

**Western Snowy Plover Nesting  
at Bolsa Chica, Orange County, California  
2013**



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- Appendix 1. Western snowy plover eggs laid, chicks hatched, and fledged at Bolsa Chica, 2013.
- Appendix 2. Distribution of western snowy plover nests at Bolsa Chica for 1997 through 2013.

## INTRODUCTION

Bolsa Chica is a coastal lowland area between two mesas, the Bolsa Chica Mesa and the Huntington Beach Mesa in Orange County, California (Figure 1). Bolsa Chica, which a century ago was under full tidal influence, has started to come full circle. Over 100 years ago, Bolsa Chica was diked-off from direct tidal influence but remained below mean sea level, becoming influenced by freshwater and acted as a sump for local drainage. In 1978, restoration began on the State's Ecological Reserve, and muted tidal influence was restored to the Inner Bolsa Bay area. At that time, two small islands, North Tern Island and South Tern Island, were created for nesting California least tern (*Sternula antillarum browni*), a State and Federal endangered species.

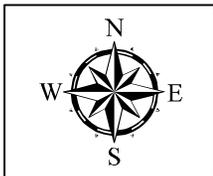
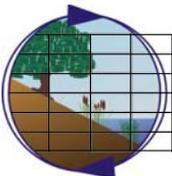
In 1997, the Bolsa Chica lowlands were acquired into public ownership. This marked the beginning of a multi-agency effort to design, evaluate, and implement a plan for restoring the fish and wildlife habitats. These habitats had been cut off from the ocean for a century and have been an operating oil field for over 50 years. Construction of the restoration project began in fall 2004 and was completed in August 2006. By the 2006 breeding season, three new nest sites were available for nesting and augmented the pre-existing North and South Tern Islands in Inner Bolsa Bay. The new ocean inlet, referred to as the Full Tidal Basin, was opened after the conclusion of the breeding season on August 24, 2006. The Full Tidal Basin is now subject to water level rise and fall that approximates the unequal semi-diurnal tidal range of southern California's ocean waters. The Muted Tidal Basin was opened to tidal influence from the Full Tidal Basin through its water control structures in March 2008.

The purpose of this investigation is to continue to improve the level of knowledge about the western snowy plover (*Charadrius nivosus nivosus*), a federally listed, threatened species that currently uses Bolsa Chica, and to attempt interim management actions to benefit the reproductive success of this species. This annual study will also aid in documenting achievement levels required to meet the goals of the Recovery Plan for the Pacific Coast Population of the Western Snowy Plover (USFWS 2007). In addition, this study will aid in assessing the success of the restoration projects and allow for modifications that would enhance utilization and increase reproductive success of the western snowy plover. This annual study was first initiated in 1997. This document reports on the 2013 snowy plover breeding season at Bolsa Chica.

## BACKGROUND

The western snowy plover is a sparrow-sized, white and tan colored shorebird with dark patches on either side of the neck, behind the eyes, and on the forehead. The coastal western snowy plover population is defined as those individuals that nest adjacent to or near tidal waters and includes all nesting colonies on the mainland coast, peninsulas, offshore islands, adjacent bays, and estuaries. The breeding range of the coastal population of the western snowy plover extends along coastal beaches from the southern portion of Washington State to southern Baja California, Mexico. The Pacific coast population of the western snowy plover is reproductively isolated from the interior populations.

The recognized breeding season of the western snowy plover normally extends from March 1 through September 15; however, there are some exceptions. The first nest at Bolsa Chica in 2009 occurred on February 23 and courting behavior has been observed as early as late January. Generally, three eggs are laid in a nest on the ground, which consists of a shallow depression scraped in the substrate. Some nests are lined with plant parts, small pebbles, or shell fragments.



**Site Locator and Vicinity Map**  
 Bolsa Chica Lowlands Restoration Project  
 Orange County, CA

**Figure 1**

Both sexes incubate the eggs for an average of 27 days. Snowy plovers will reneest after loss of a clutch or brood. Snowy plover chicks are precocial and leave the nest within hours of hatching in search of food. The tending adult(s) provide danger warnings, thermo-regulation assistance, and guide the chicks to foraging areas, but do not provide food to their chicks. Broods rarely stay in the immediate area of the nest. Young birds are able to fly within approximately 31 days of hatching.

Double brooding and polyandry are typical for this species. Snowy plover females usually leave very young chicks with the male in order to find another mate. The male typically tends the brood until the chicks fledge. Western snowy plover adults and young forage on invertebrates and insects along intertidal areas, beaches in wet sand and surf cast kelp, foredune areas of dry sand above the high tide, on salt panne, and edges of salt marshes and salt ponds (Page et al. 1995). The snowy plover is primarily a run and glean type of forager.

Poor reproductive success resulting from human disturbance, predation, and inclement weather, combined with permanent or long-term loss of nesting habitat to urban development has led to the decline in active nesting colonies as well as an overall decline in the breeding and wintering population of the western snowy plover along the Pacific coast of the United States. In southern California, the very large human population and the resultant beach recreation activities by humans have precluded the western snowy plover from breeding in several historically used beach strand areas. As a result of these factors, the Pacific coast population of the western snowy plover was federally listed as threatened with extinction on March 5, 1993 (Federal Register 1993).

#### **BOLSA CHICA STUDY AREA**

Snowy plover nesting areas within Bolsa Chica include: Seasonal Ponds (Cells 2 through 13), Future Full Tidal Basin (Cells 14 through 40 and Cell 63), Muted Tidal Basin (Cells 41 through 50 and Cell 66), North Tern Island (NTI), South Tern Island (STI), Nest Site 1 (NS1), Nest Site 2 (NS2), Nest Site 3 (NS3), and the Levee Roads of the Full Tidal Basin (Figure 2). Some areas in the vicinity of the Bolsa Chica study area were not surveyed in this study, although western snowy plovers may have used the habitats for foraging or loafing. Those areas are the ocean beach immediately to the west at Bolsa Chica State Beach, Outer Bolsa Bay, Rabbit Island, and Inner Bolsa Bay to the west of West Levee Road with the exception of NTI and STI (Figure 2).

The Seasonal Ponds, Future Full Tidal Basin, and Muted Tidal Basin are demarcated into subareas (cells) by the network of slightly elevated roads constructed decades ago for access to the oil wells. These cells were numbered and form the basis for observer navigation, nest mapping, and data recording. Each cell is unique in configuration and area. The approximate areas of some key cells are: Cell 10 (17 acres) and Cell 11 (54 acres).

