence of potential food. Therefore, the possible increased presence of potential harassment of snowy plover adults by predators such as common raven, great horned owl, northern harrier, peregrine falcon, coyote, wild pig, and other predators at exclosures should also be considered as possible causes for nest abandonment during 2012. The exclosures themselves may possibly serve as a perching location for avian predators, however, such behavior was not observed on the Refuge during 2012, or during previous field seasons.

No evidence was found in 2012 or recent years to suggest that adult snowy plover predation was increased or even present at exclosed nests. However, if such depredation events occurred they would be difficult to substantiate, unless they were actually observed.

Table 7. Detected snowy plover nest numbers and fates on the Guadalupe-Nipomo Dunes NWR during the 2002-2012 breeding seasons.

Year	Total Nests		Hatch		Destroyed Predators		Destroyed Surf		Destroyed Wind		Destroyed Unknown		Abandoned		Fate Unknown	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
2002	43		18	42	15	35	0	0	0	0	4	9	4	9	2	5
2003	34		10	29	21	62	0	0	1	3	1	3	1	3	0	0
2004	49		16	33	23	47	1	2	0	0	4	8	5	10	0	0
2005	38		21	55	9	24	2	5	1	3	4	11	1	3	0	0
2006	37		18	49	13	35	2	5	1	3	3	8	0	0	0	0
2007	23		7	30	6	26	0	0	0	0	2	9	7	30	1	4
2008	39		15	38	14	36	0	0	1	3	1	3	5	13	3	8
2009	50		11	22	20	40	1	2	2	4	9	18	6	12	1	2
2010	26		17	65	4	15	2	8	0	0	1	4	1	4	1	4
2011	40		13	33	17	43	0	0	0	0	0	0	10	25	0	0
2012	21		8	38	4	19	1	5	0	0	0	0	8	38	0	0
11-Year Data (2002-2012)																
Total	400		154		146		9		6		29		48		8	
Mean	36		14	39	13	37	1	2	1	2	3	7	4	12	1	2
10-Year Data (2002-2011)																
Total	379		146		142		8		6		29		40		8	
Mean	38		15	39	14	37	1	2	1	2	3	8	4	11	1	2

Table 8. Numbers of detected snowy plover chicks hatched by year on the Guadalupe-Nipomo Dunes NWR from 2002-2012. The 11-year total and mean are provided for 2002-2012. The 10-year total and mean are provided for 2002-2011.

Year	# Chicks
2002	51
2003	29
2004	50
2005	46
2006	53
2007	18
2008	41
2009	28
2010	46
2011	31
2012	19
11-Yr. Total:	412
11-Yr. Mean:	37
10-Yr. Total:	393
10-Yr. Mean:	39

The 2012 predation loss of 4 nests (19% predation rate) was much lower than the previous ten-year annual mean predation loss of 14 nests (36% predation rate). This lower predation rate may be a result of having a higher percentage (71%) of nests being protected by exclosures than past years. Of special note, none of the exclosed nests were depredated.

In recent years, the accumulation of successful nest hatches has largely been a function of vigilant adaptive management of nest exclosures. The successful management of nest exclosures has been a delicate balancing act of evaluating higher predation of non-exclosed nests with higher abandonment of exclosed nests.

Human Trespass Levels

Due to the frequent high winds which rapidly cover tracks, the presence of surf wash and high tides which also cover tracks, and the relatively few monitoring days per week, all human visitor presence and trespass incidents are not detected during each snowy plover breeding season. Therefore, field biologists likely tend to underestimate the number of human visitors and trespass events on the Refuge. Considering this tendency, the 106 human visitors with 6 trespasses into snowy plover breeding habitat detected in 2012 (Table 3, Appendix E) were both likely higher.

Since the creation of the Refuge, the level of human trespass into snowy plover breeding habitat has caused ongoing management concerns. Due to these concerns, the Refuge continually adapts its snowy plover management strategy to the changing environmental conditions and human activities.

During 2008, we started recording quantitative human visitor and trespass information during our snowy plover breeding season surveys. When compared to 2008-2009, in 2010 there was a substantial reduction in trespass frequency from human activities. During 2008-2009 snowy plover breeding seasons, visitor days ranged from 80-91, with total trespass of known visitors into closed breeding habitat, ranging from 61%-69%. During 2010, 104 visitor days were recorded, and 37% total trespasses were detected. During 2011, 96 visitors were recorded, with a 7% trespass rate. During 2012, 96 visitors were recorded, with a 7% detected trespass rate. Therefore, the rate of trespass recorded during the 2012 snowy plover breeding season was the same as the 2011 trespass rate. The 7% trespass rates detected for 2011 and 2012 are substantially lower than the 37% to 69% trespass rates recorded from 2008-2010 (Table 9).

Table 9. Summary of detected human visitor activities on the Guadalupe-Nipomo Dunes NWR during the 2008 through 2012 snowy plover breeding seasons.

Year (# Surveys)	Activity	# Visitors Days Detected	% of Total Visitors Detected	# Trespass Incidents (% Trespass)*	% Total Trespass Incidents
2008 (39)	Hiking	75	82%	61	97%
	Fishing	16	18%	2	3%
	Other	0	0%	0	0%
	Total	91	100%	63 (69%)	100%
2009 (59)	Hiking	24	30%	11	22%
	Fishing	37	46%	23	47%
	Other	19	24%	15	31%
	Total	80	100%	49 (61%)	100%
2010 (65)	Hiking	35	34%	34	89%
	Fishing	66	63%	2	5%
	Other	3	3%	2	5%
	Total	104	100%	38 (37%)	99%
2011 (65)	Hiking	24	25%	0	0%
	Fishing	56	58%	4	57%
	Jogging	2	2%	0	0%
	Unknown	14	15%	3	43%
	Total	96	100%	7 (7%)	100%
2012 (54)	Hiking	8	8%	N/A	N/A
	Fishing	71	67%	N/A	N/A
	Jogging	20	19%	N/A	N/A
	Unknown	7	7%	7	100%
	Total	106	100%	N/A (7%)	100%

*During 2012 we were not able to determine the activity type being performed by trespassers.

Low Flying Aircraft (LFA)

Field observations of LFA have been recorded on the Refuge since 2009. The 4 LFA events observed during the 2012 snowy plover breeding season were considerably lower than the 11-17 events observed from 2009 through 2011 (Table 10). A similar number of field days (54-65) for snowy plover breeding surveys were performed each year from 2009-2012 (Table 10). The decreased number of LFA observed during 2012 may be a consequence of the field surveys typically being conducted earlier in the morning than in the past few years. Frequently, the Guadalupe-Nipomo Dunes, including the Refuge, experience low clouds and /or morning fog in the morning hours. These low clouds and fog reduce visibility for aircraft flying in the area. Field biologists typically record most observations of aircraft over the Refuge after 11am, when the low clouds or fog typically clear up.

Based upon the above information, the 4 LFA recorded over the Refuge during 2011 likely does not represent an actual decrease over previous years. More likely, this reduced number of LFA probably reflects a sampling bias inflicted by early morning sampling, when fewer aircraft are flying in the area.

As discussed in the Refuge annual snowy plover breeding season monitoring report for 2011 (Greenwald 2012), this reduction of trespasses may be a result of changes in monitoring protocol, greater presence of uniformed agency biologists, greater presence of official agency vehicles, and changes in symbolic fencing that were initiated in the beginning of the 2011 snowy plover breeding season. Based on the past two years of low detected trespass rates, we will continue to implement these changes that were initiated in 2011.

Table 10. Summary of low flying aircraft (LFA) events observed on the Guadalupe-Nipomo Dunes NWR during the 2009-2012 snowy plover breeding seasons.

Aircraft Type	Airplane		Helicopter		Gyrocopter		Ultralight	
	# Incidents	Estimated AGL (ft)						
2009	4	15-800	2	30-250	2	300	4	200-300
2010	4	50-500	2	500	2	400-500	3	50-300
2011	13	50-500	1	1,500	1	1,000	2	50-300
2012	3	50-200	0	N/A	0	N/A	1	30

Habitat Restoration

European beach grass, Hottentot fig, and purple ragwort are three of the primary invasive plants that are encroaching into the Refuge upper beach or foredune areas, and consequently causing loss of presently used and potential breeding habitat for snowy plover and least tern.