The Seasonal Ponds are predominantly salt panne and the most dominant plant species is pickleweed (*Sarcocornia pacifica*). Portions of the ponds are seasonally inundated with fresh to brackish water that become highly saline as evaporation concentrates the remaining water in diminishing pools over the salt panne. Beginning in 2012 ocean water was introduced into Cells 11, 13, 14, and 19 from the Full Tidal Basin in order to provide habitat for the wintering waterfowl and to control encroachment of reed growth in Cell 11.

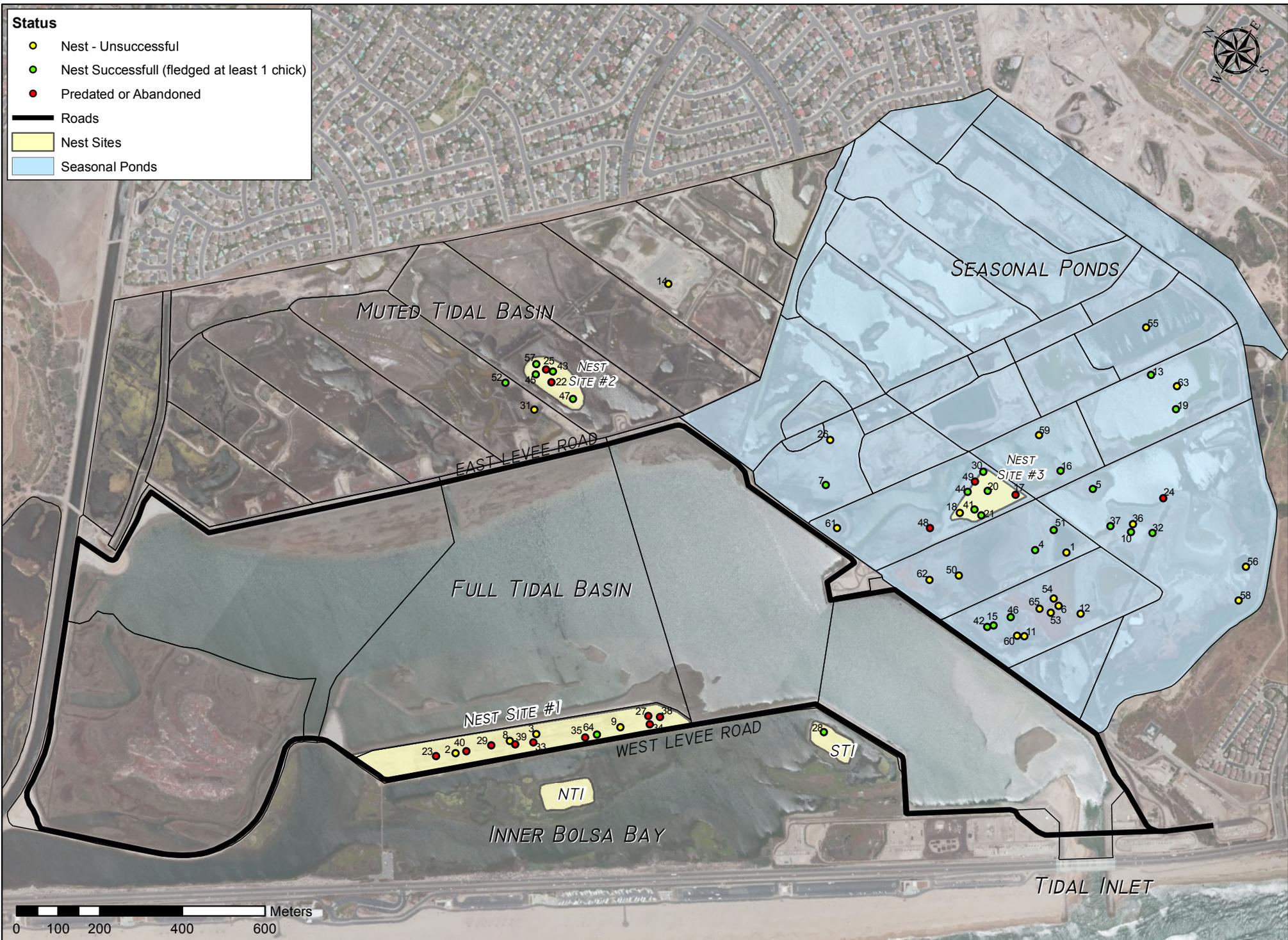


Figure 2. Western Snowy Plover Nesting Sites

The Future Full Tidal Basin lies between the Seasonal Ponds and the Muted Tidal Basin and includes Freeman Creek. These zones are very similar to the Seasonal Ponds and consist mainly of salt panne and pickleweed, although there are some areas that retain water year-round (Cells 30 and 38). Though these areas are mostly unsuitable for nesting the margins were regularly checked for nesting plovers.

The Muted Tidal Basin occupies the northeastern section of Bolsa Chica and is divided into west, central, and east basins. Muted tidal influence was introduced to the west Muted Tidal Basin in March 2008, and later to the central and east basins in March and May 2011, respectively. Due to considerable tidal muting in the Full Tidal Basin, the central and east Muted Tidal Basins were non-tidal in 2013, though water levels were manually adjusted on several occasions for various management purposes. The Muted Tidal Basins are largely inundated, composed of pickleweed, open water, and mudflat, and are generally considered unsuitable for western snowy plover nesting.

NTI and STI are well established, created islands surrounded by the muted tidal waters of Inner Bolsa Bay. The surface is dredge spoil with a developed boundary of intertidal or salt tolerant vegetation. STI is a regular breeding area for California least terns but also has several snowy plover nests per season. NTI has been used primarily by elegant tern (*Thalasseus elegans*), royal tern (*Thalasseus maximus*), Caspian tern (*Hydroprogne caspia*), black skimmers (*Rynchops niger*), and occasionally by western snowy plovers.

NS1 is a large linear nesting area between Inner Bolsa Bay and the Full Tidal Basin that was built during the creation of the Full Tidal Basin. The surface is dredge spoil that forms a flat surface that extends from the West Levee Rd. toward the basin. The shoreline of the nest site is now under full tidal influence. The northeastern shoreline is becoming more structured, with pickleweed forming in the intertidal zone. Fences have been installed at both ends of the nest site in order to prevent the public from accessing the site and to limit the access of mammalian predators. During the winter of 2013 most of the vegetation had been removed from the nest site by mechanical scarification and 6 inches of sand treated with herbicide was added. The site remained only lightly vegetated throughout the breeding season. The vegetative growth was primarily beach sand-verbena (*Abronia umbellata* var. *umbellata*), a native perennial and five-hook bassia (*Bassia hyssopifolia*), an invasive non-native plant.