The initial groundwork for a pilot project to control European beach grass on the Refuge was conducted in December 2012 and January 2013 by the Land Conservancy of San Luis Obispo County. This project has been designed to remove European beach grass from five acres of foredunes habitat located in the northwest corner of the Refuge (Land Conservancy 2012). In this pilot project, European beach grass is being treated with backpack sprayer applications of fluazifop-p-butyl, a monocot-specific herbicide that specifically targets grasses. This European beach grass control project is scheduled to be continued for at least three treatment seasons. The primary goals of this project are to: 1) remove European beach grass, 2) restore natural sand dune dynamics and naturally restore native habitats, and 3) create new breeding habitat for snowy plover and least tern.

If this project proves to be successful, larger-scale versions will be implemented, and more suitable breeding habitat on the Refuge would be restored or created for snowy plover and least tern. Additionally, Refuge staff are investigating the use of the herbicides clethodim and imazapyr to control European beach grass. Although fluazifop-p-butyl has a relatively low reported toxicity, clethodim and imazapyr have even lower reported toxicities.

Additionally, projects utilizing volunteers to hand-pull Hottentot fig and purple ragwort will be implemented in the future.

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Appendix A. Vertebrate animal species that were directly observed or detected by sign in snowy plover breeding habitat on the Guadalupe-Nipomo Dunes NWR during the 2012 breeding season.

Birds

American avocet (*Recurvirostra americana*)
American kestrel (*Falco sparverius*)
American pipit (*Anthus rubescens*)
American white pelican (*Pelecanus erythrorhynchos*)
Barn swallow (*Hirundo rustica*)
Black-bellied plover (*Pluvialis squatarola*)
Black phoebe (*Sayornis nigricans*)
Black turnstone (*Arenaria melanocephala*)
Brewer's blackbird (*Euphagus cyanocephalus*)
California brown pelican (*Pelecanus occidentalis californicus*)
California gull (*Larus californicus*)
Caspian tern (*Hydroprogne caspia*)
Cliff swallow (*Petrochelidon pyrrhonota*)
Common raven (*Corvus corax*)
Cooper's hawk (*Accipiter cooperii*)
Caspian tern (*Hydroprogne caspia*)
Dowitcher (*Limnodromus* sp.)
Dunlin (*Calidris alpina*)
Great horned owl (*Bubo virginianus*)
Heermann's gull (*Larus heermanni*)
Horned lark (*Eremophila alpestris*)
House finch (*Carpodacus mexicanus*)
Loggerhead shrike (*Lanius ludovicianus*)
Long-billed curlew (*Numenius americanus*)
Merlin (*Falco columbarius*)
Northern harrier (*Circus cyaneus*)
Mourning dove (*Zenaida macroura*)
Osprey (*Pandion haliaetus*)
Peregrine falcon (*Falco peregrinus*)
Red-necked phalarope (*Phalaropus lobatus*)
Red-tailed hawk (*Buteo jamaicensis*)
Red-winged blackbird (*Agelaius phoeniceus*)
Ring-billed gull (*Larus delawarensis*)
Royal tern (*Thalasseus maxima*)
Ruddy turnstone (*Arenaria interpres*)
Sanderling (*Calidris alba*)
Say's phoebe (*Sayornis saya*)
Spotted sandpiper (*Actitis macularius*)
Semipalmated plover (*Charadrius semipalmatus*)
Turkey vulture (*Cathartes aura*)
Western gull (*Larus occidentalis*)
Western meadowlark (*Sturnella neglecta*)
Western sandpiper (*Calidris mauri*)
Western scrub jay (*Aphelocoma californica*)
Whimbrel (*Numenius phaeopus*)
White-crowned sparrow (*Zonotrichia leucophrys*)
Willet (*Catoptrophorus semipalmatus*)

Mammals

California sea lion (*Zalophus californianus*)
Coyote (*Canis latrans*)
Pocket gopher (*Thomomys* sp.)
Mule deer (*Odocoileus hemionus*)
Rabbit (unidentified Leporidae tracks)
Raccoon (*Procyon lotor*)
Virginia opossum (*Didelphis virginiana*)
Wild pig (*Sus scrofa*)

Appendix B. Numbers of adult snowy plover counted by date on the Guadalupe-Nipomo Dunes NWR during the 2012 breeding season.