NS2 and NS3 are also created sites in Cell 42 and Cell 14, respectively. NS2 is located in the east Muted Tidal Basin and NS3 is within the Seasonal Ponds. These sites were built up with fill and covered with sand. Both nest sites require some weed control. Some chicks on NS2 forage on the site while others are led from the site by the adult by swimming across surrounding water. Chicks on NS3 tend to leave the site immediately after hatching to seek forage in the surrounding seasonal pond cells. NS3 now has a 6-foot high chain link fence surrounding the entire nesting site. This was installed during the winter of 2012.



Nest Site 1 after mechanical scarification and addition of new sand.

Public access is not allowed on any of the nest sites. The human presence in the study area is mostly related to the operation of the oil field, consisting of large and small oil service vehicles and small work crews along the roads and well pads.

## STUDY METHODS

The principal survey effort for western snowy plover in 2013 was undertaken by California Department of Fish & Wildlife (CDFW) staff member, Peter Knapp, with assistance from Ross Griswold, a CDFW volunteer, and Gary Keller, a CDFW staff member. Surveys were conducted daily by one or more individuals beginning in mid-February and continue until the end of August. Each nest was checked daily, from a distance, to ensure that it was still active.

The accessibility and size of each nesting site dictated survey methods. STI and NS1 were surveyed by vehicle from the West Levee Road prior to arrival of the California least terns and then on foot once nesting was initiated. NTI was used primarily by nesting large terns and black skimmer and, therefore, required minimal monitoring for western snowy plover. Observations of this nesting site were made from the West Levee Road. NS2 was surveyed by vehicle from the East Levee Road using a spotting scope with occasional survey efforts occurring on foot. NS3 was surveyed by vehicle from the north end of the site. The large majority of suitable western snowy plover nesting habitat in the Seasonal Ponds was visible from the road network. Therefore, the observer(s) would slowly drive along the roads that subdivide this area. Frequent stops were made to examine specific areas adjacent to the road with binoculars or spotting scope without exiting the vehicle.

During each survey for western snowy plover, observers documented the location of any new nests. NS1, NS2, and NS3 were sectioned by markers, which formed the basis for data recording. NS1 is significantly larger than the other two nest sites; therefore, NS1 was sectioned south to north from A through CC in a regular grid. Each snowy plover nest located during survey efforts was marked with a numbered tongue depressor, mapped for ease of relocation on subsequent visits, and a mini-enclosure (ME) was placed on the nest.

On all sites it was usually possible to follow the movements and determine the fate of chicks of each brood since there was dispersion over space and time sufficient to differentiate between broods. In a few cases banded adults identified specific broods. Broods were observed daily. These regular brood observations were conducted to determine chick survival and fledgling production, as well as to detect movement between cells and use of specific cells for brood rearing.

A range-wide, Breeding Season Window Survey was conducted at Bolsa Chica in May 2013. The survey was conducted in the same manner as in previous years and in accordance with the guidelines set out in the Snowy Plover Recovery Plan (U.S. Fish and Wildlife Service 2007).

## PROTECTION FROM PREDATORS

Once a nest was discovered, a welded wire ME was anchored in place over the top of the nest and left in place until the eggs in the nest hatched. The MEs are 28 inches in width on all four sides and 16 inches in height. These dimensions have proven effective in deterring predation by corvids, gulls, and coyotes (*Canis latrans*). The use of the ME contributes greatly to the low egg predation at Bolsa Chica. Aversion nests, used to deter coyote and corvid nest predation, were not effectively used during the 2013 breeding season.

In 2013 larger MEs (48"x48"x20") were introduced on NS1 to preclude depredation by coyotes that have recently started digging in the fresh sand to gain access to the eggs under the ME. These larger ME's may have been an attraction to a predator as adult plovers disappeared after their laying eggs. To prevent the further loss of adults these MEs were removed from nests 29, 33, 34, 35, 38, 39, and 40 and each of these nests were subsequently lost to predation by gulls.

Observations were made of potential predators during the surveys. Predator management actions were then enacted commensurate with the threat to snowy plover breeding activity by that specific predator. Predator management has been a necessary recovery action for the California least tern for decades. In places such as Bolsa Chica where snowy plovers nest in proximity to the least tern, predator management activities on behalf of one species will also benefit the other species. In 2013, predator management was undertaken by Wally Ross of CDFW.

Clay roof tiles were placed on STI, NS1, NS2, and NS3 to provide shelter for young least tern and plover chicks. Adult plovers also used the tiles as a viewing platform for chick movement.

## RESULTS AND DISCUSSION

In 2013, the first snowy plover nest was established on March 21 in Cell 9 of the Seasonal Ponds. There were a total of 66 nests producing 37 fledglings for the season (Table 1).

**Table 1. Males, Females, Nests and Fledgling Production 1997-2013.**

Year	Females	Males	Total Adults	Total Nests	Fledglings	Total Fl/Nest	Fl/Male
2013	22	31	53	66	37	0.56	1.19
2012	26	31	57	68	77	1.13	2.48
2011	20 (1 unk)	28	49	73	62	0.85	2.21
2010	22	23	45	64	63	0.98	2.74
2009	25	22	47	70	42-70*	0.60-1.00*	1.91-3.18*
2008	22	28	50	67	57-109*	0.85-1.62*	2.04-3.89*
2007	18	12	30	50	25	0.50	2.08
2006	27	35	62	71	64	0.90	1.83
2005	25	41	66	51	75	1.47	1.83
2004	25	20	45	65	79	1.22	3.95
2003	15	16	31	32	44	1.38	2.75
2002	19	20	39	50	27	0.54	1.35
2001	19	18	37	55	57	1.04	3.17
2000	15	16	31	39	42	1.08	2.63
1999	12	11	32	38	23	0.61	2.09
1998	11	16	27	34	25	0.74	1.56
1997	14	20	34	30	nd	nd	nd

Fl = fledglings, nd = not determined

\* based on minimum/maximum numbers of fledglings

## NUMBERS OF MALE AND FEMALE SNOWY PLOVERS

During May 2013, a Range-wide, Breeding Season Window Survey was conducted. The total number of snowy plovers present at Bolsa Chica was 53 adults: 22 females and 31 males (Table 1).

Based on calculating the highest number of nests (calculated as 2 adults) during the breeding season and combining that with the number of broods (calculated as 1 adult) present at the same time an estimate was made for the minimum number of adults present at Bolsa Chica. On April 24 and 25 there were 26 active nests and 2 broods present totaling a minimum estimate 54 adults. This confirms the accuracy and value of the window survey.

The management goal of the Snowy Plover Recovery Plan for Bolsa Chica is 70 adults.

## NEST DISTRIBUTION AND CHRONOLOGIES

Snowy plover utilized all available nest sites at Bolsa Chica in 2013 except NTI. Seasonal Ponds had 42% of all nests, NS1 had 23%, NS3 had 12%, Future Full Tidal Basin had 8%, and NS2 had 8% of all nests (Figure 2, Table 2). Cell 45, immediately adjacent to NS2 in the Muted Tidal Basin, was also used for nesting, as it was in 2009, 2011, and 2012. Cell 40, also in the Muted Tidal Basin, was used for the first time in 2012 and again in 2013. Appendix 1 provides the cell location, start and end dates, nest fates, and eggs and chicks produced for each nest in 2013. Appendix 2 provides information on historical nest distribution.

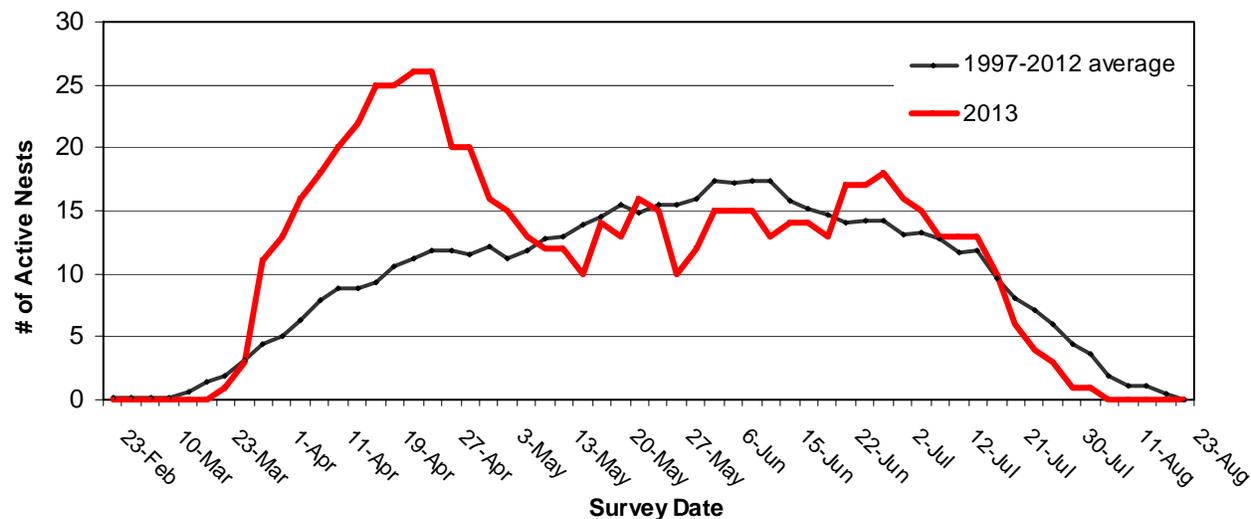
**Table 2. 2013 Nest, Nest Fate, and Reproductive Success Distribution by Cell**

Location	Total Nests	Nests Failed	Nests Hatched (# chicks)	Fledglings
<b>Seasonal Ponds:</b>	<b>28</b>	<b>1</b>	<b>27 (74)</b>	<b>18</b>
Cell 9	5	0	5 (13)	3
Cell 10	10	0	10 (27)	4
Cell 11	8	1	7 (20)	4
Cell 12	3	0	3 (9)	4
Cell 13	2	0	2 (5)	3
<b>Nest Site 1</b>	<b>16</b>	<b>11</b>	<b>5 (14)</b>	<b>3</b>
<b>Nest Site 2</b>	<b>4</b>	<b>1</b>	<b>3 (9)</b>	<b>5*</b>
<b>Nest Site 3</b>	<b>8</b>	<b>2</b>	<b>6 (18)</b>	<b>6</b>
<b>Future Full Tidal Basin:</b>	<b>5</b>	<b>1</b>	<b>4 (10)</b>	<b>2</b>
Cell 14	2	1	1 (3)	0
Cell 19	2	0	2 (5)	2
Cell 22	1	0	1 (2)	0
<b>STI</b>	<b>1</b>	<b>0</b>	<b>1 (3)</b>	<b>1</b>
<b>Muted Tidal Basin</b>	<b>2</b>	<b>0</b>	<b>2 (6)</b>	<b>1</b>
Cell 40	1	0	1 (3)	0
Cell 45	1	0	1 (3)	1
<b>80 Road</b>	<b>2</b>	<b>0</b>	<b>2 (6)</b>	<b>1</b>
<b>Total</b>	<b>66</b>	<b>16</b>	<b>50 (140)</b>	<b>37*</b>

\* includes bird raised at the Wetlands and Wildlife Care Center of Orange County.

The State and Federal Endangered California least tern also nests at Bolsa Chica. Snowy plover egg laying typically begins several months before the least tern begins its egg laying. This has been the case at Bolsa Chica as well. The two species tolerate the co-location of their nests. This was apparent in 2013 when they both nested on STI, NS1, NS2, and NS3.

In 2013, the first plover nest was initiated March 21 somewhat later than average. However, the number of snowy plover nests rose quickly to 26 nests by April 26 (Figure 3). The last known nests hatched during the first few days of August (Figure 3). Fifty (76%) nests survived to hatch. There was an active nest and/or a prefledge brood for a total of 176 days of the 2013 breeding season at Bolsa Chica.