Date	Gender				Date	Gender			
	Male	Female	Unknown	Total		Male	Female	Unknown	Total
3/8	9	12	4	25	8/6	1	2	0	3
3/9	4	5	0	9	8/10	4	0	0	4
3/14	5	8	0	13	8/13	7	0	1	8
3/16	1	4	0	5	8/17	4	1	0	5
3/20	1	1	0	2	8/22	4	1	0	5
3/23	1	1	0	2	8/27	2	1	12	15
3/29	1	1	0	2	9/6	0	1	0	1
3/30	2	2	0	4					
4/3	3	3	0	6					
4/10	10	5	0	15					
4/11	6	5	0	11					
4/19	4	5	5	14					
4/23	9	5	0	14					
4/27	3	6	0	9					
5/1	5	6	0	11					
5/4	12	12	0	24					
5/7	5	11	1	17					
5/10	6	4	2	12					
5/14	5	5	0	10					
5/17	5	6	3	14					
5/21	8	6	1	15					
5/22	6	8	0	14					
5/24	5	5	0	10					
5/28	3	6	0	9					
6/1	5	7	1	13					
6/5	4	3	1	8					
6/8	10	4	5	19					
6/12	17	5	2	24					
6/15	9	4	0	13					
6/21	5	6	0	11					
6/26	2	2	0	4					
6/28	4	5	0	9					
7/2	1	2	0	0					
7/5	10	6	0	16					
7/10	6	6	3	15					
7/13	0	3	1	4					
7/16	10	6	14	30					
7/20	3	4	3	10					
7/23	3	4	0	7					
7/27	6	5	2	13					
7/30	1	4	0	5					
8/2	3	2	0	5					

Appendix C. Data summary for snowy plover nests observed at the Guadalupe-Nipomo Dunes NWR during the 2012.

Nest #	Date Found	# Eggs When Found	Final # Eggs	Exclosure Date	Nest Fate Observation Date	Nest Fate	# Eggs Hatched
1	04/10	1	1	04/11/12	04/17	abandoned	0
2	04/17	1	1	none	04/17	raven	0
3	04/23	1	3	04/23/12	5/14 - 5/17	abandoned	0
4	05/01	1	2	05/01/12	05/07	abandoned	0
5	05/01	1	3	05/01/12	6/4 - 6/5	hatch	2
6	05/07	1	1	05/07/12	05/10	abandoned	0
7	05/14	3	3	none	05/19	hatch	3
8	05/14	3	2	05/14/12	6/4 - 6/5	hatch	2
9	05/14	2	2	none	05/13	coyote	0
10	05/14	2	3	05/14/12	6/15 - 6/21	hatch	1
11	05/21	2	3	none	5/24 - 5/28	unknown predator	0
12	05/21	2	3	05/21/12	06/05	surf	0
13	05/24	1	3	05/24/12	6/15 - 6/26	abandoned	0
14	06/12	2	3	06/12/12	6/21 - 6/26	abandoned	0
15	06/15	3	3	06/15/12	06/21	abandoned	0
16	06/15	3	3	none	6/15 - 6/20	unknown avian	0
17	06/15	1	3	06/15/12	6/26 - 6/28	abandoned	0
18	06/26	2	3	06/26/12	7/26 - 7/27	hatch	3
19	06/26	1	3	06/26/12	07/27	hatch	3
20	06/28	1	3	06/28/12	7/28 - 7/29	hatch	3
21	07/13	2	2	none	8/7 - 8/9	hatch	2
Total Hatched Eggs:							19

Appendix D. Data summary for snowy plover chicks observed at the Guadalupe-Nipomo Dunes NWR during the 2012 breeding season.