**Figure 3. 1997-2013 Bolsa Chica Active Nest Chronology.**

### NEST SITE SELECTION

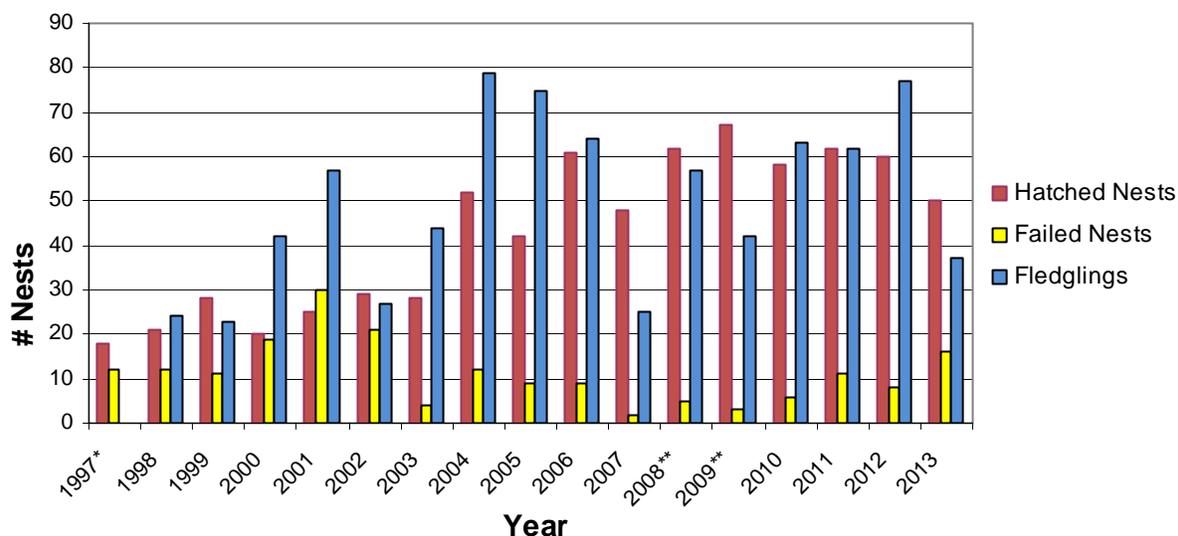
In 2013, for the first time recorded at Bolsa Chica three identical nest locations were used in Cell 10 in the same year; Nests 6 and 54, Nests 15 and 42, and Nests 11 and 60 (Figure 2). None of these birds were banded so it is unknown if the same adults were associated with any of the nests. In addition Nests 5, 12, 16, and 19 had identical nest placement as nests in the previous year.

Prior to the start of the breeding season the locations of Nests 5, 12, 16, and 19 were enhanced by Peter Knapp through the dispersal of large-grained sand and shells within a two-foot radius of the previous nest site. These locations were in the Seasonal Ponds where the salt panne substrate seldom changes. This enhancement may have encouraged nest site selection.

### EGGS, CHICKS, AND FLEDGLING PRODUCTION

A total of 185 snowy plover eggs were produced at Bolsa Chica in 2013, with 45 eggs abandoned, predated or failed to hatch, and the remaining eggs producing 140 chicks. Of these 140 total chicks produced in 2013, only 37 survived to fledge (Table 2, Figure 4). Of the chicks hatched, 18 (13%)

died within the first day of hatching, 34 (24%) died within the first two days, and 66 (47%) died within the first week of hatching. Among the chicks that perished, 17% died within the first day, 32% died within the first two days, and 64% died within the first week of hatching.



**Figure 4. Comparison of Number of Western Snowy Plover Hatched Nests, Failed Nests, and Fledglings 1997-2013 at Bolsa Chica.**

\* no fledgling data available

\*\* based on the minimum number of fledglings

Of the 66 nests found in 2013, only Nest 66 was found as a brood only and the nest was not specifically located. This was a 3-chick brood located in the MTB. The remaining 64 nests were judged to be complete and one nest was lost to predation after the first egg was laid (Nest 24). Ten completed clutches were 2-egg clutches and the remaining 54 were 3-egg clutches (Appendix 1).



Photo by P. Knapp

Nest 26 in Cell 19 found adorned by broken bottles. See front cover.

Eight nests were abandoned. The cause of abandonment of Nests 2, 17, 22, 23, 25, 27, 48, and 49 is undocumented. Incubation of these nests was 13, 43, 22, 16, 19, 33, 49, and 44 days, respectively. The cause of abandonment of Nest 2 was blowing sand, which buried the eggs. The eggs were uncovered within 24 hours but the nest was abandoned. The female from this nest renested within 9 days at a location within 50 feet of the old nest. Nest 17 and 48 were classified as abandoned when eggs were collected from the nest after an abnormally long incubation period of 43 and 49 days respectively.

These eggs were sent to the Western Foundation of Vertebrate Zoology (WFVZ) and determined to be sterile. This is the seventh and eighth instance of this occurring at Bolsa Chica; in 2009 there

were two nests, one nest in 2010, two nests in 2011, and one nest in 2012. These were all unbanded birds.

Eight nests were predated in 2013 and all but one was located on NS1. The nests on NS1 were either depredated by gulls or were suspected of being depredated by gulls. One nest was predated in Cell 11 but the cause is unknown.

For the third time at Bolsa Chica, 19 unhatched eggs were salvaged and given to the WFVZ for analysis of sterility. The results of the analysis are presented in Table 3.

**Table 3. Results of Analysis by the Western Foundation of Vertebrate Zoology (WFVZ) of Abandoned or Sterile Snowy Plover Eggs.**

Nest #	Clutch size	Eggs hatched	Eggs abandoned (collected)	Notes	Results from WFVZ
2	2	0	2	Nest lost to wind-blown sand	One had a medium embryo and one had no development
17	3	0	3	Long incubation, incubated for 43 days	No visible development
22	3	0	3	Nest abandoned	All 3 had embryos, two listed as medium to large and one listed as small
23	3	0	3	Nest abandoned	Large embryos
25	3	0	3	Nest abandoned	Large embryos
48	3	0	3	Long incubation, incubated for 49 days	No visible development
49	3	0	3	Nest abandoned	Small embryos

One chick from Nest 12 was taken to the Wetlands and Wildlife Care Center of Orange County (WWCCOC) after it was discovered hatching one day after the male and two siblings had left the location of the nest. A second chick from Nest 43 was also taken to the WWCCOC after it was observed to be unable to lift its head and was orphaned by the adults that had two other chicks. Both birds were successfully raised and released at Bolsa Chica after banding. To aid in the release of the fledglings, a temporary shelter or halfway house was built to provide shelter to the young birds while they familiarized themselves with their surroundings. The shelter consisted of a framed wire cage that was open at both ends and measures 60 inches by 30 inches with a height of 19.5 inches. It was placed over a small amount of pickleweed to offer the young fledgling some cover while inside the shelter. This shelter was first used in 2010 and appears to have increased the survival of these hand-reared fledglings.

Nest 9 on NS1 was found on April 1 as a complete clutch of 3 eggs and was incubated by an unbanded female until April 18. She disappeared at this time and it was assumed that the nest was abandoned. Upon further daily observations the male was observed incubating on its own until three chicks hatched on May 2.

Of the 66 nests at Bolsa Chica in 2013, a total of 37 fledglings were produced. The overall fledge rate (fledglings/nest) was 0.56 (Table 1). There was also the lowest fledglings/male rate (1.19) that has been encountered since we began collecting data at this site. NS2 and STI were the most successful nesting areas with a fledge rate of 1.0. This is still fairly low and the sample sizes are only from five and one nest, respectively. NS3 had 8 nests and had a fledge rate of 0.75.