Date	Location (BM #)	From Nest #	# Chicks	Adults Present	Notes
21-May	6.7	R7	2	VV:BY M	
22-May	6.7	R7	2	VV:BY M	
24-May	6.7	R7	2	VV:BY M	
5-Jun	6.4	R5	2	FU	
6-Jun	4.0	R8	2		
8-Jun	6.5	R8	2	MU	
15-Jun	6.5	R8	1	MU	
28-Jun	5.7	?	1		juvenile running in foredunes
27-Jul	6.6	R19	2	VV:BY M	
27-Jul	6.6	R18	3	NB:PB F	
30-Jul	1.0	ODSVRA	3	FU	1 chick unbanded; 2 chicks banded = GA:BY & VV:AW
30-Jul	5.8	R20	3	MU	unbanded chicks 1-2 days old
30-Jul	6.6	R19	3	VV:BY M	chicks about 5 days old
30-Jul	6.9	R18	3	NB:PB F	chicks unbanded, about 5 days old, foraging
2-Aug	5.8	R20?	3	FU	
2-Aug	6.6	R19	3	VV:BY M	foraging on shoreline
2-Aug	7.0	GRP	3		probably from Chevron Guadalupe Restoration Project
2-Aug	6.9	R18	3	NB:PB F	unbanded chicks running along edge of foredunes
6-Aug	6.0	R18+R19	6	MU+FU	6 chicks grouped together; adults fighting
10-Aug	5.8	R20?	3	MU	unbanded chicks running along edge of foredunes
10-Aug	6.0	?	3	MU	unbanded chicks running along edge of foredunes
10-Aug	6.2	R19	3	VV:BY M	unbanded chicks foraging along wrack line
10-Aug	6.8	R18	3	NB:PB M	chicks and adult observed along symbolic fence line
13-Aug	4.1	ODSVRA	2	MU	chicks 2-3 weeks old, 1 unbanded + 1 banded = GA:BY
13-Aug	4.9	R21	2	UU	chicks small
13-Aug	5.8	?	3	MU	chicks about 2 weeks old
13-Aug	6.5	R19	2	VV:BY M	possibly a third chick present
13-Aug	6.8	R18?	1		chick about 3 weeks old and larger than chick at BM 6.5
13-Aug	6.0	R20?	3	MU	chicks about 2-3 weeks old; larger than chicks at BM 5.8
17-Aug	4.9	R21	2	FU	
17-Aug	5.4	?	1	MU	large chick ran south
17-Aug	5.5	R19	3	VV:BY M	chicks foraging along wrack line
17-Aug	5.8	R20	1	MU	large chick
17-Aug	6.8	R18	2	NB:PB M	chicks close to fledge
22-Aug	4.0	?	2	FU	chicks about 1 week old
22-Aug	6.5	?	2	MU	chicks close to fledge
22-Aug	6.8	R19	3	VV:BY M	chicks large, foraging
22-Aug	6.9	R18	2	NB:PB M	large chicks
27-Aug	3.8	?	2	MU	medium-sized chicks

Letters separated by colons indicate color band combinations on the legs of snowy plover (read from top left to bottom right): B = blue, G = green, N = brown, P = pink, R = red, Y = yellow, V = violet; Other abbreviations: F = female; FU = female unbanded; GRP = Chevron Guadalupe Restoration Project; M = male; MU = male unbanded; ODSVRSR = Ocean Dunes State Vehicular Recreation Area; R = refuge nest (followed by a nest number); UU = unidentified gender + unbanded

Appendix E. Summary of human trespass activities into posted snowy plover breeding habitat observed during the 2012 breeding season on the Guadalupe-Nipomo Dunes NWR. BM = beach marker.

Date	# Trespass Events	Description
3/14	2	2 sets of tracks 30' inside posted habitat at BM 2.2; drew shapes in sand; went out same way
4/3	1	At least one person 20' east of fence line; built small hut out of driftwood at BM 1.0; went out same way
4/10	1	1 set of barefoot tracks 10' east of fence line at BM 0.2
6/12	1	Tracks go to large orange buoy at BM 4.1, about 30' east of fence line; tracks come back out at BM 4.0
6/12	1	Tracks go in at BM 6.5 and out at BM 5.5; went about 20' inside posted habitat.

Total 6