The Seasonal Ponds was the most successful nesting area in 2012 with a fledge rate of 1.92 but in 2013 it had a fledge rate of only 0.64.

The number of nests in 2013 on NS1 has increased to 16 nests from a low of 12 nests in 2012 and decreased from a high of 37 nests in 2008. The fledgling rate was very low at 0.2. In 2012 the fledgling rate was 1.92.

NS2 had a record 13 nests in 2011, 7 nests in 2012, and decreased to 4 nests in 2013. In 2011 NS2 had a fledgling rate of 0.38 and in 2012 it was 0.57. In 2013, the number of nests was low but the fledge rate increased to 1.3. Crowding by other snowy plover broods is believed to have had a negative effect on reproductive success on NS2.

NS3 had a fledge rate of 0.75 in 2013 and 0.67 in 2012. Broods from nests on NS3 left the site and foraged in the Seasonal Ponds.



Adult male incubating nest (Nest 37) joined by his pre-fledged sibling from Nest 5. They are sitting together under an ME while the male incubates his new nest.

The significant reduction in fledgling success from 77 in 2012 to 37 in 2013 is attributable to the following three depredation factors: 1) predation of nests on NS1 by gulls; 2) presence of two northern harriers (*Circus cyaneus*) during the breeding season; and 3) presence of other avian predators during the breeding season including American kestrel (*Falco sparverius*) and red-tailed hawk (*Buteo jamaicensis*).

An analysis of the 20 eggs provided to the WFVZ revealed 13 eggs with some development and 7 with no development (Table 3). Of the 13 eggs with some development, 12 came from 4 complete 3-egg clutches and 1 from a 2-egg clutch. Of the infertile eggs, 6 came from two nests of complete 3-egg clutches that were incubated from abnormal periods of time in excess of 40 days. See management section for recommended 2014 actions in these situations.

### BROOD TRACKING

Due to the chronological and geographic spacing of each brood, it is usually possible to locate and identify individual broods over the period before they fledge and it is these observations that are the basis for determining fledgling success. As generally seen in prior years, in 2013 each brood tended to stay together and the males prevented overlap or co-mingling with other broods. There were

confrontations between the males if the broods wandered too close together or tried to take advantage of the same resources. This was apparent on NS2.

Broods hatched from NS3 relocated within days to locations within the Seasonal Ponds to seek food. Snowy plovers readily used the roads of Bolsa Chica to cover distances of 1/3 to 3/4 mile. In the Seasonal Ponds, broods would move about or change cells but could generally be identified. More than one cell may be used by a brood, and often a brood will travel to another cell within one or two days of hatching. As an example, a family of two adults and three recently hatched chicks used service roads to travel from Cell 45 to Cell 19 in a little over three hours.

#### **OBSERVATIONS OF BANDED ADULTS**

A limited number of banded birds were observed or were breeding this year at Bolsa Chica.

On NS1, a female YNRY unsuccessfully nested once (Nest 2, lost to blowing sand) and was believed predated subsequently on Nest 23.

A male, YNWR, was present from early April thru mid-August, but was not identified with a specific nest. Further observations of this male led to the speculation that he may have been infertile. This male attempted to nest at Bolsa Chica in 2011 and 2012 but a nest was never located. This bird was banded as a fledgling at Bolsa Chica after being raised at WWCCOC in 2010.

Two captive reared birds YNWB and YNBW were released at Bolsa Chica respectively on June 4 and August 1, 2013.

Other sightings were limited to a single observation or for a short duration. They included BOGG on February 3 through February 22; WWYS on March 30, NWNR on March 22; and KS:YRYR on July 2.

#### **PREDATION**

In 2013 there were eight nests predated. This is abnormally high for Bolsa Chica. Seven predated nests were on NS1 and one nest was predated in Cell 11.

On NS1, larger ME measuring 4 feet square and 20 inches high were introduced for the first time. Coyotes had attempted to dig under the smaller ME last year in areas where the sand was soft and were successful in one case. The coyote was able to dig around the nest until the eggs rolled down into the depression that was created. Our original mini-exclosure measured 28 inches square and 16 inches high and is still actively used at Bolsa Chica.

Due to the addition of new, soft sand to NS1 the use of this larger ME was introduced, in order to protect these nests. The larger ME was used on Nests 29, 33, 34, 35, 38, 39, and 40. Observations of these nests and the absence of incubating adults on three of the nests led to the conclusion that adult predation may have occurred and that the larger ME may have attracted an unknown predator. The use of the larger ME was immediately discontinued and they were removed leaving the nests unprotected. The eggs from the seven remaining nests were subsequently taken by gulls.



Coyote dug all the way around ME (Nest 4 in Cell 9) but unable to reach eggs.

In the Seasonal Ponds, coyotes routinely attempted to attack ME-protected nests but were unsuccessful. See photo of Nest 4 in Cell 9. All protected nests in the Seasonal Ponds survived to hatch.

A pair of northern harriers were present for the first time during the later part of the snowy plover breeding season. They were suspected to be the primary cause of chick loss in the Seasonal Ponds. Documentation was limited to observations of their hunting in the foraging areas of the snowy plover chicks.

## MANAGEMENT RECOMMENDATIONS/ACTION ITEMS

Many recommendations from past years have been implemented with good results. These actions included: 1) placing tiles on the nest sites for the chicks to hide under, both providing protection from predation and a viewing platform for adults; 2) deploying MEs (28 inches square and 16 inches high) on every snowy plover nest to reduce egg loss due to predation; 3) utilizing drift fences to create dunes and maintain the sand on NS3; and 4) continuing weed management on all manmade nest sites. These management efforts have been effective in the enhancement of nest sites and improving reproductive success of the snowy plover and should continue. It is also recommended that monitoring continue with the same intensity that has occurred in the past in order to maintain this quality of management within the nest sites.

### 1. Management of NS1.

During the 2012 fall season vegetation was removed mechanically from large sections of NS1 and refurbished with fresh sand. This substantially restored the site to unvegetated habitat for the snowy plovers and least terns for the 2013 breeding season.

### 2. Vegetation Control on NS1, NS2, and NS3.

Continue vegetation management through manual removal of non-native plants and the use of herbicide.

### 3. Improve water management in the Seasonal Ponds

The Seasonal Ponds are an extremely important foraging and nesting area for the snowy plover. Based upon the recent history of early nest initiations and the fledgling success from those nests it would appear advantageous to have areas within the Seasonal Ponds managed to support earlier nesting. Currently the Seasonal Ponds are inundated with water and are not really available for

nesting until at least mid-April. Due to the early nesting it has become even more important to have a flexible management process for balancing the amount of water in these cells. Improving water management at the Seasonal Ponds has been an issue for several years; however, a number of solutions have been implemented to improve the flow of water out of these cells to make them available for snowy plover nesting and foraging. These include repair of culverts between cells and installation of a permanent pump in Freeman Creek (to which the ponds drain) so that excess storm water can be pumped out to the Full Tidal Basin.

From the middle of the 2012 nesting season, apparent increases in the fresh water levels in Cell 11 promoted unusual freshwater marsh vegetation growth. One method to control this growth is provided for in the Bolsa Chica Lowlands Water Management Plan: Seasonal Ponds and Freeman Creek Water Management Unit (M&A 2011). This requires management to introduce salt water into the Seasonal Ponds beginning immediately after the close of the breeding season. This normally would begin in September. The salt water did stop the spread of freshwater and did impact some standing growth. Use of channels to let the salt water inundate standing growth is proposed.

**4. Conduct a study of nest abandonment utilizing a protocol developed during the 2013 season.**

This protocol is:

*Ideally a mini-exclosure (ME) is placed upon a nest as soon as the first egg(s) are observed. Regular observations thereafter are made to determine the status of a nest including continued incubation, disturbance and/or hatching. When a nest with a complete clutch of eggs is observed unattended by an adult, the observer will continue observation of the nest for fifteen (15) minutes or until the adult returns to resume incubation, whichever occurs first. If the nest is unattended after 15 minutes, the observer documents the time unattended and investigates a disturbance and/or hatching. If the clutch is still complete after the investigation, the observer will repeat the observation one (1) hour later. If the nest is now attended by an adult, document this and resume a normal schedule. If the nest is still unattended, repeat the 5 minute observation, document, and return in one hour. Abandonment of the nest will be assumed if the attending adult is not present after three hourly observations. At this time the observer can consider salvage of the eggs and deliver them to a permitted care facility for incubation and required care.*

**5. Enhancement of potential nest site.**

At the start of the breeding season several locations within the Seasonal Ponds were enhanced by spreading a combination of large-grained sands and small shell fragments in areas that had previously been selected by snowy plovers as suitable nesting sites. It is thought that this enhancement may have encouraged nest site selection. The recommendation is to continue the enhancement of these areas each year.

**6. Determine the individual(s) responsible for sterile eggs production**

There have been one or two nests per year for at least three years that have been incubated for extended periods of time. These have been collected and sent to the Western Foundation of Vertebrate Zoology or analysis. The results have been that the eggs are sterile and have not developed. It is unknown if this is due to one or more snowy plovers. In the event that individual

nests are incubated for an abnormal length of time, we propose to trap and band the adults associated with the specific nests. This will identify adults that may suffer from infertility.

#### **7. Use of Mini-exlosures.**

Due to the potential threat to snowy plover adults the use of the larger ME (4 feet square and 20 inches high) should be discontinued. The reason for the threat is unknown but any loss of adult plovers is unacceptable. The use of the smaller ME (28 inches square and 16 inches high) will continue due to its proven success.

The endangered California least tern, which nests in the same locations as the western snowy plover, needs to be considered in all management efforts. Ongoing and adaptive management actions are essential to improving western snowy plover reproductive success at Bolsa Chica, which provides the best nesting option for snowy plovers within a 60-mile radius.

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**Appendix 1. Snowy plover eggs laid, chicks hatched, and fledged at Bolsa Chica, 2013**

<b>Nest #</b>	<b>Cell #</b>	<b>date found</b>	<b>date ended</b>	<b>eggs</b>	<b>nest fate</b>	<b>chicks</b>	<b>fledglings</b>	<b>comments</b>
1	CELL 9	3-21	4-24	2	<b>H</b>	2	0	
2	NS1 V2	3-26	4-8	2	<b>A</b>	0	0	Nest lost to wind-blown sand, female YN:RY, collected 2 eggs (WFVZ), one medium embryo, one undeveloped.
3	NS1 O2	3-28	4-30	3	<b>2H/1A</b>	2	1	Collected egg.
4	CELL 9	3-28	4-29	3	<b>H</b>	3	2	
5	CELL 11	3-29	4-24	3	<b>H</b>	3	1	
6	CELL 10	3-29	4-26	3	<b>H</b>	3	0	
7	CELL 19	3-30	4-30	3	<b>H</b>	2	2	
8	NS1 Q2	3-31	4-27	3	<b>H</b>	3	0	
9	NS1 H1	4-01	5-02	3	<b>H</b>	3	0	
10	CELL 11	4-01	5-01	3	<b>H</b>	3	1	
11	CELL 10	4-02	4-26	3	<b>2H/1A</b>	2	0	Collected egg.
12	CELL 10	4-03	5-06	3	<b>H</b>	3	0	
13	CELL 12	4-05	4-26	3	<b>H</b>	3	2	One chick to WWCCOC, hatched later than other chicks and brood had left the area.
14	CELL 40	4-04	5-05	3	<b>H</b>	3	0	
15	CELL 10	4-04	5-08	3	<b>2H/1A</b>	2	2	Collected egg.
16	CELL 13	4-10	5-12	3	<b>H</b>	3	3	
17	NS3 A4	4-10	5-23	3	<b>S</b>	0	0	Collected 3 eggs after abnormally long incubation (WFVZ), eggs sterile.
18	NS3 F1	4-11	5-12	3	<b>H</b>	3	0	
19	CELL 12	4-11	5-13	3	<b>H</b>	3	2	
20	NS3 C2	4-15	5-12	3	<b>H</b>	3	2	
21	NS3 E3	4-16	5-16	3	<b>H</b>	3	1	
22	NS2 D1	4-16	5-08	3	<b>A</b>	0	0	Collected 3 eggs after abandoned (WFVZ); small to large embryos.
23	NS1 W2	4-17	5-03	3	<b>A</b>	0	0	Collected 3 eggs after abandoned (WFVZ); large embryos; female YN:RY.
24	CELL 11	4-18	4-18	1	<b>P</b>	0	0	

<u>Nest #</u>	<u>Cell #</u>	<u>date found</u>	<u>date ended</u>	<u>eggs</u>	<u>nest fate</u>	<u>chicks</u>	<u>fledglings</u>	<u>comments</u>
25	NS2 F2	4-19	5-08	3	<b>A</b>	0	0	Collected 3 eggs after abandoned (WFVZ); large embryos
26	CELL 19	4-20	5-13	2	<b>H</b>	2	0	
27	NS1 E2	4-22	4-25	2	<b>A</b>	0	0	Collected 2 eggs after abandoned (WFVZ); large embryos
28	STI	4-25	5-04	3	<b>H</b>	3	1	
29	NS1 S2	4-28	5-27	3	<b>P</b>	0	0	Gull predation suspected
30	NS3 A1	5-08	6-03	3	<b>H</b>	3	1	
31	80 ROAD	5-11	6-11	3	<b>H</b>	3	0	
32	CELL 11	5-13	6-07	3	<b>H</b>	3	1	
33	NS1 O2	5-13	5-25	2	<b>P</b>	0	0	Predated by Gulls
34	NS1 Z1	5-13	5-15	2	<b>P</b>	0	0	Predated by Gulls
35	NS1 K1	5-13	5-19	3	<b>P</b>	0	0	Gull predation suspected
36	CELL 11	5-14	6-10	3	<b>H</b>	3	0	
37	CELL 11	5-17	6-13	3	<b>H</b>	3	1	
38	NS1 D2	5-21	5-27	3	<b>P</b>	0	0	Predated by Gulls
39	NS1 Q2	5-21	5-27	3	<b>P</b>	0	0	Predated by Gulls
40	NS1 U2	5-21	5-26	3	<b>P</b>	0	0	Predated by Gulls
41	NS3 E3	5-23	6-05	3	<b>H</b>	3	1	
42	CELL 10	5-22	6-19	3	<b>H</b>	3	1	
43	NS2 E2	5-23	6-17	3	<b>H</b>	3	2	1 chick taken to WWCCOC after being abandoned by adults
44	NS3 C1	5-23	6-19	3	<b>H</b>	3	1	
45	NS2 F1	5-23	6-19	3	<b>H</b>	3	2	
46	CELL 10	5-29	6-27	3	<b>H</b>	3	1	
47	NS1 A1	6-06	7-04	3	<b>H</b>	3	2	
48	CELL 14	6-06	7-25	3	<b>S</b>	0	0	Collected 3 egg after abnormally long incubation (WFVZ); eggs sterile
49	NS3 B1	6-07	7-21	3	<b>A</b>	0	0	Collected 3 egg; (WFVZ); small embryos
50	CELL 9	6-07	7-02	3	<b>H</b>	3	0	
51	CELL 9	6-10	7-08	3	<b>H</b>	3	1	

<u>Nest #</u>	<u>Cell #</u>	<u>date found</u>	<u>date ended</u>	<u>eggs</u>	<u>nest fate</u>	<u>chicks</u>	<u>fledglings</u>	<u>comments</u>
52	80 ROAD	6-11	7-04	3	H	3	1	
53	CELL 10	6-12	7-08	3	H	3	0	
54	CELL 10	6-19	7-17	3	2H/1A	2	0	
55	CELL 22	6-21	7-20	2	H	2	0	
56	CELL 22	6-21	7-17	3	H	3	0	
57	NS2 G2	6-22	6-30	3	H	3	1	
58	CELL 11	6-22	7-17	2	H	2	0	
59	CELL 13	6-24	7-22	2	H	2	0	
60	CELL 10	6-27	7-22	3	H	3	0	
61	CELL 14	6-29	7-20	3	H	3	0	
62	CELL 9	6-29	7-28	2	H	2	0	
63	CELL 12	7-02	7-28	3	H	3	0	
64	NS1 K1	7-07	8-02	3	H	3	1	
65	CELL 10	7-17	7-19	3	H	3	0	
66	CELL 45	7-20	7-20	3	H	3	1	
<b>2013 Season Totals</b>				<b>186 eggs</b>	<b>50H, 6A, 2S, 8P 66 Nests</b>	<b>140 chicks</b>	<b>37 fledglings</b>	

P = predated; A = abandoned; H = hatched, S = sterile eggs.

**Note:** In the Nest Fate column, **2H1A** means the nest hatched but only two eggs produced chicks, one egg was abandoned.

WFVZ= Western Foundation of Vertebrate Zoology; PK=Peter Knapp; WWCCOC = Wetlands and Wildlife Care Center of Orange County

**Appendix 2. Distribution of Western Snowy Plover Nests at Bolsa Chica for 1997 through 2013.**

**Distribution of nests throughout Bolsa Chica**

<b>Year</b>	<b>Total # Nests</b>	<b>Cells eliminated during restoration</b>	<b>Seasonal Ponds</b>	<b>FFTB</b>	<b>MTB</b>	<b>NTI</b>	<b>NS1</b>	<b>NS2</b>	<b>NS3</b>	<b>STI</b>	<b>Other</b>
1997	31	14	11	4						2	
1998	34	16	15	2						1	
1999	38	14	11	11						2	
2000	39	11	21	6						1	
2001	55	19	29	5						2	
2002	50	14	17	19							
2003	32	11	9	3						9	
2004	65	17	33	10						5	
2005	51	6	30	8						7	
2006	71	13	13	16			16	1	8	4	
2007	50		10	9			19		8	4	
2008	67		10	10			37		5	4	1
2009	70		16	9	1	1	32	3	5	3	
2010	64		11	4		1	26	4	14	2	2
2011	73		19	7	1	1	12	13	16	3	1
2012	68		26	11			12	7	9		3
2013	66		28	5	2		16	4	8	1	2

**Distribution of Nests by Cell**

<b>Year</b>	<b>Cell 2</b>	<b>Cell 9</b>	<b>Cell 10</b>	<b>Cell 11</b>	<b>Cell 12</b>	<b>Cell 13</b>	<b>Cell 14</b>	<b>Cell 17</b>	<b>Cell 18</b>	<b>Cell 19</b>	<b>Cell 22</b>	<b>Cell 25</b>	<b>Cell 30</b>	<b>Cell 31</b>	<b>Cell 32</b>	<b>Cell 33</b>	<b>Cell 34</b>	<b>Cell 36</b>	<b>Cell 40</b>	<b>Cell 45</b>
1997			4	7			1		1		2									
1998		2	7	6			1				1									
1999			6	5			1	1		5	4									
2000		2	6	12	1		1	1			1							3		
2001	1	8	11	9						5										
2002	1	2	1	10		3	3	5			10							1		
2003		6	1		2				2	1										
2004		5	12	13	2	1	1		3	1	4		1							
2005	1	6	8	12	3		1			4						3				
2006			2	6	5						13				2	1				
2007			1	6		3				1	3				4		1			
2008		2	5		3					4	6									
2009		2	6	2	5	1	2			2	3	1		1						1
2010		2	5	3	1		3				1									
2011		9	3	3	1	3	3			1	2				1					1
2012		6	4	9	4	3	2			3	3		1		1				1	
2013		5	10	8	3	2	2			2	1								1	1